



CANADA'S RESOURCE SECTOR

Protecting the Golden Goose

Philip Cross and Jack Mintz



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Executive summary | *sommaire*

Despite the importance of natural resources to our economy, Canadians often downplay or ignore this sector’s historical and continuing contribution. Prime Minister Justin Trudeau, in his 2016 inaugural address to the World Economic Forum at Davos, articulated the growing discomfort with our resource riches: “My predecessor wanted you to know Canada for its resources. I want you to know Canadians for our resourcefulness.” The federal government excluded the resource industries when recently touting Canada’s attractiveness to foreign investors. Even some prominent media play up a false argument that Canada’s bountiful resources make Canadians lazy or squeeze out growth in other industries.

This paper examines the sizeable contribution of natural resources to Canada’s economy. The resource sector includes primary production of agriculture, fishing, forestry, mining, and mineral fuels, and many manufacturing industries like food, wood, petroleum, and mining products. The paper begins by examining the effect of natural resources on Canada’s GDP, employment, investment, and international trade, and then proceeds by outlining the importance of natural resource industries to Canadians living in remote areas (notably Indigenous peoples), how resources foster the cultural values that encourage entrepreneurship and innovation, and ultimately how they allow all Canadians to survive our unforgiving geography and climate.

Key conclusions include the following:

- Natural resources contribute 14.9 percent of Canada’s GDP, with the energy industry alone accounting for half of resource output. Resources account for over 45 percent of manufacturing output.
- Nearly one in ten jobs are related to resources, employing 1.3 million Canadians.
- Canada’s comparative advantage in trade depends heavily on its resource sector, which accounted for 58 percent of all merchandise exports in 2023. Natural resources are the only sector in which Canada has a trade surplus, and resource exports by themselves total more than all of Canada’s merchandise imports.
- Despite a prolonged investment slump in an increasingly hostile regulatory environment, natural resource industries still account for nearly half of all business investment in Canada.

- At over 30 percent, effective tax rates on new oil and gas investment are twice as high as for other industries. The time required for initial regulatory approvals is double the legislated requirement under the *Impact Assessment Act*. Regulatory delays add another fifth in tax costs on investment.

The dominant role that natural resource industries continue to play in investment and exports reflects the vital importance of this sector to Canada's ability to compete in international markets. In the years before the pandemic, the Bank of Canada stressed the importance of shifting growth from household and government spending, fuelled mainly by debt, to investment and exports. However, except for residential investment driven by population growth, this shift never occurred, largely because of the reluctance of firms to commit to the investments needed to improve our export competitiveness and capacity. With interest rates normalizing after governments and households took on even more debt because of the pandemic, the importance of investment and exports to long-term growth has only increased.

Discounting Canada's natural resource sector continues a tradition among some economists and policy-makers of denigrating its contribution to our economic development. This disparagement dates back to the Staples Thesis and the recent critique that resource industries have hampered the development of other knowledge-based industries.

People downplay the importance of natural resources to Canada for several reasons. Critics have long cultivated a negative image of the resource sector by using such disapproving terms as "trap," "curse," and "disease" in their critiques of a "staples trap," a "resource curse" and the "Dutch disease." Compounding this negativity is that most natural resource industries are located outside of core urban areas, making them nearly invisible to media, cultural, and academic elites. Natural resources also are shackled with the inaccurate image of being low tech and requiring little effort or ambition to win the "geographic lottery" that comes from being blessed with a resource endowment. Finally, the country's abundant resources are believed to overtly inhibit the development of knowledge industries in Canada.

All these prejudices are patently false. The history of resource development in Canada has been driven by a steady stream of inventions and innovations; Canadians have often pushed themselves to the technological frontier with new technologies in wheat, canola, hydroelectricity, metals, and the oil sands. More broadly, natural resource industries cultivate the cultural values that support entrepreneurship and innovation in all industries because their cyclical nature requires a flexible labour force and tolerance of creative destruction; their capital-intensity necessitates high savings and long-term planning; and their dependence on foreign markets encourages a receptivity to international trade and investment flows.

The primordial importance of natural resources, especially energy, means that the transition to new energy sources must be well-managed and based on economic fundamentals to avoid economic disruption. Governments encourage the transition by using taxes and regulations to raise the cost of fossil fuels while subsidizing renewable energy. However, this transition has proceeded slowly because of its high costs and growing resistance from an

electorate already struggling with the recent surge in inflation and interest rates. If the transition to new energy sources continues to be mismanaged Canadians will experience an even steeper decline in their incomes than has occurred over the past decade, further eroding our standing in an increasingly dangerous and volatile world.

The difficulty for Canada – and for almost every nation – in making the transition to new energy sources reflects the fact that energy consumption is fundamental to long-term economic development. **MLI**

Malgré l'importance des ressources naturelles pour l'économie, au Canada, on minimise ou on ignore souvent la contribution historique et durable de ce secteur. Dans son discours inaugural devant le Forum économique mondial de Davos en 2016, le premier ministre Justin Trudeau a énoncé clairement l'inconfort grandissant à l'égard de nos richesses naturelles : « Mes prédécesseurs voulaient que vous sachiez que le Canada est connu pour ses ressources. Je veux maintenant que vous connaissiez les Canadiens pour leur ingéniosité. » Le gouvernement fédéral a écarté les industries de ressources lorsqu'il a récemment vanté les mérites du Canada auprès des investisseurs étrangers. Même des médias de premier plan ont affirmé que les ressources abondantes du Canada rendent les gens paresseux ou soutirent la croissance du reste des secteurs, des arguments sans fondement.

Ce document met en lumière le remarquable apport des ressources naturelles à l'économie canadienne. Elles englobent les productions primaires – agriculture, pêche, foresterie et exploitation minière – les combustibles minéraux, ainsi que de nombreuses industries manufacturières comme les aliments, le bois, le pétrole et les produits miniers. On examine d'abord leur impact sur le PIB, l'emploi, l'investissement et le commerce international du Canada, puis leur importance dans les régions isolées (notamment pour les peuples autochtones), leur pouvoir à favoriser les valeurs inhérentes à l'esprit d'entreprise et à l'innovation et, enfin, la façon dont elles permettent à l'ensemble des Canadiennes et Canadiens de survivre dans un territoire et un climat éprouvant.

Les principales conclusions sont les suivantes :

- Les ressources naturelles représentent 14,9 % du PIB du Canada, l'énergie représentant à elle seule la moitié de la production du secteur. Les ressources et comptent pour plus de 45 % de la production manufacturière.
- Près d'un emploi sur dix est lié aux ressources, secteur qui emploie 1,3 million de Canadiens.
- L'avantage comparatif du Canada pour le commerce dépend fortement de ses ressources naturelles, qui sont intervenues pour 58 % des exportations totales de marchandises en 2023. Il s'agit du seul secteur à afficher un excédent commercial, ses exportations surpassant l'ensemble des importations canadiennes de marchandises.

- *Malgré le marasme prolongé de l'investissement dans un environnement réglementaire de plus en plus hostile, les ressources naturelles comptent encore pour près de la moitié des investissements des entreprises au Canada.*
- *Les taux effectifs d'imposition applicables aux nouveaux investissements dans le pétrole et le gaz dépassent 30 %, le double de ceux des autres secteurs. Le temps nécessaire à l'obtention des approbations réglementaires initiales est deux fois plus long que celui prévu par la Loi sur l'évaluation d'impact. Ces délais rajoutent encore 20 % au coût fiscal de l'investissement.*

Le rôle toujours dominant des ressources naturelles dans l'investissement et les exportations ne saurait être dissocié de leur importance vitale pour la capacité concurrentielle du Canada sur les marchés internationaux. Avant la pandémie, la Banque du Canada insistait sur l'importance de transférer la croissance des dépenses largement à crédit des ménages et du gouvernement vers l'investissement et les exportations. Cependant, sauf pour l'investissement résidentiel issu de la croissance démographique, ce transfert n'a jamais eu lieu, en grande partie parce que les entreprises hésitent à soutenir les investissements requis pour améliorer la compétitivité à l'exportation et la capacité. Face à la normalisation des taux d'intérêt par suite de l'endettement encore plus marqué des gouvernements et des ménages dû à la pandémie, l'importance d'investir et d'exporter pour la croissance à long terme n'a cessé d'augmenter.

Négliger la portée des ressources naturelles du Canada perpétue une tradition chez certains économistes et décideurs qui discréditent leur apport au développement économique. Cette pratique remonte à la théorie des principales ressources (Staples Thesis) et s'inscrit, plus récemment, dans la critique des ressources en tant qu'entrave au développement des industries fondées sur les connaissances.

Les gens mésestiment l'importance des ressources naturelles pour le Canada pour plusieurs raisons. La critique a longtemps cultivé une image négative à leur égard en usant de termes désobligeants tels que « piège », « malédiction » et « syndrome » pour décrire le « piège des ressources », la « malédiction des ressources » et le « syndrome hollandais ». Ce négativisme est aggravé par le fait qu'elles sont exploitées pour la plupart hors des noyaux urbains, ce qui les rend pratiquement invisibles pour les élites médiatiques, culturelles et universitaires. Elles demeurent également enchaînées à cette image inexacte d'industries peu technologiques n'exigeant qu'une faible dépense de moyens pour remporter la « loto géographique » quand on dispose de généreuses dotations. Enfin, l'abondance de ressources est considérée comme un frein au développement des industries du savoir au Canada.

Toutes ces idées sont manifestement fausses. L'exploitation au Canada a été historiquement marquée par un flux constant d'inventions et d'innovations; le Canada a souvent repoussé les frontières par ses nouvelles technologies pour le blé, le canola, l'hydroélectricité, les métaux et les sables bitumineux. De manière générale, ces industries sont propices aux valeurs qui renforcent l'esprit d'entreprise et l'innovation dans tous les

secteurs, car leur nature cyclique exige une main-d'œuvre flexible et une tolérance à la destruction créatrice; leur intensité capitalistique nécessite beaucoup d'épargne et de planification à long terme; et leur dépendance à l'égard des marchés étrangers oblige à reconnaître le rôle joué par le commerce international et les flux d'investissement.

En d'autres termes, les ressources, en particulier l'énergie, ont autant d'importance parce que la transition vers de nouvelles sources doit être efficace et fondée sur des facteurs économiques fondamentaux pour éviter toute perturbation économique. Les gouvernements encouragent la transition à coup d'impôts et de réglementations pour renchérir les carburants, et de subventions pour les énergies renouvelables. Toutefois, cette transition ne se fait que lentement, car elle est onéreuse et provoque la résistance croissante d'un électorat déjà très éprouvé par la récente poussée de l'inflation et des taux d'intérêt. Si la transition vers de nouvelles sources d'énergie continue d'être mal gérée, la population connaîtra une baisse de revenus encore plus importante que celle de la dernière décennie, ce qui érodera encore la position du Canada dans un monde de plus en plus dangereux et instable.

La difficulté pour le Canada – et pour presque tous les pays – de passer à de nouvelles sources d'énergie tient au fait que sa consommation est fondamentale pour le développement économique à long terme. **MLI**

Introduction

Have Canadians lost sight of the importance of the country’s resource sector? In 2023, the government of Canada listed key facts about Canada’s attractiveness for foreign direct investment (Office of the Chief Economist, Global Affairs Canada 2023). Undoubtedly our well-educated workforce, stable financial sector, and trade linkages, among other factors, are important to Canada’s success. Nonetheless, nowhere does the Global Affairs document mention Canada’s abundant resources: land, forests, water, agriculture, minerals, metals, and oil and gas. As W.L. Morton observed in 1968: “No Canadian has found it necessary seriously to revise Cartier’s spontaneous comment as he gazed on the Labrador coast of the Shield. It was, he said in awe, ‘the land that God gave Cain.’ The main task of Canadian life has been to make something of this formidable heritage” (Morton 1968, 5).

