A POLICY SYSTEM FOR CONTINUOUS IMPROVEMENT

Strategies to bolster industrial energy management practices and outcomes in Canada

James Gaede, Brendan Haley

Efficiency Canada

Carleton University

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c/o Carleton University
1125 Colonel By Drive
Ottawa, ON K1S 5B6
https://www.efficiencycanada.org

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The views and perspectives expressed are those of the authors, who take responsibility for any errors or emissions within.

About the authors

James Gaede is a Research Manager with Efficiency Canada. He has a PhD in Political Science from Carleton University, and has published research on energy forecasting, carbon capture and storage, and energy storage. Previously, he held postdoctoral fellowships at both the University of Waterloo and Carleton University.

Brendan Haley is Efficiency Canada's Director of Policy Research. He has a PhD in Public Policy from Carleton University, a Master of Environmental Studies from York University, and a Bachelor of Science in Economics from Dalhousie University. Before joining Efficiency Canada on a full-time basis in September, 2018, Brendan was a Banting Postdoctoral Fellow at Dalhousie University.

About Efficiency Canada

Efficiency Canada is the national voice for an energy efficient economy. Our mission is to create a sustainable environment and better life for all Canadians by making our country a global leader in energy efficiency policy, technology, and jobs. Efficiency Canada is housed at Carleton University's Sustainable Energy Research Centre, which is located on the traditional unceded territories of the Algonquin nation.

Executive summary

The challenge of the decarbonizing industry in Canada has reached a notable scale. Industry accounts for approximately 35 per cent of final energy demand and 40 per cent of total greenhouse gas w(GHG) emissions in Canada. In order to hit national emission reduction targets for 2030, the scale of reductions required from industry are roughly equivalent to 69 megatonnes of carbon dioxide or equivalent emissions (MtCO2e) from the oil and gas sector (39 per cent below 2020 levels), and 20 MtCO2e from heavy industries such as cement, fertilizer, or iron and steel manufacturing (28 per cent below 2020 levels).

Energy efficiency improvements will play an important role in this transition. Hitting these emission reduction levels will require dramatic reductions in both energy and GHG emission intensity (both measured against industrial GDP). Despite some improvement in both indicators since the mid-1990s, for most industrial subsectors aggregate data shows Canadian industry lags most other advanced industrial economies in terms of industrial energy intensity. Analysis from Natural Resources Canada and the International Energy Agency (IEA) shows that energy efficiency improvements alone could improve industrial energy intensity by 16 per cent between 2016 and 2030, delivering emission reductions of approximately 25 MtCO2e.

Improved energy management practices are essential enabling tools that drive *continuous improvements* in industrial energy use performance and GHG reductions. Energy management is an umbrella term capturing a range of practices and activities to identify, measure, and control energy use in organizations. A comprehensive approach to energy management that integrates different components of energy management into an overarching framework—and into a series of processes that improve energy performance, decrease energy intensity, reduce environmental impacts, and achieve operational efficiencies—is referred to as an energy management system (EnMS). Like other management systems, an EnMS follows a Plan-Do-Check-Act (PDCA) approach to work toward continuous improvement in energy use, and organizations can have their EnMS certified under international standards (e.g., ISO 50001). Wider adoption of EnMS in Canadian industry would have significant environmental, competitive, and societal benefits.

However, a policy system scan suggests that, despite federal and provincial programs to support energy management, current approaches may not be sufficient to deliver continuous improvement:

- **Energy management is not integrated in broader federal and provincial climate and industry strategies, or related policies or programs.** The North American approach to industrial energy management is largely voluntary, with few requirements for industry to develop plans, conduct energy auditing, or report performance indicators. The federal government administers several programs related to energy management, but energy management is not otherwise integrated with other industrial and climate initiatives (e.g., the output-based industrial carbon pricing system, Net Zero Accelerator fund).

- **The existence of energy management practices and their impacts are difficult to track in a rigorous way, due in part to low levels of certification and the general lack of performance reporting requirements.** Data from the ISO shows vastly higher numbers of 50001 certifications in Europe than in other regions. This is likely due, primarily, to a European Union rule requiring mandatory energy auditing for industrial facilities (unless they have an ISO 50001-certified EnMS in place). Discussions with experts in Canada and reviews of program evaluations and other studies suggests low interest in ISO 50001 certification in Canada. Alternative programs (e.g., US DOE's SEP 50001 and ISO Ready programs) do incorporate performance verification, though adoption in Canada is rare or non-existent.
- **Emerging rules and practices regarding climate risk and environmental, social, and governance (ESG) corporate reporting requirements may require greater transparency.** Recent developments suggest that rules will soon be in place requiring securities issuers in Canada to disclose climate-related risks, based on the Task-force on Climate-related Financial Disclosure (TCFD) principles. A Canadian Sustainability Standards Board is being established to oversee the adoption and implementation of ESG standards for a Canadian context. The Canadian financial sector is also looking to align lending, insuring, and investment activities with a net-zero future. These developments represent an opportunity to promote the adoption of energy management practices. These practices would also help develop the capacity to report on other key performance indicators and attract investment dollars for Canadian industry. However, they do not presently incorporate considerations of energy management.

Our review of literature and discussions with policymakers, program administrators, and experts in this policy area suggest three policy system-level challenges inhibiting transparent, continuous improvement in energy management:

- *Interest:* Despite continuous improvement in energy use performance being beneficial for key stakeholders (i.e., industry, utilities, and government), current institutional arrangements in demand-side management, prevailing business practices, and climate policy do not align to encourage actors to take such a long-term perspective.

- *Resources:* Provincial demand-side management programs, closely related climate and industry policy systems (e.g., industrial output-based carbon pricing systems), and additional federal support for energy management are not sufficiently coordinated to provide the certainty of long-term support for continuous improvement in energy management practices and outcomes.
- *Legitimacy:* Interest in and support for energy management (like the related world of ESG reporting) can be limited by perceived illegitimacy, which arises from a question of whether professed plans, achievements, and impacts are real—a question which derives from the intents and actions of organizations involved, but also the principles, rules, and institutions that govern them.

To address these systemic challenges, a *policy system* for continuous improvement is required. A policy system approach to energy management would recognize the practice as a national environmental and competitive necessity. Industrial energy use practices (like industrial climate impacts) are too important to be the responsibility of industry alone. This will require aligning and building upon existing policy resources and initiatives, as well as the creation of new rules, re-defining expectations, and the integration of energy management-related requirements in ancillary policy system developments.

Specific recommendations include:

1. *Follow the management system process:* A policy system to facilitate continuous improvement in industrial energy use should itself adhere to the management system iterative PDCA. However, these actions should be the responsibility of all key stakeholders, not industry alone.
2. *Create or build upon industrial subsector networks:* Networks composed of industry, governments, utilities, and financial sector organizations should be established to promote shared responsibility for planning and measurement, along with evaluation frameworks for achieving net-zero policy goals. Energy management indicators should be integrated in these frameworks.
3. *Strengthen energy management-related requirements across the broader policy system:* Following international examples, mandatory requirements for energy auditing and performance reporting should be established for heavy industry, backed up by 'penalty defaults' for non-participation. To help drive improved business practices

and overcome financial barriers, energy management requirements should also be integrated into related policy systems or program initiatives, like industrial output-based carbon pricing or flagship funding programs for net-zero projects.

4. *Consolidate reporting initiatives related to sustainability with similar policy initiatives:* To offset the potential burden of these requirements, public resources should be directed to the consolidation of, and compliance with, various existing and emerging corporate reporting initiatives related to sustainability. This could also help to improve the perceived legitimacy of corporate plans related to sustainability and reported impacts.

5. *Find the right balance with transparency:* Evaluating progress is an integral step in any management system. A policy system for continuous improvement should incorporate indicators of both process and outcomes, but with sufficient flexibility and methodological rigour to be accessible, sensitive to industry concerns of proprietary information, and be perceived as legitimate. Developments in climate risk and ESG reporting may lead toward greater transparency.

6. *Leverage provincial utility and energy efficiency program systems:* The technical expertise, program experience, and relationship with industry that provincial utilities and energy efficiency program administrators and implementers have is an essential to achieve meaningful energy and sustainability performance improvements through energy management practices and outcomes. Policy makers should seek to leverage these resources through institutional, regulatory, and program strategy adjustments to align actors with a long-term focus on continuous improvement.

Introduction

The Government of Canada has committed to reducing national greenhouse gas emissions by 40 to 45 per cent below 2005 levels by 2030.[1] In raw numbers, this entails reducing emissions by between 227 and 264 Mt below 2020 levels. This will require significant emissions reductions in the industrial sector, which includes oil and gas, heavy industry (including mining, iron and steel production, cement, and others), and light manufacturing. According to the federal government's 2022 Emission Reduction Plan, the oil and gas sector will need to reduce emissions by approximately 69 MtCO2e, and heavy industry by 20 MtCO2e below 2020 levels to hit national targets. This report aims to identify and assess challenges and opportunities for *industrial energy management* to contribute to Canada's broader climate change efforts. Approximately 70 per cent of industrial emissions result from energy combustion.

Energy management is an umbrella term encompassing a range of different initiatives and business practices to monitor, benchmark, and improve the energy use performance of facilities and industrial production processes over time. Energy management practices have the potential to significantly improve energy efficiency, save money, drive energy savings and to accomplish other business objectives related to energy use, like demand or greenhouse gas emission reductions.[2] However, despite widespread program support for energy management across Canada, tracking the breadth and depth of energy management practices in Canadian, and their impact in industry is difficult. Canadian industry is both energy and carbon intensive, and overall industrial energy intensity is higher than in other OECD countries. While there have been improvements in energy intensity over the past 30 years, energy efficiency has played a negligible role in this trend according to modelling by Natural Resources Canada.[3]

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[1] Environment and Climate Change Canada, "Government of Canada Confirms Ambitious New Greenhouse Gas Emissions Reduction Target," Government of Canada, July 12, 2021, https://www.canada.ca/en/environment-climate-change/news/2021/07/government-of-canada-confirms-ambitious-new-greenhouse-gas-emissions-reduction-target.html.

[2] Sergio Dias Consulting LLC, "California SEM Design Guide For: Cycle 1, 2, and 3" (Pacific Gas and Electric; San Diego Gas and Electric; Southern California Edison; Southern California Gas Company, July 5, 2022), 2.

[3] Natural Resources Canada, "Table 7(a): Energy Use Analysis - Industrial Sector," Government of Canada, Energy Efficiency Trends Analysis Tables, National Energy Use Database, Jan. 30, 2020, 7, https://oee.nrcan.gc.ca/corporate/statistics/neud/dpa/showTable.cfm?type=AN&sector=ind&juris=00&rn=11&page=0.

This report takes a policy system approach to identify challenges facing industrial energy management in Canada and then explore policy and program opportunities to facilitate greater uptake of and transparency in energy management systems and their outcomes. We define a policy system as the broad set of institutions, actors (public and private), and legislation and regulation that, together, constitute the functioning and governance of a particular issue area. Our approach to assessing this question consists of primary and secondary research and interviews with stakeholders involved in these policy communities. The policy systems of particular importance to this research objective include utility demand-side management, provincial and federal climate change and industrial policy, and corporate accounting and pollution-related reporting requirements. Important stakeholders in these policy systems include utilities and energy efficiency program administrators, technical experts and energy management implementers or consultants, industry representatives, and policymakers.

Background

Industry in Canada comprises approximately 35 per cent of final energy demand[4] and contributes a significant share of overall national GHG emissions. In Canada's 2022 National Inventory Report (NIR), the combination of the oil and gas sector,[5] heavy industry,[6] and light manufacturing[7] accounted for approximately 264 MtCO2e emissions in 2020, or roughly 39 per cent of total Canadian GHG emissions (note that this figure does not include emissions associated with industrial electricity demand if it is generated by the grid rather than on industrial sites).[8] To meet our emissions reduction target for 2030 (227 MtCO2e), federal government modelling shows that oil and gas would need to reduce emissions by 31 per cent

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[4] Statistics Canada, "Supply and Demand of Primary and Secondary Energy in Terajoules, Annual," Government of Canada, 2021, https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=2510002901.

