THE COMMUNITY TRANSFORMATIONS PROJECT

Supporting Workers and Communities on the Road to Net Zero

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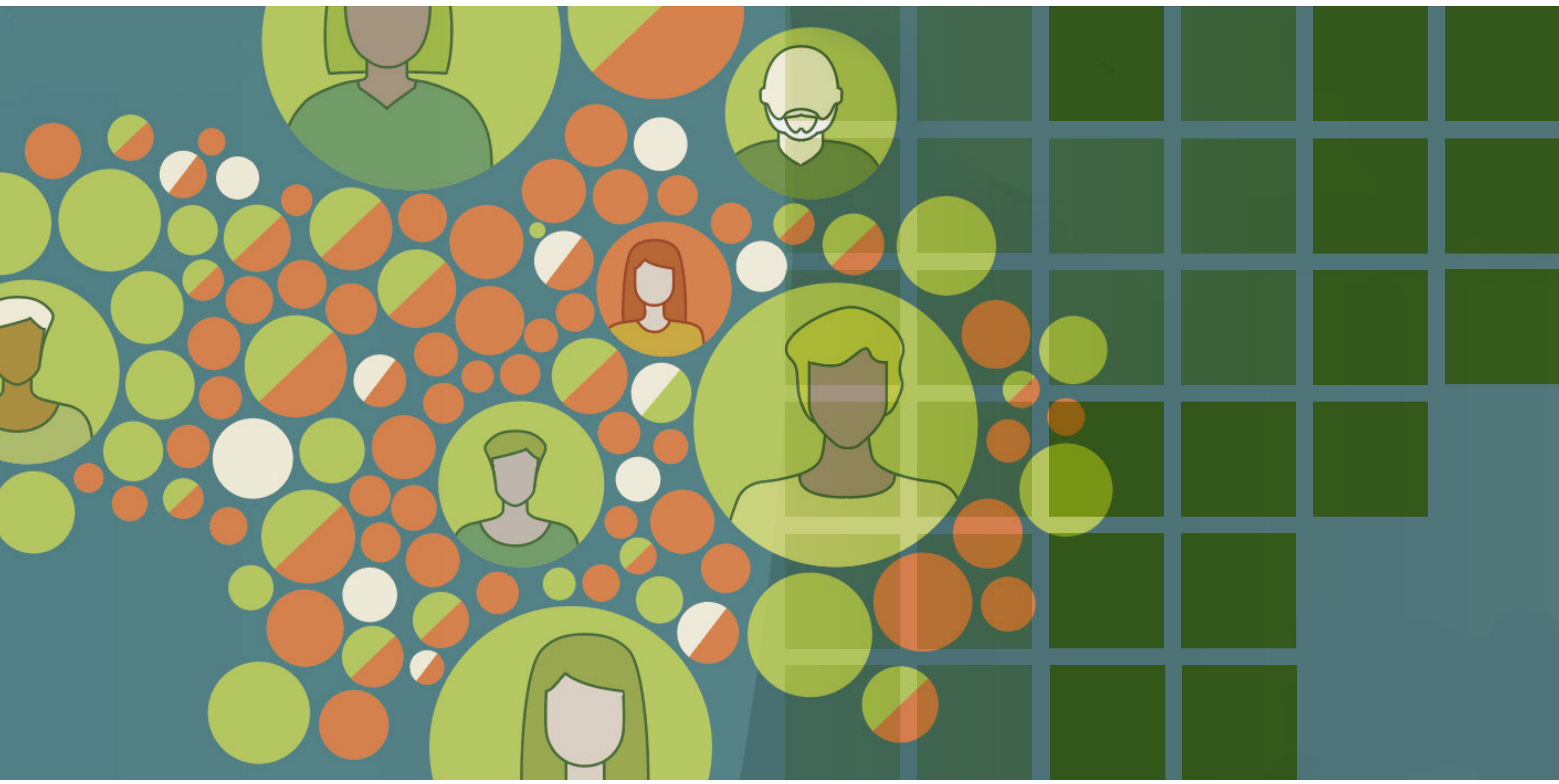

A METHODOLOGY FOR MEASURING COMMUNITY SUSCEPTIBILITY

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ABOUT THIS STUDY

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INTRODUCTION

As part of global efforts to avoid the most dangerous effects of climate change, the federal government has made international commitments to reduce national greenhouse-gas (GHG) emissions by at least 40 per cent below 2005 levels by 2030 and to achieve net-zero emissions by 2050 (Government of Canada, 2024). At the same time, other countries are taking action to reduce GHG emissions that are driving investments in new technologies, energy sources and services that will transform markets and shift trade patterns (IEA, 2024a).

The scale, scope and timing of the resulting economic and societal transformation over the coming decades carry a lot of uncertainty. However, the direction of change in many sectors is clear, irrespective of near- or long-term changes in Canadian policy. Using various analytical approaches that rely on both historical data and future scenarios, it is possible to identify Canadian communities that are likely to be susceptible to workforce disruption. Disruption could involve widespread job change, requirements for reskilling or upskilling, inflows or outflows of workers, worker shortages, adjustments to earnings or unemployment (see box 1).

Temporary workforce disruption may be positive for a community or region in the long run. For example, public and private investment in electric vehicle and battery manufacturing has expanded in southern Ontario, creating job opportunities. At the same time, some workers in the auto sector may require retraining to adapt their skill sets to the shift toward electric vehicles. In fact, some businesses in growth industries are concerned that a shortage of skilled labour and a lack of housing for workers could constrain the pace of growth (Ontario Chamber of Commerce, 2023; Statistics Canada, 2024a).

Governments at all levels can play a role in supporting workers, employers and communities to get ahead of change and build resilience. Identifying susceptibility at a community level could help federal and provincial governments better target investments in economic development, training and emission-reducing projects.

With this in mind, the Institute for Research on Public Policy (IRPP) has launched The Community Transformations Project, a multi-year initiative exploring the challenges and opportunities facing workers and communities, as well as actions that governments can take to better support them. The IRPP has a long history of research on government policies to support Canadian workers, including policies on skills and adult learning, Employment Insurance and more. Given the breadth and depth of this project, the IRPP has partnered with the Canadian Community Economic Development Network's Community Data Program and The Energy Mix, and has engaged several external experts to undertake detailed studies to support and complement our work.

The goal of the project is not to predict the future but, rather, to explore areas of susceptibility and the policy actions that can build resilience. Through research, data analysis and interviews with people who work in the sectors and live in the communities likely to be affected, the project will gather information, insight and advice that can support

Box 1. Susceptibility is not a rationale for rolling back climate policies

Community susceptibility is a measure of the potential for workforce disruption. Certain sectors are more likely to shrink or transform as a result of global efforts to reduce GHG emissions, though companies can adapt by reducing emissions or shifting product lines. Even if the change is net positive for the local economy, there could be friction for individual workers as the need for certain skills evolves.

Some of the disruption can be linked to federal, provincial or territorial government policies aimed at reducing emissions. For exporters, it may be linked to actions in other countries or global market forces.

Although there may be a need to adjust policy approaches or provide targeted support to communities, susceptibility is not a compelling rationale for reducing climate policy ambition. Delaying business action to reduce emissions or adapt product lines could end up harming communities more in the long run because they will be less prepared for sudden market or policy changes.

It is also important to keep in mind that the changing climate will also result in community workforce disruption. Wildfires, floods and other weather-related disasters exacerbated by climate change are already growing more frequent and costly, threatening households and Canadian industries and requiring costly evacuation and rebuilding.

Sources: Cutean et al. (2022); Lulham et al. (2023); Samson et al. (2022); Vivid Economics (2021).

government decision-making and empower workers and communities to successfully navigate the transformation in the years ahead.

A key part of the project is an interactive map of community susceptibility, which is based on a methodology that was developed over more than a year of data gathering, analysis and consultation with experts.

The following sections describe the methodology used to develop the map. The map and its associated data will be freely available on the IRPP website. Any feedback we receive will be used to make adjustments and continually improve its utility.

MAPPING SUSCEPTIBILITY PROVIDES A FOUNDATION FOR FURTHER RESEARCH AND ANALYSIS

The map ranks communities according to their susceptibility to workforce disruption associated with transformations likely to arise from efforts to reduce GHG emissions in Canada and around the world.

We focus on the likelihood of significant workforce disruption for two reasons.

First, there is a wide body of literature that examines the link between major shifts in local labour markets and changes in the socio-economic conditions of communities (Alasia et al., 2008; O'Hagan & Cecil, 2007; Vermeulen & Braakmann, 2023; Weaver et al., 2024). When a significant share of a local workforce is coping with disruption, there can be community-level impacts on the local economy as well as in areas such as housing (Notowidigdo, 2020) and the level of trust in government and community institutions (Wietzke, 2015).