The main task of this paper is to remind Canadians of the primordial importance that resources have brought to our high standard of living today. Since the beginning of Canada’s development, resources have been key to our success, initially attracting many immigrants to be fur traders, lumberjacks, prospectors, and farmers. The Staples Thesis¹ is part of Canada’s DNA. Canada’s culture, economy, and political history were rooted in the exploitation and export of its staples: fur, fishing, wheat, mined metals, and coal. While abundant resources can be mismanaged, resulting in corruption, unbalanced growth, and poorly distributed wealth (collectively known as “the resource curse”), Canadians have demonstrated their ability to “make something of this formidable heritage” (Morton 1968, 5). Not all successful countries are blessed with abundant resources, but developed countries such as Australia, Canada, the United States, and several in northern Europe have leveraged their natural resources to create a high standard of living. Natural

resources such as agriculture, fishing, forestry, mining, and oil and gas are foundational to nearly half of our manufacturing industries – if we were not rich in resources, we would lose significant competitive advantage that would have to be made up in some way.

The resource sector accounts for 14.9 percent of Canada’s primary, manufacturing, and service output. While energy by itself represents one half of the resource sector, value-added from mining, forestry, fishing, and agriculture provides abundant products and services to Canada and other countries to which we export. As we will show shortly, resource-based manufacturing has become the dominant force in the recent growth of manufacturing, accounting for 46.5 percent of all factory output in 2019.

“*Energy itself has been critical to mankind’s development since the beginning of time.*”

Energy itself has been critical to mankind’s development since the beginning of time. The use of fire for cooking, heat, and light followed by hydro, coal, steam, fossil fuel, and other energy sources enabled humans to use electricity, move from place to place, communicate, manufacture products, provide services, and even reach outer space. Canada has been a regional energy superpower providing energy resources to the United States in particular; energy accounts for the largest share of our global exports. Without the export of oil and gas, and to a lesser extent coal and electricity, Canada’s exchange rate would be sharply lower, depressing incomes measured in US dollars and triggering a brain drain of Canada’s most talented people as they emigrate to wealthier countries. Already, Canada’s per-capita real GDP (in 2012 dollars) is only 56 percent of US per-capita real GDP (Mintz 2023).

With the energy transition away from fossil fuels expected to take place this century, Canada will be challenged to maintain its standard of living. Non-conventional oil extraction generates \$997 per working hour in 2022, far more

than any other sector in the Canadian economy (the average is \$61 dollars) (Statistics Canada 2024, Table 36-10-0480-01). A shift of employment from this sector to others will lower GDP unless Canada is able to successfully develop other high value-added industries. Keeping this in mind, leveraging our current energy and other resources to create new products like hydrogen, carbon fibres, metals, potash and minerals, agricultural products, and other potential manufactured innovations remains a key to Canada's success.

Further, given that an energy transition requires considerable time, we should take advantage of the demand in the world market for fossil fuels, especially natural gas as a transition fuel. We should also ensure that our other resource products such as wheat, fertilizers, and critical minerals are developed for export markets. As part of the Western world's alliance, Canada must contribute all its resources to ensure our collective security, which will become even more critical given the growing divisions between the West and Russia and China (Imray and Magome 2023). When the BRICS bloc of nations – currently comprising Brazil, Russia, India, China, and South Africa – is expanded to include Argentina, Egypt, Ethiopia, Iran, Saudi Arabia, and the United Arab Emirates, it will represent 40 percent of the world's population and 25 percent of global GDP.

This paper proceeds as follows. In the next section we discuss the importance of resources as a source of comparative advantage in trade and economic growth. We follow this with an analysis of the economic importance of the resource sector to economic development in general. We then measure the direct and indirect contribution of the resource economy to Canada's development. The final section focuses on the energy transition and the policy framework needed to facilitate the major investment this transition will require in the coming years.

The resource sector and Canada's comparative advantage

Trade and productivity are key elements of Canada's success as a small open economy since before Confederation. As a colony in the British Empire, Canada had access to British markets prior to the 1840s, and then had a reciprocal trade agreement with the United States until 1866. Prime Minister John A. Macdonald's National Policy reverted to mercantilism by implementing tariffs to protect manufacturing in Central Canada from American and European imports. Not all parts of Canada were in favour of protectionism, especially the Maritimes and the West that had to buy more expensive consumer and industrial goods from Central Canadian manufacturers rather than import cheaper goods from foreign producers.

As a trade policy, mercantilism implies that economic gains come from running trade surpluses. Yet before Confederation, opposition to mercantilism was growing in the British Empire. Adam Smith (1776) observed that it is not possible for all countries to simultaneously post trade surpluses since a surplus for one country means that another must run a deficit. Instead, Smith argued in favour of a liberalized trade policy based on absolute trade advantages whereby a country would specialize in those goods and services it could produce more cheaply than another country. Ignoring other factors of production (e.g., capital) for now, the average cost of producing a product is the compensation paid to labour divided by the value of production.

A country with high labour productivity (output per working hour) tends to have lower unit costs of production given the same wage levels.² Smith argued that cheap imports are a benefit to any economy since labour can be put to better use producing and exporting other products that cost less to produce domestically.

The problem with the theory of absolute advantage is that if a country imports cheaper products from all other countries, it would not be able to export its own products. The absolute advantage framework can then be used to support the mercantilist view that tariffs and non-tariff barriers should be implemented to prevent imports from displacing domestic production and employment. This is exactly what happened recently in the United States when policies became more protectionist compared to the 1990s and early 2000s,

beginning with the Buy America policies under Barack Obama and continuing with the America First policies under Donald Trump. Trump argued that American workers were disadvantaged by cheap imports from other countries due to North American free trade agreements and China's entry into the World Trade Organization. His solution as a mercantilist? Impose tariffs and non-tariff barriers to protect workers in the United States.

(...) If a country imports cheaper products from all other countries, it would not be able to export its own products.

As an alternative to the absolute trade advantage, in 1817 David Ricardo proposed the concept of “comparative advantage,” which remains a bedrock of today's trade theory (Ricardo 1821). Ricardo argued that liberalized trade would lead to economic gains by nations specializing and exporting products that have the lowest opportunity cost of production in the domestic economy. For example, suppose Canada is highly productive in producing wheat relative to cheese while the United Kingdom has lower costs for producing cheese but not wheat. Just to reinforce the point about comparative advantage, suppose Canada has substantially higher labour productivity for both industries compared to the UK so its unit cost of production in both industries is below that of the UK for both products. Despite Canada's absolute advantage in both wheat and cheese, it only has a comparative advantage in producing wheat, not cheese. In other words, assuming that wage rates paid to labour are the same across its economy, Canada should use its labour to produce the good with the highest labour productivity (wheat) rather than producing the one with lower labour productivity (cheese). Given the low opportunity cost of labour used to produce wheat, Canada could boost its GDP by increasing wheat production to sell to the UK and reducing its production of cheese, instead importing cheese from the UK where its production has a lower opportunity cost of labour compared to wheat. Both Canada and the UK realize gains in GDP from trade by Canada exporting wheat to the UK and the UK exporting cheese to Canada.

TABLE 1: Labour productivity and Canada’s top merchandise exports by major product in 2021

	Labour productivity*	Export value (\$ billion)	Share of Canada’s merchandise exports (%)
Crude petroleum	950.1	81.2	16.8
Cars	60.6	29.0	5.99
Petroleum gas	649.0	15.0	3.11
Refined petroleum	611.2	11.4	2.36
Gold	136.5	14.3	2.95
Sawn wood	39.7	13.3	2.75
Motor vehicles parts and accessories	65.0	10.9	2.26
Packaged medicaments	54.1	8.6	1.77
Iron ore	540.9	8.3	1.72
Raw aluminum	132.7	8.3	1.72
Wheat	83.5	6.9	1.43

*Labour productivity is value-added per working hour. Productivity measures are matched to specific trade categories. Source: OEC (Undated), Statistics Canada 2024, Table 36-10-0480-01.

The theory of comparative advantage has been confirmed by several empirical studies (see the recent survey by Rivera-Batiz, Erbil, and Opanasets (2020, 91–95)). Expanding the Ricardian model to a multi-product and multi-country context, studies have demonstrated that a country naturally exports more of those products that have a high labour productivity and lower unit costs. Although not a perfect correlation, this is the case for Canada. As shown in Table 1, Canada’s most important exports are generally from those sectors of the economy where labour productivity is above the national average (on average, much smaller levels of trade occur in those industries, not shown in the table, with lower labour productivity). Productivity – measured as GDP (value-added) per working hour – is highest in oil and gas, followed by metal mining. However, the relationship between labour productivity and the quantity of exports is not perfect in every case. For instance, cars and vehicle parts and accessories are important exports, but labour productivity

in that sector is only somewhat better than the national average of \$58.5 for the goods producing industries (Statistics Canada 2024, Table 36-10-0480-01). Sawn wood is a major export commodity (sixth highest) but labour productivity in that category is only \$40 per working hour, well below the national average.

The last observation in the previous paragraph raises some crucial questions in explaining comparative advantage – why does labour productivity differ so much across countries? There are several reasons, which we discuss briefly:

- **Factor endowments:** Obviously, labour is not the only factor of production – companies also use tangible capital (such as machinery and equipment), land, and natural resources to produce products. Countries with a greater abundance of a given factor of production benefit from a lower opportunity cost of using that factor, and therefore tend to export products that more intensively use that factor (Heckscher 1919; Ohlin 1933). So, it is not surprising that Canada, with its large endowment of arable land, forests, and non-renewable resources and relatively small population, has a comparative advantage in manufacturing goods that are based on agricultural, forestry, mining, and oil and gas inputs but not labour-intensive manufacturing such as textiles and many consumer goods.³
- **Technology and capital investment:** Technology can be broadly interpreted to include research and development and other forms of discovery leading to innovations (including exploration in mining and oil and gas). Productivity depends on both the supply of ideas and their adoption. Innovation can benefit not only an inventor but also other businesses able to copy ideas without bearing the cost of invention. Hence, intellectual property rights – patents, trademarks, and copyright – are legal means by which a company can protect the economic rents from its valuable intellectual property. With regard to technological adoption, countries that invest in new vintages of tangible and intangible capital reduce unit production costs or provide new products that domestic and international consumers value. Given Canada's declining expenditure in both research and development and low investment rates since 2015, our per capita GDP has risen less quickly than in other countries. The lack of

productivity has led to Canada exporting raw materials more than manufactured finished products. Canada's capital per worker is lower than in the United States (Robson and Bafale 2023), which indicates that Canada is less competitive in trading capital-intensive products than the United States.

- **Human capital:** Countries with more skilled labour are able to produce high-value exports. Even though Canada is less labour-intensive than many other countries, its human capital provides a larger “endowment” of labour (adjusted for quality) that helps Canada produce 3.2 percent of global GDP with less than 1 percent of the world's labour.
- **Migration:** Immigration (population inflow) and emigration (population outflow) add to or subtract from a country's labour endowment. Thus, more net migration, assuming fixed resources and capital, lowers the opportunity cost of labour-intensive exports as wages decline. This enables labour-intensive industries to expand, which can drive up wages. Further, if capital increases to absorb new migrants, the migration may have little effect on wages as well. Thus, studies are mixed regarding the impact of migration on unemployment and low-skilled wages (Rivera-Batiz and Opanasets 2020, 105–6).
- **Market structures:** Much trade takes place within industries, rather than between industries, which was the focus of early comparative advantage theory. Intermediate goods made up 40 percent of Canada's international merchandise trade value in 2022.⁴ Trade within industries often takes advantage of local or regional differences in cost conditions, resource availability, and transportation costs. For example, auto parts and refined oil may be sold from Canada to the US and vice versa within the same company to minimize costs or cater to differences in consumer preferences. Although technology differences and factor endowments including resources can explain intra-industry trade, market structures also play a role. Trade tends to take place in markets that are close to each other in geography and culture, which for Canada points squarely at the US market. With local economies of scale, production will be concentrated in

locations with factors of production agglomerating in larger urban centres such as the Greater Toronto Area, Montreal, Calgary/Edmonton, and Vancouver. With economies of scope, producing many product lines could reduce the average overall costs, thereby enabling companies to compete simultaneously in many specialized markets. Products are differentiated, enabling some companies with multiple product lines to cross regions to dominate a market. Companies in protected markets that have little competition earn high profits invite foreign firms to enter the market – this can result in cross-hauling as domestic and foreign firms compete with each other in different markets (Brander and Krugman 1983).