[5] Oil and gas extraction and processing, as well as petroleum refining and natural gas distribution
[6] Mining, pulp and paper, iron and steel, chemicals and fertilizer manufacturing, cement manufacturing, lime and gypsum manufacturing
[7] Textiles, food and beverage, automotive and other light manufacturing
[8] Environment and Climate Change Canada, "Canada's Official Greenhouse Gas Inventory," Government of Canada, 2022, https://data.ec.gc.ca/data/substances/monitor/canada-s-official-greenhouse-gas-inventory/B-Economic-Sector/?lang=en.

and heavy industry by 39 per cent, compared to 2005 levels—or about 69 MtCO2e (39 per cent) and 20 MtCO2e (28 per cent) below each sector's emissions in 2020, respectively.[9]

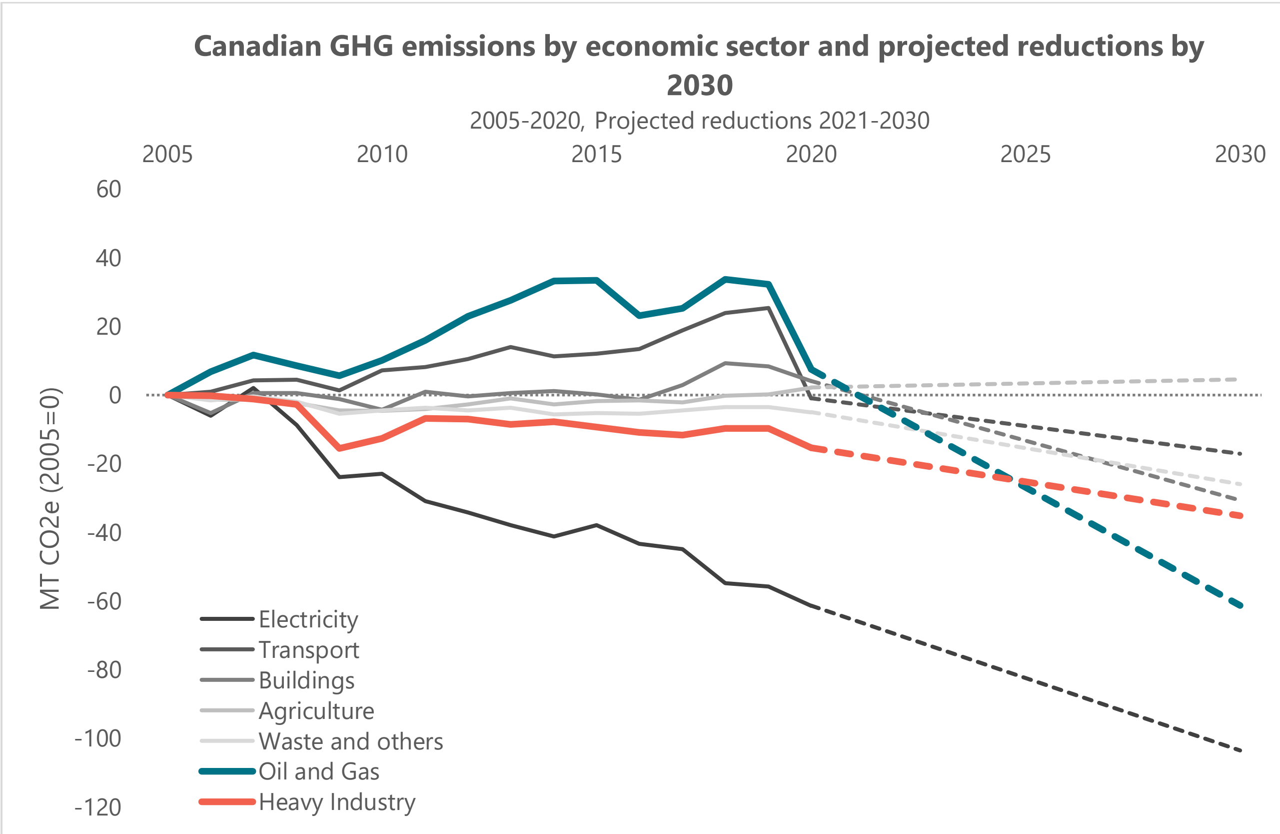

Figure 1) Canadian GHG emissions by economic sector and projected reductions by 2030. Source: Environment Canada (2022) National Inventory Report, Ottawa, ON

The scale of this challenge is significant. Hitting industrial emissions targets will require dramatic improvements in energy intensity *and* the GHG intensity of fuels, necessarily leading to absolute reductions in GHG emissions.[10] Data from the Canadian Energy and Emissions Data Centre

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[9] Environment and Climate Change Canada, "2030 Emissions Reduction Plan: Canada's next Steps for Clean Air and a Strong Economy" (Ottawa, ON: Government of Canada, 2022), 90, https://www.canada.ca/content/dam/eccc/documents/pdf/climate-change/erp/Canada-2030-Emissions-Reduction-Plan-eng.pdf.

[10] Performance metrics based on intensity can represent real reductions in energy and GHG emissions, but not necessarily if production is increasing. Indeed, increased production alone can lead to intensity reductions without any tangible change in energy use or greenhouse gas emissions. Hitting climate change targets will ultimately require absolute reductions in industrial GHG emissions.

(CEEDC) at Simon Fraser University shows energy and emission intensity (both measured against GDP) have improved in heavy industry and light manufacturing since the mid-1990s. Oil and gas, on the other hand, saw energy and emission intensity grow significantly until 2010/2011, declining slightly thereafter, yet ending considerably higher in 2020 than in 1995.

The table below shows energy intensity, GHG emission intensity of energy, and GHG emission intensity of GDP for each sector. Figures in parentheses show the relative change since 1995 (negative percentages mean increasing intensity). Holding the current carbon intensity of energy in heavy industry steady (and excluding emissions from industrial processes), energy intensity would have to improve by a further 52 per cent to hit the 28 per cent reduction in emissions projected by the federal government. For oil and gas, energy intensity would need to drop by 41 per cent.

Table 1) Changes in energy and GHG emission intensity of Canadian industrial sectors, 1995–2020. Source: Canadian Energy and Emissions Data Centre (2022)

	Energy intensity (MJ/$ in 2012)	**GHG intensity of energy** (KgCO2e/GJ)	**GHG intensity of GDP** (KgCO2e /$ in 2012)
	Energy includes electricity use	*Excluding process emissions; excluding electricity use*	*Including process emissions*
Oil and gas	21.3 (-52%)	55.2 (6%)	1.1 (-46%)
Heavy industry	20.3 (37%)	36.6 (11%)	0.8 (52%)
Light manufacturing	3.2 (13%)	35.8 (18%)	0.2 (32%)

In all, about 70 per cent (188 MtCO2e) of total industrial emissions result from energy combustion. According to a 2018 study by the IEA and Natural Resources Canada, energy efficiency improvements could improve aggregate industrial energy intensity by about 16 per cent between 2016 and 2030, delivering approximately 25 MtCO2 in GHG reductions from energy combustion from both manufacturing (heavy and light) and oil and gas.[11] Achieving this would require roughly $100 billion in additional investments in industrial energy efficiency.[12]

[11] International Energy Agency and Natural Resources Canada, "Energy Efficiency Potential in Canada to 2050," Insight Series 2018 (Paris: International Energy Agency, 2018), 20, 39.

[12] International Energy Agency and Natural Resources Canada, 33.

Another 18 per cent (50 MtCO2e) of total industrial emissions come from fugitive sources (e.g., natural gas venting and flaring) in the oil and gas sector, and 12 per cent (32 MtCO2e) from industrial processes in the heavy industry sector—mainly cement manufacturing, chemical and fertilizer manufacturing, and primary metal manufacturing. Reducing these emissions will require methods in addition to incremental efficiency improvements. These include methane regulation, carbon capture and storage, adopting innovative (and less mature) industrial production processes, and others.[13]

In short, the Canadian industrial sector faces difficult emission reduction targets for 2030 and beyond. Hitting these targets will require reductions in both energy and GHG emission intensity, the latter requiring actions to address emissions outside energy combustion. In heavy industry, at least a small portion of emissions reductions may need to come from advanced industrial process techniques or carbon capture and storage. Given the geographically varied and heterogenous energy and carbon intensities of different industrial sectors, finding solutions will likely have to be highly customized to individual facilities.

Energy management

Energy management is an important tool in the broader set of energy and emissions reduction strategies for industry (as well as large commercial and institutional buildings) and has the added benefit of being generally applicable across subsectors. Broadly speaking, energy management is an umbrella term capturing a range of activities or practices to identify, measure, and improve the use of energy, typically with the objective of improving efficiency and reducing energy costs. Energy management practice may be characterized by commitments to a goal or target, identification and execution of energy savings projects and activities, and a system for performance monitoring and reporting or benchmarking. These activities often vary in their scope (e.g., single system or entire facility) and technicality (e.g., best practices and strategies versus hardware or software to track energy use).

Contemporary energy efficiency programming related to energy management often provides support for activities such as:

1) **Energy auditing.** Energy auditing involves collecting and reviewing data on energy use patterns; surveying facilities; taking measurements of systems that use energy; observing and reviewing operating practices; and analyzing energy use data. The

[13] International Energy Agency, "Achieving Net Zero Heavy Industry Sectors in G7 Members" (Paris: IEA/OECD, 2022).

purpose of an audit is to determine where, when, why, and how energy is being used in a facility or in a specific system within it.[14]

2) **Benchmarking.** Natural Resources Canada identifies two types of benchmarking: energy performance benchmarking (or comparing energy use per unit of physical production, or energy intensity) within industrial subsectors, and energy 'best practices' benchmarking, which compares operations and systems against best-in-class operations, not necessarily within the same subsector.[15] Energy performance benchmarking enables labelling and disclosure of highly energy efficient facilities through programs like ENERGY STAR for industry.[16]

3) **Feasibility studies.** Feasibility studies are similar to energy audits but are typically conducted only for specific systems that use energy within a facility, and are intended to ascertain the costs and benefits of making efficiency improvements to that system. Feasibility studies can thereby influence investment decisions within the company.

4) **Energy management information systems.** An energy management information system (EMIS) is a performance management system used to enable organizations to manage energy use and costs. They include technical systems (hardware and software) that make energy performance within an organization more visible, facilitating monitoring, tracking and analysis, and planning and decision making.[17]

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[14] Canadian Industry Program for Energy Conservation, "Energy Savings Toolbox - An Energy Audit Manual and Tool" (Ottawa, ON: Natural Resources Canada; Government of Canada), 2, accessed May 4, 2022, https://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/oee/pdf/publications/infosource/pub/cipec/energyauditmanualandtool.pdf.

[15] Natural Resources Canada, "Energy Benchmarking for Industry," Government of Canada (Natural Resources Canada, Dec. 12, 2017), https://www.nrcan.gc.ca/energy-efficiency/energy-efficiency-for-industry/energy-management-industry/energy-benchmarking-industry/20407.

[16] Natural Resources Canada, "ENERGY STAR for Industry Certification," Government of Canada (Natural Resources Canada, Aug. 1, 2017), https://www.nrcan.gc.ca/energy-efficiency/energy-star-canada/energy-star-for-industry/energy-star-industry/19858.

[17] Natural Resources Canada, "Energy Management Information Systems," Government of Canada (Natural Resources Canada, Dec. 12, 2017), https://www.nrcan.gc.ca/energy/efficiency/energy-efficiency-industry/energy-management-industry/energy-management-information-systems/20403.

5) **Workforce training and capacity building.** There are many ways for organizations to build energy management capacity. One approach would be to hire a Certified Energy Manager (CEM) to take responsibility for the organization's energy management activities. Though responsibilities can be more diffused as well. They may fall to a dedicated committee or involve senior executives, for instance. Training and education can also be provided to employees on the importance of and best practices for energy management.

6) **Strategic energy management.** Strategic energy management (SEM) programs are generally targeted more at behavioural and operational changes in business practices, and thus organizational culture (though the structure of SEM programs varies across jurisdictions). According to the CEE, the three minimum components of SEM are: building a commitment in the organization to energy management, developing the processes and capacities for planning and implementation of improvements, and finally establishing the ability to measure and report performance within the company.[18]

A comprehensive approach to energy management would involve both narrow and wide scope, behavioural and technical, activities. Energy management may also vary in systematization—the extent to which disparate components of energy management are integrated in a comprehensive strategy or plan, typically referred to as an energy management system, or EnMS.

Continuous improvement

In general terms, 'management systems' refers to the set of policies, procedures, and processes an organization develops to manage the interrelated parts of its business to achieve certain objectives.[19] Importantly, such management systems are oriented toward continuous improvement—a systematic approach to the management of business products, services, or processes focused on continued, incremental, or 'breakthrough' improvement.[20]

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[18] Consortium for Energy Efficiency, "CEE Strategic Energy Management Minimum Elements" (Boston, MA: Consortium for Energy Efficiency, 2018), https://library.cee1.org/sites/default/files/library/11283/SEM_Minimum_Elements.pdf.

[19] International Standards Organization, "Management System Standards," ISO, accessed Jan. 31, 2023, https://www.iso.org/management-system-standards.html.

[20] American Society for Quality, "Continuous Improvement Model," 2022, https://asq.org/quality-resources/continuous-improvement.

At the core of a management system is the four-step PDCA process. In the context of an EnMS, the planning phase involves identifying scope, boundaries and organization needs and expectations; establishing the energy management team; conducting an energy review or audit; identifying significant energy uses; establishing energy performance indicators, baselines, objectives and targets for energy use improvement; and developing action plans to achieve targeted results. These action plans are then implemented in the 'do' phase, followed by monitoring, measurement and analysis of energy performance and the EnMS itself in the 'check' phase. Finally, action is taken to address any identified problems from the check phase.[21] The PDCA process is intended to be iterative, meaning that one cycle through the process does not end it, but instead informs the next cycle.

A systematized approach to energy management can be standardized and, accordingly, certified. The ISO 50001 family of standards provide frameworks and guidance for various aspects of designing and implementing energy management systems, conducting energy audits, measuring energy performance, and the certification of energy management systems (as being compliant with ISO 50001).[22]

Certification, in theory, improves public transparency—since certifications can be tracked, for example—and it bolsters certainty in the rigor of energy management practices or reported performance indicators. Notably, however, there are no requirements within ISO 50001 standards for public reporting of energy use performance improvements over time.

