



Facts and Figures of the Canadian Mining Industry

FACTS & FIGURES 2018



The Mining Association of Canada

ADVOCACY STEWARDSHIP COLLABORATION

THE MINING ASSOCIATION OF CANADA

The Mining Association of Canada (MAC) is the national organization of the Canadian mining industry. We represent companies involved in mineral exploration, mining, smelting, refining and semi-fabrication. Our member companies account for most of Canada's output of metals and minerals.

MAC's functions include advocacy, stewardship and collaboration. Our goals are to promote the industry's interests nationally and internationally, to work with governments on policies affecting minerals, to inform the public and to encourage member firms to cooperate to solve common problems. We work closely with provincial and territorial mining associations, other industries, and environmental and community groups in Canada and around the world.

DATA AND SOURCES

This annual report reflects currently available data, the majority from 2017, though some from prior years and some from 2018. Dollar amounts are expressed in Canadian dollars unless noted otherwise.

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TABLE OF CONTENTS

LIST OF FIGURES	04
LIST OF ANNEXES	05
STATE OF THE INDUSTRY AND KEY ISSUES	06
MINING: ONE INDUSTRY, MANY APPLICATIONS	09
1. MINING AND THE CANADIAN ECONOMY	10
Global Economic Trends	10
Mining's Contribution to the Canadian Economy	12
Mining in the Provinces and Territories	12
Taxes and Other Payments to Governments	14
Indirect Contributions to Mining Industry Suppliers	14
2. THE ACTIVITIES: PRODUCTION, PROCESSING AND TRANSPORTATION	25
Production of Key Minerals	25
Production Values	25
Processing of Minerals	26
Transportation of Mining Products	26
3. THE MONEY: RESERVES, PRICES, FINANCING, EXPLORATION AND INVESTMENT	35
Canadian Reserves	35
Mineral and Metal Prices	35
Financing	36
Exploration	36
Investment	38
4. THE PEOPLE: EMPLOYMENT, COSTS AND INNOVATION	46
Mining Industry Employment	46
Workplace Safety and Health	49
Key Costs	50
Innovation and Research and Development	50
5. THE ENVIRONMENT: SUSTAINABLE DEVELOPMENT AND SOCIAL RESPONSIBILITY	56
Environmental Stewardship	56
Climate Change and the Mining Industry	59
The Clean Energy Economy	62
Indigenous Relations and Benefit Agreements	63
Regulatory Environment	65
6. THE WORLD: INTERNATIONAL MARKET ACTIVITIES AND DEVELOPMENTS	72
Canadian Mining's International Presence	72
Canada's Mineral Trade	74
Canada's Trade Policies	74
The Canadian Investment Regime	77
ANNEXES	84
THE CANADIAN MINING INDUSTRY AT A GLANCE	108