Second, workforce disruption ties in closely to the evolving international dialogue on people-centred transitions, which are now viewed as essential to the success of energy system transformation at the pace and scale required to avoid the worst impacts of climate change (IEA, 2021). People-centred transitions focus on policy approaches that ensure decent jobs and worker protection; improve social and economic development; build equity, inclusion and fairness; and include people as active participants in the process (IEA, 2024b).

To measure susceptibility to workforce disruption, we selected a methodology that is not tied to a particular government policy direction or global emissions-reduction scenario. This approach allows for a more grounded discussion of the risks and opportunities, separate from current political and policy debates or assumptions regarding the pace of global market change. It also allows us to focus on the core concepts of community susceptibility and resilience — not the changes that are more difficult to predict and largely outside the control of local communities.

In communities where the proportion of workers directly exposed to disruption is high, there is also a greater chance of indirect disruption that affects the community more broadly. For example, if a large facility closes in a small community, it can also affect businesses that supply goods or services to the facility and its workers.

Our focus on workers who work directly in sectors and facilities that are more likely to be disrupted is a baseline estimate of the level of overall disruption a community might experience. Other factors can also influence worker outcomes including their age and education level, the community's proximity to other population centres, and the pre-existing availability of training and support services. At the community level, there may also be planned investments that will reduce susceptibility that are not yet reflected in the data. For example, General Motors' auto assembly plant in Ingersoll, Ontario, transitioned to manufacturing fully electric delivery vans, helping to improve the resilience of the community's largest employer (IRPP, 2025).

To capture some of these other factors and local perspectives, we selected 10 communities across Canada to profile, using a combination of interviews with people who work and live in the areas that are likely to be affected, as well as local data analysis and research. Project team members are travelling to the communities to gather insights from local leaders. Communities were selected to ensure diversity across sectors and regions. A list of profiled communities can be found in Appendix A. Each profile will be available on the IRPP website as it is completed.

The mapping exercise and community profiles, as well as additional consultations and analysis, will be used to develop five policy briefs that look at specific actions governments can take to build worker and community resilience. The first brief looks at community-led transformation strategies and is available on the IRPP's website. Additional in-depth studies will be published in 2025 and 2026.

THREE WAYS TO MEASURE COMMUNITY SUSCEPTIBILITY

Our methodology for measuring community susceptibility builds on previous research on potential employment implications of emission reductions. For example, some studies have focused on employment in fossil fuel production and distribution (Stanford, 2021). Others have looked at the share of community wages coming from emissions-intensive sectors, or the share of workers employed in sectors susceptible to global transformation (Chartered Professional Accountants Canada, n.d.; Samson et al., 2022). Economic modelling is another tool that is often used to estimate the possible change in employment associated with various climate policy scenarios (Clean Energy Canada, 2023; Navius Research, 2023).

Each approach has its merits and drawbacks. None capture all the potential sources of susceptibility, interactions or local nuances that play a role in worker and community outcomes. The IRPP and its partner organizations explored a variety of methodological options throughout 2023 and 2024, testing different approaches and consulting with external experts.

Ultimately, we landed on an approach that takes advantage of publicly available data to estimate the extent to which communities rely on sectors that are or are likely to be impacted by the transformation. To capture the various challenges communities could face, we selected three core metrics. Across the three indicators, we use the share of local employment or the presence of high-emitting facilities to estimate the relevance of these sectors to a community.

1. **Facility Susceptibility (FS)**: Communities are ranked according to the emissions from large facilities divided by the size of the community's labour force. A cement production plant, for example, could be a large emitter, employer, contractor and consumer in a small community.
2. **Intensity Susceptibility (IS)**: Communities are ranked according to the average emissions intensity of sectors with employment in the community, weighted for the share of the local labour force in those sectors. For example, a community might have many small employers active in food manufacturing and truck transportation, two emissions-intensive sectors.
3. **Market Susceptibility (MS)**: Communities are ranked according to the proportion of employment in export-oriented sectors that are undergoing or are expected to undergo major global market transformations. For example, communities with a high proportion of employment in auto manufacturing are not captured in the FS or IS metrics because most auto emissions are associated with the combustion of gasoline or diesel in a vehicle on the road, not the manufacturing of the vehicle. However, the global shift away from gasoline-powered vehicles to electric vehicles is creating significant market disruption that may lead to workforce disruption in communities with high proportions of employment in the sector.

In the absence of concrete thresholds for what makes a community susceptible, we focus on the communities with the highest scores. We rank the communities to help identify where to focus research and policy efforts.

Across the three indicators, there are a small number of communities at the very top of the distribution whose scores are significantly higher than the national mean. We place each community into one of six susceptibility groups — ranging from "Not susceptible" to "Most susceptible" — intended to capture these trends in the distribution of each of the metrics (see table 1).

The thresholds are designed to identify the highest-scoring communities across the three metrics using a standardized and easy to understand approach. Future research could identify other ways to group the data or alternative thresholds to measure different levels of susceptibility.

Applying these groupings across the three metrics allows us to compare communities between and within groups. We do not add all scores to derive a single susceptibility score for each community. That approach would require us to make assumptions about the relative importance or weight of each of the three types of susceptibility. Furthermore, combining the metrics would also obscure the source of susceptibility, which is important to validate the findings at the local level and develop a targeted policy response.

Instead, we calculate a fourth metric, which we call "top-scoring communities." For this metric, we select the highest score across the FS, IS and MS indicators for each community. Communities identified as most susceptible in the top-score metric are among the top 2 per cent of communities in at least one of the three susceptibility metrics. For example, a community that scored in the top 2 per cent in the FS metric, in the top 5 per cent in the IS metric and in the top 5 per cent in the MS metric would be given a score of "most susceptible" based on its top 2 per cent FS ranking.

This approach will help governments and communities see the full picture of susceptibility without developing a complex index that loses the direct connection to on-the-ground realities.

To facilitate analysis and visualization at the national scale, we define communities as census divisions.[1] The methodology could, however, be applied to any other census geographical unit. Census divisions have two advantages: they are sufficiently large to delimit a reasonable

Table 1. Criteria for assigning communities into susceptibility groups

Relative position	Group
The top 2 per cent of communities	Most susceptible
Between the top 2 and 5 per cent	More susceptible
Between the top 5 and 10 per cent	Moderately susceptible
Below the top 10 per cent but above the national mean	Less susceptible
Below the national mean	Least susceptible
Communities with no employment or large facilities in relevant industries	Not susceptible

[1] Census divisions are groups of neighbouring municipalities used by Statistics Canada. They are meant to act as counties or regional districts and serve as intermediate geographic areas between province or territory and municipality (census subdivision). In 2021, there were 293 census divisions across the country.

Box 2. Limitations that apply to all metrics

All metrics use 2021 census data to measure employment by sector and census division. There may have been important changes before and after 2021 that could influence results. Similarly, using historical data does not capture future plans. For example, Algoma Steel in Sault Ste. Marie, Ont., is in the midst of a shift away from coal use, which is expected to cost $825 million to $875 million and reduce GHG emissions by 70 per cent (Jones, 2024). However, the investment still brings major change to workers that may justify categorizing the community as susceptible. At the very least, other communities can learn from Sault Ste. Marie's experience with a major technological transformation.

Census divisions may also not always be a good proxy for communities in rural or remote regions where they cover large tracts of land. However, the methodology can be applied at any geographical level. A provincial government, for example, might want to consider the susceptibility of census subdivisions.

Susceptibility categories (e.g., most, more, moderately, etc.) are useful to present the data across all three metrics in a similar way (e.g., top 2 per cent, top 5 per cent, etc.). However, they may hide nuances in the distributions of each metric. For example, there may be a cluster of communities right around the cut-off for susceptibility, with some above the line and others below. Additional analysis is needed at the community level to validate findings. The IRPP can provide the underlying data upon request to researchers interested in extending the analysis.

commuting zone in most parts of the country; and they cover the entire country, ensuring that we've captured urban, rural and remote communities and workers. See box 2 for a discussion of some of the limitations associated with using census divisions.

Our approach is meant to be transparent, replicable and verifiable. The data sources used are public and updated on a regular basis, which will also allow us and other researchers to track changes as new data become available.

As the IRPP receives feedback on the map and new sources of data, we will reflect on the approach and methodology and may periodically make adjustments. Other areas of the project, such as community profiles and policy briefs, may also provide insights or introduce new questions that lead us to analyze the data in a new way.