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[21] International Standards Organization, "ISO 50001:2018 Energy Management Systems — Requirements with Guidance for Use (Preview)," ISO, 2018, 50001, https://www.iso.org/obp/ui/#iso:std:iso:50001:ed-2:v1:en.

[22] International Standards Organization, "ISO 14000 Family — Environmental Management," ISO, accessed May 9, 2022, https://www.iso.org/iso-14001-environmental-management.html; International Standards Organization, "ISO 50001 — Energy Management," ISO, accessed May 9, 2022, https://www.iso.org/iso-50001-energy-management.html.

Consequently, the US Department of Energy developed its own certification program, called Superior Energy Performance (SEP) 50001 which recognizes ISO 50001 compliance, while also including requirements for verification of energy performance improvements. Based on the extent of improvement, participants can achieve one of three performance tiers: platinum, gold, or silver. The US DOE has also developed an ISO 50001-ready designation that is intended to give recognition to the existence of EnMS, but without the additional costs associated with pursuing full third-party certification. Recently, Natural Resources Canada launched the 50001 Ready Canada program as well, alongside a navigator tool to help guide industry through the 25 tasks necessary to align with ISO 50001.[23]

Benefits of energy management

The implementation of energy management systems leads directly to energy savings and GHG reductions, which improve business efficiency, cost savings and, therefore, competitiveness. A review found an EnMS can lead to organizational energy savings of between 10 per cent and 30 per cent overall, and between 10 per cent and 20 per cent in just the first five years. [24] Research by Natural Resources Canada found Canada companies certified under ISO 50001 achieved cumulative energy performance improvements of nearly 10 per cent in the first two years.[25] A recent study of 86 case studies representing 204 facilities that participated in the Clean Energy Ministerial Energy Management Leadership Challenge between 2016 and 2017 found that cost savings and return on investment resulting from ISO 50001 implementation were the most commonly reported benefit (71 per cent of case studies),. Additionally, it found that only 54 per cent of case studies mentioned cost savings and return on investment as their motivation for initially pursuing ISO 50001 (more frequently reported motivators included existing organizational energy goals, environmental sustainability, and government regulations or

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[23] Natural Resources Canada, "50001 Ready Canada Recognition Process," Government of Canada (Natural Resources Canada, Nov. 16, 2022), https://natural-resources.canada.ca/our-natural-resources/get-50001-ready-canada-recognition-the-ready-navigator-tool/50001-ready-canada-recognition-process/24769.

[24] Institute for Industrial Productivity and International Energy Agency, "Energy Management Programmes for Industry: Gaining through Saving" (Paris: IEA/OECD, 2012), 17, 20, https://iea.blob.core.windows.net/assets/23d44fd8-40b2-4e06-bc17-46ab45b8c5be/policypathwaysindustry.pdf.

[25] Natural Resources Canada, "ISO 50001 Energy Management Systems Standard," Government of Canada (Natural Resources Canada, Dec. 12, 2017), https://www.nrcan.gc.ca/energy-efficiency/energy-efficiency-for-industry/energy-management-industry/iso-50001-energy-management-systems-standard/20405.

incentives).[26] Many participants were surprised by the energy savings and economic benefits achieved.

Organizational energy savings can lead to substantial national energy savings and GHG reductions. In a 2017 survey of 14 strategic energy management (SEM) programs in North America, the Consortium for Energy Efficiency found that, by 2016, more than 1,000 sites had implemented SEM practices. Twelve of these programs have achieved combined electricity savings of around 324 gigawatt hours (GWh) and natural gas savings of around 950 terajoules (TJ).[27] Approximately a quarter of the electricity savings and one third of the natural gas savings were from operational and maintenance practices while the rest came from capital projects. A 2021 market study of Canadian SEM programs by the ACEEE, which conducted bottom-up and top-down modelling of energy savings and GHG reduction potential, found that expanding SEM programs in Canada could lead to electricity savings of between 0.4 and 181 petajoules (PJ) and GHG reductions of between 0.2 and 8.6 Mt of GHGs by 2030, depending on modelling approach and assumptions about the rate of uptake and spread of SEM practices by 2030.[28] At its highest technical potential, expansion of SEM programs could therefore account for 19 per cent of Canada's 2030 GHG reduction targets for industry.

The global potential of energy management is substantial. The Energy Management Working Group of the Clean Energy Ministerial established the ISO 50001 Global Impacts Research Network to develop a transparent and adaptable methodology to estimate the energy savings and GHG reduction potential of ISO 50001. The resulting tool, along with estimates of global impacts, were published in the academic journal, Energy Policy, in 2017.[29] The study found that,

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[26] Heidi Fuchs, Arian Aghajanzadeh, and Peter Therkelsen, "Identification of Drivers, Benefits, and Challenges of ISO 50001 through Case Study Content Analysis," *Energy Policy* 142 (July 1, 2020): 111443, https://doi.org/10.1016/j.enpol.2020.111443.

[27] Jess Burgess, "2017 Strategic Energy Management Program Summary" (Boston, MA: Consortium for Energy Efficiency, May 2018), https://library.cee1.org/system/files/library/13619/CEE_2017SEMProgramSummary.pdf; Ethan Rogers, Andrew Whitlock, and Kelly Rohrer, "Features and Performance of Energy Management Programs" (Washington, D.C.: American Council for an Energy Efficient Economy (ACEEE), 2019).

[28] Andrew Whitlock, Ed Rightor, and Andrew Hoffmeister, "Canadian Strategic Energy Management Market Study" (Washington, D.C.: American Council for an Energy-Efficient Economy (ACEEE), Nov. 2021).

[29] Aimee McKane et al., "Predicting the Quantifiable Impacts of ISO 50001 on Climate Change Mitigation," *Energy Policy* 107 (Aug. 1, 2017): 278–88, https://doi.org/10.1016/j.enpol.2017.04.049.

under an assumption that 50 per cent of global industrial and service sector energy consumption under ISO 50001 systems, cumulative primary energy savings by 2030 could reach 105 exajoules (EJ), 6,500 Mt of avoided GHGs, and cost savings of $700 million. According to the authors, the avoided annual CO2 emissions in 2030 alone would be equivalent to removing 210 million passenger vehicles from the road.

Energy efficiency improvements often deliver co-benefits (alternatively, non-energy benefits). According to the Institute for Industrial Productivity and the IEA, co-benefits of EnMSs to organizations include productivity gains, improved product quality, lower non-energy operating costs, longer equipment life, reduced maintenance costs, less waste generation, better resource efficiency, the improvement of workplace conditions, and pollution reductions.[30] Considering co-benefits—which, they note, often exceed the value of energy savings themselves—further reduces the payback times for investments in an EnMS.

According to Fuchs et al., employee motivation, strengthening company culture, and creating a culture of continuous improvement are among the top benefits and keys to success of EnMS, noted by nearly half of case studies they reviewed.[31] These organizational capacity and cultural benefits can help to ensure investments in energy efficiency attain the maximum energy savings. For instance, a milestone evaluation study of BC Hydro's Leadership in Energy Management Industrial program (LEM-I) between 2015 and 2017 found that sites with energy managers achieved 3.7 per cent reductions in site energy consumption through capital projects versus 0.9 per cent in sites without energy managers, and that sites with energy managers and active SEM practices achieved over 5.5 per cent energy savings from capital projects implemented between F2015 and F2017.

Finally, in reducing energy use and GHG emissions, energy management can help organizations comply with government policies and regulations, develop internal capacity to aid in the implementation of innovative decarbonization technology, and demonstrate value to investors concerned about ESG and related issues. All these elements can help make the organization more resilient to risks associated with climate change and the transition to a net-zero economy.

A study by the Institute for Industrial Productivity and the IEA noted that banks will be better able to assess risks and returns from potential investments when companies document energy

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[30] Institute for Industrial Productivity and International Energy Agency, "Energy Management Programmes for Industry: Gaining through Saving," 18.

[31] Fuchs, Aghajanzadeh, and Therkelsen, "Identification of Drivers, Benefits, and Challenges of ISO 50001 through Case Study Content Analysis."

performance indicators and GHG reductions. The growing prominence of ESG in the investment world suggests that organizations (industry and investors) will need to develop the internal resources and knowledge necessary to identify energy and climate-related risks to their business, as well as the technical skills to measure, benchmark, and report on energy and climate-related management practices.

Policy systems, energy management, and continuous improvement

Energy management can improve the competitiveness of Canada's industrial sector, particularly in an investment context increasingly attuned to climate risks and transition opportunities. Policies and programs to support industrial energy management thus fall at the intersection between climate and industrial policy, potentially serving both climate mitigation and adaptation policy needs, as well as bolstering Canadian industry. Recent developments in finance and investment focused on sustainability, and rules and requirements around corporate reporting, are also important.

Unfortunately, our approach to energy management to date has not enabled analysis of the extent to which it is contributing to continuous improvement. In federal and provincial climate and industry policy, energy management in industry has generally taken a back seat to other strategies (e.g., carbon capture and storage), and is not integrated into related policy systems, like the output-based carbon pricing systems for industry in most provinces. Tracking the extent of energy management practices in industry, let alone the performance impacts thereof, is challenging, despite the fact policy systems already exist to track GHG emissions and other pollutants in industry. Greater transparency could be helpful in aligning Canadian industry with emerging requirements for climate risk and ESG reporting, but there is presently little connection between these two issue areas.

Climate and industry policy

Federal government

Energy efficiency has had a place in the federal policy landscape since the 1970s. It is largely based on voluntary participation by industry. More recently, the field has focused efforts on promoting EnMS certification. Energy efficiency improvement— specifically ISO 50001 and SEP 50001 EnMS initiatives—was a core part of the 2016 Pan-Canadian Framework on Clean Growth and Climate Change.[32] More recently, the federal government's policy focus appears to have shifted somewhat toward other industrial decarbonization strategies.

[32] Environment and Climate Change Canada, "Pan-Canadian Framework on Clean Growth and Climate Change: Canada's Plan to Address Climate Change and Grow the Economy." (Ottawa: Government of Canada, 2016), http://www.deslibris.ca/ID/10065393.

The Canadian Industry Partnership for Energy Conservation (CIPEC) has existed since 1975 as a key vehicle for collaboration between industry and Natural Resources Canada.[33] It is a voluntary network of companies, trade associations and other groups, and is required to participate in the Energy Star for Industry program (which uses energy performance indicators to benchmark facilities against others in North America), and the ENERGY STAR Challenge for Industry (which gives recognition to facilities that manage to reduce energy use by 10 per cent within five years). CIPEC also has a number of sector-specific task forces and plays a very important role in promoting energy efficiency and conservation in industry. However, CIPEC events and resources tend to be highly technical, which may restrict its audience to technical experts and engineers, along with companies large enough to support these roles.

Natural Resources Canada has also offered incentives for ISO 50001-compliant EnMS development and certification; EMIS projects; and process integration and computational fluid dynamics studies for some time. Up until 2023, this program supported industrial facilities by covering up to 50 per cent of eligible costs (to a maximum of $40,000), or up to $200,000 for a multi-facility implementation, which can be stacked with provincial incentives, if applicable, up to 75 per cent of total project costs. The program did not have adequate funding, however, and reportedly could only support a handful of projects per year.

In 2022, the 2030 Emission Reduction Plan committed to expanding this program with a $194 million investment, initially intended to be specifically targeted toward small- and medium-sized enterprises. However, when the overhauled program was officially launched in early 2023—now titled the Green Industrial Facilities and Manufacturing Program (GIFMP)—it had taken a significantly different form.[34] The GIFMP consists of two tracks. Track 1, which targets provincial governments, utilities, and industrial associations, offers support of up to $20 million per proposal to deliver energy management-related programming to industry. Track 2, scheduled to be launched later in 2023, is closer in form to the original energy management program, offering direct financial support to industrial facilities. Measures under both tracks will be completed by 2027.

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[33] Pierre Langlois and Genevieve Gauthier, "Federal," in *Canadian Energy Efficiency Outlook: A National Effort for Tackling Climate Change*, ed. Pierre Langlois and Genevieve Gauthier (New York: River Publishers, 2018), 4, https://doi.org/10.1201/9781003151326.

[34] Natural Resources Canada, "Green Industrial Facilities and Manufacturing Program," Government of Canada (Natural Resources Canada, Feb. 7, 2023), https://natural-resources.canada.ca/energy-efficiency/energy-efficiency-for-industry/financial-assistance-energy-efficiency-projects/green-industrial-facilities-and-manufacturing-program-funding-eligibility/24934.

The GIFMP represents a substantial departure from and expansion (approximately 65 times the annual funding of the previous program) of the federal government's previous approach to industrial energy management. The program supports a wider range of energy management related activities, includes GHG reductions as an important eligibility consideration, and includes requirements to bolster long-term performance reporting as well. The program continues the historical voluntary approach to energy management in North America, however, and it is unclear to what extent it is integrated with other federal climate/industrial initiatives.