- **Governance:** Domestic institutions and governance play an important role in the development of comparative advantage and a country's productivity. International trade involves millions of contracts to swap goods and services among participating companies. Countries with poor governance that lowers productivity find it more costly to export goods and services. Canada ranks well on the Corruption Index (it is 13th out of 180 countries), but its score has been dropping steadily in Transparency International's Corruption Perception Index from 92 (out of 100) in 2000, to 83 in 2015, to 74 in 2022 (Transparency International 2024). In particular, experts estimate that between \$43 billion and \$113 billion a year are laundered through Canada's financial system, and 15 companies in Canada have been blacklisted by the World Bank for corrupt practices (World Bank 2024). Poor governance also leads to lower productivity and higher production costs as permits are more costly to obtain, transportation infrastructure is harder to build or, even if it is built, of poor quality. Of 190 countries, Canada ranks poorly in obtaining construction permits (64th), getting electricity hooked up (124th), contract enforcement (100th), moving goods across our border (50th), and registering property (36th) (World Bank 2020). These governance issues are particularly important for resource development, which has stalled since the implementation of Bill C-69 in 2015 and the *Impact Assessment Act* in 2019 that have stopped most oil and gas development in Canada.

Even with the development of “new trade theory” that goes beyond the original Ricardian model, comparative advantage remains a critical determinant for growth. Along with comparative advantage comes investment in strategic industries as a source of growth. Without doubt, the resource sector has played a key role in Canada’s economic development in the past and the future as we further elaborate below.

Natural resources, especially energy, and Canada’s economic development

To examine the importance of natural resources in Canada’s economy, this section begins with an overview of the close link between resource consumption, especially of energy, and long-term economic development. Given the considerable importance of resources to our economy and society, we study the perplexing hostility to resources expressed in several narratives about Canada’s economy under the umbrella of the so-called “resource curse.” These include the Staples and Dutch Disease theses and the more recent belief that resource development is antithetical to “knowledge industries” – when knowledge itself has been a critical input into the exploitation of our natural resources.

These critical narratives contrast with the unabashed enthusiasm for resource development in the United States, which has been central to its self-image of American exceptionalism. The section concludes by summarizing why transitions from one energy source to another take decades, and how a transition to green energy must be managed carefully when it is not supported by lower prices in the marketplace and therefore potentially raises the cost of energy.

It is worth underlining the ubiquitous contribution of natural resources to maintaining and improving our society’s lifestyle. Reliance on energy especially is omnipresent: every industry uses energy in some form, either directly as an input into products such as chemicals and plastics, or indirectly as fuel to power machinery and equipment and supply the electricity that maintains the computers and the lighting, cooling, and heating in buildings.

Furthermore, while energy sources can be substituted for each other – Germany was so desperately short of gasoline in the Second World War that it devised techniques to squeeze oil out of its coal deposits while Japan resorted to soybean oil and other biofuels (Naam 2013, 71) – it is nearly impossible to substitute non-energy inputs for energy.⁵

The universal dependence of economic activity on energy reflects the critical role the latter plays in economic growth. There is an abundant literature about the primordial importance of energy for long-term economic growth. Roger Fouquet, a London School of Economics professor specializing in the relationship between economic development, energy use, and the environment, observed that “there is a close relationship between energy consumption and economic development” (Fouquet 2009, 1). Vaclav Smil, a renowned Canadian academic expert on energy, the environment, and population changes, is emphatic that “To talk about energy *and* the economy is a tautology: every economic activity is fundamentally nothing but a conversion of one kind of energy to another, and monies are just a convenient (and often rather unrepresentative) proxy for valuing the energy flows” (Smil 2017, 344).⁶

Ian Morris (2011) identifies energy as one of four critical factors contributing to economic growth since the beginning of history. Examining the development of societies over 10 millennia, Morris quantifies how development is primarily based on the amount of energy that can be usefully captured, the ability to organize production efficiently (measured by the size of its largest cities), war-making capability (weapons, troop strength, logistics), and information technology (speed and reach of writing, printing, telecommunication, etc.).

Kenneth Friesen bluntly concludes that “the history of today’s industrialized world is the history of fossil fuel energy” (2020, 11). Alex Epstein clarifies that the industrial revolution “in practice meant an *energy* revolution” (2014, 78 [italics in the original]). Describing the history of energy in Canada, University of Toronto historian Ruth Sandwell summarizes how “it was the massive nineteenth-century shift to fossil fuels and electricity that, unbeknownst to economic theorists of the time, would eventually transform almost every aspect of life and work, and in ways that would dramatically increase opportunities for economic growth for the first time in history” (Sandwell 2016, 8).

The dependence of economic growth on energy has been on display for centuries. Morris has documented how both the Agricultural Revolution thousands of years ago and the Industrial Revolution in the late eighteenth century reflected a sharp increase in the ability of humans to “capture” new energy sources. (Morris 2010, 35) The Industrial Revolution “can be regarded as the process whereby the large-scale exploitation of new sources of energy by means of inanimate converters was set on foot” (Cipolla 1978, 54). The crucial role of fossil fuels in the Industrial Revolution is reflected in how their share of global energy soared from 5 percent in 1850 to 80 percent in 2020 with only a small decline to 75 percent by 2030 according to the International Energy Agency (IEA) forecast (Yergin 2011, 3; IEA 2023).

The Industrial Revolution’s growing demand for fossil fuels reflects how they proved to be efficient and convenient in meeting the energy needs of modern economies. Coal was the first widespread source of inanimate energy. This began a cumulative process, where a rising supply of energy stimulated more economic growth, which in turn encouraged the discovery of new sources of energy, notably other fossil fuels.



Steadily declining energy prices played a key role in raising our standard of living over the last two centuries.

Steadily declining energy prices played a key role in raising our standard of living over the last two centuries. Lower prices were driven by successive transitions to cheaper energy sources, as we moved from timber to coal to oil and gas. The low cost of petroleum and its adaptability to many industrial processes spurred its widespread use in products and processes, something often overlooked because its low price diminishes its share of inputs in GDP statistics even as its ubiquity as an input demonstrates that it is irreplaceable. The indispensability of energy is fully – if unpleasantly – revealed whenever energy prices spike due to temporary shortages (such as in the aftermath of

Russia's invasion of Ukraine) or when an electrical blackout occurs (such as occurred in Ontario in 2003 or California in 2001). This is why, as will be discussed in a later section, the transition from fossil fuels to green energy sources such as wind, solar, hydrogen, or nuclear has to be well managed to ensure that energy remains both reliable and low-cost to avoid undermining economic growth and our standard of living.

Energy's key role in the economy is confirmed by the very high correlations (over 0.9) between average per capita GDP and energy consumption across all countries (Smil 2017, 347). This close relationship is summarized by Medlock: "in developing nations a lack of modern energy services is a principal cause of low levels of economic and social development. Access to electricity promotes social development and improved welfare by allowing greater access to information via computer, radio and television, cleaner means of storing and preparing food, and the attainment of heating and cooling services" (Medlock 2009, 89).

The important role of energy in raising incomes explains the difficulty that middle and low-income countries have meeting lower emissions targets. Between 2005 and 2018, greenhouse gas emissions have fallen among Western industrialized countries who collectively emit less than China alone does. However, global greenhouse gas emissions rose 23.0 percent because of a 40.9 percent increase in non-OECD nations, especially a 70 percent surge in China and India, which together account for 32 percent of global GHG emissions (World Resources Institute 2024). The practical difficulty of lowering energy consumption and therefore emissions in developing countries supports Smil's observation that "a decoupling of economic growth and energy consumption during early stages of modern economic development would defy the laws of thermodynamics" (Smil 2017, 350).

The correlation between energy consumption and a nation's economic development does not mean there are not differences within homogeneous groups of countries. As Smil observes, "to become rich requires a substantial increase in energy use, but the relative energy consumption increase among affluent societies, whether measured per GDP unit or per capita, varies widely" (Smil 2017, 347). Making the transition out of poverty requires a considerable amount of energy, but remaining prosperous is consistent with some variation in energy consumption (North America's is very high, parts of Europe somewhat lower) or even a decline, as long as energy consumption remains

substantial. Canadians should also be aware that a reverse transition is possible: a large drop in energy consumption can happen in countries when per capita GDP plunges, as occurred in Russia and other Eastern Bloc countries after communism collapsed in 1989. Green energy policies in Canada need to focus on maximizing energy efficiency while maintaining a high standard of living, not lowering our per capita GDP to a level comparable with the next tier of nations (such as Poland, Portugal, or Mexico).

A complicating factor is that rich nations have the option of “offshoring” their energy consumption by importing energy-intensive manufactured goods from Asia, especially China. Such a move reduces measured emissions in North America or Europe, while doing nothing to reduce global emissions as energy consumption shifts to Asian nations that often rely on energy sources with above-average emissions, notably coal.

The age of fossil fuels is far from over. The IEA foresees fossil fuels continuing to supply 73 percent of all the world’s energy in 2030 (International Energy Agency 2023, 101). The critical and irreplaceable role of fossil fuels in our economy is why IEA scenarios of net-zero greenhouse gas emissions acknowledge that future fossil fuel use will not decline to zero in gross terms. For example, the IEA’s net-zero scenario for 2050 allows for global demand for crude oil of 24.3 million barrels a day (demand has grown to a record 102 million barrels a day in 2023), with industrial feedstock replacing road transportation as the leading source of demand for oil (IEA 2023, 130–132). This hard-to-replace aspect of demand for oil reflects that some industrial uses require petroleum, notably the petrochemical, iron and steel, and cement industries (IEA 2023, 112). Aviation and shipping fuel also is proving difficult to replace since batteries weigh too much to be economical for transporting heavy loads (IEA 2023, 29). At this point, “net-zero” 2050 targets are aspirational, and China and India have made it clear they do not plan on reaching net-zero emissions until after 2060 and 2070 respectively. Given the growing GHG emissions in non-OECD countries this decade, it is highly unlikely that the world will reach net-zero emissions by 2050.

The economic importance of Canada's natural resources

After defining the natural resource industries, this section conducts a detailed analysis of their importance for Canada's GDP, employment, business investment, and international trade. In doing so, it also highlights some of the major individual resource industries contributing to these trends over time, especially the primary sector and resource-based manufacturers.⁷

What are natural resources?

Natural resources are clearly important to Canada's economy. However, there is surprisingly little agreement among economists on what industries constitute our natural resource sector (Cross 2015). More telling is the lack of rigour in most attempts to define the resource sector – most classifications are based largely on the whims of the author, especially for which industries outside of the primary sector should be included.

This paper defines the natural resources sector as all primary industries (agriculture, forestry, fishing, and mining) plus utilities (mostly electricity), pipelines, and manufacturers using natural resources for 17 percent or more of all inputs. According to Statistics Canada's Input/Output tables, these manufacturers include food, wood, paper, petroleum refining, chemicals, non-metallic minerals, and primary metals. (See Cross 2015, for more on the methodology of defining natural resources.)

Inputs of natural resources refer only to purchases made outside of the primary sector. As will become obvious in the next section, one of the defining characteristics of the primary sector and utilities is they extract resources from their natural state by applying capital and labour, not by purchasing them from another producer. So, for example, utilities only purchase 23 percent of their inputs from the primary sector because the water that hydro-generating power plants use is available at little cost (after the capital investment of building a dam, which is not counted as an input in the National Accounts).

The criterion for defining resource-based industries outside of the primary sector is the share of total inputs bought from all primary industries and utilities, and not just one industry within the primary sector. This captures

industries dependent on more than one resource as a critical part of their production process. For example, the smelting and refining of non-ferrous metals requires large inputs of both metal ores and electricity. The country of origin of the inputs is not important to this definition of resources: in the case of aluminum, for example, the metal input (bauxite) must be imported into Canada, where it is made into aluminum by combining it with the key resource input of plentiful electricity.

Consistency of classification varies slightly across different data sets. Output, employment, and business investment use an industry classification, while international trade data are based on a commodity classification. Since Statistics Canada's classification for exports is based on commodities and not industries, there will not be perfect consistency.