Facility Susceptibility

The Facility Susceptibility (FS) score for a community is calculated by dividing total emissions from large emitters (LEs) in the census division by the size of the community's labour force.

$$\textit{FS score} = \textit{LE emissions per worker} = \frac{\textit{total emissions from LEs}}{\textit{size of community labour force}}$$

Data sources

Facility-level data for 2021 were obtained from the "facility-reported greenhouse gas" dataset, part of Environment and Climate Change Canada's (ECCC) Greenhouse Gas Reporting Program (ECCC, n.d.). The program requires facilities emitting more than

10 kilotonnes of carbon dioxide equivalent (CO_2e) to submit a report to the department (ECCC, 2023). Data are updated annually and include information about the facility, such as its name, location, reporting company and industry,[2] as well as a breakdown of emissions by GHG. We refer to all facilities included in this dataset as LEs (table 2).

Table 2. The 10 highest-emitting facilities in Canada, 2021

Facility name	Municipality	Census division	Province	Industry	Reporting company	2021 emissions (tonnes CO_2e)
Mildred Lake and Aurora Plant Sites	Fort McMurray	Division No. 16 (4816)	AB	Mined oil sands extraction	Syncrude Canada Ltd.	12,518,177
Suncor Energy Inc. Oil Sands	Fort McMurray	Division No. 16 (4816)	AB	Mined oilsands extraction	Suncor Energy Oil Sands Limited Partnership	8,054,421
Genesee Thermal Generating Station	Warburg	Division No. 11 (4811)	AB	Fossil-fuel electric power generation	Capital Power Generation Services Inc.	7,589,629
Cold Lake	Grand Centre	Division No. 12 (4812)	AB	Insitu oilsands extraction	Imperial Oil Resources Limited	5,769,183
Firebag	Fort McMurray	Division No. 16 (4816)	AB	Insitu oilsands extraction	Suncor Energy Oil Sands Limited Partnership	5,582,360
Horizon Oil Sands Processing Plant and Mine	Fort McMurray	Division No. 16 (4816)	AB	Mined oilsands extraction	Canadian Natural Resources Limited	5,484,071
Keephills Thermal Electric Power Generating Plant	Duffield	Division No. 11 (4811)	AB	Fossil-fuel electric power generation	TransAlta Generation Partnership	4,654,155
TransCanada Pipeline, Alberta System	Fairview	Division No. 19 (4819)	AB	Pipeline transportation of natural gas	Nova Gas Transmission Ltd.	4,290,950
Boundary Dam Power Station	Estevan	Division No. 1 (4701)	SK	Fossil-fuel electric power generation	Saskatchewan Power Corporation	4,283,542
Algoma Steel Inc.	Sault Ste. Marie	Algoma (3557)	ON	Iron and steel mills and ferro-alloy manufacturing	Algoma Steel Inc.	4,112,890

Source: 2021 facility-reported greenhouse gas data (ECCC, 2023)
Notes: Firms in pipeline transportation are excluded from the analysis because employment is more likely to be spread out through multiple census divisions (see FS limitations). There have been major changes in many large-emitting facilities since 2021. For example, the Keephills and Genesee electric power generation stations in Alberta transitioned from coal power to natural gas in late 2021 and 2023, respectively (Capital Power, n.d.; TransAlta, 2021).

[2] All datasets used classify sectors and industries according to the North American Industry Classification System (NAICS). Developed by the governments of Canada, the U.S. and Mexico, the system is meant to provide common definitions for types of economic activity across the three countries.

We exclude facilities in pipeline transportation (NAICS 486) because employment is likely to be spread out across multiple census divisions. Community emission totals were calculated by aligning the geographic co-ordinates of the individual facilities with the corresponding census division.

Census 2021 labour force counts by census division come from Statistics Canada. Labour force counts include all people aged 15 and older who were employed or unemployed at the time of response.

In 2021, there were 1,681 facilities that reported annual emissions of more than 10,000 tonnes of CO_2e to ECCC. Another 152 chose to voluntarily report their emissions despite not reaching the threshold (ECCC, 2023). Together, they directly emitted the equivalent of 285 megatonnes (millions of tonnes) of GHGs, or 43 per cent of all domestic emissions in that year.

Emissions from LEs are highly concentrated among a small number of regions and industries.[3] The top 10 emitting facilities in 2021 (less than 0.5 per cent of facilities) were responsible for 22 per cent of all emissions from LEs. These included coal and natural gas power generation, oil and gas extraction, and pipeline transportation.[4] These industries, along with petroleum refineries, produced the most emissions, accounting for more than 60 per cent of total LE emissions in 2021. Other high-emitting subsectors included metal, non-metallic mineral and chemical manufacturing, as well as mining and quarrying. The largest number of individual reporting facilities were in conventional oil and gas extraction, accounting for almost 40 per cent of the total (670 facilities).

More than half of emissions from LEs came from facilities reporting from Alberta (53 per cent), with the second- and third-highest proportions coming from Ontario (16 per cent) and Saskatchewan (10 per cent). Of the 293 census divisions in Canada, there were 78 with no reported large emitters in 2021.

Strengths of the Facility Susceptibility indicator

An advantage of the FS metric is that it allows for a direct estimate of industrial emissions at the community level. While regional emissions data are not publicly available through Statistics Canada, the ECCC Large Emitters Database (2024) includes the geographical co-ordinates of all facilities that report. Using spatial analysis software, we assigned each facility to a census division. We then calculated total emissions from LEs in a community by summing the emissions of all facilities located within the census division. Then we divided total census-division facility emissions by the number of people in the local labour force to calculate the facility susceptibility score (see figure 1 and table 3).

[3] According to Statistics Canada, economic sectors are denoted using two-digit North American Industry Classification System (NAICS) codes. Subsectors are groups of industry groups and correspond to three-digit codes. Industry groups are made up of industries, denoted by four-digit NAICS codes.

[4] Facilities in pipeline transportation (NAICS 486) are excluded from our analysis because employment is likely to be spread out across multiple census divisions (see FS data).

Figure 1. Facility susceptibility scores of census divisions by susceptibility groups, 2021

Source: IRPP calculations based on the 2021 census (Statistics Canada, 2022b) and the Greenhouse Gas Reporting Program (ECCC, 2023).
Notes: Excludes communities in the "not susceptible" group listed in table 3. The lowest- and highest-scoring communities are labelled.

Table 3. Summary of census divisions by facility susceptibility groups, 2021

	Not susceptible	Least susceptible	Less susceptible	Moderately susceptible	More susceptible	Most susceptible
Number of communities	78	168	17	15	9	6
People in the labour force	1,177,190	16,981,930	472,605	437,860	129,270	111,420
Share of Canada's labour force	6%	88%	2%	2%	<1%	<1%
Median size of local labour force	8,383	31,280	19,980	27,135	13,780	11,635
Minimum FS score	0.00	<.001	0.03	0.06	0.12	0.41
Median FS score	0.00	<.01	0.04	0.08	0.18	0.59
Maximum FS score	0.00	0.03	0.06	0.10	0.36	1.29

Source: IRPP calculations based on the 2021 census (Statistics Canada, 2022b) and the Greenhouse Gas Reporting Program (ECCC, 2023).

Due to their size, the nature of production or the availability of natural resources, large emitting facilities are likely to be located in rural or remote areas or small municipalities, away from large population centres. This is why our indicator is composed of both LE emissions in a census division, which approximates the magnitude of the decarbonization required, as well as the size of the census division labour force, which estimates how reliant the census division is on its large-emitting facilities. The presence of LEs in a community is a clear source of susceptibility because they are responsible for a disproportionately large share of all emissions.

In Canada, policies to decarbonize LEs are predicted to be the main drivers of emissions reductions by 2030 (Dion & Linden-Fraser, 2024). LEs are already subject to federal or provincial/territorial climate policies such as the federal coal phase-out regulations, the federal output-based pricing system, the Alberta Technology Innovation and Emissions Reduction regulation or the Quebec cap-and-trade system. Even if climate policies and targets change, Canada is unlikely to achieve meaningful emissions reductions without decarbonizing its largest emitters because they account for more than 40 per cent of domestic emissions.

Many facilities are also major exporters, exposing them to changes in global demand for their products or to trade measures such as the European Union's Carbon Border Adjustment Mechanism aimed at ensuring that emissions-intensive imports of steel, aluminum, iron, cement, electricity, hydrogen and fertilizers do not erode the competitiveness of EU manufacturers subject to the EU emissions-trading system (European Commission, n.d.). Additionally, a growing number of countries are moving to decarbonize their heavy industries through the adoption of innovative technologies (United Nations Framework Convention on Climate Change, 2024). Facilities that do not decarbonize may be less competitive in the future (Canadian Climate Institute, 2021).