For example, since the release of the 2016 Pan-Canadian Framework on Clean Growth and Climate Change, carbon pricing has been a prominent policy instrument in Canada. Provinces can implement their own carbon tax or cap-and-trade system, or they have the federal backstop system put in place instead. There are two separate pricing mechanisms: a general fuel charge, and an output-based (or intensity based benchmarks) pricing system for industry. Use of proceeds from the output-based pricing system (OBPS) for industry implemented by the federal government are planned to support GHG reduction projects through a decarbonization incentive program and the Future Electricity Fund. GHG offset regulations were made official on June 8, 2022.[35]

Concerns have been raised about the strength and scope of provincial industrial carbon pricing systems established in compliance with the federal policies.[36] In 2021, Environment Canada announced a handful of adjustments to strengthen the benchmark industry carbon pricing system, including mandating coverage for industrial process emissions and requiring better reporting from the provinces. However, according to Dirac and Sawyer, the federal government could have gone further to curb industrial emissions, by setting minimum performance standards for industrial emitters, or including annual tightening rates within the federal OBPS.[37]

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[35] Environment and Climate Change Canada, "Canada's Greenhouse Gas Offset Credit System," Government of Canada, Oct. 29, 2020, https://www.canada.ca/en/environment-climate-change/services/climate-change/pricing-pollution-how-it-will-work/output-based-pricing-system/federal-greenhouse-gas-offset-system.html.

[36] D. Sawyer et al., "2020 Expert Assessment of Carbon Pricing Systems" (Canadian Institute for Climate Choices, 2021).

[37] Renaud Gignac and David Sawyer, "Canada's Carbon Pricing Update Improves Certainty, but Neglects Industrial Emissions," *Canadian Climate Institute* (blog), Aug. 12, 2021, https://climateinstitute.ca/canadas-carbon-pricing-update/.

Finally, there are a host of other industrial decarbonization and clean economy policies, which include:

- The Net-Zero Challenge is a voluntary initiative encouraging businesses to develop net-zero emission plans and seeks to normalize this as a 'default business practice.
- The Net Zero Accelerator Initiative is an $8 billion project within the Strategic Innovation Fund soliciting project applications to decarbonize high emitting sectors, foster competitiveness, and develop clean technology.
- There are also sector-specific policies, including the Battery Innovation and Manufacturing Ecosystem and the Hydrogen Strategy.

While these related initiatives are not all intended to directly address energy efficiency or energy management, they are policy and program resources the federal government could leverage to drive more uptake of EnMS. Big-ticket items like the Net Zero Accelerator aim to receive transformative decarbonization projects, and the industrial carbon pricing system must engage in a political push-pull with industries and the provinces to define minimum GHG intensity sectoral benchmarks. As noted above, having the capacity to manage energy use can lead to better outcomes from other energy related improvements a business may undertake. Similarly, industry carbon pricing systems present an opportunity to incorporate rules and expectations, regarding industry plans, and set benchmarks or standards for improvement. Presently, neither set of initiatives explicitly incorporate energy management considerations.

Provincial governments

Energy efficiency and energy management have not played as prominent roles in provincial industrial climate change policies as methane regulation, innovation, and carbon capture and storage (the latter particularly in Alberta and Saskatchewan). Some provinces have made concerted efforts or commitments to improve industrial energy efficiency as part of their climate change strategies, and most have developed some program supports for energy management through their utility demand-side management systems. The cornerstone of most provincial industrial and climate change strategies and institutions is the pricing system for GHGs, and its administration.

Québec is the only province to have explicitly included energy management as a core aspect of their industrial climate change strategy. The Energy Transition Master Plan (TEQ), originally released in 2018, includes energy management systems as one of three main actions in the industrial sector, stating an objective to provide additional financial incentives to program participants with an ISO 50001 Energy Management System certification, and leading towards making the certification mandatory for all large enterprises that participate in incentive programs between 2023 and 2028. The province currently offers higher incentives ($60/t CO2e vs $40–50/t CO2e removed) for large industrial customers who have achieved ISO 50001 certification under its EcoPerformance energy management program.[38] The recent extension of the TEQ to 2026 restates the commitment to make ISO 50001 mandatory for participation in government-led incentive programs around 2023 or 2024.

Next to Québec, British Columbia and Alberta have the most explicitly developed industrial climate change policy systems and strategies, utilizing carbon pricing revenues to support energy efficiency improvements, though in particularly different administrative structures. BC launched its suite of CleanBC initiatives in 2018, including both the CleanBC Industry Fund (which funds GHG reduction projects) and the CleanBC Industrial Incentive Program (which returns a portion of paid carbon taxes to facilities exceeding world carbon intensity benchmarks). Both programs are funded at the portion of carbon price revenues from industry contributions above $30/t CO2e. The province also offered an ISO 50001 implementation incentive which matched federal funding between 2015–2020. The province has also laid out a clear vision for the future for industry in its 2021 CleanBC Roadmap to 2030, which sets sectoral emission reduction targets, commits to expanding the CleanBC programs for industry, plans to launch a new industrial climate program specifically for oil and gas in 2023, and will require new large industrial facilities to have net zero by 2050 plans and demonstrate plans for emission reduction compliance in 2030 and 2040.

Utilities in British Columbia have also offered energy management programs for many years. The energy manager program at BC Hydro started in the mid-2000s. More holistic energy management programs of some form or another (for electricity customers of all sizes) have been in the market since before 2010. But they have only been around officially as strategic energy management (as per the CEE minimum elements) since 2012. A SEM program for natural gas customers offered by FortisBC has been available since 2019. BC Hydro has also recently embarked on a concerted electrification and load growth strategy and expanded its demand-side management activities to focus more on capacity building and fuel switching, alongside energy efficiency. BC Hydro also delivers the province's CleanBC programs. Strategic energy management programs will serve as the foundation for much of these activities.

At the core Alberta's current industrial climate policy is the Technology Innovation and Emissions System, which includes the Technology Innovation and Emissions Reduction (TIER)

[38] Innovation et transition énergétiques, "Programme ÉcoPerformance," Government of Quebec, 2022, https://transitionenergetique.gouv.qc.ca/en/affaires/programmes/ecoperformance.

regulation. TIER replaced the former Carbon Competitiveness Incentive Regulation in January, 2020, which itself replaced the even earlier Specified Gas Reporting Regulation of 2004 (the legislation that first required facilities with more than 10kt CO_2e emissions per year to submit annual reports). TIER, and the former CCIR, are effectively Alberta's output-based pricing system for industrial emissions. The proceeds have funded several industrial programs, with some targeting energy efficiency improvements—such as the current $131 million in funding represented by the Industrial Energy Efficiency and Carbon Capture, Utilization and Storage program, or the previous sector-specific industrial energy efficiency program, which targeted the pulp and paper, chemical, fertilizer, and metals industries. The repeal of the 2017 Climate Leadership Act in 2019 ended the 'carbon levy,' which had supported the work of Energy Efficiency Alberta (which subsequently closed in 2020). Several energy management programs —an on-site energy manager program, and two strategic energy management programs, one for all industry, one specifically for large final emitters—were transferred to the Department of Environment and Parks and received additional funding from the federal government. These continued to run until 2021. Utilities in Alberta do not have demand-side management programs.

Though other energy management programs have been offered in other provinces for years as well (notably, Nova Scotia and Ontario), energy efficiency—or energy management, for that matter—has not figured as prominently in their industrial climate change strategies to date. Setting up a provincially administered industrial OBPS was the primary focus for industrial policy in Manitoba, New Brunswick, Nova Scotia, Ontario, and Saskatchewan. The most recent climate strategies for Newfoundland and Labrador and Prince Edward Island do not identify actions for industry, specifically. Nova Scotia, New Brunswick, Newfoundland and Labrador, PEI, and Saskatchewan each allocate carbon pricing revenues to some form of dedicated fund for emissions reduction projects, and both New Brunswick and Nova Scotia use some of these funds to support energy efficiency programs (including, in Nova Scotia, an industrial energy manager program). Saskatchewan has yet to detail how its technology fund will operate, and Ontario has not yet specified how it will use proceeds from its OBPS. Manitoba is the only province that remains on both the federal fuel charge and OBPS backstops.

The Québec government's EcoPerformance program is the only provincial program in Canada to explicitly provide financial incentives for EnMS certification, and to leverage incentives in other programs to drive certification. Many provincial program administrators state their programs are informed by ISO 50001 guidelines and support is provided if the customer indicated an interest in pursuing certification, though this support is largely consultative. However, while some programs may be based on ISO 50001 principles, and training on ISO 50001 is provided to those interested, no provincial policy or program actively pushes for ISO 50001 certification. Rather, the focus of program administrators generally appears to be on short-term energy savings and using SEM-like programs to drive or structure participation in other programs. The motivation and decision to pursue ISO 50001 is entirely discretionary, up to the customer, and not a focus of any program administrator.

However, program evaluations and studies suggest that interest in pursuing certifications like ISO 50001 is low, or at least not strong, among industrial program participants. A 2020 evaluation of Efficiency Nova Scotia's energy management programs found plans for certification varied among program participants—two out of five participants surveyed stated a high likelihood they would pursue certification in the next three years, two stated a 50 per cent likelihood, and one stated they had already accomplished their goals and achieved ISO 50001 ready status.[39] The evaluator also conducted a jurisdictional scan of one other Canadian (BC Hydro) and four US program administrators, and found that none offered incentive support or detailed technical assistance for certification, and several jurisdictions reported low interest among participants. Similarly, a study conducted by Ipsos in 2021 for Enbridge found low interest in support for pursuing certifications like ISO 50001 among the 33 large industrial customers interviewed, with only 11 respondents indicating they were very or somewhat interested. Respondents reported much higher levels of interest in other elements associated with energy management however, including support for metering and submetering equipment (82 per cent interested), developing an energy management plan (76 per cent), process optimization (76 per cent), and incentives for EMIS implementation and training (73 per cent).[40]

International examples

Energy management and energy efficiency may be promoted and supported through programs and initiatives at both the federal and provincial levels in Canada, but few connections exist to other policy initiatives. Contrast this approach with that taken in Europe or Asia, where energy management is often more integrated in broader industrial and/or climate policy strategies. Under the 2012 European Union Energy Efficiency Directive, EU member countries were required to mandate regular (every four years) energy auditing of large companies with a goal to encourage companies to exploit identified energy efficiency opportunities. The directive also

[39] Econoler, "Final Report: 2020 DSM Programs Evaluation" (Nova Scotia: EfficiencyOne, March 26, 2021), 65.

[40] Ipsos, "Enbridge Gas Inc. DSM Next Gen Customer Engagement (Industrial): Final Report," Enbridge 2023-2027 DSM Plan (Toronto: Enbridge Gas Inc., Jan. 2021), 42.

called for countries to introduce national incentives to support energy audits for SMEs.[41] In many countries, ISO 50001 certification is an alternative compliance path that exempts the organization from the energy audit requirement.

In Germany, the Energy and Climate Fund (established in 2010) provides funding to energy intensive industry actors to help offset costs associated with the EU emissions trading system (ETS). The government also provides incentive programs for EMIS, EnMS, and for enterprise-specific measures to increase the efficiency of the entire production process. Companies are required to report energy audit data to a non-public government database (though ISO 50001 certifications exempt companies from the audit requirements). Other incentives include exemptions from certain taxes for companies, as well as a program for the introduction and retention of ISO 50001 in SMEs. Recently, government and industry actors have also established 'energy efficiency networks'—a network of between eight and 15 companies that receive energy savings advice and recommendations from an energy consultant and set energy intensity targets for themselves, as well as action plans to achieve it.

In the UK, there are three main industrial initiatives. The Climate Change Agreement (CCA) is a voluntary initiative encouraging energy intensive participants to set energy efficiency or GHG reduction targets in exchange for a reduced climate change levy. The Carbon Reduction Commitment CRC Energy Efficiency Scheme (CRECEES), which was available until 2019, offered a range of information, reputational, and financial supports to encourage organizations to develop energy management strategies. Finally, the Energy Savings Opportunity Scheme (ESOS) is the UK's implementation of the EU energy audit requirements, which requires certain facilities to undergo energy auditing every four years.[42]

In Japan,[43] all energy efficiency policy is rooted in the 1979 Energy Efficiency Act, which established performance standards, energy reporting, and energy management requirements for all sectors. The act requires companies to establish energy management systems and report yearly energy consumption, and to submit mid- and long-term energy efficiency plans. The act also sets a non-binding performance target for companies to reduce energy intensity by one per

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[41] International Energy Agency, "Energy Policies of IEA Countries: United Kingdom 2019 Review" (Paris: IEA/OECD, 2019).

[42] "Energy Savings Opportunity Scheme (ESOS)," GOV.UK, accessed Jan. 31, 2023, https://www.gov.uk/guidance/energy-savings-opportunity-scheme-esos.

[43] International Energy Agency, "Japan 2021 Energy Policy Review" (Paris: IEA/OECD, March 16, 2021), https://doi.org/10.1787/72bb987a-en.

cent per year. In Korea,[44] the government requires five-year energy efficiency plans. The latest plan includes a target to install 1,500 energy management information systems by 2030, which includes promoting the uptake of ISO 50001. The government plans to conduct energy savings performance evaluations for five years after the EMIS project implementation. Korea also has a voluntary annual one per cent performance target for industry, and companies over a certain energy consumption threshold are obliged to conduct energy auditing every five years.

Tracking energy management

It is difficult to determine the extent to which energy management practices are widespread in industry for many reasons (low interest in certification being one). Internationally, we can track ISO 50001 certifications as a proxy for industrial management systems. According to data collected through the ISO's own annual survey of all its certifications, most ISO 50001 certifications are concentrated in Europe (69 per cent of all certifications in 2020), followed by East Asia and Pacific (23 per cent). North America accounted for only 0.5 per cent of all certifications, or 106 certifications. Within Europe, Germany alone had 6,436 certifications, followed by the UK at 1,277 in 2020. China accounts for 83 per cent of certifications in East Asia.