LIST OF FIGURES

Figure 1:	Canada's Real Gross Domestic Product by Industry, 2007–2017	16
Figure 2:	Canada's Real Gross Domestic Product, Mining, Mineral Manufacturing, and Oil and Gas, 2007-2017	17
Figure 3:	Natural Resources Satellite Account, Indicators, Annual (Dollars X 1,000,000)	18
Figure 4:	Canadian Mining Industry Clusters	20
Figure 5:	Value of Canadian Mineral Production by Province and Territory, 2008 and 2017 ^P	21
Figure 6:	Total Mineral Development Expenditures, by Stage and Province and Territory, 2017 ^P	22
Figure 7:	Comparative Analysis of Canada and US Mineral Tax Treatment	23
Figure 8:	Canada V USA: A Tax Comparison	24
Figure 9:	Value of Canadian Mineral Production, 1999–2017 ^P	29
Figure 10:	Canada's Top Ten Metallic and Non-Metallic Mineral Products, by Value of Production, 2006 and 2016 ^P	30
Figure 11:	Production of Synthetic Crude Oil by Oil Sands Mining Plants, Alberta and Canada, by Quantity and Value, 1998-2017	31
Figure 12:	Non-Ferrous Smelters and Refineries in Canada, 2017	32
Figure 13:	Canadian Production of Selected Refined Metals, 2004-2017 ^P	34
Figure 14:	Crude Minerals and Processed Mineral Products Transported by Canadian Railways, 2004-2017 ^P	34
Figure 15:	Canadian Reserves of Selected Metals, 1980 - 2016 ^P	40
Figure 16:	Metal Prices, 2001-2017	41
Figure 17:	Monthly Metal Prices 2018	42
Figure 18:	Mining Equity Raised - Role of Toronto Stock Exchange, 2000–2017	42
Figure 19:	Geographic Reach of TSX - Listed Companies, January 2018	43
Figure 20:	Mineral Exploration and Deposit Appraisal Expenditures, by Province and Territory, 2006 - 2018 ⁱ	43
Figure 21:	Mineral Exploration and Deposit Appraisal Expenditures, by Company Type, 2007 - 2018 ⁱ	44
Figure 22:	Mineral Exploration and Deposit Appraisal Expenditures, by Target, 2008 and 2017 ^P	44
Figure 23:	Capital Expenditures in the Canadian Mining Industry, 2009 - 2018 ⁱ	45
Figure 24:	Minerals Sector Employment, by Subsector and Product Group, 2017	53
Figure 25:	Representation of Women in Mining Industry and All Industries, Selected Occupations and All Occupations (2011 & 2016)	53
Figure 26:	Representation of Indigenous Peoples in the Workforce, Mining Industry and All Industries, 2016	54
Figure 27:	Representation of New Canadians and Visible Minorities in the Mining Workforce (2006, 2011, 2016)	54
Figure 28:	Cumulative Hiring Requirements* by Forecast Scenario (2019–2029)	55
Figure 29:	Selected Costs of Production in the Mineral Industry ¹ , 2016	55
Figure 30:	MAC Member Company Application of International Standards and Programs	66
Figure 31:	TSM Tailings Management	67
Figure 32:	TSM Biodiversity Conservation Management	68
Figure 33:	TSM Energy Use And Ghg Emissions Management	69
Figure 34:	Mining Industry Energy and GHG Emissions Data, 1990 and 2014 -2016	70
Figure 35:	Environmental Assessments Under Ceaa 2012-2018	71
Figure 36:	The Geographical Distribution of Canada's Mining Assets, 2016	78
Figure 37:	Canadian Mineral Industry Direct Investment Abroad and Foreign Direct Investment Stocks, 1999-2017 ^P	79
Figure 38:	Mining Company Investment in Host Countries - 2017	80
Figure 39:	Balance of Canada's Mineral Trade, 2017	82
Figure 40:	Value of Canada's Mining and Mineral Processing Industry Trade, 2003-2017	83

LIST OF ANNEXES

Annex 1:	Producing Mines in Canada, 2017	84
Annex 2:	Mining Establishments in Canada, by Mineral, Province or Territory, 2016	89
Annex 3:	Canadian Production of Leading Minerals, by Province and Territory, 2017 ^P	90
Annex 4:	Canada's World Role as a Producer of Certain Important Minerals, 2017 ^P	91
Annex 5:	Mineral Production of Canada, 2010 - 2017 ^P	95
Annex 6:	Canadian Reserves of Selected Major Metals, 1978 - 2016 ^P	98
Annex 7:	Employment Count and Annual Compensation in the Canadian Mining, Smelting and Refining Industries, 2007-2017	99
Annex 8:	Total Compensation per Job, by Select Canadian Industrial Sector, 2007-2017	101
Annex 9:	Domestic Exports of Minerals and Mineral Products, by Commodity and Country of Destination, 2017	102
Annex 10:	Total Imports of Minerals and Mineral Products, by Commodity and Country of Import, 2017	105



STATE OF THE INDUSTRY AND KEY ISSUES

IN AN ERA OF RAPID TECHNOLOGICAL AND CLIMATE CHANGE, CANADA HAS THE OPPORTUNITY TO PROVIDE THE WORLD WITH RESPONSIBLY SOURCED RAW MATERIALS ESSENTIAL TO THE TRANSITION TO A LOWER-CARBON ECONOMY, WHILE SIMULTANEOUSLY BENEFITING FROM A MAJOR DOMESTIC ECONOMIC DRIVER.