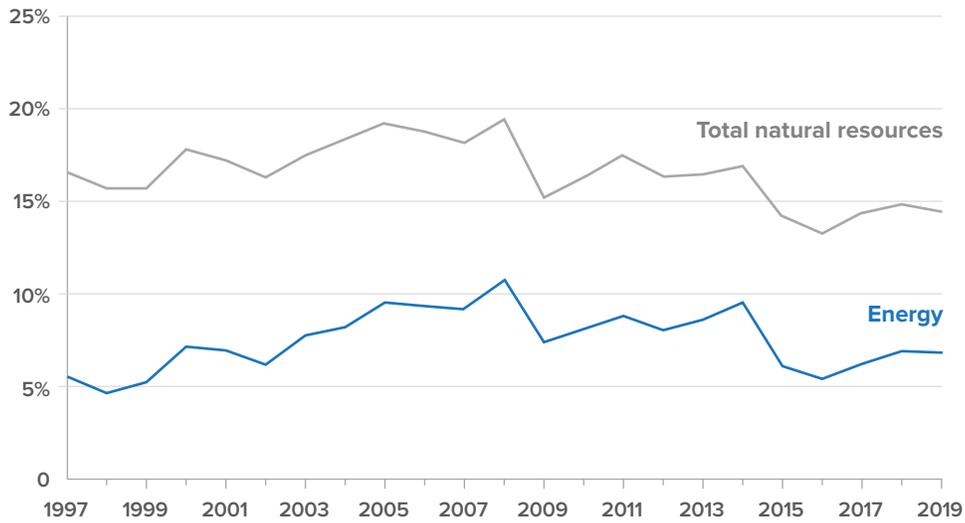
Gross domestic product

In 2019,⁸ the natural resource industries listed above directly contributed \$323 billion to Canada's GDP, or 14.9 percent. The share of resources in Canada's economy has fallen since 2008, reflecting how lower prices, especially for oil after 2015, outweighed higher production volumes. The resource sector was as large as 19.5 percent of total GDP at the height of the resource boom in 2008, and 16.8 percent in 2014 before oil prices crashed. Most of the long-term slide in the share of natural resources contributing to GDP originated in the energy sector, down 4.0 points since 2008, while the non-energy sector share dipped only 1.1 points (see Figure 1, page 25).

Of the 14.9 percent of GDP directly attributable to resource industries, \$212.8 billion or 9.8 percentage points (or just under two-thirds) originated in the primary industries and utilities. Another 4.6 percentage points came from resource-based manufacturing. The remaining 0.5 percentage points reflected output in the pipeline industry. By comparison, transportation equipment manufacturing (which includes the auto and aerospace industries) accounted for only 1.5 percent of GDP in 2019 yet are deemed important enough to receive generous government subsidies. Even Canada's huge finance and insurance industries account for 6.8 percent of GDP, less than half the contribution of our resource sector.

Within the primary sector and utilities, oil and gas alone accounted for 43.2 percent of its total output of \$212.8 billion (see Table 2). The \$100.1

FIGURE 1: Share of natural resources contributing to GDP



Source: Statistics Canada 2023b, Table 36-10-0401-01.

billion of resource-based manufacturing output is led by 34 percent from petroleum-based manufacturers⁹ and 28.6 percent from the food industry. The remainder reflects contributions of 19 percent each from forestry-based and mining-based manufacturing and 16 percent from mining other than oil and gas.¹⁰

There is little evidence in Canada to support the undocumented assertion that advanced staples economies evolve “from ‘pure’ extraction to secondary processing and manufacturing.” (Hutton 2008, 45) On the contrary, the share of resource-based manufacturing in Canada’s resource economy fell from a high of 43.0 percent in 1997 to 31.0 percent in 2019, reaching a low of about 26 percent at the peak of the resource booms in 2008 and 2014. The declining share of resource-based manufacturing reflects the near-tripling of oil and gas production within the mining sector and the doubling of output in agriculture, forestry, and fishing along with utilities. By comparison, resource-based manufacturing expanded by a pedestrian 62 percent between 1997 and 2019. This contradicts the widely held idea that growth in our economy, especially in natural resources, lies in “moving up the value-added chain.” Over the last two decades, the greatest opportunities for growth have been in the primary sector, not the secondary processing of resources.

TABLE 2: GDP from resource-based industries, 2019 (in \$ millions)

Agriculture, forestry, fishing	\$39,263
Mining	\$123,013, of which \$91,947 is from oil and gas (including services) and \$31,065 from other mining
Utilities	\$50,536
Manufacturing of:	\$100,128
• food	\$28,650
• wood	\$9,335
• paper	\$9,217
• petroleum	\$13,578
• chemicals	\$20,521
• non-metallic minerals	\$7,050
• primary metals	\$11,777
Pipeline transport	\$10,087
Total resource-based GDP	\$323,027
Total GDP	\$2,161,924

Source: Statistics Canada 2023b, Table 36-10-0401-01.

It is also worth noting that natural resources play an important role in all provinces. Their share of GDP ranges from just under 10 percent in Ontario and Nova Scotia to 30 percent or more in Alberta, Newfoundland & Labrador, and Saskatchewan. While oil and gas deposits are concentrated in Alberta, BC, Saskatchewan, and Newfoundland and Labrador, forestry and mining are sizeable in Ontario and Quebec, and agriculture is significant in Manitoba and Prince Edward Island. Most provinces have significant electric utility industries. The distribution of natural resources across the country contrasts with industries such as automobile and aerospace manufacturing, which are 90 percent concentrated in Ontario and Quebec, or even finance and insurance, which generates 70 percent of its income in Central Canada.

Energy as the dominant natural resource industry in Canada

Energy is by far the leading commodity within the resource sector. The energy sector is defined as the oil and gas industry (including services to mining, which is mostly exploration and development of oil and gas), utilities, oil refining, and pipeline transport. Altogether, energy accounts for over half (61.6 percent) of the \$323 billion of GDP income generated by Canada's resource industries. In turn, the oil and gas industry accounts for nearly two-thirds (62.4 percent) of GDP in the energy sector, at \$123.0 billion out of energy GDP of \$197.2 billion. Utilities make the next largest contribution at nearly \$51 billion, followed by petroleum refining at almost \$14 billion and pipelines at just over \$10 billion.

The importance of the resource sector and especially energy in Canada's economy will increase significantly when two large projects come on-line after nearly a decade of investment. Crude oil exports should benefit from the completion of the Trans Mountain pipeline, which will facilitate access to Pacific markets as an alternative to the relatively low prices dictated by Canada's current position of only being able to access oil markets in the US Midwest. More importantly, work will soon finish on Canada's first liquefied natural gas complex in British Columbia. This decade-long \$40 billion project will increase the volume of natural gas exports by about 16 percent a year and will also give Canada access to markets in Asia where natural gas prices are significantly higher than in North America. However, plans for the second phase of the BC LNG plant are subject to further regulator review and concerns about GHG emissions from natural gas power supply might scuttle its development (see Nickel and Williams 2023; Williams 2023).

Natural resources are the foundation of Canada's manufacturing

Natural resources and manufacturing are often portrayed as having opposing interests since higher resource prices can impose rising costs on manufacturers. More broadly, a boom in commodity prices sometimes puts upward pressure on Canada's exchange rate, which dampens manufacturing revenues and profits.¹¹ The allegation was made frequently in 2007 and 2008 that Canada's factory sector suffered as higher commodity prices helped push the exchange rate beyond parity with the US dollar in the 2000s (often referred to as Dutch Disease. See Cross 2013).

However, these arguments are incomplete and therefore misleading. The Canadian dollar does not always move with commodity prices since other factors affect exchange rates including Canada-US interest rate differentials and foreign indebtedness. For example, as recently as 2022, energy prices soared in the wake of Russia's invasion of Ukraine, but the Canadian dollar remained weak. This disconnect is reflected in the Bank of Canada's inability to forecast Canada's foreign exchange rate: instead, the Bank simply assumes the exchange rate will remain at its current level for the entire projection period. Furthermore, the high reliance of Canadian manufacturing on imported inputs shields many from a rising dollar's negative impact on revenues and profits because the rising exchange rate lowers the price of imports.

The reality is that Canada's natural resources are the base on which much of our manufacturing is built. Resource-based manufacturing has become the dominant force in the recent growth of manufacturing, accounting for 46.5 percent of all manufacturing output in 2019. The share is even higher in rural areas, where industries such as lumber, pulp and paper, and smelting and refining provide much needed jobs for rural communities, especially for Indigenous people. For example, employment in the primary sector and utilities accounted for only 1.7 percent of jobs in Canada's nine largest cities, but 6.6 percent of jobs in the rest of Canada.¹²

Linkages to other sectors

The above calculations of the importance of natural resources to the Canadian economy only reveal their direct impact. Natural resources have many other linkages to each other and to the rest of the economy. These include the indirect impact of buying inputs from all sectors of the economy. As well, there is the induced impact when money earned in the resource sector is spent at retail outlets and on services ranging from restaurants to rinks.¹³

The largest impact of natural resource output is within the resource sector itself. For example, raising resource output by 10 percent has indirect and induced impacts ranging from a 12.8 percent boost for forestry, fishing, and hunting to an 8.0 percent boost for agriculture, a 6 percent boost for mining, and 4 percent for utilities. This reflects how many resource industries use inputs sourced from other resource industries. For example, boosting food processing within manufacturing draws more production from farmers

and fishermen, while increased wood and pulp and paper output necessitates more forestry output.

The economic stimulus from more resource production is not limited to the resource sector. Demand for most private sector services rises between 2 and 3 percent in response to every 10 percent gain in resource production because, as the production of resources expands, they need more services as well as increasing amounts of raw materials and fuel. These services include transportation to carry more inputs to their production facilities and then carry their output to markets in Canada and abroad. Many of these products will go through a warehouse on their way to market. And the increased pace of operations in resource firms means they purchase more services, including the financing of their operations, insurance, and a wide range of business services (such as lawyers to draw up contracts with customers and accountants to keep their books).

“The money earned from people working in the resource sector stimulates demand for a number of consumer services.”

As well, the money earned from people working in the resource sector stimulates demand for a number of consumer services. Retailers benefit the most, with a 2.0 percent gain. Not far behind are accommodation and food as well as arts and recreation (which includes entertainment such as spectator sports).

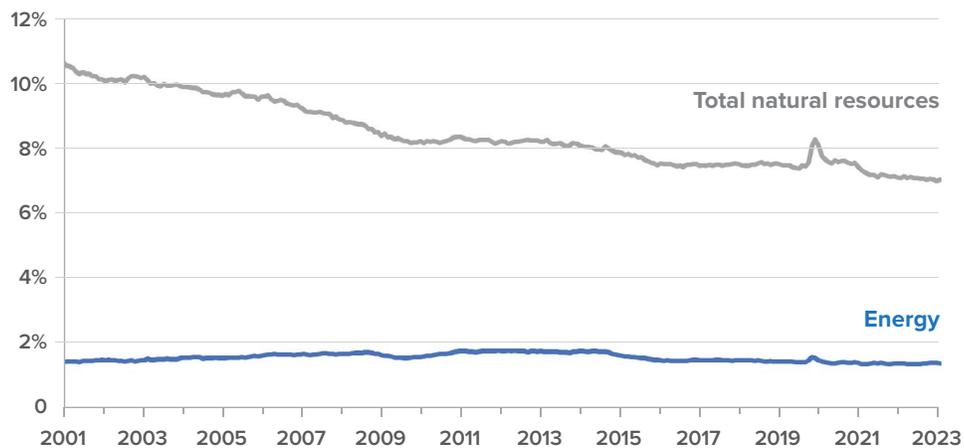
The only services sectors whose production does not see an appreciable direct benefit from more resource output are the government and non-profit industries. This result reflects the fact that resource industries do not purchase inputs directly from the government or non-profit sectors to boost their output. This does not mean that governments do not benefit from resource revenues. Rising resource output and incomes eventually lead to increased demand for a wide range of government services. This was seen in the boom in Alberta before 2015, which raised demand for everything from roads to the oil sands to more hospitals and schools as people migrated to the province. More importantly, the taxes the resource sector pays (including those from its employees) are an important source of the revenues that sustain government operations.