Limitations of the Facility Susceptibility indicator

One major limitation of this metric is that it does not account for how many workers in a community directly work in LE facilities. However, direct employment is only one factor in community susceptibility. For example, the facility may use local contractors for construction or catering. Employees might also be significant purchasers of goods or services from small businesses. Other businesses may rely on infrastructure developed for the facility, such as a port or rail line. Local governments might also benefit from property tax revenues, which support more public services and employment.

A more significant limitation is that census employment data may not always align with employment in large facilities. We use census employment data based on where people live, which will not capture workers who live outside the census division where the facility is located and those who travel to the census division for seasonal or temporary employment. For example, a worker who lives in Montreal but travels to a remote mining camp in northern Quebec for work would not be counted as an employee in the northern Quebec census division. The IRPP will undertake additional analysis using data based on where people work and their commuting patterns.

To fully understand the role of a large facility in a community, more in-depth community analysis will be required.

Intensity Susceptibility

The Intensity Susceptibility (IS) score for a community is equal to the average emissions intensity of sectors with employment in the community, weighted for the share of the local labour force employed (or last employed) in those sectors.

IS score = average emissions intensity of local sectors, weighted for share of local labour force size in each sector

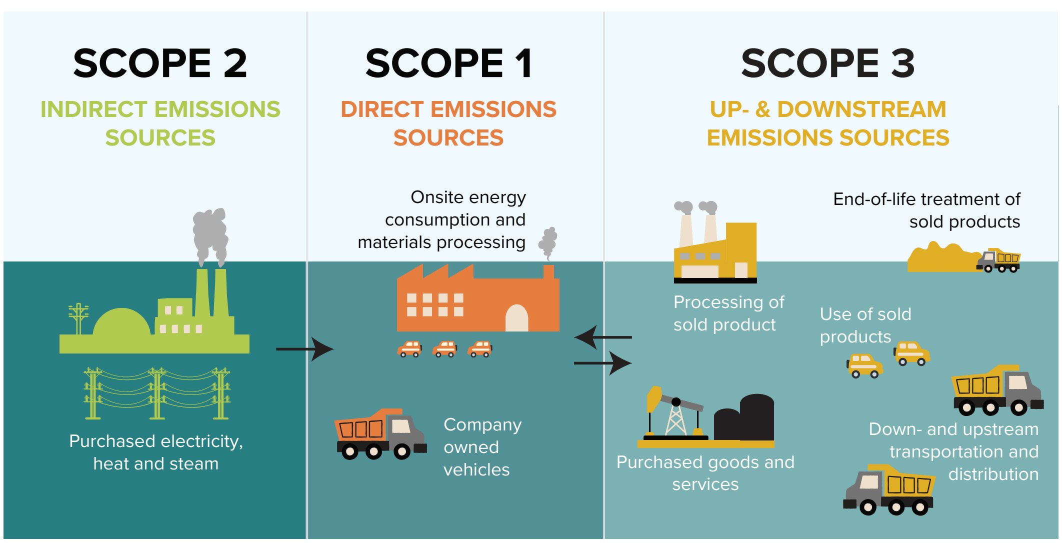
$$= (EI_{sector\ A} * \text{share of local labour force}_{sector\ A}) + (EI_{sector\ B} * \text{share of local labour force}_{sector\ B}) + \ldots$$

Data sources

National emissions-intensity data by economic sector come from the Canadian Climate Institute's Canadian emissions intensity database, developed by 440 Megatonnes (Canadian Climate Institute, n.d.). To calculate the emissions intensity of Canadian sectors, the authors allocate national emissions from the National Inventory Report (NIR) across the responsible sectors and divide their emissions by the sector's value-added (or GDP). This is the value generated by an industry in 2021, minus the cost of materials and services used in production, and comes from Statistics Canada's Supply and Use Tables (Statistics Canada, 2024b).

According to international carbon accounting standards, emissions are grouped into three categories or scopes (see figure 2; Greenhouse Gas Protocol, n.d.). Scope 1 includes emissions produced in the facility or by company-controlled transportation. Scope 2 refers to emissions from electricity, heating, cooling or steam purchased by the company. Scope 3 captures embedded emissions across the supply chain.

Figure 2. Emissions are often grouped into Scopes 1, 2 and 3



Source: https://climateactionnavigator.oliverwymanforum.com/scope-3-emissions

In this case, the authors of the Canadian Climate Institute database, developed by 440 Megatonnes, allocate Scope 3 upstream emissions (such as those stemming from purchased inputs) to industries and distribute Scope 3 downstream emissions (emissions from the use of the final product or service) across 51 final demand categories for expenditure or exports (Stiebert & Sawyer, n.d.). They use industry-level energy and facility emissions data to map Scope 1 and 2 emissions from the NIR to specific industries, and the National Symmetric Input-Output Tables to model ways in which embodied carbon passes through supply chains (Scope 3 emissions). However, since the data do not include emissions associated with the use of products in other countries, the emissions intensity of some industries can sometimes be under- or overestimated (see limitations below).

In 2021, roughly 67 megatonnes of CO_2e were allocated across all three scopes to petroleum and coal product manufacturing, which includes oil refineries. This includes direct emissions from combustion during production, purchases of power and embedded emissions in all sector inputs. The emissions stemming from the use of products (e.g., asphalt, fuels and oils) are allocated across buyers, such as industries that use the products as inputs, or to final demand when they are exported or bought by households and governments.

Census 2021 labour force counts by industry (4-digit NAICS code) and census division come from Statistics Canada (2022b). Labour force counts include all people aged 15 and older who were employed or unemployed at the time of response. Since emissions intensity data are available for a selection of industries and industry groups (non-overlapping and covering virtually the whole economy), we aggregated census labour force counts to match when required.

We also used Statistics Canada's 2021 Canadian Business Register (Statistics Canada, 2022a) to roughly estimate employment counts in industries not covered by our census data. Specifically, we broke down utilities (NAICS 221) into fossil fuel power generation (221112), natural gas distribution (2212), and water, sewage and other systems (2213). We excluded the rest of power generation (hydro, renewables and nuclear) because emissions-intensity data are available only for the parent industry group (2211 electric power generation), which would overestimate the susceptibility of employment in these subsectors. We also exclude employment in crop (111) and animal production (112), because employment counts are grouped together in census data as a combined subsector called "farms" (see limitations).

Based on total emissions across all three scopes, the highest-emitting industries in 2021 were oil and gas extraction, food manufacturing, petroleum and coal product manufacturing, and electric power generation. Some produce the bulk of their emissions during production (Scope 1), such as power generation. For others, such as food and petroleum, and coal product manufacturing, emissions are largely embedded in the materials they use in production (Scope 3; see table 4).

However, using emissions intensity, the focus of this indicator, the most emissions-intensive sectors in 2021 were animal production and aquaculture; water and sewage; iron and steel manufacturing; petroleum and coal product manufacturing; and water transportation.

Table 4. The 15 industries with the highest emissions intensity in Canada, 2021

Industry	Scope 1 emissions (tCO_2e)	Scope 2 emissions (tCO_2e)	Scope 3 emissions (tCO_2e)	GDP (thousands of dollars)	Scope 1-3 emissions intensity ($kgCO_2e/\$$)
Animal production and aquaculture	37,367,712	578,636	9,866,161	6,444,021	7.4
Water, sewage and other systems	3,195,999	6,322	132,893	493,932	6.8
Iron and steel mills and ferro-alloy manufacturing	13,423,249	566,599	3,098,681	3,296,235	5.2
Petroleum and coal product manufacturing	16,935,030	417,676	49,473,494	13,511,107	4.9
Water transportation	6,037,868	3,378	877,119	1,577,542	4.4
Cement and concrete product manufacturing	11,826,010	261,622	1,646,605	4,468,888	3.1
Non-ferrous metal (except aluminum) production and processing	2,440,480	318,567	5,923,146	3,988,722	2.2
Conventional oil and gas extraction	76,452,757	650,661	5,127,515	37,825,618	2.2
Waste management and remediation services	18,433,896	45,692	977,196	9,067,282	2.1
Alumina and aluminum production and processing	7,315,505	1,320,513	1,447,111	4,889,798	2.1
Food manufacturing	4,583,851	1,279,838	61,439,844	32,691,074	2.1
Air transportation	5,639,709	11,662	1,921,234	3,760,189	2.0
Crop production	31,399,627	1,631,494	9,671,979	23,076,375	1.9
Electric power generation, transmission and distribution	61,325,923	0	3,968,585	39,803,621	1.6
Non-conventional oil extraction	80,176,641	1,239,231	6,385,749	56,356,352	1.6

Source: Canadian Climate Institute's Emissions Intensity Database, developed by 440 Megatonnes (n.d.).
Note: Emissions intensity is obtained by adding an industry's Scope 1-3 emissions and dividing it by the industry's GDP. Only Canadian emissions are included, which can underestimate the Scope 3 emissions of exported products such as oil (see limitations below). Crop and animal production are excluded because employment in these industries is grouped together in census data (see IS limitations).