[44] International Energy Agency, "Korea 2020 Energy Policy Review" (Paris: IEA/OECD, Dec. 16, 2020), https://doi.org/10.1787/2f15bd8f-en.

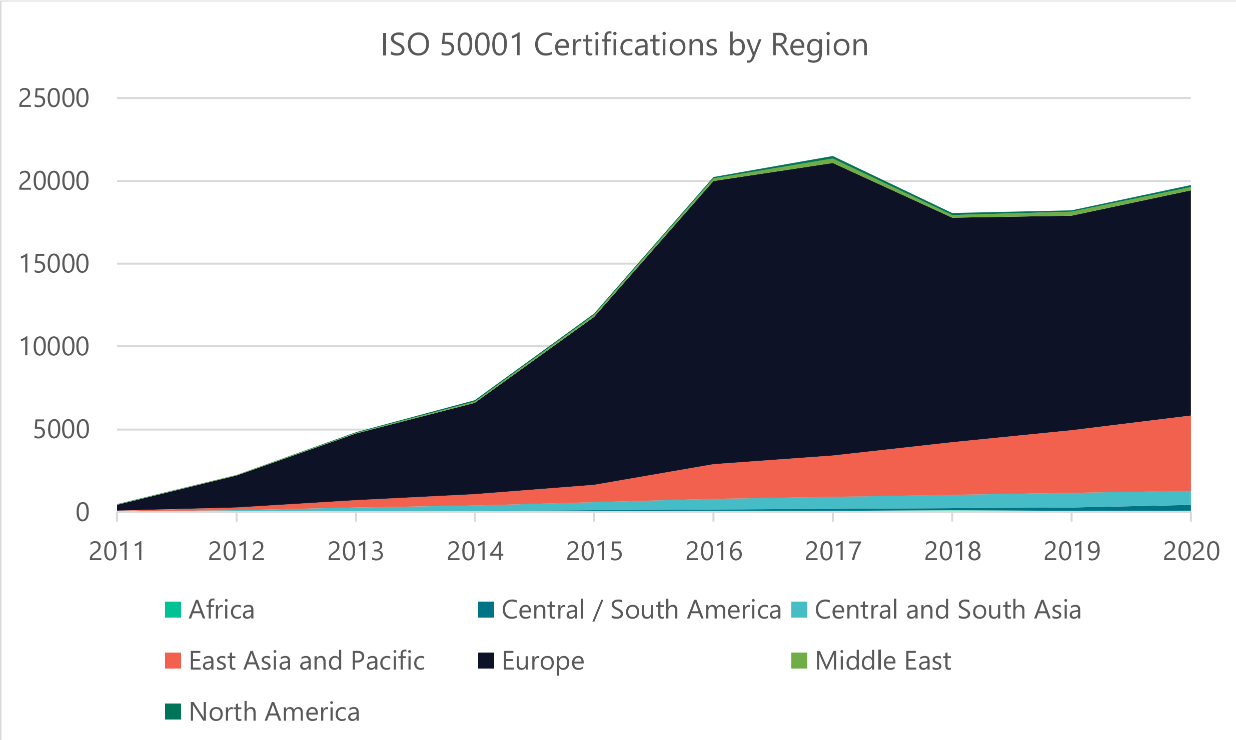

Figure 3) ISO 50001 certifications by geographic region.

Tracking ISO 50001 certifications within Canada is more challenging. According to data gathered by the ISO in its annual survey of certifications,[45] there were 18 active ISO 50001 certifications in Canada in 2020, across 24 separate sites.[46] Natural Resources Canada also maintains a list on its website, which lists 19 companies and 168 sites (or 43 sites when excluding 125 Hilton hotels and resorts). (Note: both datasets would include commercial or institutional facilities).

Assuming NRCan's list of ISO 50001 certifications is accurate, a very small percentage of Canadian industry—and, therefore, industrial energy use and emissions—has a comprehensive energy management system in place (especially considering the Natural Resources Canada list includes commercial or institutional companies). Companies that produce over 10 kt of GHGs annually are required to compile and report annual emissions through the Greenhouse Gas Reporting program, established in 2004 under the authority of section 46 of the Canadian Environmental Protection Act. Each entry is categorized by North American Industry

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[45] International Standards Organization, "ISO Survey 2021," ISO, accessed Jan. 31, 2023, https://www.iso.org/the-iso-survey.html.

[46] Data on certifications in this dataset is geo-located in the country from which the certifying agent originated, not necessarily the country in which the certified organization operates. It is possible, therefore, that Canadian ISO 50001 certifications could differ from this value.

Classification System (NAICS) code to the six-digit level, which allows for summary data to be produced for industrial subsectors. According to this data, 442 companies produced approximately 72 per cent of industrial emissions in Canada, or 28 per cent of total national emissions, in 2020. If all the 19 ISO 50001 certificates listed by Natural Resources Canada were industrial, only two per cent of facilities would presently have an (certified) energy management system in place.

Table 3) Industrial companies and facilities exceeding 10KtCO2e emissions per year[47]

	NAICS codes	**Companies**	**Facilities**	**GHGs** (MtCO2e)
Total industry*	-	442	1198	189.7
Oil and gas	211, 32411	134	720	118.7
Heavy industry*	-	211	314	66.5
Mining	2122, 2123	*59*	*81*	*7.5*
Smelting and refining	331313, 33141	*11*	*21*	*8.2*
Pulp and paper	322	*54*	*78*	*5.9*
Iron and steel	3311, 33151	*14*	*20*	*13.4*
Cement	327310	*7*	*15*	*10.5*
Lime and gypsum	32741, 32742	*8*	*16*	*1.9*
Chemicals & fertilizers	325	*63*	*83*	*19.1*
Light manufacturing	311, 312, 321, 326, 332-339	104	164	4.6
** Totals may not sum due to duplication of companies / facilities across subsectors*				

Comparing Canada to other countries suggests that it is plausible that the tighter integration between national industrial and climate policy and energy management contributed to greater uptake of industrial energy management systems in Europe. The data suggests a large proportion of Canada's largest industrial companies do not practice energy management in a systematic fashion. However, caution should be exercised in inferring from ISO 50001 certifications about the extent and impact of energy management systems in North America and abroad for several reasons:

[47] Environment and Climate Change Canada, "Greenhouse Gas Emissions from Large Facilities," research, Government of Canada, July 6, 2010, https://www.canada.ca/en/environment-climate-change/services/environmental-indicators/greenhouse-gas-emissions/large-facilities.html.

1) Companies in Europe could be pursuing ISO 50001 solely to avoid energy auditing requirements, and may not be truly committed to developing a corporate culture of continuous improvement (e.g., a 'box-checking' approach to certification).
2) The absence of public performance reporting requirements in the ISO 50001 standard means actual energy savings impacts of energy management at the facility level are not tracked (outside of the limited period of an organization's participation in an energy management program in North America, perhaps).
3) Companies could establish ISO 50001-compliant energy management systems but decide not to pursue certification. Thus, the true extent of energy management practices in Canada could be greater than suggested by certifications.

Highly aggregated energy intensity figures for manufacturing suggest most European countries are more energy efficient than Canadian industry, which could in part be due to wider uptake of energy management practices (see Figure 3 below). While these differences could also be due to differences in the structure of each country's industrial sector, comparing the percentage changes in energy intensity between 2000 and 2018 shows Canada second from the bottom, with only a 9.2 per cent improvement. The median improvement of all countries included in this data was 31 per cent.

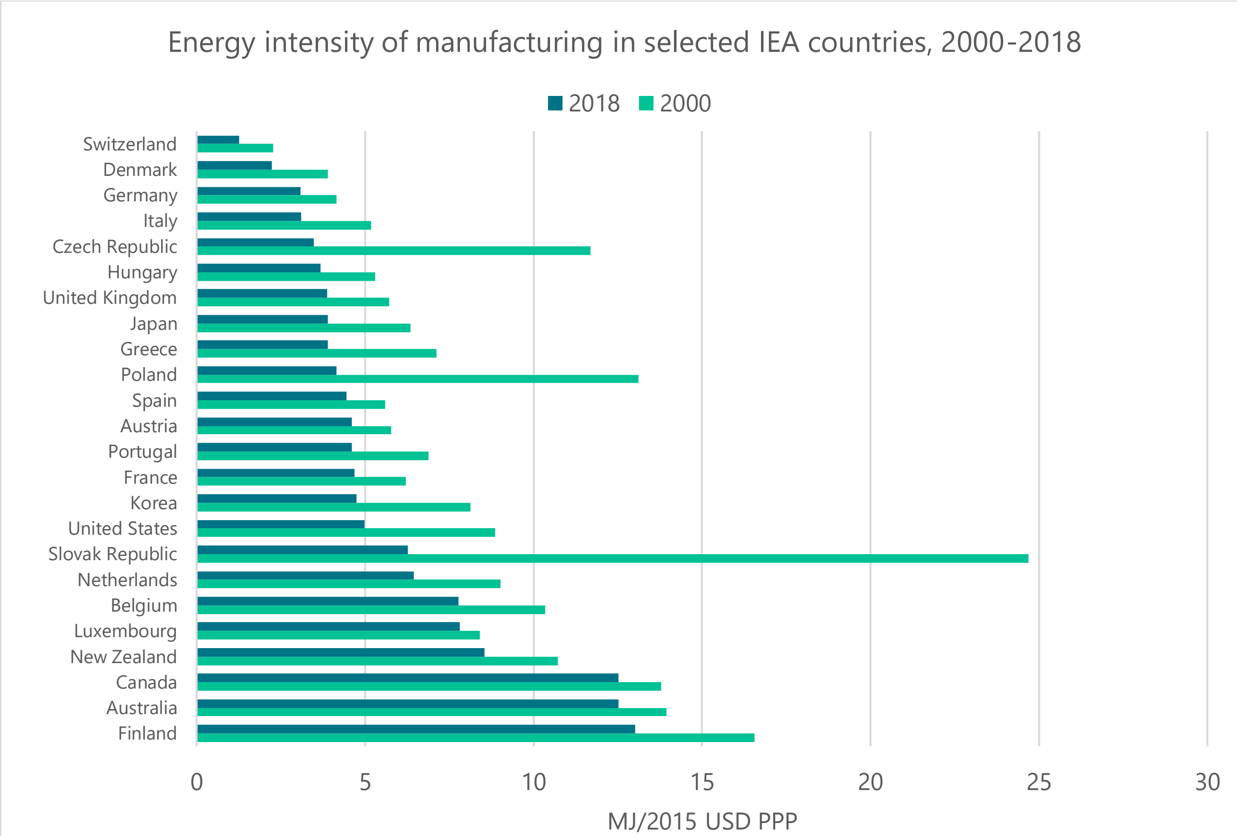

Figure 4) Energy intensity of manufacturing in select IEA countries, 2000–2018[48]

It is thus difficult to ascertain the extent of energy management practices in Canadian industry, let alone its impacts. This contrasts with existing policy and institutions tracking GHGs and other industrial products and disclose that information publicly. For example, many of the companies listed in the large final emitters database also have a National Pollutant Release Inventory (NPRI) number. The NPRI is a public inventory of pollutant release, disposal, and transfer. Among the information collected and presented in the NPRI are company pollution prevention plans and activities. Nothing similar exists for energy use, intensity, or management plans.

Climate risk and ESG reporting

Recent trends in sustainability focused finance and investment, and the resulting policy and program developments, may eventually call for greater transparency. Broadly speaking, sustainability focused investment considers organizational governance, strategies, and risk management practices in the context of climate change and identifies the metrics and targets to

[48] International Energy Agency, "Energy Intensity of Manufacturing in Selected IEA Countries, 2000-2018," IEA, accessed Jan. 31, 2023, https://www.iea.org/data-and-statistics/charts/energy-intensity-of-manufacturing-in-selected-iea-countries-2000-2018.

monitor performance toward the desired future condition (e.g., net-zero emissions). Energy management thus stands to benefit from these trends, which create an additional incentive to develop and disclose energy management strategies and performance results.

At the core of sustainability focused finance and investment trends is a growing recognition of the materiality of climate-related risks and opportunities. Materiality refers to the types of information considered relevant for the consideration and decision-making of stakeholders in the reporting company.[49] Broadly speaking, there are two perspectives on materiality: financial materiality, where the relevant stakeholders are primarily investors and the scope of influence concerns information relevant to the economic value creation of the company; and impact materiality, where stakeholders include many other groups (e.g., employees, communities) and the relevant information includes impacts on the economy, environment, and people.[50]

Recent policy developments in Canada are much more focused on financial rather than impact materiality. The Canadian Securities Administrators (CSA) launched a consultation process in October, 2021, regarding proposed rules to implement the recommendations of the Task-force on Climate-related Financial Disclosure (TCFD) in Canada.[51] The TCFD requires reporting securities issuers to disclose material information related to the organizational governance of climate-related risks, to identify and provide strategies for addressing climate risks specific to the organization, to describe organizational practices for assessing climate risks, and to disclose metrics and targets used to assess relevant climate-related risks.