Employment

Natural resources contribute slightly less to total employment than to output, reflecting the capital-intensive nature of most of these industries. In July 2023, natural resources employed 1.3 million people in Canada, a number that has changed little over the past two decades.¹⁴ Stability is a distinctive feature of natural resource employment compared with its large fluctuations in incomes, investment, and exports. The constancy of resource jobs reflects the stability of the volume of production compared to the volatility of resource prices. The stability of overall employment in natural resources contradicts Hutton’s assertion in 2008 that resource industries “will be severely limited not only by the depletion (and even exhaustion) of key resource stocks but also by the job-shedding characteristics of advanced-technology resource industries striving to maintain competitive positions.” (Hutton 2008, 54) The share of employment in natural resources trended down from 10.4 percent in 2001 to 7.0 percent in 2023, reflecting faster job growth in most services and fewer jobs in agriculture and forestry (see Figure 2).

Despite the overall constancy of jobs, there have been major shifts within the natural resource industries. Employment in agriculture declined steadily from 440,000 jobs in 1991 to 260,000 in 2023 as farms continue to mechanize (tellingly, investment in agriculture has more than tripled to

FIGURE 2: Share of people employed in natural resources



Source: Statistics Canada 2024b, Table 12-10-0220-01 and 2024c, Table 14-10-0291-01.

\$10 billion by 2023 over the same period). Jobs in the oil and gas sector (which includes both drilling and the extraction of oil and gas) expanded 56 percent from 84,000 in 2001 to 131,000 in 2023. Meanwhile, mining outside of oil and gas increased their payrolls 63 percent from 51,000 to 83,000 jobs over the same period, about equally split between metal and non-metal mining. Employment in utilities also has risen by nearly a third since 2001. Resource-based manufacturing industries reduced their payrolls about 15 percent, from 719,000 jobs in 2001 to 600,000 in 2023, mostly because of downsizing in lumber and paper mills and automation in primary metals.

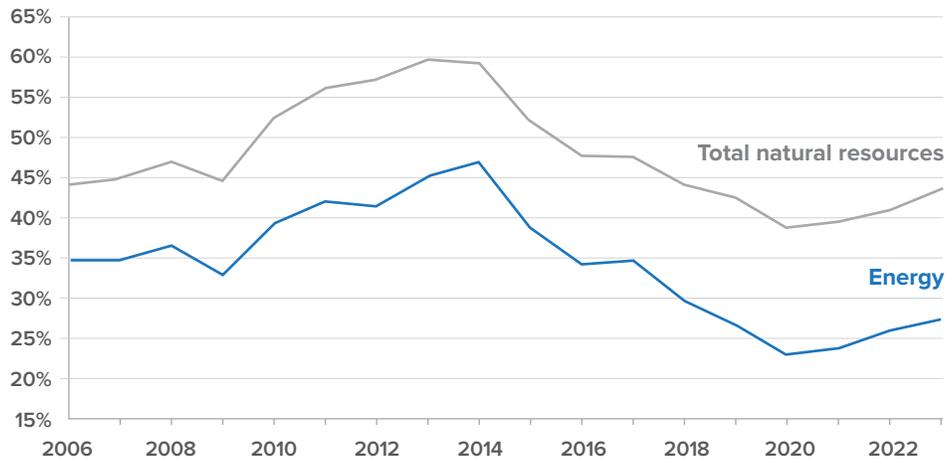
Business investment

While their capital-intensity limits their jobs numbers, natural resources are the dominant force in business investment in Canada (Figure 3, page 33). In 2023, they accounted for \$109.0 billion or 43.6 percent of all business investment in structures, machinery, and equipment (Statistics Canada 2024d, Table 34-10-0036-01; and 2024e, Table 34-10-0035-01). This share has fallen from its peak of 59.3 percent in 2014 at the height of the boom in oil and gas investment. Energy accounts for 62.7 percent of all investment in the resource sector; while still dominant, this is below its 80 percent share reached at the peak of the oil and gas boom in 2014.¹⁵ Besides lower prices for oil and gas after 2014, investment has been hampered by a lack of access to more lucrative markets outside of the US as well as uncertainty surrounding the regulatory approval process for oil and gas projects.

While investment slowed in the energy sector, it surged in non-energy resources. Investment in farming was especially buoyant, rising from \$2.7 billion in 2006 to \$9.2 billion in 2023. Capital spending also rose sharply for non-energy mining as prices firmed for metals. Utilities also increased their capital outlays three-fold, as they struggled to keep up with rising demand for electricity. Investment rose in all resource-based manufacturing industries (apart from a slight dip at oil refineries) as they continue to automate.

Investment in resources has been deterred by several factors. Demand for capital falls when commodity prices decline as they did in late 2014 and during the pandemic year 2020. Since 2021, commodity prices have recovered. With higher prices and an expected demand for mining products due to the energy transition, demand is increasing for metallic and non-metallic mineral investments.

FIGURE 3: Share of natural resources in business capital expenditures (non-residential tangible assets)



Source: Statistics Canada 2024d, Table 34-10-0036-01; and 2024e, Table 34-10-0035-01.

Investment also depends on financing costs that have recently risen after exceptionally low interest rates prevailed after the financial crisis of 2008 until 2021. With rising government spending financed by the printing of money, inflation rates jumped well above central bank targets (2 percent in Canada) leading to higher real interest rates that are expected to prevail in the future.

Regulation also has deterred investment in Canada's resource industries. Projects are taking much longer to be approved especially under the *Impact Assessment Act*, which has only approved one resource project as of January 2024 since its inception in August 2019 (Impact Assessment Agency of Canada 2024). The legislation requires four stages of approval: planning (180-day limit), statement of impact by the proponent (up to three years), impact assessment (330 to 600 days), and decision-making (30 to 90 days). While 25 assessed projects have been subject to the initial planning phase, it has taken an average of 332 days to complete (the longest was 693 days), well beyond the 180-day requirement, largely due to stoppages in reviews. So far, 11 projects have completed the planning phase of which three were sent to BC authorities for approval. None have proceeded to the third or fourth stages except for the Cedar LNG project in BC. Overall, with hardly any projects reviewed having passed the planning stage, the process will likely take far longer than

the prescribed limits that indicate that the four phases should total up to roughly five years.

The resource sector is taxed at widely different rates. There are extensive tax benefits for mining, forestry, and agriculture, while oil and gas are more heavily taxed than other sectors (Table 3 above). Federal and provincial governments have been reducing tax preferences in oil and gas production for over a decade, scaling back exploration tax credits and accelerated depreciation for mine expansion, development expenditures, and the Atlantic Investment Tax Credit for oil and gas mining (it remains in place for agriculture, forestry, fishing, and manufacturing in the Atlantic Provinces and the Gaspé region). Some tax preferences remain for resource companies, particularly for mining (with an enhanced credit for critical minerals), mining exploration, inventory expensing for agriculture, flow-through shares for mining and oil and gas, and accelerated depreciation for capital expenditure. Clean energy investments are favoured with investment tax credits and a corporate income tax rate that is half of the regular corporate income tax. Manufacturing investments benefit from a much lower effective tax rate on new investments compared to service industries, utilities, and construction. Canada has one of the most biased tax systems in favour of manufacturing of any OECD country (Bazel and Mintz 2021, 12).

Two important changes will result in higher taxes on resource investment. Accelerated depreciation, initially introduced in November 2018, is to be phased out starting in 2024 and will be eliminated by 2028. The full phase-out of accelerated depreciation will result in the effective tax rate on new investments (excluding oil and gas and mining) rising by a quarter, especially in manufacturing, which, unlike other sectors, was able to fully expense its capital expenditures under the incentive.

As discussed above, the time taken to complete projects indelibly discourages capital investment. In Table 3, the estimated impact of taxes on mining and on oil and gas investment is based on the time typically taken to develop reserves available for production from start to finish (an average of 10 years for exploration and 6 years to development). Increasing the time taken to develop projects adds to the cost of capital. In an analysis of 14 resource projects prior to 2019, the average time for oil, gas, and electricity projects to gain federal approval varied from 1.58 years to 8.67 years, with an average time of 4.54 years (Cameron and Hutton 2018). As Figure 4 shows, the fiscal and regulatory delay costs for projects in 2018 (without accelerated depreciation

TABLE 3: Marginal effective tax rates on new investment by sector in Canada 2022 (in %)

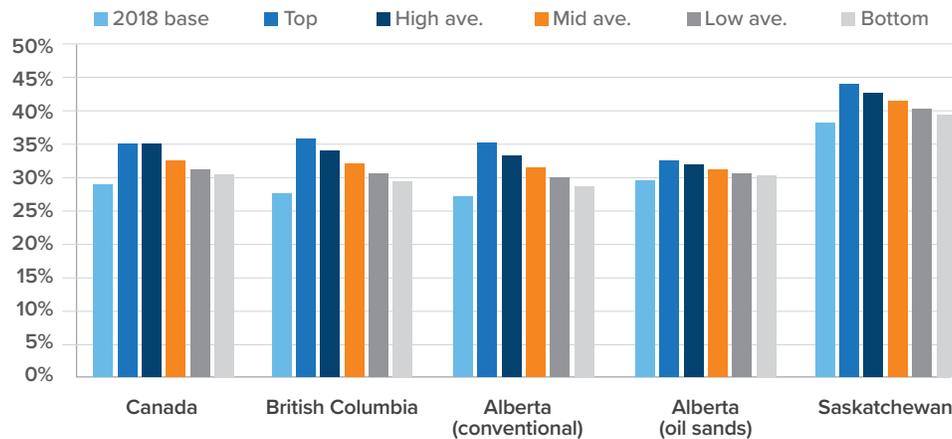
	With accelerated depreciation	Phased out accelerated depreciation
Agriculture	14.7	18.4
Forestry	7.2	15.2
Mining: non-critical (iron)	10.7	Not estimated
critical (copper)	8.1	
Oil and Gas	24.9	30.1
Manufacturing	7.4	15.8
Utilities	15.4	19.2
Construction	20.8	23.1
Transportation	14.8	17.8
Communications	15.9	22.3
Wholesale trade	21.1	23.3
Retail trade	22.9	24.7
Other services	20.4	24.7
AGGREGATE*	15.6	19.5
United States*	22.6	27.0

*Excludes oil and gas and mining.

Note: Marginal effective tax rates are equal to the annualized value of taxes paid as share of the pre-tax rate of return on capital. Taxes include corporate income taxes, transfer taxes, sales taxes on capital purchases, and royalties and mining profit taxes payments on marginal investment income.

Source: calculations by Philip Bazel and Jack Mintz.

FIGURE 4: Effective fiscal and regulatory delay cost burdens on new investment



Source: calculations by Philip Bazel for 4 pipelines, 2 oil sands, 5 electrical generation projects, 2 transmission lines, and 1 LNG plant

TABLE 4: Personal income tax rates for G7 countries, 2023

	Top marginal rate	Top income as a share of the average wage
Japan	55.9	8.4
France	55.4	14.2
Canada	53.5	2.7
Germany	47.5	5.3
Italy	47.2	1.6
United Kingdom	45.0	3.4
United States	43.5	8.5

Source: OECD, Tax Statistics. stats.oecd.org/index.aspx?DataSetCode=TABLE_I7.

that was later developed) rises from 29.1 to 30.2 percent if 1.58 years are added to the length of time for development and to 34.7 percent if 8.67 years are added. The latter implies an increase in the effective fiscal and regulatory burden of 20 percent.

The decision to produce in Canada also depends not only on capital taxation but also labour taxes and the taxation of intermediate goods, including energy. Personal and payroll taxes can affect competitiveness by discouraging work effort and entrepreneurship, and discourage mobile persons from working in Canada, resulting in higher labour costs (Kleven, Landais, Muñoz, and Stancheva 2020). Canada's personal income tax rates are amongst the highest of G7 countries and the top marginal rate applies at a low threshold of only 2.7 times the average wage, a much lower wage than in the United States when it kicks in at 8.5 times the average wage (Table 4).