These industries, along with the rest shown in table 4, produce the most emissions relative to the value of their goods. This may be due to the numerator (i.e., high emissions), the denominator (i.e., the low value of production) or both.[5]

Since the database includes most economic sectors, all 293 census divisions have some employment in industries for which emissions intensity is tracked.

[5] This makes it a less reliable indicator for some industries like water, sewage, and other systems (NAICS 2213), which are not particularly high-emitting but are deemed emissions-intensive due to the relatively low value of production.

To calculate this indicator, we add scope 1-3 emissions intensity for each subsector and industry included in the Canadian Emissions Intensity database. We then calculate the average emissions intensity of subsectors and industries at the community level, weighted for share of local labour force employed (or last employed) in those subsectors and industries (see figure 3 and table 5).

Advantages of the Intensity Susceptibility indicator

Emissions intensity measures how many GHG emissions it takes to produce $1 worth of products and services. It is a reasonable proxy for sector susceptibility to Canadian and global efforts to reduce GHG emissions and market forces increasingly favouring lower-emitting production. A higher emissions intensity indicates the scale of exposure to emissions-intensive inputs that may see cost increases, climate policies or trade measures that could increase production costs, and shifts in market demand toward lower carbon products. As global efforts to reduce GHG emissions accelerate in the coming decades, companies that are less emissions-intensive are expected to be more profitable (Canadian Climate Institute, 2021). Companies with tight profit margins may also struggle to afford emissions reductions if large capital investments are required and low-cost financing is difficult to obtain (CCC, 2024).

Measuring the proportion of employment in emissions-intensive sectors indicates the dependence of communities on sectors that may be more exposed to increased costs. It provides a more complete picture of the community than the Facility Susceptibility measure because it captures small employers across a range of emissions-intensive sectors, including food manufacturing and truck transportation.

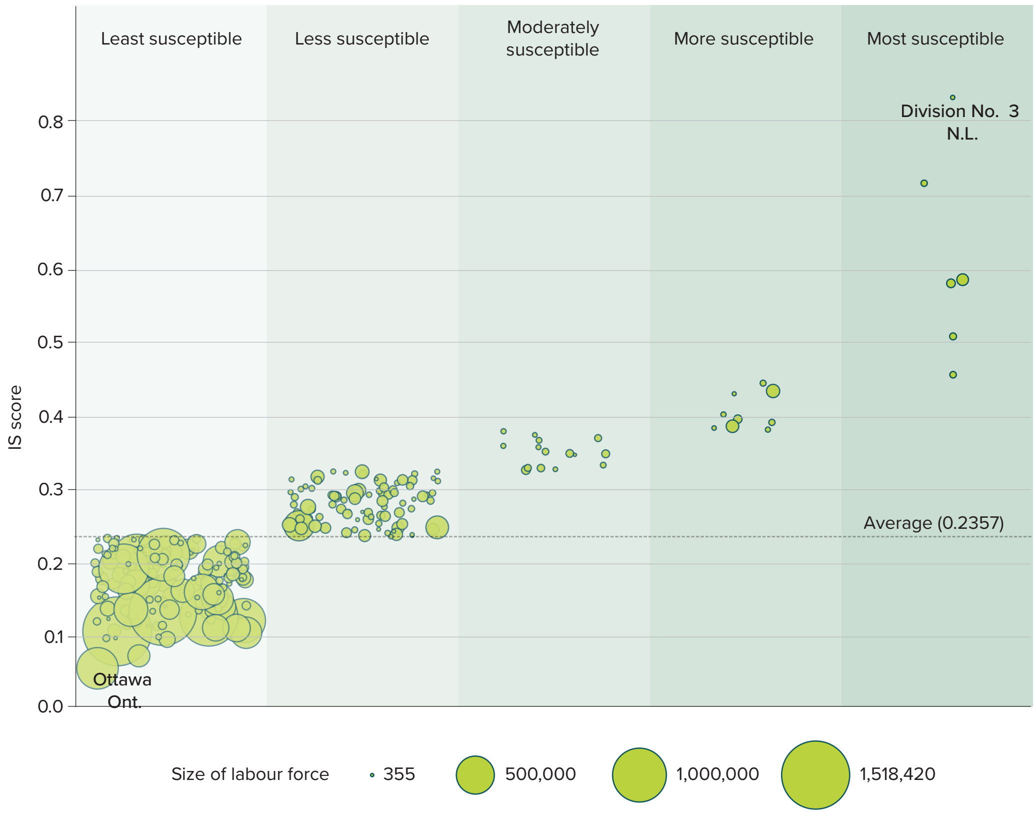
Of these sectors, those that export will face pressure from other countries with border carbon adjustments, currently in place in the EU and being considered by the U.K., Australia and Japan (World Bank, 2024). Sectors that don't keep up with international competitors could face lower demand for their products as industries move to reduce the emissions intensities of their supply chains.

Additionally, some emissions-intensive sectors are subject to federal and provincial industrial carbon-pricing systems and regulations. Others may face increased costs from the purchase of fuels such as gasoline and diesel, which are covered by the fuel levy and the Clean Fuels Regulations. The cost of gasoline could increase by up to 54 cents per litre by 2030 under current policy plans.[6] Companies that can shift to lower-emission fuels or alternative energy sources will be able to avoid these new input or transportation costs.

Even if the current policy mix changes, emissions-intensive sectors are more likely to be subject to domestic climate policies, international trade measures and competitive market forces.

[6] Based on estimates of the cost trajectory of gasoline (37 cents by 2030; Canada Revenue Agency, 2023) and price increases from Clean Fuel Regulations (up to 17 cents by 2030; Ammar et al., 2023).

Figure 3. Intensity susceptibility scores of census divisions by susceptibility groups, 2021



Source: IRPP calculations based on the 2021 census (Statistics Canada, 2022b) and the Canadian Climate Institute's Emissions Intensity Database (n.d.).
Notes: The lowest- and highest-scoring communities are labelled.

Table 5. Summary of census divisions by intensity susceptibility groups, 2021

	Least susceptible	Less susceptible	Moderately susceptible	More susceptible	Most susceptible
Number of communities	170	93	15	9	6
People in the labour force	16,278,875	2,548,710	186,585	181,270	114,835
Share of Canada's labour force	84%	13%	1%	1%	<1%
Median size of local labour force	25,635	16,255	10,515	11,360	14,423
Minimum IS score	0.06	0.24	0.33	0.38	0.46
Median IS score	0.19	0.29	0.35	0.40	0.58
Maximum IS score	0.23	0.33	0.38	0.45	0.83

Source: IRPP calculations based on the 2021 census (Statistics Canada, 2022b) and the Canadian Climate Institute's Emissions Intensity Database (n.d.).

Limitations of the Intensity Susceptibility indicator

Emissions-intensity data cover all domestic emissions across most economic sectors but are only available as a national average for a specific combination of subsectors and industry groups. While national average sector-emissions intensity serves as a reasonable estimate in most cases, it may underestimate or overestimate emissions intensity — and, therefore, susceptibility — of local facilities or companies that differ from the average.

For this reason, we adjusted the approach for certain sectors. For example, electricity sector emissions-intensity data are available for the electric power generation, transmission and distribution subsector (NAICS 2211), but not the industries it encompasses, which include both low-emission power sources such as renewable, hydroelectric and nuclear, as well as coal and natural gas electric-power generation.

Because the national average for the subsector is likely to overestimate the susceptibility of communities with employment in low-emission power production, we exclude employment in these industries from the calculation of community Intensity Susceptibility. This underestimates the susceptibility of communities with employment in fossil fuel power generation, but coal and natural gas power generation are captured in the Facility Susceptibility metric.

Other subsectors impacted by the challenge of using a national average emissions intensity are crop (111) and animal production (112), which are largely grouped together as “farms” in census 2021 data. The average emissions intensity of animal production is significantly higher than crop production (7.4 versus 1.9 kilograms of CO_2e per dollar), and emissions intensity can vary considerably between commodities and regions (Canadian Climate Institute, n.d.).