While implementing an energy management system could help organizations comply with these requirements, forming part of an organization's governance and strategy for mitigating climate risks and helping to manage and reduce GHG emissions, there are no requirements within the TCFD to disclose energy management practices, plans, or outcomes. The proposed regulations from the CSA do not include any specific requirements for energy management or performance

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[49] Global Reporting Initiative, "The Materiality Madness: Why Definitions Matter," The GRI Perspective, Feb. gust22, 2022, https://www.globalreporting.org/media/r2oojx53/gri-perspective-the-materiality-madness.pdf.

[50] Global Reporting Initiative, "A Business Case for Environment & Society," The GRI Perspective, Jan. 24, 2022, https://www.globalreporting.org/media/ervdeb02/gri-perspective-business-case-for-environment-and-society.pdf.

[51] Canadian Securities Administrators, "Consultation Climate-Related Disclosure Update and CSA Notice and Request for Comment Proposed National Instrument 51-107 Disclosure of Climate-Related Matters," Oct. 18, 2021, https://doi.org/10.1163/9789004322714_cclc_2021-0225-782.

reporting, and potentially may not require securities issuers to report Scope 2 or Scope 3 emissions.

The TCFD is considered a framework, not a set of standards, for corporate climate-related reporting. A framework helps to contextualize information and provide flexibility in reporting but does not prescribe methods. A standard conversely establishes specific and detailed criteria or metrics for what should be reported on for different topics.[52] The recently published draft baseline requirements from International Financial Reporting Standards Foundation (IFRS) and the International Sustainability Standards Board (ISSB) build on frameworks like the TCFD to establish standards relating to sustainability[53] and climate disclosure standards.[54]

The combined set of IFRS and ISSB standards go beyond basic financial materiality, though may not go quite as far toward impact materiality than competing frameworks or standards. Notably, they include disclosure requirements for energy management plans for some industrial sectors. The climate-related disclosure standards include general, cross-industry requirements for certain metrics (e.g., Scope 1, 2, and 3 emissions). They also incorporate industry specific standards derived from standards developed by the Sustainability Accounting Standards Board (SASB). These standards set out unique reporting requirements for numerous industry subsectors across 11 broad groupings using a Sustainable Industry Classification System (SICS).[55] Reporting on energy management plans is considered material for a number of industries in these standards, including chemicals, iron and steel, cement, metals and mining, pulp and paper, industrial machinery and goods, and auto parts manufacturing (but not oil and gas, utilities, appliance manufacturing, and automobile manufacturing).

Recent developments suggest the IFRS and ISSB requirements are becoming institutionalized in Canada. In May 2021, various Canadian accounting and auditing oversight councils and CPA Canada established the Independent Review Committee on Standard Setting in Canada to review the governance and structure of accounting, auditing, and assurance standards (including sustainability standards).[56] The committee issued a report of its findings in December, 2021, calling for, among other things, the creation of a Canadian sustainability standards board to

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[52] https://sasb.wpengine.com/about/sasb-and-other-esg-frameworks/

[53] https://www.ifrs.org/content/dam/ifrs/project/general-sustainability-related-disclosures/exposure-draft-ifrs-s1-general-requirements-for-disclosure-of-sustainability-related-financial-information.pdf

[54] https://www.ifrs.org/content/dam/ifrs/project/climate-related-disclosures/issb-exposure-draft-2022-2-climate-related-disclosures.pdf

[55] https://www.sasb.org/wp-content/uploads/2018/11/SICS-Industry-List.pdf

[56] https://www.newswire.ca/news-releases/accounting-and-auditing-standards-oversight-councils-initiate-review-of-standard-setting-in-canada-801793361.html

work alongside existing standard-setting boards and councils in Canada,[57] and to liaise with the IFRS and ISSB in adapting and supporting the implementation of the ISSB baseline standards in a Canadian context. The CSSB was formally announced in June 2022 and aims to be operational by April 2023.[58]

The Canadian financial sector is increasingly looking to align their lending, insuring and investment activities with a net-zero emissions future, represented by their participation in initiatives such as the UN-convened Net-Zero Banking Alliance (NZBA) and the Glasgow Financial Alliance for Net-Zero (GFANZ). Broadly, these efforts reflect the position, as defined by GFANZ, that the greatest emissions reductions may be achieved by directing financing and related services to firms and/or assets that need to transition, rather than by divesting from them.[59] A key challenge in doing so is to ascertain whether (or to what extent) a company is truly aligned or seeking to align with a transition pathway toward net-zero emissions. As of October, 2021, six of Canada's largest banks had joined the NZBA, including Bank of Montreal, CIBC, National Bank of Canada, Royal Bank, Scotiabank, and TD.[60]

Certain industrial subsectors have developed their own sustainability standards, frameworks, and certification programs. Perhaps the oldest such program is the chemical industry's Responsible Care program, established in Canada in 1985, following the Bhopal disaster. Though initially focused primarily on workplace and environmental safety, since 1992 the program has aligned the main areas on which companies must report with the UN Sustainable Development Goals. This encompasses a wide range of issues related to sustainability. Participation in the program is a requirement for membership in the national industry association, and periodic third-party verification by experts and members of the public is required to remain certified by the program.

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[57] Canada is unique in its approach to standard-setting, which is legally housed within the professional accountancy body (CPA Canada), while other jurisdictions make it a function of government, or a separate private sector entity.
[58] https://www.frascanada.ca/en/cssb
[59] Glasgow Financial Alliance for Net Zero, "Financial Institution Net-Zero Transition Plans: Executive Summary," n.d.

[60] BMO Financial Group, "Six of Canada's Largest Banks Join United-Nations-Convened Net-Zero Banking Alliance," Cision (Newswire), Oct. 15, 2021, https://www.newswire.ca/news-releases/six-of-canada-s-largest-banks-join-united-nations-convened-net-zero-banking-alliance-801190199.html.

Similar standard and certification programs exist for other industries, such as steel (Responsible Steel)[61], and mining (Towards Sustainable Mining).[62]

There are, thus, a plethora of competing frameworks, standards, protocols, and platforms for reporting on climate-related risks and/or broader ESG goals and activities. This can lead to confusion and criticism of the legitimacy of ESG commitments (see ‘Challenges’ below). One of the key recommendations from the IEA in its recent report, “Achieving Net Zero Heavy Industry Sectors in G7 Members,” is for governments to work on consolidating and coordinating among various measurement standards for assessing emissions intensity of materials, and to ensure their fitness for the purpose of a clean energy transition—both in terms of existing methods and innovative processes that could be deployed at scale in the future.[63] Ensuring harmonized reporting requirements include statements of energy management plans, and preferably energy use performance reporting, could create more market demand for them. Conversely, developing energy management capacities now will help prepare industry for this new and emerging investment and financing context.

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[61] “ResponsibleSteel: Standards and Certification,” accessed Jan. 31, 2023, https://www.responsiblesteel.org/.

[62] “Towards Sustainable Mining,” *The Mining Association of Canada* (blog), accessed Jan. 31, 2023, https://mining.ca/towards-sustainable-mining/.

[63] International Energy Agency, “Achieving Net Zero Heavy Industry Sectors in G7 Members.”

Challenges facing energy management in Canada

The preceding section surveyed existing and emerging policy systems and programs that could directly or tangentially impact energy management practices in Canada. This survey found that energy management is at best a secondary concern in many federal and provincial climate and industrial policy strategies, and that it is not closely integrated into many flagship policies and programs. It also noted that it is difficult to track the existence of energy management practices or their outcomes. While climate risk and ESG reporting rules in Canada present an opportunity for energy management, the present state of rules in Canada is not conducive to transparent, continuous improvement in energy performance.

This section discusses the challenges facing energy management in Canada that derive from the present configuration of these policy systems. This analysis is informed by the information above, as well as literature research and discussions with experts, including program administrators and implementers, technical experts, industry representatives, and policymakers. Other studies tend to categorize challenges by their type, such as financial, market, organizational, etc.[64] This approach tends to isolate barriers to overcome, but it risks masking the interconnections between factors that influence uptake of energy management systems. The approach taken here is to instead organize this discussion by the underlying issue associated with a given policy system. In this respect, we identify three broad factors shaping both the challenges facing energy management and the opportunities to address them: interests, resources, and legitimacy.

Interests

Business has an interest in the cost savings and efficiencies improved energy efficiency may bring. Utilities have an interest in ensuring long-term, persisting energy savings to meet required goals and to avoid supply side energy system costs. Governments have broader societal interests in industrial competitiveness, the environmental and macroeconomic implications of energy waste which has been primarily focused on reducing GHGs with increased emphasis on climate policy. But, one of the principal challenges facing energy management is that policy systems and associated institutions are not organized such that the interests of the key actors involved (industry, government, program administrators) align in the pursuit of long-term, verifiable, and continuous improvements in industrial energy management and efficiency.

[64] Institute for Industrial Productivity and International Energy Agency, "Energy Management Programmes for Industry: Gaining through Saving."

It is widely recognized having the full support of senior management is of critical importance to the success of an organization developing and implementing an energy management system. Indeed, having the express support of management is a condition for eligibility in several SEM programs already in place in Canada. At the same time, however, many experts and people working in the field have found that "production is literally everything," in many industrial workplaces, and—even in situations where there is executive support—proposing changes to production processes for energy management purposes is often a non-starter. In some cases, there may be internal personnel issues to resolve, since energy management may be the responsibility of a dedicated energy manager or a chief engineer, who may be perceived to be working against the production manager. More generally, there may be a competition within the company over the allocation of capital toward production versus energy efficiency projects. Another broader issue concerns the depth of corporate appreciation of and concern for sustainability impacts associated with their businesses, beyond how these may impact the future wellbeing of the company.

In short, though management may support the idea of energy management in principle and may be motivated to pursue it for reasons other than financial interests, it is generally of secondary importance compared to production. This situation creates an odd sort of policy risk associated with generous incentive programs or mandatory regulations. Either may dilute the motivation of a business to implement an energy management system, making the likelihood of true corporate culture change less likely—and with it, persistent, continuous improvement. Standardization and certification are not guarantees against this. Some experts we spoke to suggested companies may take a 'box-checking' approach to ISO 50001 if they are mandated to get certified, or if certification is an alternative compliance method for other energy related mandates. This may be particularly true in the absence of performance reporting requirements, as required under the US Superior Energy Performance program. Others suggested financial incentives could work against persisting energy management practices, if the existence of the incentive was critical for the decision to participate in a program and the business achieves its initial outcomes within a short time frame, and then the incentives go away.

Unfortunately, as shown by evaluation studies and discussions with program administrators, it can be difficult to attract program participants to non-incentive SEM programs. Conversely, energy management programs with incentives (e.g., for an on-site energy manager) may struggle to achieve cost-effectiveness, since most of the energy savings achieved will likely be from participation in other, incentive industrial programs the energy manager directed the business to participate in. In some cases, such energy savings are attributed only to the custom or prescriptive program, not the energy management program. SEM programs are, thus, often treated as enabling or customer engagement initiatives, used to help drive participation in other industrial program offerings. As Rogers et al., note, energy management programs require a different set of resources than rebate programs—specifically a long-term approach to customer engagement—which raises costs for program administrators. If program administrator goals can be met through conventional prescriptive/custom programs, why should they bother with SEM?[65]

This indicates another dimension to the underlying disjunction of interests. Though energy efficiency program administrators (in many cases utilities) do have an interest in projects that reliably deliver energy savings over a long time, targets are often set for annual incremental energy savings, and cost-effectiveness is reduced by requirements for long-term engagement when future energy savings are uncertain. In this context, an ideal energy efficiency program maximizes long-term savings while minimizing program administrator involvement past the year in which the initial, incremental annual savings are recorded. However, the persistence or continuous improvement of energy management practices may require long-term continuous involvement and engagement from the program administrator Similarly, if the program participant continues with energy management after their participation in the program ends (which they may not, if their initial goals were achieved), any further incremental energy savings realized because of energy management provide no reporting benefit to the program administrator (unless attributed to a separate industrial efficiency program).

The interests of efficiency program administrators are more in realizing reportable energy savings than they are in continuously improving energy management practices (let alone standardization and certification). Policymakers, conversely, are generally more interested in developing the capacity for energy management in industry, and in how capacity can be strengthened, measured, and tracked (i.e., through standardization and certification). In short, program administrators are more interested in (short-run) outcomes, while policymakers are more interested in process. While most provincial energy management programs are designed around ISO 50001 principles, may cover all the components necessary to achieve ISO 50001-ready status, and may provide technical support for participants wishing to pursue ISO 50001 certification, none require it. Only the Québec government's EcoPerformance program and Natural Resource Canada's ISO 50001 incentive program provide incentives specifically for certification.

A further complication, particularly concerning the potential contribution of energy management to decarbonization, arises from the generally siloed approach to demand-side

[65] Rogers, Whitlock, and Rohrer, "Features and Performance of Energy Management Programs," 18.

management in Canada, within which most program supports for energy management exist. For example, an evaluation of the IESO's energy manager program found that achieving GHG reductions and a return on investment are important factors for energy managers' prioritization of projects. However, as an electricity ratepayer-funded program, energy managers only report electricity savings. While many projects energy managers pursued led to natural gas savings, these are not reported to the IESO, acting as an electricity only energy efficiency administrator. Furthermore, because the program is intended to achieve electricity savings, energy managers did not consider beneficial electrification strategies to achieve the GHG reductions that were important in prioritizing projects.