ECONOMIC CONTRIBUTION

The mining industry has contributed greatly to Canada's economic strength. The industry directly employs 426,000 workers across the country in mineral extraction, smelting, fabrication and manufacturing, and indirectly employs an additional 208,000. Proportionally, the mining industry is also the largest private sector employer of Indigenous peoples and provided over 16,500 jobs to community members in 2017. In 2017, the minerals sector directly and indirectly contributed \$97 billion, or 5%, to Canada's total nominal GDP.

Internationally, Canada is one of the leading mining countries and one of the largest producers of minerals and metals. The industry accounted for 19%, or \$97 billion, of the value of Canadian goods exports in 2017, selling a diversified array of minerals and metals abroad.

Canada remained the world's top destination for non-ferrous exploration spending in 2017, but continued to cede market share to other jurisdictions, including Australia. This marks the sixth consecutive year that Canada's share of international exploration investment has fallen, and underscores Canada's long-term decline in the share of global exploration spending, from 20.5% in 2008 to 13.8% in 2017. This is indicative of the fierce competition for global mineral investment, and the financing challenges junior companies are facing. The federal government's recognition of this challenge, and subsequent decision to renew the Mineral Exploration Tax Credit for a five-year term, should help address this trend.

While mining is important to Canada at the local community level, it also contributes to the economies of large cities. Toronto, for example, is the global hub for mining finance. The Toronto Stock Exchange (TSX) and TSX Venture Exchange are the world's number one mining and exploration listing venues, where nearly one-third, or \$8.5 billion, of the world's total equity capital was raised in 2017. Vancouver features the world's leading cluster of exploration companies, while Montreal is home to major aluminum and iron ore firms. Edmonton has become a centre for oil sands expertise and Saskatoon for uranium and potash.

Other evidence of the industry's vast economic reach is that mining is the single largest industrial customer group of Canada's railways and is a major user of Canada's ports. Annually, the industry accounts for approximately 50% of total rail freight revenue generated and is the largest single shipping sector by volume by both rail and marine modes.

The average annual pay for a mining worker in 2017 exceeded \$117,000, which surpassed the average annual earnings of workers in the forestry, manufacturing, finance and construction sectors respectively.

A STATE OF TRANSITION

Canada has long been the dominant global mining nation—in mineral production, mining finance, mining services and supplies, and sustainability and safety. However, there are signs that this leadership position is slipping, which has the potential to jeopardize Canada's ability to seize new opportunities for growth.



Junior Mechanical Engineer at Agnico Eagle's Goldex mine in Quebec. Photo credit: Agnico Eagle Mines by Mathieu Dupuis.

- The value of total projects planned and under construction from 2018 to 2028 has reduced by 55% since 2014, from \$160 billion to \$72 billion.
- Only four new mining projects, all gold mines, were submitted for federal environmental assessment in 2017 – far below highs seen in 2012-2014.
- Over the last five years, Canada has lost more ground than it has gained in the commodities for which it is a top-five global producer.
- Australia's mining supply sector surpassed Canada's in recent years.
- Mining innovation dollars are steadily flowing out of Canada to countries such as Australia, Germany and South Africa.

While Canada has long benefited from a prosperous minerals and metals industry, we are not immune to global competitive forces, and cannot take the benefits and opportunities that mining presents to Canadians for granted. Critical to bolstering the industry's domestic and international leadership is a predictable, consistent and competitive domestic investment environment.

FEDERAL POLICIES AND CANADIAN MINING COMPETITIVENESS

With a federal election only months away, now more than ever it is essential that the challenges and opportunities faced by Canada's multifaceted mining sector are considered, many of which are critical to the industry's longevity.

While the government has contributed positively in some respects with policy developments and investments supporting Canada's mining sector in recent years, significant challenges persist. Domestic legislative and regulatory processes with implications for project permitting and costs endure, while recent supply chain failures have damaged Canada's reputation as a reliable trade partner.