To address this, we exclude the combined farms subsector from the calculation. However, this may underestimate the susceptibility of some agricultural communities because some farms may be emissions-intensive and major employers in the community. Future iterations of the map may include farms based on local data relating to the specific products produced.

Lastly, emissions data across scopes are derived from the total number of emissions in the National Inventory Report, which includes only Canadian emissions. This means that Scope 3 emissions can sometimes be underestimated, such as with the export of Canadian products that generate emissions when they are used outside of the country, or overestimated, such as when Canadian products rely on imported inputs that are less emissions intensive than Canadian alternatives.

Market Susceptibility

Market Susceptibility (MS) identifies export-oriented sectors where global markets are already transforming or are shown to transform under various global scenarios with different levels of climate action. The sectors were selected by reviewing global trends as well as various forward-looking global scenarios of economic and energy transformation,

Box 3. The International Energy Agency's World Energy Outlook

The International Energy Agency's annual World Energy Outlook provides a comprehensive assessment of possible trajectories for the global energy transformation based on different assumptions about the pace and scale of climate action.

In its 2024 World Energy Outlook, the IEA explores three scenarios for energy transformation to 2050:

- **Stated Policies Scenario (STEPS):** a granular, sector-by-sector analysis of the concrete policies and measures in effect as of August 2024, with an assessment of their impact on energy demand and supply, as well as an assessment of private-sector action, including fuel production and manufacturing capacity of clean energy technologies.
- **Announced Pledges Scenario (APS)**: an analysis of transformation assuming governments meet all climate commitments, including their nationally determined contributions to the United Nations Paris Agreement and longer-term net-zero emissions targets.
- **Net-Zero Emissions by 2050 Scenario (NZE)**: an analysis of a narrow but achievable pathway for the global energy sector to reach net-zero energy-related CO_2 emissions by 2050 by deploying a wide portfolio of clean energy technologies. The NZE scenario is consistent with limiting the global temperature rise to 1.5 °C (with at least a 50 per cent probability) with limited overshoot.

While IEA energy transformation scenarios are the most commonly cited, there are a range of scenarios available that use different models and assumptions. For example, the Network of Central Banks and Governors for Greening the Financial System (NGFS) provides a scenario explorer. Energy companies BP and Shell also produce their own global scenarios. Data and analytics firms Wood Mackenzie and Bloomberg New Energy Finance also produce scenario-based energy transformation outlooks.

Sources: BloombergNEF (2024a); BP (2024); International Energy Agency (2024c); NGFS (2024); Shell (2023); Wood Mackenzie (2024).

with a particular focus on the International Energy Agency's (IEA) World Energy Outlook, a well-recognized and credible source of energy analysis and projections (box 3).

Based on a review of IEA and other scenarios and trends, we selected six sectors that will experience major transformations across multiple global energy transformation pathways, referred to as MS sectors: coal mining, oil and gas extraction, support activities for mining and oil and gas extraction, petroleum manufacturing, chemical manufacturing and transportation-equipment manufacturing. The key element of uncertainty that differs across scenarios is the pace of transformation, with more rapid market change in net-zero scenarios than in the stated policies and announced pledges scenarios. Further evidence supporting the selection of each sector is provided below.

The MS score for each community is equal to the share of local labour force employed (or last employed) in MS sectors.

$$\text{MS score} = \text{share of local labour force employed (or last employed) in MS sectors} = \frac{\text{combined size of local labour force in MS sectors}}{\text{local labour force size}}$$

Data sources

Sector selection was based on a review of market trends, as well as global and domestic emissions-reduction scenarios. Labour force counts by sector and census division come from Statistics Canada's census 2021 (Statistics Canada, 2022b). Labour force counts include all people aged 15 and older, who were employed or unemployed at the time of response. Four of the 293 census divisions in Canada reported no employment in MS sectors in 2021.

Coal mining

Canada produced 47 million tonnes of coal in 2022, of which 59 per cent was metallurgical coal used for steel manufacturing and 41 per cent was thermal coal used for power generation. Canada's coal production decreased by 32 per cent between 2012 and 2022, with thermal coal accounting for 75 per cent of the decline. In 2022, Canada exported 77 per cent of the coal it produced (NRCan, 2024a). In 2023, around 10,000 people worked in the coal sector (CCEI, n.d.-a).

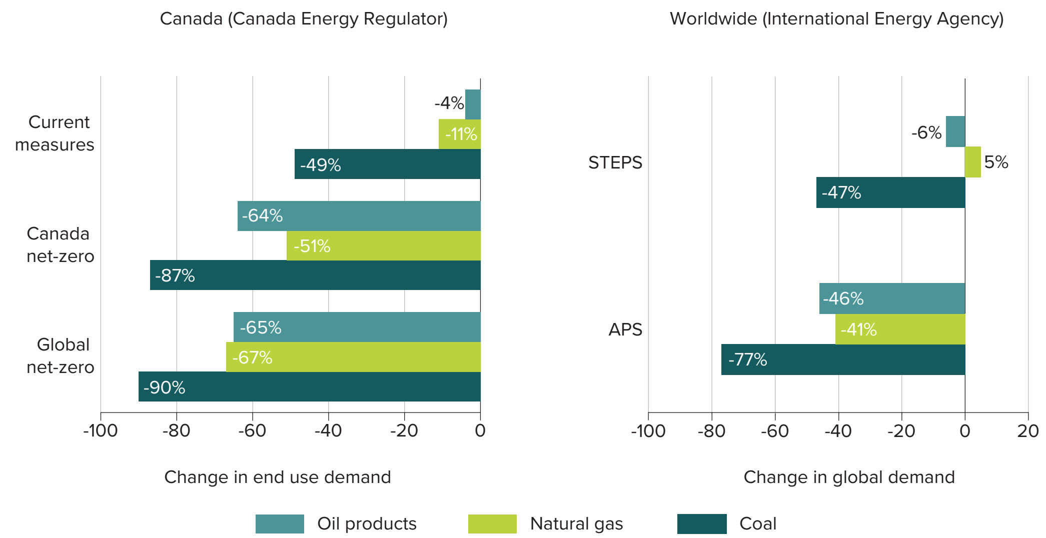
Coal demand declines under all future global energy transformation scenarios we reviewed. In the IEA's 2024 World Energy Outlook, global demand for coal falls by 47 per cent between 2023 and 2050 under the STEPS scenario, and by 77 per cent under the APS scenario (figure 4). The Asia Pacific region is projected to account for over 80 per cent of coal demand in 2050 under both scenarios. North American production falls by 80 per cent in the STEPS scenario and 93 per cent in the APS scenario (IEA, 2024c). Demand for thermal coal used for power generation declines more rapidly than metallurgical coal used for steelmaking, and there may be a short-term shortage of global supply that increases demand for Canadian metallurgical coal in the coming decade (Griffin, 2024).

The Canada Energy Regulator's (CER) 2023 report, *Canada's Energy Future*, shows that coal-fired power is mainly phased out by 2030 across Canada (CER, 2024a). Japan, which was the destination for 52 per cent of Canada's thermal coal exports in 2022, has committed to shift to renewable energy to meet its 2030 and 2050 emissions-reduction targets (NRCan, 2024a; Prime Minister's Office of Japan, 2023). China, which was the destination for 27 per cent of Canada's metallurgical coal exports in 2022, is investing in lower-emission steel production that does not use metallurgical coal (NRCan, 2024a; Shen & Schäpe, 2024; Zoryk & Sanders, 2023).

Crude oil production and petroleum products

Canada produced 4.7 million barrels of crude oil per day in August 2024, of which 4.2 million barrels per day — or 89 per cent — were exported (CCEI, n.d.-b). Most exports go to the U.S., but the start of the Trans Mountain pipeline, which runs from Alberta to the B.C. coast, in May 2024 allows for 890,000 barrels per day to be shipped to Asia and other destinations (Williams, 2024). In 2023, Canada's crude exports were valued at $124 billion, or 16 per cent of Canada's total export value (CER, 2024b). Canada also produces around 2 million barrels per day of finished petroleum products such as gasoline, aviation fuel and petrochemical feedstock (CCEI, n.d.-b). Upgraders in Alberta and Saskatchewan turn bitumen from oilsands production into synthetic crude oil, processing around 42 per cent of the bitumen produced in Canada in 2022 (CER, 2022).