Carbon taxes also have an impact on production. Carbon taxes increase the cost of energy that companies use, which therefore affects the competitiveness of their operations. Canada's carbon tax rate is now \$80 per tonne and rising to \$170 per tonne while the United States does not have a carbon tax (except for some state-level cap-and-trade levies, particularly California). Along with the phasing-out of accelerated depreciation, carbon taxation makes production in Canada less competitive. Canada is providing substantial incentives for

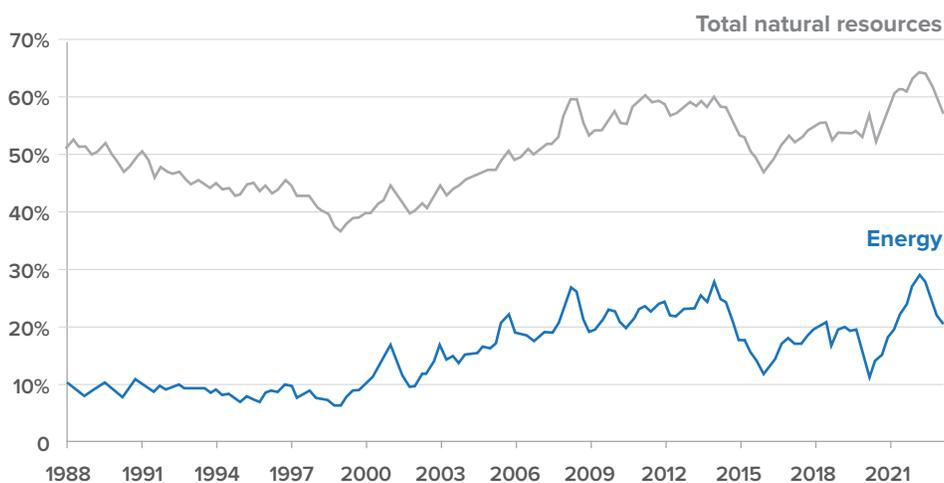
investments in emission-reducing technologies, although the US incentives under the *Inflation Reduction Act* are quite generous. Without further analysis the overall impact on cost competitiveness is uncertain.

Exports

The relative importance of natural resources and the trend for their inclusion in Canada's exports is greater and higher than for business investment (Figure 5). In the first half of 2023, the value of Canada's natural resource exports averaged \$110.6 billion, equivalent to 58.3 percent of all merchandise exports (Innovation, Science and Economic Development Canada 2024). The share of natural resources in exports fell from 50 percent in 1990 to a low of 40 percent in 2000, before beginning the boom that added 10 percentage points to their share in a little over a decade. Most of the increase reflected higher energy exports, whose share of total goods exports doubled from 10 to 20 percent in 2023 (and briefly hit almost 30 percent in mid-2022 when oil and gas prices spiked after Russia's invasion of Ukraine).

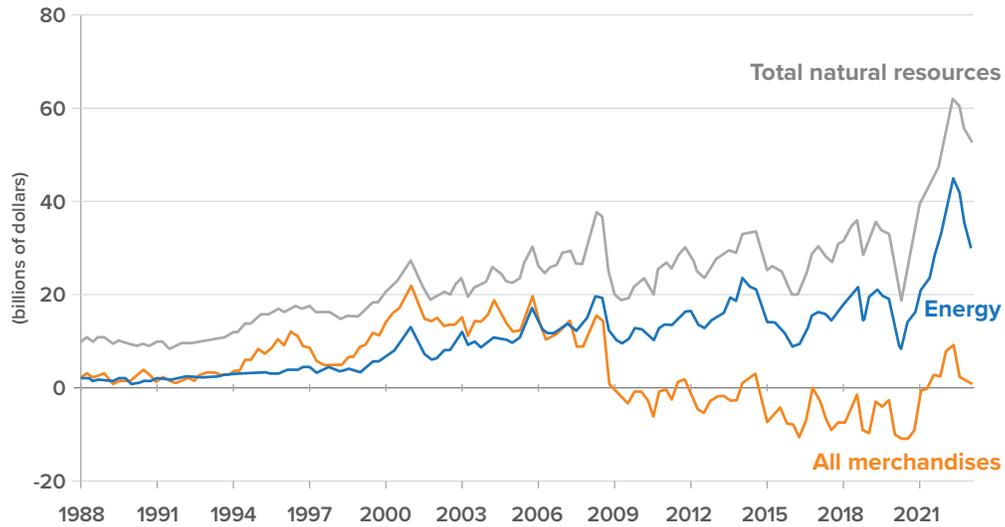
Natural resources account for all of Canada's merchandise trade surplus (Figure 6). Since 2008, Canada has run an overall trade deficit in most years. Most of this deficit originates in trade in consumer and investment goods.

FIGURE 5: Share of natural resources in Canada's exports



Source: Statistics Canada 2023c, Table 12-10-0122-01.

FIGURE 6: Canada's trade balances



Source: Statistics Canada 2023c, table 12-10-0122-01.

Meanwhile, the surplus in trade in natural resources rose to record levels in 2022, driven by soaring prices for oil and gas. Energy dominates the surplus in trade in natural resources even more than its share of resource exports. This reflects that Canada imports few energy products versus a large number of agricultural products (especially in winter) and sizeable quantities of metals, minerals, and chemical products.

Rural and Indigenous communities are especially reliant on natural resources

While natural resources are important to Canada's economy, they are especially important to rural communities. This is especially the case for Indigenous communities. Most Indigenous people (65 percent) live in rural areas, often in remote parts of Canada where there are limited opportunities for economic development (Savoie 2023, 175). As a result, Indigenous people rely on resource industries much more than do other Canadians. For example, 6.1 percent of Indigenous workers are employed in the primary and utility industries compared with 3.6 percent of non-Indigenous workers (detailed data for resource-based

manufacturing and pipeline transport are not available from the labour force survey). Aside from the legacy of discrimination, a lack of jobs perpetuates poverty in First Nation communities and “First Nation communities with lower employment rates experience higher social dysfunction” (Richards 2020, 8). J.P. Gladu, a First Nations leader in Northern Ontario, articulated the frustration of these communities, saying, “We’re tired of managing poverty – I can tell you that managing poverty is not a fun job. We want to manage wealth” (quoted in Nerberg 2023, 26).

“ *Higher incomes are why many Indigenous peoples are supportive of more development of natural resources.* ”

While aware of the importance of maintaining high environmental standards, higher incomes are why many Indigenous peoples are supportive of more development of natural resources. A poll commissioned by the Indigenous Resource Network in 2021 and 2022 found that a majority (65 percent) of Indigenous people support natural resource development while only 23 percent were opposed (the remaining 12 percent said it depends or were undecided) (Exner-Pirot and Desjarlais 2022, 3). Furthermore, a majority also supported development in all of the four resource sectors: forestry, fishing, oil and gas, and mining (Exner-Pirot and Desjarlais 2022, 4). Jobs were the number one reason for supporting resource development, reflecting how rural and reserve areas have few other opportunities (Exner-Pirot and Desjarlais 2022, 6). The dependence of First Nation communities on resource development also reflects the chronic inability of the federal government to deliver economic development, despite “substantial amounts of funds” (Savoie 2023, 137). In its 2023 Fall Economic Statement, the federal government increased its spending on Indigenous priorities by 289 percent, from \$11.4 billion in the 2015/16 fiscal year to \$32.9 billion in 2022/23 (Finance Canada 2023, 86).

Why do natural resources in Canada have a negative image?

Given the undeniable importance of natural resources to Canada's economy, it is perplexing that natural resource industries are often portrayed as a hindrance to our economic growth. Some of our leading political analysts have commented on the negative attitude many Canadians have about our resource base. Former Alberta Premier Jim Prentice wrote that "I have always been taken aback by the diffidence – even embarrassment – that many Canadians seem to feel about Canada's natural resource wealth" (Prentice and Rioux 2017, 16). Derek Burney, Brian Mulroney's former chief of staff, noted that "What once was a major competitive strength for Canada – the abundance of its natural resource base – is now shunned or stunted by ambivalent regulatory and court rulings" (Burney and Hampson 2020, 37). Negative portrayals of a "resource curse" have long been evident in the Staples Thesis of economic growth, the so-called Dutch Disease that allegedly hampers manufacturing activity, and the "reverse Midas touch" that claims that resource revenues lead to bad fiscal outcomes for governments.

Pioneered a century ago, the Staples Thesis argued that excessive reliance on resource staples made Canada "an economically weak country" by diverting capital and labour away from more productive uses in manufacturing. (Innis, 1956, 20) Another critique of export staples is they retard the "need for education and technical skills" (Howlett and Brownsey, 2008, 8) Proponents of the Staples Thesis acknowledge that the income earned from export staples (starting with Canada's cod fishing industry, followed by fur, lumber, and wheat) is necessary to build the infrastructure of developing nations. However, nations can fall into a "staples trap" if reliance on an export staple, compounded by heavy debt incurred to develop a resource, forces more resource extraction and hampers innovation in other sectors of the economy – a possibility aggravated by over-reliance on foreign capital and entrepreneurship (Howlett and Brownsey 2008, 21). This becomes especially problematic by violent swings in commodity prices and when the supply of the resource staple is exhausted over time (Watkins 1963, 61).

Resource wealth in the Staples Thesis also is regarded as undermining good public policy and is a forerunner of the critique that there exists a so-called

“resource curse.” The resource curse is regarded as explaining the instability and corruption of petrostates such as Russia, Iran, Venezuela, and Nigeria.¹⁶ However, Alan Gelb, formerly with the World Bank, argued that Canada and countries such as Norway and Britain are exceptions: “The resource curse is weaker the higher the institutional quality. Countries with a high enough index of institutional quality will experience resource dependence as a blessing rather than a curse; this applies to 15 out of the 87 countries included in their sample” (Gelb 2014, 10).

More recent research has questioned the existence of a resource curse leading to bad institutions or slow growth. Instead, “the chain of causality appears opposite to current wisdom: bad institutions are associated with high scores on the resource abundance indicator” (Brunnschweiler and Bulte 2006, 3). Researchers have taken the ratio of resource exports to GDP as a proxy for resource abundance, when in fact it is a measure of dependence. After correcting for the negative impact that poor governance has on GDP (especially non-resource production), which magnifies the dependence on resource exports, researchers found that greater abundance of natural resources “leads to better institutions and more rapid growth... We find countries should not turn their back on resource wealth to lower resource dependence” (Brunnschweiler and Bulte 2006, 22–3).

Also damaging the image of natural resources is the myth that they are incompatible with the development of the so-called “knowledge industries” that are believed to be the driver of economic growth in the twenty-first century. This belief ignores the importance of knowledge and technology in developing natural resources. Producing Canada’s natural resources has required a steady flow of innovative technologies. In agriculture, the development of the Marquis wheat strain was vital to the expansion of crops on the prairies, while the very word canola is a contraction of Canada (where it was developed) and ola (low acid oil). The agriculture industry in Canada has embraced genetically modified food, planting the fourth-largest area worldwide, led by canola, corn, and soybeans (Moore 2008, 90). Hydro power in Canada first required solving the problem of winter freeze-up and then the transmission of electricity over long distances, allowing this “white coal” to fuel industrial growth (Morton 2006, 145). In turn, electricity was a key input into aluminum, which was “a science-based industry from the start, as it required knowledge of both chemistry and electricity to extract a usable metal from the mineral bauxite” (Langlois 2023,

245). Faced with depleted stocks for species such as cod, the fishing industry increasingly relies on aquaculture, which combines “high-capital intensity and sophisticated technology” (Rayner and Howlett 2008, 121). Fracking technology has revolutionized the oil and gas industry over the last two decades. Collaboration between the oilsands industry and universities in Alberta led to technologies that replaced the traditional “bucket wheel” approach to mining the oilsands. As the head of Chevron Corp said when launching an LNG project in Australia, “Energy is no longer a commodity, it is fast turning into a technology” (Smyth and Sheppard, 2021).

“*While commodities are natural, they are not resources unless and until human beings learn how to find them, process them, and use them.*”

These examples demonstrate the key role that knowledge plays in extracting natural resources. They all contradict the portrayal of staples exports as requiring little processing or technical knowledge. Indeed, the growing importance of technology in all resource industries – ranging from a farmer planting a genetically engineered crop using precise satellite to insert the seeds to an *in situ* oilsands plant that injects steam and solvents to transform bitumen so it can be extracted more efficiently – risks making obsolete the definition of staples as agricultural and extractive resources “not requiring elaborate processing” (Wellstead 2008, 20).¹⁷ While commodities are natural, “they are not resources unless and until human beings learn how to find them, process them, and use them. Since human knowledge is an integral part of what is or is not natural resources, the total amount of natural resources is neither fixed nor necessarily declining over time” (Sowell 2016, 60).