In instances where natural gas and electric program administrators collaborate on energy management program offerings, fuel switching may occur though it might not be a priority. The IESO collaborated with both Natural Resources Canada and Enbridge to jointly offer the energy manager program in 2019. Energy managers had to commit to reducing total annual facility consumption by three per cent, through both electric and natural gas savings. Only half of the energy managers surveyed in the evaluation said they had implemented or planned to implement a beneficial electrification project, and most indicated that projects were not prioritized based on electric versus natural gas savings targets, but instead on the business case for making the improvements. The implication is that, even where program administrators collaborate on energy management program offerings, demand-side management policy systems are not configured to maximize resources directed toward public policy goals like decarbonization.

Resources

This brings us to a second set of issues affecting energy management: the necessary resources to facilitate energy management—particularly in pursuit of decarbonization—are either not allocated effectively, or are in short supply. This includes financial resources, but also policy and human resources. There are at least a few areas in which this is the case: industrial carbon pricing systems, incentive structures in efficiency programming, workforce capacity, and data availability.

The effectiveness of a carbon pricing system can be considered "a function of both a broad coverage of emission sources and an expectation of an increasingly stringent price signal that incents continuous emissions reductions."[66] In both respects, industrial carbon pricing systems in Canada are not as effective as they could be. A recent report by Sawyer et al., provides a

[66] Sawyer et al., "2020 Expert Assessment of Carbon Pricing Systems," 25.

comprehensive and technical review of carbon pricing systems in Canada, finding industrial carbon pricing systems vary from province to province in terms of thresholds for voluntary participation (which may determine access to rebates and financial supports for small= and medium-sized businesses), whether industrial process emissions are covered by pricing systems, and notes concerns about fairness, transparency, and legitimacy. The report also noted that many industry systems are opaque—quantities of compliance emissions or banked compliance units are not published by all provinces, which makes comparison of marginal costs challenging. System-wide compliance information is typically not available, which makes it impossible to assess market conditions. The generous allocation of free credits further dilutes the price signal of an already less stringent system. How the determination of trade-exposed status is made is also unclear in every jurisdiction.

There are several resource-related missed opportunities here. The patchwork of provincial systems with different levels of flexibility and stringency reduces the perceived legitimacy of these systems and fails to send long-term signals for low-carbon investment decisions. More broadly, industrial carbon pricing systems are policy resources that are not being adequately utilized to bridge to and incentivize transparent improvements in industrial energy and GHG intensity. Carbon pricing also introduces the potential to use revenues to support this broader policy mix, but there are almost no cases in Canada where carbon pricing systems are tied explicitly to energy management systems, either through incentives and/or support from revenues (similar to Québec's EcoPerformance program) or through requirements on industry to develop energy management plans (some provinces may require industrial companies to submit GHG management plans, but these are not made public).

Another resource issue impacting energy management systems is the availability, size, and continuity of incentives. Energy management is not cheap; there are many upfront costs associated with gathering the support of senior management, establishing an energy management team or hiring an energy manager, conducting energy audits or feasibility studies, and so forth. The IEA identified access to financing as a barrier to energy efficiency measures in industry.[67] In most provinces, there are program incentives for many of these components of energy management, though they are not always included in or explicitly connected to comprehensive energy management programs. Some SEM programs provide no incentives at all and interested companies may instead pay a fee to participate in them. Treating such programs as customer engagement strategies to attract more participation in other incented programs

[67] International Energy Agency, "Canada 2022 - Energy Policy Review" (Paris: IEA/OECD, 2022), 98.

appears commonplace, but leveraging incentive programs to drive participation in SEM programs is rare, if non-existent, in provincial and federal programming.

When potential participants are unclear about the real benefits of the program combined with associated operating costs of ongoing energy management, recruitment and retention becomes more challenging. The resources available in terms of finances, and administrative and technical support must be made clear. An evaluation of BC Hydro's Leaders in Energy Management (Industrial) program found that cost reduction is the main motivator of participants and that costs were cited as the biggest barrier to implementing SEM, alongside competition from other corporate initiatives and overloaded resources.[68] Conversely, other evaluations and discussions with program administrators for this report highlighted that a core benefit of SEM programs that provides value to participants is the project management and technical support provided by the program administrator, either directly or via cohort programs and consultants. However, potential participants may not be aware that they will find significant value in these non-financial supports, which may heighten concerns about returns on investment.[69]

Another issue concerning incentives and incentive structures is the continuity of funding support. In several provinces, special industrial programs, including energy management programs, have been supported through government funding —either provincial (e.g., general budgets, carbon price revenues), federal (e.g., LCEF), or a combination of both. However, these are generally not long-term, dedicated funding arrangements. Where carbon pricing revenues are used to fund projects to reduce GHGs, energy efficiency—let alone energy management systems—is not always explicitly recognized as an eligible project type. A related issue is the extent of engagement and support from utilities and/or project administrators after a customer's participation in an energy management program ends. Practices vary across the provinces but based on research conducted for Efficiency Canada's 2022 Scorecard, few program administrators have formal procedures for continued engagement post-participation.[70]

Such arrangements are not conducive to persisting comprehensive energy management system programs and create uncertainty in the broader market about the longevity of public support for energy efficiency. This is a challenge because businesses generally lack the capacity and

[68] BC Hydro, "Demand Side Management Milestone Evaluation: Summary Report F2020" (Vancouver, B.C., Dec. 2019), 17.

[69] Econoler, "Final Report: 2020 DSM Programs Evaluation."

[70] BC Hydro and FortisBC run 'alumni cohorts' for customers that have graduated from their program and are no longer eligible for the core funding option. Alumni's receive a "lighter touch" form of support.

resources to carry on with energy management systems absent dedicated support, even larger companies. The IPSOS study commissioned by Enbridge found that most large industrial companies surveyed don't have dedicated internal resources or technical expertise for energy management. Instead, energy management is often the responsibility of another person with other core responsibilities, such as innovation, research and development, plant management, or engineering. Additionally, the primary mandate is often cost containment. Owning to the lack of internal resources, few large industrial companies surveyed had an energy management plan in place. The internal resource challenge is likely exacerbated for small and medium enterprises.

While having onsite, dedicated energy managers for larger companies and cohort programs for small and medium-sized companies may help to address this problem, energy managers themselves may not always possess the resources—time, management support, technical expertise—necessary to carry out their duties optimally. For example, they may not always be equipped to deal with novel, non-routine situations (the COVID-19 pandemic, for example) in their measuring of facility consumption baselines and estimation of energy savings.[71] They may also lack the guidelines, tools or training to explore beneficial electrification solutions, or to include assessment of non-energy benefits in their analyses.[72]

A common observation made several times in our discussions with experts was that engineers (to whom the responsibility for overseeing an energy management system typically falls) are not always the most effective advocates or promoters of the benefits of energy management. While networks for industrial energy efficiency like CIPEC exist, meetings, materials, and case studies can be heavily technical, which may not be interesting or persuasive to senior decision-makers in an organization. Similarly, there are few organizations in Canada (outside of government or efficiency program administrators) that are actively promoting and advocating for industrial energy management systems. The consequence is that energy management and its potential benefits are not widely recognized and are thus not likely to garner the attention of senior industry executives, let alone persuade them of its value.

One final resource-related challenge is data, including both data availability and the ability to do something with it if it exists.[73] This challenge is multidimensional, there are data limitations

[71] McKane et al., "Predicting the Quantifiable Impacts of ISO 50001 on Climate Change Mitigation."

[72] EcoMetric, "Interim Framework Energy Manager Program PY2020: Impact and Process Evaluation" (Toronto, ON: Independent Electricity System Operator, Sept. 13, 2021).

[73] International Energy Agency, "Canada 2022 - Energy Policy Review," 98.

within firms (e.g., lack of adequate submetering); limitations in terms of overall and/or firm-level energy consumption and production data from industry; restrictions on public disclosure of such data, if it exists, for privacy and competitiveness related reasons; or, as discussed below, concerns about the legitimacy of sustainability related disclosures. The lack of good data hinders energy management practices in industry, along with investment, policy making, and advocacy efforts. Furthermore, even in instances where data does exist (e.g., through recent energy audits), there may not be sufficient human resources to analyze and interpret the data, or to establish a plan based upon it.

Legitimacy

Finally, a third set of considerations impacting energy management practices in Canada might be classified under 'perceptions of legitimacy.' This is a complex issue which touches on the actual impact of energy management practices, how energy management programs are perceived by regulators and utilities, standardization (or lack thereof) in energy management programs and reporting practices, the value and implications of the certification of energy management systems, as well as the general concept and current practice of ESG corporate reporting. At the core of this issue is the question of whether professed plans, achievements, and impacts are real—a question which is derived from the intentions and actions of organizations involved, but also the principles, rules, and institutions governing them.

As noted above, program evaluations and other studies have found there is not much interest among Canadian industry in pursuing ISO 50001 certification, even if there is an organizational commitment to developing energy management practices and systems (a finding supported by our discussions with experts). Why? Common answers include the fact that business is generally interested in energy management for its potential to reduce costs, and that this can be accomplished without ISO 50001 certification. Certification therefore presents additional, ongoing costs with little value to the business. Other answers include that businesses in North America are put off by the ISO bureaucracy, that ISO is more a 'Europe thing,' or that ISO certification is mainly just about branding. Certification does not necessarily mean there is a guarantee of a corporate commitment to continuous improvement in energy management, nor of performance. Business may take a 'box-checking' approach to EnMS if doing so is less onerous or costly than alternate regulatory mandates, and ISO 50001 certification itself has no performance reporting requirements (although alternatives, like the US DOE' SEP 50001 do). For energy management to achieve its fullest potential, there must not only be management buy-in for the purposes of cost reduction, but also a corporate recognition of the broader benefits of sustainability.[74]

Certification, in other words, may not be a reliable indicator of energy management practices or impacts. But, without the necessary standardization that underpins certification, concerns may still arise over the stated impacts of energy management, as well as the extent and duration of which it is practiced. For example, standardization in evaluation, measurement and verification practices in ISO 50001 guidelines are helpful for ensuring that energy savings are appropriately normalized (i.e., take into consideration impacts of weather, etc.). While many SEM programs in Canada are ostensibly based on ISO 50001 principles, there is still considerable variation in their design and implementation. The consequence is energy management and evaluation practices in industry resulting from such programs may also vary.

However, standardization can be a double-edged sword. While it may increase the perceived legitimacy of energy management practices and outcomes, it could also be a barrier to uptake if it doesn't permit some flexibility. In principle, rigorous and restrictive standards (and associated requirements for reporting, for example) bolster credibility. But they also risk slowing down experimentation, learning, and ultimately progressive improvements in energy efficiency. Conversely, flexible and lenient standards may be more quickly adopted and more easily promoted, but also risk being seen as lacking credibility, insincere, or easily manipulated by unscrupulous actors. The aforementioned lack of interest in pursuing energy management certification—by industry, as well as program administrators—may be due in part to this dilemma, which opens the endeavour to criticism over real impacts of energy management programs and practices.

The tensions between standardization, flexibility and uptake (and the consequent implications for legitimacy) resonate through the broader policy system for industrial energy management as well. This is perhaps most true of evolving climate and ESG reporting and investing policy regimes, where the multiplicity of standards and platforms, and often voluntary and discretionary reporting guidelines, have certainly not hindered the spread of such practices, nor criticism thereof.[75] In this context, organizations are not bound to rigorous measurements of

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[74] McKane et al., "Predicting the Quantifiable Impacts of ISO 50001 on Climate Change Mitigation."

[75] Shivaram Rajgopal, "ESG – A Defense, A Critique, And A Way Forward: An Evidence-Driven Pragmatic Perspective," Forbes, April 21, 2022, https://www.forbes.com/sites/shivaramrajgopal/2022/08/21/esg--a-defense-a-critique-and-a-way-forward-an-evidence-driven-pragmatic-perspective/.

performance or contributions to sustainability, leading to criticisms that ESG statements don't reflect real impacts and corporate commitments to sustainability are superficial at best.

This is relevant to energy management both because it is subject to the same tensions around standardization and adoption as climate risk and ESG reporting, but also because it stands to be an important component within corporate sustainability reporting practices. Uncertainties around the extent of corporate commitments to improvement, the persistence of management practices, and the credibility of outcomes impacts how energy management is perceived by many industry stakeholders, including provincial regulators and investors. This has material impacts on the financial viability of energy efficiency programs and projects. For example, regulators may resist approving SEM programs over concerns that operational energy savings don't persist, or rules may be restrictive in allowing program administrators to claim savings from operational or maintenance-related initiatives.[76]

This impacts the cost effectiveness of SEM programs, limiting the amount of DSM resources a utility could devote to it. The finance sector, while well-placed to request information from clients about energy management and energy efficiency, has to date lacked strong reasons to do so. Investors are generally not as familiar with the characteristics of energy efficiency projects as they are with other green energy projects and may lack the data monitoring and evaluation capacity to assess the credibility of industry claims. Concerns about the legitimacy of ESG-related initiatives, reports, or commitments are further exacerbated by the absence of regulations (in Canada) regarding sustainability reporting assurance.[77]

Many of these challenges ultimately stem from a lack of transparency in the world of energy management standards, management practices, or outcomes. Addressing this challenge is difficult. Many of the experts contacted for this report noted that industry is very sensitive and protective of data, particularly where there are potential competitiveness concerns. Reporting also creates an additional cost, which is unrelated to the objectives of the industry itself. Furthermore, given the relatively small number of facilities which comprise the vast majority of Canadian industrial GHG emissions and energy use, anonymizing data at the facility level is not sufficient to ensure privacy. Introducing mandatory reporting requirements would also be likely

[76] Rogers, Whitlock, and Rohrer, "Features and Performance of Energy Management Programs."