Figure 4. Percentage change in demand for oil products, natural gas and coal, Canada and worldwide, 2023-2050



Source: IRPP calculations based on Canada Energy Regulator (CER) (2023) and International Energy Agency (IEA, 2024c).
Notes: End-use energy considers the energy directly consumed by the user across three main sectors: transportation, industry, and commercial and residential buildings. It excludes the use of these products for electricity generation or non-energy uses. A brief description of the scenarios follows. More details can be found in the respective sources.

- CER, Canada net-zero: Assumes Canada achieves net-zero emissions by 2050, but the world moves more slowly to reduce GHG emissions
- CER, Global net-zero: Assumes Canada achieves net-zero emissions by 2050, and the world reduces emissions enough to limit warming to 1.5°C
- IEA, STEPS: Includes relevant policies, implementation measures and proposals as of the end of August 2024
- IEA, Announced pledges: Assumes countries implement their national targets in full and on time. Includes policies, proposals and pledges at the end of August 2024

Demand for Canada's oil is highly dependent on the pace and scale of global climate action. In the Canada Energy Regulator's scenario where the world achieves net-zero emissions by 2050, Canadian crude oil production peaks in 2026 and then declines steadily thereafter, reaching 1.22 million barrels per day in 2050, a 76 per cent decrease from 2022 levels. Other uncertainties for the sector include domestic export capacity and the cost of decarbonization technologies such as carbon capture utilization and storage, or CCUS (CER, 2023).

In the IEA scenarios, global oil demand falls by 6 per cent between 2023 and 2050 in the STEPS scenario and 46 per cent in the APS scenario (figure 4). Crucially for Canada, U.S. oil demand falls by 38 per cent in the STEPS scenario and 73 per cent in the APS scenario over the same period (IEA, 2024c). A change in U.S. climate policies could influence the trajectory for oil demand (Brown, 2024). BP's energy outlook shows global oil demand declining in both its current trajectory and net-zero scenarios (BP, 2024).

Transportation accounts for the largest source of global oil demand, and the electrification of transportation is the main source of declining oil demand. Electric and fuel cell vehicles are already displacing 1.8 million barrels of oil per day, and Bloomberg New Energy Finance projects they will displace triple that amount by 2029 (Doherty, 2024).

Natural gas production

Canada produced 16 million cubic metres of natural gas in August 2024, and exported 7 million cubic metres, or 43 per cent. Canada produces and exports more natural gas in the winter months (CCEI, n.d.-c). Most Canadian exports go to the U.S. though the construction of liquefied natural gas (LNG) facilities on the west coast will allow for exports to Asian markets.

Canada has seven LNG export terminals in varying stages of development, four LNG liquefaction facilities and two LNG import plants in operation (NRCan, 2023). LNG Canada in Kitimat, British Columbia, is set to start operations at its $40-billion terminal in mid -2025. The terminal will process around 11 per cent of current Canadian gas output (Nickel & Disavino, 2024). Five additional LNG projects have received export licences (NRCan, 2024b).

Global natural gas demand is highly dependent on the trajectory of global climate action. In the IEA's STEPS scenario, natural gas demand increases by 5 per cent between 2023 and 2050. However, in the APS scenario, natural gas demand declines by 41 per cent over the same period. U.S. demand declines under both scenarios, by 38 per cent in the STEPS scenario, and 72 per cent in the APS scenario. However, demand in the Asia-Pacific region grows by 28 per cent in the STEPS scenario, and shrinks by 39 per cent in the APS Scenario (IEA, 2024c). Decisions on the pace and scale of electrification, and investment in renewable energy and battery storage, will be key determinants of future demand for natural gas.

Analysis by the Canada Energy Regulator also shows Canadian end-use demand for natural gas declining by 11 per cent under a current measures scenario, 51 per cent under a Canada net-zero scenario, and 67 per cent under a global net-zero scenario (figure 4; CER, 2023).

The other challenge for Canadian LNG projects is global competition. Suppliers in the U.S., Qatar and Mozambique can produce LNG at a lower cost (O'Connor, 2024). The IEA's World Energy Outlook (2024c) states that LNG supply could exceed demand by 2030 under all three of its scenarios if all projects that are under construction are completed on time. If global supply exceeds global demand, international gas prices will decline and there will be fierce competition among LNG suppliers. Natural gas may also increasingly face competition from low-emission gases such as biomethane, low-emission hydrogen and e-methane (IEA, 2024d).

Transportation equipment manufacturing

Canada had over 3,500 businesses active in transportation equipment manufacturing in 2023, contributing around $28 billion to Canada's GDP and employing over 200,000 people (ISED, 2023a). The sector includes motor vehicles and parts, aerospace and aerospace parts, railroad rolling stock, and ship and boat building. Motor vehicles and parts, and aircraft and other transportation equipment and parts accounted for around 17 per cent of Canada's goods exports in 2023 (Global Affairs Canada, 2024). In 2021, close to 70 per cent of all Canadian workers in transportation equipment manufacturing worked on motor vehicle assembly and parts, another 22 per cent on aerospace and the remainder on railroads, ships and other parts of the subsector (Statistics Canada, 2022b).

Road transportation is highly likely to experience significant transformation over the coming decades. Globally, nearly one in five cars sold in 2023 were electric, representing a 35 per cent year-over-year increase (IEA, 2024e). In the IEA's STEPS scenario, one of every two cars sold will be battery electric or a plug-in hybrid vehicle by 2035 and more vans, buses and trucks will be electric (figure 5; IEA, 2024e). Bloomberg's 2024 Electric Vehicle Outlook acknowledges that the EV transition has slowed in the near term, but still projects that 73 per cent of passenger vehicles, 66 per cent of commercial vans and 43 per cent of heavy trucks will be zero emission by 2040 in its economic transition scenario (BNEF, 2024b).

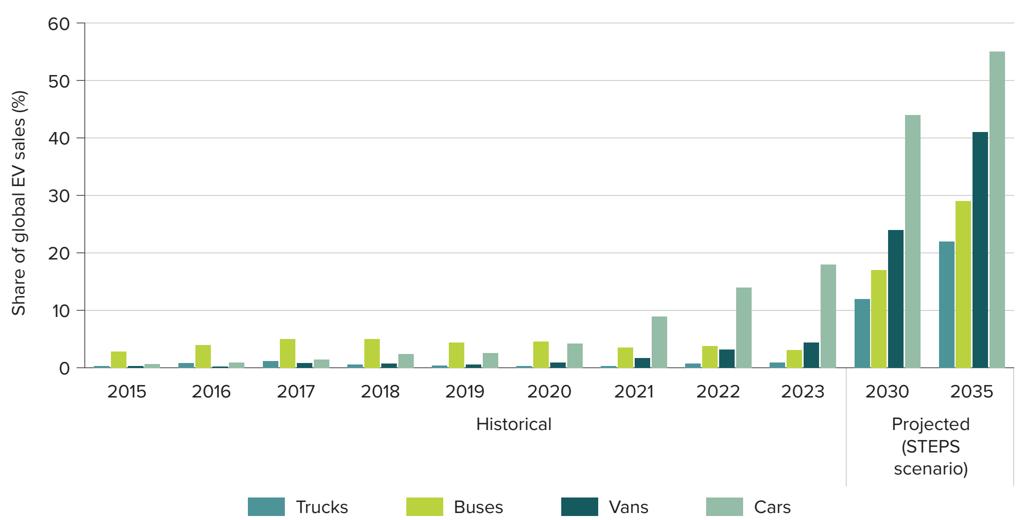
In the U.S., 10 per cent of new cars sold in 2023 were electric (IEA, 2024e). Canada also reached the 10 per cent mark in 2023 (CER, 2024c). In the first quarter of 2020, there were 19,603 new vehicle registrations that were battery electric, hybrid electric or plug-in hybrid electric in Canada. Four years later, this number had more than quadrupled to 83,344 (Statistics Canada, 2024c).

There has also been significant investment in Canada in electric vehicle and battery manufacturing. Investments in Canada related to electric vehicle and battery production totalled $52.6 billion by 2024, of which roughly $19 billion was invested in the previous two years (AccelerateZev, n.d.).

Canada's air transportation industries have also outlined aspirational goals to reach net-zero emissions by 2050 (Transport Canada, 2022). International Civil Aviation Organization (ICAO) member states have adopted a collective long-term global aspirational goal of net-zero carbon emissions by 2050 (ICAO, 2022). However, the technologies needed to decarbonize these industries are in earlier stages of development, so the transformation may be slower to materialize (IEA, 2023a).

Bombardier, Canada's largest aerospace manufacturer, is undertaking research on a new type of airplane with the goal to reduce aircraft carbon emissions by up to 50 per cent

Figure 5. Historic and projected share of global EV sales



Source: IRPP calculations based on International Energy Agency (2024b).