This explains why repeated predictions that the world will run out of resources were spectacularly wrong: because technology has devised either new methods of finding and extracting resources or developing substitutes. For example, some fish species have been severely depleted, while British Columbia’s pine forests were ravaged by the pine beetle infestation starting in

the 1990s. Nevertheless, Canada's fishing and forestry output was sustained and eventually expanded by harvesting other species and innovative new technologies, such as aquaculture.

Of most concern are forecasts that energy supplies could run out, given our dependence on cheap energy to sustain our standard of living. The geologist M. King Hubbert famously predicted that US oil production would peak in 1970 and then irrevocably decline. Instead, oil production in the US has risen to record levels as fracking technology led to the development of oil trapped in massive shale deposits in several regions (Helm 2012, 139).

As petroleum geologist Wallace E. Pratt is quoted as saying, oil "is first found in the minds of men" (Cole 1996). The recent evolution of the source of crude oil proves Pratt's point, as the US has become the world's leading oil producer by developing its deep water and shale deposits, "two plays that couldn't exist according to our professors and our mentors," as Chevron geologist Robert Ryan noted (Klump 2013). Similar predictions by William Jevons that Britain would exhaust its coal reserves in the nineteenth century, and by the Club of Rome in the 1970s that several commodities would be in short supply by 2000, also proved fallacious.

While many economists and historians have been ambivalent if not overtly hostile to the role of natural resources in Canada's economic development, the United States has revelled in the fact that it is "exceptionally endowed with resources" (Tyrrell 2021, 24). American leaders have embraced bountiful natural resources as part of what makes the US exceptional compared with Europe. Soon after the founding of the United States, President Thomas Jefferson in 1801 promulgated "a thesis of American exceptionalism based on material abundance" creating "a synthesis of political individualism founded on liberty and the largesse of the land itself" (Tyrrell 2021, 28). Henry Ward Beecher in the mid-nineteenth century elaborated on this view, arguing "the nation was prosperous because of its environment." Beecher drew attention to "the unexampled resources of this country,' including 'soil, climate, seacoast, rivers, [and] lakes' that had 'secured our prosperity'" (quoted in Tyrrel 2021, 65). The abundance of resources conferred several advantages to the US. It provided "a pronounced cost advantage" for resource-based manufacturing (Langlois 2013, 74). Resources required knowledge and innovation: as Gavin Wright argued, "The abundance of mineral resources was itself an outgrowth of America's technological progress" (Langlois 2013, 74).

The American attitude to the relationship between natural resources and knowledge is fundamentally different from Canada's. Instead of following the Canadian view that the country should transition from a resource economy to a knowledge economy,¹⁸ Americans understand that having both is better for economic growth. Americans embrace that resources and knowledge are intertwined, not opposed: knowledge is required to extract and develop natural resources and the income generated from resource development can be invested in the physical and human capital deployed in other industries. Paul Romer in 1996 summarized that for the US, "the surprising conclusion that emerges from recent historical scholarship is that resource abundance interacted with scale to create a technological lead in manufacturing that persisted well into the 20th century" (Romer 1996, 7). This was reflected in an increase in the resource intensity of US exports between 1880 and 1930 (Romer 1996, 10).

Former Federal Reserve Board Chair Alan Greenspan concluded that "It's easy to see the impact of resource wealth in American history. You can see it in the succession of commodity-driven crazes – most notably the gold rush of 1849 and the oil booms of the early 1900s and 1950s – that have gripped the country. You can see it in giant export industries such as wheat. But one of the most important impacts was invisible. America didn't suffer from the resource constraints that have slowed growth in other countries" (Greenspan and Wooldridge 2018, 10–11). As Bhu Srinivasan concluded in his history of American capitalism, "American culture must be credited for encouraging the exact form of behavior that maximized this national advantage" (2017, 151).

The separation of natural resources from the knowledge economy is therefore unjustified. As noted earlier, specialized knowledge and innovation has been crucial to the development of natural resources in Canada. A Statistics Canada study found that resource industries rank high in their employment of knowledge workers. Out of 265 business sector industries, resource industries in fishing, oil and gas, and pipelines rank among the top 23 industries in the high-knowledge category (Beckstead and Gellatly 2004, 18–19).

A more recent critique of how natural resources are a mixed blessing for economic development is the Dutch Disease hypothesis. Dutch Disease occurs when a booming resource sector's export earnings cause the foreign exchange rate to appreciate, which reduces the competitiveness of manufacturing industries. In the worst case of Dutch Disease, the benefits of a resource boom

inevitably turn to economic costs in the bust part of the cycle, but the negative impact on manufacturing lingers. The surge of the Canadian dollar beyond parity with the US greenback in the 2007 and 2008 boom spawned concerns that Dutch Disease was hollowing out our manufacturing industry.

As noted earlier, the Dutch Disease thesis does not apply to Canada for several reasons. Our exchange rate does not move closely with commodity prices, as was amply demonstrated in 2022 when oil and gas prices soared but the Canadian dollar barely moved. Meanwhile, natural resources not only are not a hindrance to manufacturing, they are the backbone of Canada's manufacturing sector, directly accounting for nearly half of all factory output as estimated above. Finally, manufacturers have increasingly used imported inputs to hedge their risk from fluctuations in the exchange rate.

“ *Meanwhile, natural resources not only are not a hindrance to manufacturing, they are the backbone of Canada's manufacturing sector.* ”

Another potential problem for resource economies is what Daniel Yergin calls “the reversed Midas touch” that leads to “incurable fiscal rigidity” (2011, 108-9). When oil prices are rising, governments spend more on programs and infrastructure, “but when world oil prices go down and the nations’ revenues fall, governments dare not cut back on spending” (2011, 111). The idea of a reverse Midas touch traces its origins to one of the first research papers by Australian economist W. Max Corden on Dutch Disease, which said “it might be argued that the true Dutch Disease in the Netherlands was not the adverse effects on manufacturing... but rather the use of Booming Sector revenues for social service levels which are not sustainable, but for which it has been politically difficult to reduce” (Corden 1984, 359). This model fits Canada well, especially Alberta, which regularly showers its public sector with money during booms in oil prices but has proved incapable of cutting spending when oil revenues

nose-dive. Even so, some nations have been able to control public spending during resource booms, notably Norway, which mandates most government resource revenues be invested in its sovereign wealth fund. Alternatively, surpluses could be used to pay down debt or improve tax competitiveness (Mintz, Tombe, Emes, and Hill 2023).

More broadly, economists are putting increasing emphasis on how natural resource industries cultivate the cultural values that encourage entrepreneurship, innovation, and ultimately higher economic growth. This contradicts a common assumption that natural resources lead to a lazy, parasitic culture in which winning the “geographic lottery” of a resource endowment actually discourages the cultivation of these values; a sarcastic cartoon in the *Globe and Mail* at the height of the commodity boom before 2008 shows a Canadian beaver relaxing on top of his winnings from the commodity price roulette wheel proclaiming, “I owe it all to thrift, prudence and judicious planning.”

The reality is that natural resources require and even foster the cultural values associated with entrepreneurship and innovation. Alberta’s oilsands are a good example. They played only a minor role in Canada’s oil industry until the late 1990s, when a combination of a new provincial royalty regime, preferential corporate tax incentives, and technological breakthroughs ignited the surge in their development that raised their share of Canadian oil production from less than 20 percent to nearly 70 percent in just two decades (Cross 2021a).

It is no coincidence that Alberta, with its large dependence on natural resources such as energy and agriculture, has the best track record in Canada of entrepreneurship and innovation. The cyclical nature of the fortunes of natural resources encourages its labour force to be flexible and discourages the growth of a public sector that becomes burdensome when the economy turns down. The capricious nature of farming and oil and gas prices fosters a tolerance of failure and the reward of success – another way of saying “creative destruction” – that are important to entrepreneurship. The capital-intensive nature of most natural resource developments means that firms need high rates of savings and a long-term planning horizon, both of which are key to long-term economic growth. Since most natural resources are destined for export, society will be broadly supportive of free trade agreements that are beneficial to most sectors and encourage governments to maintain a lighter regulatory burden (Cross 2021b, 9–14).

The consequences of Canada's disparagement of its resource sector, especially oil and gas, are enormous for our economy and our stature on the world stage. Just over a decade ago, Prime Minister Stephen Harper spoke of Canada's aspiration to be an "energy superpower," although our rank as the fifth-largest producer of energy in the world is compromised by an almost exclusive orientation to North American markets. Recent developments provided an opportunity to maximize that power, both economically and strategically, due to the rapid growth of LNG demand and the withdrawal of Russian supplies from key markets in Europe and North America. Instead, Canada wasted these opportunities because of a wide range of policies, regulations, and public posturing that slowed the development of its energy, especially oil and gas. The result is that Canada no longer is regarded as a global energy power. It is revealing that in its *World Energy Outlook* for 2023, the International Energy Agency does not mention Canada even once in its discussion of regional trends. In just over a decade, Canada has gone from superpower stature in energy to irrelevance, leaving the field open to others (notably the United States) to surge to the forefront.

The growing anti-resource bias in Canadian society is also reflected in changing attitudes to mining outside of oil and gas, which has depressed investment flows. Canada used to champion the mining industry; the author Stephen Leacock wrote with "unbridled optimism" that mining the Canadian Shield had created "the greatest mineral district of all the world" (quoted in Sandlos and Keeling 2021, 83). Canada's prowess in mining was reflected in its position as the base for many mining companies, helping make Toronto "the mine-financing capital of the world." (McAllister 2008, 159)

Investment in mining today should be expanding, especially for metals that are required for solar and wind projects and for battery storage for electric vehicles (electrifying the economy requires metals such as aluminum, cobalt, copper, lithium, nickel, silver, and zinc, according to *The Economist* (2022)). Instead, there has been a sharp drop in initial public offerings (IPOs) in Canada for mining since 2012, which have averaged less than \$10 billion a year compared with over \$30 billion in the previous six years (McGee 2023b). The drop in investment in junior mining companies is significant for the long-term. The Canadian mining industry is a two-tiered system, where many junior companies undertake the high-risk search for new deposits, and the large companies then buy and develop any major discoveries (investment by junior companies

was encouraged by the creation of flow-through shares in the federal Mineral Exploration Tax Credit) (Amis 2015). So, the sharp decline in investment in junior companies threatens the long-term production of metals in Canada.

This aversion to investing in Canada's metal mining industry appears rooted in excessive regulation, as clearly global demand exists for the product and Canada's tax regime is favourable. One investor in the long-delayed Ring of Fire project in Northern Ontario wrote Prime Minister Justin Trudeau to say the project was in peril because of "Timelines to advance environmental assessments, permitting and construction of the infrastructure corridor and Eagle's Nest, as well as far-reaching consultation requirements are placing the viability of the project at risk" (McGee, 2023a). These are long-standing complaints. Nearly a decade ago, the chief executive officer of mining giant Cliffs Natural Resources Inc. called every investment in Canada in recent years a "disaster" that failed to generate any profit; as a result, he said "I'm walking away from Canada big time" (Van Praet 2014).

The importance of managing the lengthy transition to new energy sources

There is an extensive literature on the difficulty of making the transition from one dominant energy source to another, even when a lower cost for the new energy source provides an incentive to make the shift. We know this because nations with advanced economies have made the transition to new primary energy sources several times over the past two centuries, moving from wood to coal to petroleum to natural gas (see Fouquet 2009, 11). Canada has made similar transitions to new energy sources. These include a "shift from reliance on wood, to coal, electricity (created first by coal and then hydro and then nuclear energy), oil, and then natural gas" (Sandwell 2016, 16). Today, many foresee a shift from fossil fuels to renewable energy sources such as solar, wind, nuclear, and hydro in response to climate change.

One lesson from past energy transitions, however, is they require several decades to complete. Coal is one example of how slowly these transitions occur.