Immediate action by government to quell increasing investment leakage and minimize the impacts of projected low-growth scenarios is needed. Specifically, the Mining Association of Canada (MAC) and its members urge the federal government to:

- **Improve the federal project review process:** The process should be effective and timely, from pre-environmental

assessment (EA) to post-EA permitting, with meaningful consultation with Indigenous communities.

- **Invest in critical infrastructure in remote and northern regions:** Establish a specific allocation for Canada's Arctic within the Canada Infrastructure Bank that has flexible criteria shaped in recognition of unique Arctic realities, or develop a stand-alone Arctic fund to advance clean energy and development priorities in the region.
- **Improve Canada's transportation network:** The mining industry is the largest user of Canada's rail and marine transportation networks. As such, it is important that an efficient logistics supply chain is in place to effectively move products to market and bolster overall business competitiveness.
- **Address climate change while protecting Canadian businesses:** We have persistently underscored the need for climate change policy to ensure the competitiveness of EITE sectors, to be sensitive to changing economic and geographical realities and supply-chain exposure, and to minimize compliance burden. Approaches that fail to address these concerns risk creating carbon leakage that will diminish Canadian competitiveness with no global net gain in GHG reductions – a “lose-lose” scenario.
- **Enhance industry innovation:** Just as minerals and metals are key inputs into the low-carbon economy, the technologies that they produce are critical to enhancing industry environmental performance. Public policies and investments that recognize and support the industry's innovation priorities are essential.
- **Improve access to trade:** It is essential that the government's agenda to enhance and diversify market access through the negotiation of strategic free trade agreements with key partners is prioritized.
- **Accelerate Indigenous inclusion in mining:** All of the above will determine whether and the extent to which the mining industry can continue to develop and maintain strong and trusting relationships with Indigenous communities near, or with an interest in, mining activities.

Canada's mining industry continues to evolve, particularly in its work in sustainable mining practices through MAC's externally-verified performance system, *Towards Sustainable Mining® (TSM®)*. This program, which was recently profiled in the United Nations Climate Change Secretariat's report on climate change action, has received international attention, and five countries outside of

Canada have adopted *TSM* to support meeting society's needs for minerals, metals and energy products in the most socially, economically and environmentally responsible way. This is a testament to Canadian mining leadership on the world stage.

Looking forward, there is a tremendous opportunity for Canada. To achieve it, policies and regulations that encourage sustainable mining development, both at home and abroad, are essential to enable our sector to expand its already significant contributions to communities across the country, while improving our environmental performance. ■



Pizye Nankamba collects rock samples in the underground of Barrick's Hemlo mine.

— MINING —

ONE INDUSTRY, MANY APPLICATIONS

Photo credit: Sherritt International

THE MINING INDUSTRY IS CRUCIAL TO THE EVERYDAY LIFE OF ALL CANADIANS. WE NEED MINING TO BUILD THE PRODUCTS WE RELY ON IN OUR DAILY LIVES, AND FOR THE TECHNOLOGIES AND INFRASTRUCTURE REQUIRED FOR A LOW CARBON FUTURE.

The mining and mineral manufacturing sector – covering metal, non-metal and coal mines; oil sands mining operations; and manufacturing in the form of smelters, refineries, and fabrication facilities – is generically known as the “mining industry.”

MINING AND ITS ROLE IN A LOW CARBON FUTURE

There is a natural synergy between mining and clean technology. Raw materials are transformed into technology that, having gone full circle, assists mining operations in reducing environmental footprints and enhancing efficiency and reliability. These same raw materials also enable the world to transition to a low carbon future.

Clean energy and “green” products require metals and minerals as building blocks. Water purification systems rely on nickel and a host of rare earth elements. Hybrid cars draw energy from nickel hydride batteries and use far more copper than traditional vehicles. Efficient, lightweight vehicles and aircraft need aluminum as well as lighter composites and alloys involving nickel and other metals to reduce weight and improve efficiency. Clean energy sources such as nuclear, solar, wind and hydrogen use a range of minerals and metals in their equipment and processes.