(Bombardier, n.d.). Sustainable aviation fuel is now being sold in Canada, with the first purchase by WestJet from Shell Aviation in 2024 (WestJet, 2024).

Chemical manufacturing

Canada had over 3,500 businesses active in chemical manufacturing in 2023, contributing around $31 billion to Canada's GDP and employing over 90,000 people (ISED, 2023b). Basic and industrial chemical, plastic and rubber products accounted for 5.5 per cent of Canada's goods exports in 2023 (Global Affairs Canada, 2024). Around 72 per cent of exports go to the U.S., and another 7 per cent go to China (CCC, 2024).

Nineteen large petrochemical and industrial gas manufacturing facilities are responsible for more than 75 per cent of the sector's emissions (CCC, 2024). At the same time, many of the technologies needed to achieve GHG emissions reductions rely on the chemicals sector. Low-emissions chemicals are an opportunity for growth in chemical manufacturing (e.g., plastics in EVs, resins protecting solar panels, refrigerants in heat pumps). Internationally, there have been investments in net-zero chemicals, including electric crackers, a process used to break down large hydrocarbons into smaller molecules, and low-carbon ammonia facilities (CEC, 2024).

Demand for primary chemicals could also decline with increased plastic recycling and more efficient fertilizer use (IEA, 2023b). In the IEA's NZE scenario, chemical recycling is widely adopted in advanced economies by 2050 (IEA, 2024c). China is also ramping up its domestic petrochemical production and is poised to increasingly displace petrochemical imports from other regions (IEA, 2024c).

The energy transition is driving a convergence of sectors, with some oil and gas companies moving into chemical markets. At the same time, some chemical companies are moving into lithium processing, battery manufacturing and clean ammonia. There are both new opportunities and risks in the sector's transformation (Yankovitz et al., 2023).

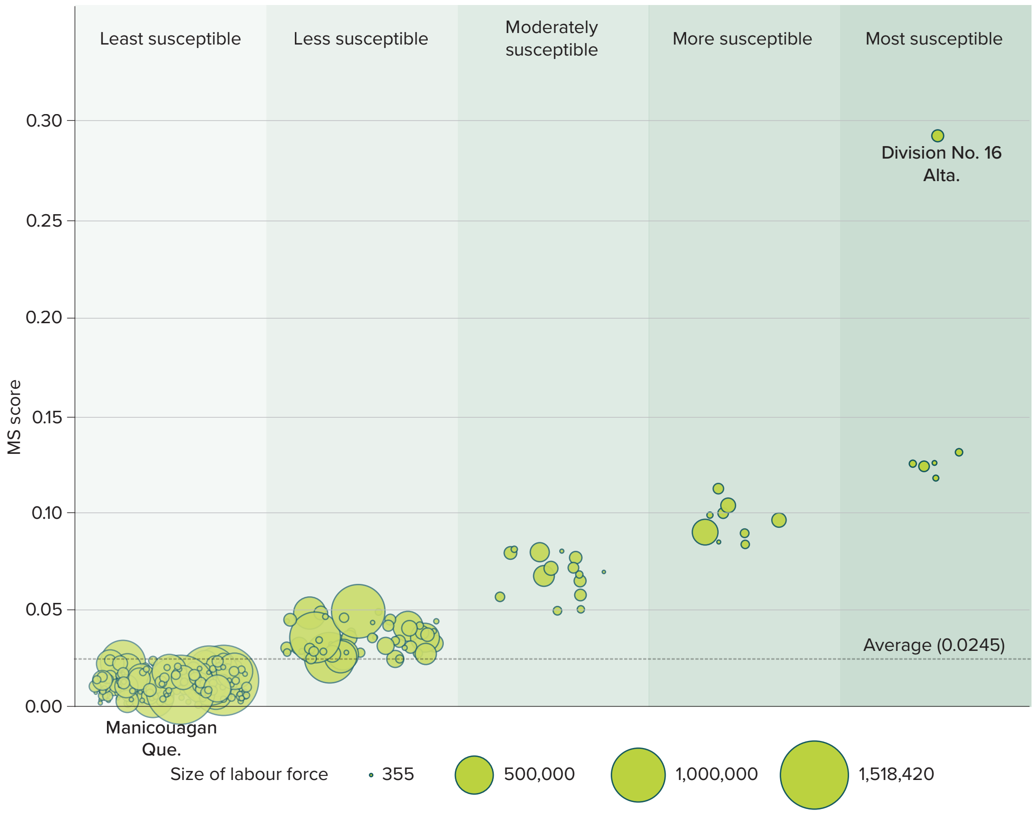
Advantages of the Market Susceptibility indicator

The Market Susceptibility metric captures sectors and communities that are not identified in the other metrics (see figure 6 and table 6). For example, auto manufacturing has a low emissions intensity relative to other sectors identified in the Intensity Susceptibility metric. However, metrics reliant on emissions miss the major market transformation that is happening as the auto sector shifts from producing gasoline- and diesel-powered vehicles to electric vehicles.

The Market Susceptibility metric focuses on export-oriented sectors and captures different sources of susceptibility that are not related to GHG emissions. For example, the most significant challenge facing the oil production sector is the long-term decline in global demand for the product.

This metric is also the only one that is forward-looking, considering the potential evolution of markets in response to global and domestic efforts to reduce GHG emissions. For example, chemical manufacturing is expected to undergo a significant market transformation with

Figure 6. Market susceptibility scores of census divisions by susceptibility groups, 2021



Source: IRPP calculations based on the 2021 census (Statistics Canada, 2022b).
Notes: Excludes communities in the "not susceptible" group listed in table 6. The lowest- and highest-scoring communities are labelled.

Table 6. Summary of census divisions by market susceptibility groups, 2021

	Not susceptible	Least susceptible	Less susceptible	Moderately susceptible	More susceptible	Most susceptible
Number of communities	4	206	53	15	9	6
People in the labour force	13,140	12,582,750	5,507,070	619,385	461,570	126,360
Share of Canada's labour force	<0.1%	65%	29%	3%	2%	<1%
Median size of local labour force	2,665	17,598	32,190	34,595	33,545	15,903
Minimum MS score	0.000	0.001	0.025	0.049	0.084	0.118
Median MS score	0.000	0.012	0.034	0.069	0.096	0.125
Maximum MS score	0.000	0.024	0.049	0.081	0.112	0.294

Source: IRPP calculations based on the 2021 census (Statistics Canada, 2022b).

both new product opportunities and new sources of competition that are not captured by looking solely at sector emissions.

Communities facing market susceptibility may achieve positive outcomes in the long run if companies and communities can position themselves to adapt and develop new products that align with future directions in demand.

Limitations of the Market Susceptibility indicator

Forward-looking global scenarios are not predictions, and the timing, scale and scope of global market transformations are uncertain. The competitiveness of natural gas production in Canada, for example, is highly dependent on fluctuations in global demand and supply, as well as costs relative to competitors. However, it may still be appropriate to identify a community with significant employment in natural gas production as susceptible, given the risk of market volatility in future years.

The selection of sectors may fail to capture important differences at the local level that may be important to determining the degree of community susceptibility. For example, the decline in demand for thermal coal for power generation is expected to occur faster than the decline in demand for metallurgical coal for steelmaking. However, identifying a metallurgical coal community as susceptible can help highlight the need for a longer-term community plan to address the global steel production sector's shift away from coal.

ENGAGING WITH THE IRPP

The IRPP welcomes input and questions from communities, workers, businesses, industry associations, governments, NGOs, researchers and others who are interested in the project. Please reach out to communitytransformations@irpp.org if you have questions or feedback, or to speak with the staff team behind this project.

APPENDIX A: COMMUNITY PROFILES

As part of the Community Transformations Project, we will publish profiles of municipalities located within the following 10 census divisions, which were selected based on the results of our mapping exercise. Our intention is to cover a diverse group of communities across Canada, with varying sources of susceptibility. To inform the profiles, The Energy Mix and the IRPP visited the communities and interviewed local stakeholders.

Communities and corresponding census divisions:

- Cape Breton (Cape Breton)
- Channel-Port aux Basques, Newfoundland and Labrador (Division No. 3)
- Estevan, Saskatchewan (Division No. 1)
- Fort McMurray, Alberta (Division No. 16)
- Ingersoll, Ontario (Oxford)
- Kitimat, British Columbia (Kitimat-Stikine)
- Neepawa, Manitoba (Division No. 15)
- Port-Daniel-Gascons, Quebec (Le Rocher-Percé)
- Sault Ste. Marie, Ontario (Algoma)
- Yellowknife, Northwest Territories (Region 6)

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