Coal provided just 7.3 percent of Canada’s total energy consumption in 1871, rising to 41 percent 30 years later in 1902, and then an all-time high of 66 percent in 1918 (Watson 2016, 21). Even then, the timeline during which Canada embraced coal is relatively rapid for an energy transition. After reviewing the changes in the world’s primary energy consumption, one researcher observed that “all of the Industrial Age energy sources follow a similar trend when entering the market. It takes 40 to 50 years for an energy source to go from 1% to 10% of market share, and an energy source that eventually comes to occupy half of the market will take almost a century to do so” (de Sousa, quoted in Rhodes 2018, 339). Yergin summarized how “history demonstrates that energy transition takes a long time. It took almost a century before oil overtook coal as the number one energy source” (2011, 715). Smil concludes that a global energy transition “takes two or three generations, or 50–75 years, for a new resource to capture a large share of the energy market” (2017, 395).

Energy transitions span decades because of what Yergin calls “the law of long lead times” (2011, 715). One reason for the long lead is the time required to learn how to make and use new energy sources. For example, gasoline used in motor vehicles meant “filling stations need gasoline, gasoline comes from oil, oil had to be discovered, refineries had to process it, pipelines had to deliver the oil to the refineries and the gasoline to the cities where the cars were driven” (Rhodes 2018, 339).

Most importantly, energy transitions take time because of “the prerequisites for enormous infrastructure investment and the inertia of massively embedded energy systems” (Smil 2017, 397). Energy systems require huge amounts of capital, often with life spans of 60 years or more in the case of commercial buildings, industrial and power plants, and residential homes. Building a major new offshore oil platform or an oil sands plant requires a decade or more. It takes five years to develop a new automobile and the auto fleet turns over at a rate of only about 8 percent a year, implying a total overhaul of the fleet needs two decades to complete (Yergin 2011, 715).

Because of the considerable capital embedded in the existing energy infrastructure built upon fossil fuels, weaning our society off fossil fuels will be a much more difficult process than many assume. Our energy-dependent civilization involves a wide range of infrastructure, including “mines, oil and gas fields, thermal power stations, hydroelectric dams, pipeline networks, ports, refineries, iron and steel mills, aluminum smelters, fertilizer plants, railroads,

multilane highways, airports, skyscraper-dominated downtowns, an extensive suburbia” (Smil 2017, 422). The reality is that fossil fuels will be part of our economy for decades to come, and our economic, energy, and environmental policies need to be grounded in this reality. The goal of net-zero emissions by 2050 assumes the usual decades-long transition to new energy sources can be shortened dramatically, when the current trajectory of both fossil fuel and green energy production points to a slow transition.

What is making the transition to green energy more difficult is that, while past transitions were facilitated and incentivized by lower costs, the transition to renewable energy sources or capturing the carbon from existing fossil fuel sources typically raises costs.

“Governments try to manipulate market prices to encourage the switch from fossil fuels to renewable energy.”

Governments try to manipulate market prices to encourage the switch from fossil fuels to renewable energy by raising the price of fossil fuels with carbon taxes while subsidizing the cost of wind and solar energy. However, bureaucratic regulation or meddling with market prices often is slow, imprecise, or misguided. In Ontario, guaranteeing high prices to producers of solar and wind power in 2007 led to unbearable costs for consumers in the name of misguided industrial policy. Similarly, the shortage of natural gas in Europe following Russia’s 2022 invasion of Ukraine has led governments, notably in Germany where the Green Party is part of the governing coalition, to slow or reverse plans to shift to renewable energy. More recently, the Canadian government lowered its carbon tax on home heating oil because of the burden to households (especially in the Atlantic provinces where 30 percent of households rely heavily on oil to heat their homes in winter) (Canada 2022).

Government regulations themselves have delayed the transition to new energy sources. For example, the US government in 1978 banned outright the burning of natural gas in power plants, delaying their transition from coal to natural gas. The reason for the ban on natural gas power plants was

that government-mandated prices for natural gas were so low they resulted in a shortage (Yergin 2011, 318). Prices began to be deregulated in 1978, but the *Fuel Use Act* still banned power plants from burning natural gas to generate electricity (Yergin 2011, 319). This is one reason that the transition to natural gas has proceeded at a slower pace than previous transitions to coal and oil (Smil 2017, 395).

The cost of combating climate change will be higher than necessary if the transition from fossil fuels to new energy sources is not well managed. Jean Pisani-Ferry in a recent report argued that while he was optimistic about the long-run effects of transitioning to a carbon-neutral economy, there “is no reason to overlook transitions costs. These costs, while bearable, are likely to be significant. Rather than pretending that they are trivial, policymakers should face reality and design transition strategies accordingly” (quoted in Wallace 2021). It is impossible to predict which energy sources technology will enable us to develop in the future or how they will boost the efficient use of energy, any more than it was possible a few years ago to predict the shale revolution in oil and gas. Climate change goals do not justify limiting fossil fuels at all costs.

The transition away from fossil fuels must be managed skillfully to prevent energy prices from escalating rapidly or creating shortfalls of supply. The political difficulty of managing an economy between the Scylla of soaring prices and the Charybdis of shortages was amply demonstrated late in 2021. Even while touting America’s return to the Paris Accord on climate change, putting a moratorium on drilling for oil on federal lands, and killing the Keystone XL pipeline, President Biden pleaded with OPEC to raise production¹⁹ while engineering a coordinated drawdown of strategic oil reserves in order to lower prices (along with the United Kingdom, India, and Japan).

There is no reason why Canada cannot try to make arrangements to receive carbon credits for its large forest sinks or to receive credits from countries that substitute natural gas for coal energy, consistent with the 2015 Paris Agreement (Article 6) to reduce emissions (Gessaroli 2023). As Gessaroli argues in his paper: “An important criterion for making projects ITMO [Internationally Transferred Mitigation Outcomes] eligible is that the project would not have gone ahead without carbon credits being available. This suggests deals should be structured involving LNG exports along with some other value-added Canadian participation that assists a developing country in switching from coal to LNG as a fuel source.”

Conclusions

The resource sector has enabled Canadians today to enjoy a high standard of living. Since Confederation, resources have been key to our success, providing high incomes to Canadians and attracting immigrants from all parts of the world to work in agriculture, forestry, fishing, and non-renewable resource sectors. Countries such as Canada with good governance and well-performing businesses and institutions have avoided the “resource curse” as resource revenues have been used to finance public services at reasonable tax rates. The resource sector accounts for 15 percent of Canada’s primary, manufacturing, and service output (energy is one half of the resource sector). Refining and processing natural resources accounts for nearly half of Canada’s manufacturing sector.

The transition to green energy will be a major challenge to Canada with its rich energy resources. It will be expensive to move from fossil fuels to renewable energy even if the energy transition pursues the least-cost path. Nations with advanced economies have made the transition to new primary energy sources several times over the past two centuries, whether from wood to coal or coal to oil and gas. One lesson from past energy transitions, however, is that they require several decades to accomplish. Huge amounts of capital are involved, often with life spans of 60 years or more. Similarly, a total overhaul of the fleet needs two decades to complete.

In the interim, Canada should take advantage of its resource wealth by exporting agriculture, mining, forestry, oil, and natural gas products that the world will need in the coming years. That is the strategy taken by other resource-rich countries today, whether they be Norway and Saudi Arabia with their abundant oil and natural gas reserves, New Zealand with its agricultural products, or Australia and, until recently, the United States with LNG. This strategy requires a completely different approach than that currently employed in Canada, which is choosing the high-cost rather than least-cost approach to the energy transition.

Canada has proven that it cannot only compete in global resource markets, but it can drive new innovations by building on our existing knowledge. In the early twentieth century, Canada developed a new strain of Marquis wheat that thrived in colder climates. Quebec pioneered the transmission of electricity over

vast expanses. More recently, Alberta's oil firms developed new technologies to separate crude oil trapped in its oilsands. By applying human ingenuity to the vast potential of our natural resources, Canada unabashedly can contribute to the well-being of people here and around the world. Canadians can make a legacy of the land gifted to us. [MLI](#)

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Endnotes

- 1 The Staples Thesis – which asserts that “the export of natural resources, or staples, from Canada to more advanced economies, has a pervasive impact on the economy as well as on the social and political systems” (Watson 2013) – is often associated with Harold Innis (University of Toronto), although other important contributors include William A. Mackintosh and Mel Watkins (Watkins 1963).
- 2 In many cases, a country like Canada might have higher wages than another but still have an absolute cost advantage because Canadian labour productivity is so much higher than elsewhere.
- 3 Stolper and Samuelson (1941) also demonstrate that trade leads to “factor price equalization” whereby wages rise relative to capital returns in those countries that export labour-intensive products and import capital-intensive products and vice-versa for countries with more capital relative to labour. Given that capital is internationally traded so that the price of capital is similar across countries, trade will lead to wage rate equalization. This in part explains the reduction in world inequality with globalization after 1990 as income in developing countries rose with increased exports to more to Europe and North America, which also led to a compression of unskilled wages in developed economies (Rivera-Batiz et al. 2020, 102).
- 4 About half of Canadian exports to the United States are intra-firm trade as are a quarter of those to other countries. See Statistics Canada (2023a).
- 5 The US rationed gasoline during the Second World War to discourage driving and thereby conserve its supply of rubber for tires, not because of a lack of oil (Langlois 2023, 290).
- 6 By unrepresentative, Smil means that the low cost of energy means its dollar contribution to GDP does not capture its critical role in our society and economy. Smil went on to write that “All natural processes and all human actions are, in the most fundamental physical sense, transformations of

energy. Civilization's advances can be seen as a quest for higher energy use required to produce increased food harvests, to mobilize a greater output and variety of materials, to produce more, and more diverse, goods, to enable higher mobility, and to create access to a virtually unlimited amount of information" (Smil 2017, 385).

- 7 The level of detail presented in this paper is the two-digit industry classification for most industries, and three-digits within manufacturing and transportation, although the results for all initially were compiled at the three-digit level. Some studies use a finer level of detail outside of manufacturing and transportation. While this level of disaggregation is available for GDP, it is not published for employment, business investment, or exports. Therefore, the analysis is constrained to the level of detail published for the latter three in assessing the importance of resources in measures other than GDP.
- 8 Data for 2020 was released in November 2023 after this paper was written. It shows the COVID pandemic lowered the resource share of GDP to 13.6 percent, mostly because of the temporary drop in oil prices that has since been reversed.
- 9 Petroleum-based manufacturers refine petroleum and produce chemicals.
- 10 The forestry-based manufacturers produce wood and pulp and paper; metals-based manufacturers produce primary metals and non-metallic minerals.
- 11 A rising Canadian dollar dampens revenues from exports because when the foreign exchange (usually US dollars) earned from exports is brought back into Canada and converted into Canadian dollars, by definition each US dollar buys fewer Canadian dollars as the exchange rate appreciates.
- 12 Data are for August 2023 and come from the labour force survey, Statistics Canada table 14-10-0379-01: Employment by industry, three-month moving average, unadjusted for seasonality. This data does not have detailed estimates for employment within manufacturing.
- 13 These indirect and induced impacts can be quantified using Statistics Canada's Input/Output database within the National Accounts. These input-output (I/O) results should be interpreted cautiously. Multiplier analysis is useful for showing where incomes and jobs are created and the linkages among different industries and how these linkages compare with each other. However, multiplier analysis distorts macro analysis; for example, the impact of a downturn in the resource sector on GDP would be partly offset by the shift of labour and capital currently employed in

natural resources to other sectors of the economy. Multipliers based on input-output analysis also fail to take into account resource constraints.

- 14 Employment data come from the survey of employment, payrolls, and hours (Statistics Canada table 12-10-0220-01). Since that survey does not cover agriculture, we use the labour force survey estimate for agriculture (Statistics Canada Table 14-10-0291-01).
- 15 The energy sector includes capital spending by the oil and gas industry, support to the oil and gas industry, utilities, petroleum refining, and pipeline transport.
- 16 An earlier example of corruption involving resources was the infamous Teapot Dome scandal during the Hoover Presidency which involved oil leases (Langlois 2023, 241).
- 17 Wellstead followed Gordon Bertram's 1963 definition of staples industries as those "based on agriculture and extractive resources, not requiring elaborate processing and finding a large portion of their market in international trade." (Wellstead 2008, 20)
- 18 As expressed by Mary Ng, then the Minister of Small Business, Export Promotion, and International Trade, on *The Logic*, May 9, 2020.
- 19 OPEC refused to raise output, telling President Joe Biden to increase US production (Cohen 2021).

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