[77] Independent Review Committee on Standard Setting in Canada, "Consultation Paper – Independent Review Committee on Standard Setting in Canada," Dec. 8, 2021, https://www.ircsscanada.ca/en/consultation-paper.

to encounter industry opposition, which further complicates strategies for addressing transparency issues.

All of this is to say that striking the optimal balance between standardization and flexibility, adoption and legitimacy, is a core policy challenge for improving industrial energy management and its contribution to low carbon transitions in Canada. The tendency of utility systems to focus on incremental energy savings and the tendency of governments to focus on standardization of processes (i.e., ISO 50001) have not yet proven to be solutions to this challenge—either on their own, or in combination with each other. As interest in and rules concerning climate risk and ESG reporting continue to be formalized and routinized in Canada and abroad, it will be imperative to consider how and where energy management fits within such practices, and what performance indicators should be reported to overcome concerns about legitimacy.

A policy system for continuous improvement

According to the IEA, “ambitious, stable, and well-designed policy frameworks” will be vital to creating the conditions for heavy industry sectors to transition to a net-zero future.[78] The scale of the challenge is daunting—in just the next eight years, Canadian industry actors will need to cut emissions by roughly 33 per cent below 2020 levels. The real challenge will come in the years that follow, as industry will need to go beyond the current market and economic potential for emissions reduction and pursue more transformative changes. To meet this challenge, Canadians policymakers must deploy all policy approaches available to them and make sure policy systems function well.

In this report we examine the policy system(s) that surround industrial energy management in Canada. Through this process, we discovered an irony: Presently configured, the policy context for energy management does not itself reinforce a PDCA process characteristic of management systems oriented toward continuous improvement. If we wish to maximize the potential benefits of energy management, we need a policy system for continuous improvement.

A policy system approach to energy management would recognize the practice as a national environmental and competitive necessity, not a voluntary ‘opt-in’ opportunity. Industrial energy use practices (e.g., industrial climate impacts) are too important to be the responsibility of industry alone. This would entail industry facing wider societal expectations with respect to their energy management. However, they should also expect public sector partnerships and support in return. Corporate-specific energy management systems should be part of a larger partnership with actors in the policy system (e.g., governments, utilities, financial institutions, etc.) which situates such activities in a longer-term, policy goal-oriented perspective.

Accomplishing this will require aligning and building upon existing policy resources and initiatives, as well as the creation of new rules, re-defining expectations, and the integration of energy management-related requirements in ancillary policy system developments. In doing so, policymakers should give consideration to how the policy system for energy management can work to overcome challenges inherent in the current misalignment of interests among key stakeholders: the allocation (or shortage) of financial, technical, and policy resources, along with concerns about the legitimacy of both processes related to corporate sustainability and their reported outcomes.

[78] International Energy Agency, “Achieving Net Zero Heavy Industry Sectors in G7 Members.”

There are several policy actors relevant to energy management, including utility demand side management program administrators and implementers, and the CIPEC. Most provinces have programs to support strategic energy management, or other components of energy management. The recently launched federal GIFMP program substantially increases the resources available to support industrial energy management (albeit still from a voluntary approach). There are also broader federal programs and policies that could be more closely integrated with energy management, including the industrial carbon pricing system, GHG and pollution reporting compliance infrastructures, and the federal Net Zero Accelerator Initiative. In addition, there are emerging public and private sector rules around climate risk and ESG reporting.

It is possible to design a policy system from these resources that facilitates wider industrial engagement with energy management practices, reinforces certainty about their efficacy and persistence, and directs them toward long-term societal goals. Below, we discuss how these policy systems can be re-oriented to foster long-term, continuous improvement in industrial energy management.

1) Follow the management system process

There is a difference between promoting EnMS in industry and creating a policy system context that is conducive to energy management more generally. On the latter issue, we suggest there is value in following the PDCA management system process. Rather than have all those stages as the responsibility of an industrial facility or company, each action would be the shared responsibility of industry, government, utilities, and financial organizations. Like a cohort-style SEM program, the policy system should also be oriented toward 'experimental governance,' which promotes knowledge sharing, learning, and iterative improvement, rather than limited public–private engagements.[79] The federal government's GIFMP program approaches these objectives. It also aims to support projects that promote replicability and learning. But on a project-by-project basis, the overarching plan context is not as explicit as it could be, and the program does not appear to be connected with other work the federal government is doing on roadmaps for certain industrial subsectors.

2) Create or build upon industrial subsector networks

[79] David G Victor and Charles F. Sabel, "Fixing the Climate: Strategies for an Uncertain World," *Brookings* (blog), Oct. 7, 2022, https://www.brookings.edu/books/fixing-the-climate-strategies-for-an-uncertain-world/.

An ideal policy system would begin by establishing clear, consensus-based pathways for long-term improvement in industrial energy use and GHG emissions and identifying the process—and performance-based metrics—by which progress toward these goals will be assessed. The development of these pathways would be the shared responsibility of industry, government, utilities, and financial organization networks, organized for key industrial subsectors. CIPEC provides a model which might be built upon to establish such networks, though it is important that planning networks engage stakeholders at senior decision-making levels, and not get bogged down in technicalities.

Critically, these networks should recognize the industrial competitiveness and innovation opportunities as well as energy efficiency and energy management-related aspects of a clean industry transition. For example, the federal government and the Cement Association of Canada recently jointly published a roadmap to net-zero carbon concrete by 2050.[80] The report establishes a pathway for emissions reductions and highlights some of the critical technical solutions (current and future) as well as policy tools by which government and industry can work together to reach their targets. However, the report does not explicitly include energy management activities as a potential tool (though energy efficiency upgrades are recognized as one important solution). This is a missed opportunity to embed energy management-related policy goals into an important public–private collaborative planning activity.

3) Strengthen requirements related to energy management across the broader policy system

In addition to creating or building upon existing sub-sectoral networks, a policy system for continuous improvement for energy management should seek to go beyond a strictly voluntary approach. There are several ways to approach this. For instance, following the European and Asian examples noted above, Canada could mandate periodic energy auditing of large industrial facilities and reporting of results to government (with or without alternative compliance mechanisms, like ISO 50001), and/or require industry to develop and report energy management plans.

To facilitate active involvement in the energy management policy system, policymakers should aim to create what are known as 'penalty defaults' in experimental governance. These are disadvantages private companies create for themselves by not actively participating. The

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[80] Innovation, Science and Economic Development Canada and Cement Association of Canada, "Roadmap to Net-Zero Carbon Concrete by 2050" (Ottawa, ON: Government of Canada, Nov. 9, 2022), https://ised-isde.canada.ca/site/clean-growth-hub/en/roadmap-net-zero-carbon-concrete-2050.

concept is most important when facilitating engagement in the learning process, which involves the exchange of less codifiable information. More integration between EnMS and other government programs should create an advantage for active participants and a de facto penalty for lacklustre participants. For instance, good projects for the federal Net Zero Accelerator Initiative can be developed within the public–private subsector networks discussed above, which the public sector can readily fund thanks to the co-development and information exchange that occurred as part of the management system process.

Another potential source of penalty defaults involves integration of energy management elements into ESG requirements, which could see non-participants lose both legitimacy and access to private finance. Failure to participate at all through non-compliance with mandatory audit and reporting requirements suggested should be met with heavy penalties. But we emphasize that active participation in the continuous learning process is most important.

4) Consolidate and act on sustainability reporting and policy and related initiatives

Industry could view strengthened energy management-related requirements as an added regulatory burden. However, as noted in this research, there are already several reporting initiatives specific to industry and related to sustainability, which are generally mandatory for membership in the associated industry association. In addition, there are emerging rules and expectations around corporate climate risk and ESG reporting.

While there are valid concerns about the legitimacy of many ESG-related frameworks, initiatives, and impacts, the trend seems unlikely to abate and will require greater transparency. There is, thus, an opportunity to reduce the overall reporting burden on industry and to improve the legitimacy of these initiatives by working to consolidate these efforts, while also integrating energy management requirements therein.

At the same time, requirements for audits only produce audits; they do not on their own produce plans and goals or lead to actions to improve energy use performance. Requirements for industry to undertake and report on certain aspects of energy management (even if consolidated) must be backed up by adequate support for workforce capacity development and situated within comprehensive policy goals which also meet the needs of industry.

5) Find the right balance on transparency

Integral to the notion of ‘continuous improvement’ is that things keep improving. An issue our research grappled with was whether indicators of effective processes (e.g., ISO 50001 certification) are sufficient to demonstrate both a commitment to continuously improving energy use, and concrete performance improvements. Other programs, like the US DOE's SEP 50001 certification, incorporate performance targets and verification in part to address this issue. At the same time, our research suggests that interest in ISO 50001 certification is low in Canada, which casts doubt over the likelihood of interest in a more rigorous, similar program.

On the flip side of process certification is outcome verification, such as through public reporting of key performance indicators like energy or GHG intensity (output-based) at the facility or company level. However, there may be competitiveness risks and confidentiality concerns, especially given the relatively small numbers of companies comprising most of the energy use and GHG emissions in each subsector. A core challenge of a policy system geared toward continuous improvement in energy management will thus be to strike the right balance for transparency, such that the legitimacy of the underlying plans and impacts are not called into question.

We note trends in climate risk and ESG reporting may be evolving toward increased pressure for transparency and intensity based disclosure.

6) Leverage provincial utility and/or energy efficiency program systems

As noted above, technical expertise and guidance from utilities is valuable to industry, and most provinces currently offer programs to support energy management. However, the present structure of demand-side management institutions does not lend themselves toward a long-term perspective focused on continuous improvement. This results in a proven technology bias rather than experimentation with new solutions or 'soft' technologies related to cultural and behavioural change or operational improvements. Utility DSM also often operates in fuel silos, with specific focus on electricity and/or natural gas savings, instead of fuel neutral energy efficiency or GHG reductions.

A larger policy network focused on energy management could fix this mismatch by seeing federal and provincial governments funding initiatives through traditional DSM providers that fall outside of traditional utility system objectives. Relevant co-developed objectives could include:

- Fuel-neutral and GHG reduction energy saving goals, coupled with cost effectiveness testing rules (e.g., program versus portfolio level) and other planning procedures (e.g., timelines) to facilitate long term perspectives
- Pilot projects and innovation-oriented activities

- Tracking the adoption of up-to-date energy management system processes and technologies (e.g., feasibility studies, energy management information systems, embedded energy managers)
- Evaluating based on gross energy savings over a longer period or pay-for-performance approaches that track measured savings at the portfolio level, rather than net savings from programs, which must pass narrow cost-effectiveness tests
- Technical assistance and common platforms to track and manage decarbonization efforts, and training energy managers in latest decarbonization tools

These are all objectives and activities that could be supported by traditional utility DSM implementers that do not neatly fit within utility regulatory systems, but that could be supported by better policy system design and coordination.

Conclusion

This study seeks to identify and assess policy system challenges and opportunities for industrial energy management to contribute to decarbonization. It also seeks to outline program and policy strategies to facilitate greater adoption of, and improved outcomes from, energy management practices in industry. In this report, the term 'industry' encompasses the oil and gas, heavy industry (mining, chemicals, metals, pulp and paper, cement), and light manufacturing sectors. Energy management is an umbrella term encompassing a range of different initiatives, technologies, and behavioral and operational practices, in varying degrees of comprehensiveness (or the extent to which they are systematized and codified in business practices) and persistence to monitor, benchmark, and reduce the energy use of facilities and industrial production processes.

The policy areas of particular importance to this research included utility demand-side management, provincial and federal climate change and industrial policies, and corporate accounting and pollution-related reporting requirements. Research consists of literature review, desk research, and discussions with practitioners—including policymakers, program administrators, technical experts and implementers, and industry representatives. The report consists of three main sections: a background section that defines energy management and its benefits and situates it within the context of climate change targets for Canadian industry; an overview and discussion of industry and industrial and climate policy systems and programs in Canada and abroad; and an analytical section that situates challenges facing energy management in Canada within the three categories of interests, resources, and legitimacy.

We conclude by advocating for taking a policy system approach to addressing the challenges facing—and realizing the opportunities emerging in—industrial energy management in Canada. A policy system for continuous improvement would seek to de-compartmentalize and distribute energy management responsibilities among industry, government and utilities, following the Plan, Do, Check, Ask process of management systems to build on existing policy system resources to better align interests and resources toward a longer-term focus on continuous improvement in industrial energy use. To address concerns about the legitimacy of corporate claims and impacts on sustainability, a policy system approach would emphasize the creation of industrial subsector-specific networks, establish clear and transparent pathways to achieving a net-zero future, and identify the necessary performance indicators required to track progress toward these goals, while ensuring space for iterative learning, experimentation, and planning.

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