Because the mining industry is vital to daily life and Canada’s future, its opportunities, challenges, investments and needs are inseparable from those of broader society. Historically, thanks to the industry’s innovation and investment, and the strategic support of governments, Canada has benefited from low-cost mineral and metal products, good jobs and

significant wealth development opportunities. During this time, company best practices have resulted in the international recognition of the Canadian mining industry as a global leader in corporate social responsibility and environmental stewardship. Looking forward, as global competition for mineral investment increases, Canada must adapt to preserve its leadership. ■

PRODUCTS THAT RELY ON MINING

- **Batteries** (nickel, cadmium, lithium, cobalt)
- **Circuitry** (gold, copper, aluminum, steel, lithium, titanium, silver, cobalt, tin, lead, zinc)
- **Display screens** (silicon, boron, lead, barium, strontium, phosphorus, indium)
- **Electric cars** (copper, lithium, aluminum, nickel, cadmium, cobalt, zinc)
- **Musical instruments** (copper, silver, steel, nickel, brass, cobalt, copper, iron, aluminum)
- **Sports equipment** (graphite, aluminum, titanium, calcium carbonate, sulphur)
- **Wind turbines** (steelmaking coal, iron ore, copper, nickel)
- **Energy** (coal, uranium, oil sands)



SECTION 1

MINING AND THE CANADIAN ECONOMY

LIKE OUR NATION'S ECONOMY, THE CANADIAN MINING INDUSTRY IS NOT IMMUNE TO GLOBAL ECONOMIC TRENDS. THE PROFITABILITY OF COMPANIES DEPENDS IN PART ON THE PERFORMANCE OF COMMODITY PRICES, WHICH ARE SUBJECT TO MARKET VOLATILITY AND DRIVEN BY GLOBAL SUPPLY AND DEMAND. IN TURN, THE EXTENT TO WHICH MINING COMPANIES CONTRIBUTE TO THE CANADIAN ECONOMY, BE IT THROUGH DIRECT AND INDIRECT EMPLOYMENT OR TAXES AND ROYALTIES, DEPENDS ON THEIR ABILITY TO OPERATE PROFITABLY. ECONOMIC FORECASTS HELP COMPANIES PLAN THEIR BUSINESS ACTIVITIES.

GLOBAL ECONOMIC TRENDS

In October, the International Monetary Fund (IMF) revised down its forecast for 2018-19 global growth, projecting the global economy to grow at 3.7% over the next two years – a projection consistent with 2017 global growth levels. The October update reduced the organization's April forecast by 0.2 percentage points, attributing the weakened forecast to increased trade tensions and associated disruptions in the flow of goods and services. Maurice Obstfeld, IMF's Chief Economist, explained that "the impacts of trade policy and uncertainty are becoming evident at the macroeconomic level, while anecdotal evidence accumulates on the resulting harm to companies. Trade policy reflects politics, and politics remain unsettled in several countries, posing further risks."

Despite the revised forecast, projected growth remains stronger than in recent years. However, the longevity of political and trade uncertainty, particularly between the world's two largest economies, may challenge the resiliency of projected global economic growth. With China as the world's leading consumer of a host of minerals and metals, markets have already reacted to the escalating trade war between China and the US.

For example, commodity prices retreated broadly in August on concerns that mounting tariffs between the US and China would reduce demand for industrial materials. Meanwhile, the White House continues to escalate its trade dispute with Beijing, leveling further tariffs on another \$200 billion in Chinese exports in mid-September. At the time of writing, it was premature to assess the broader ripple-

through effect of these developments on global demand for mineral and metal products.

Emerging Economies

Despite the above uncertainty, the IMF forecasts that GDP growth from emerging markets and developing economies will persist at 2017 levels, or 4.7% for 2018-19 respectively. Reversing their consecutive year-over-year negative GDP growth in 2017, Russia and Brazil's economies are forecast to further expand by 0.2 and 0.4 percentage points respectively in 2018, with the Brazilian economy forecast to grow by a further 1% in 2019.

Bouncing back after recent volatility, India's economic growth is projected to rise year-over-year through to 2019, capping at 7.4%, while China's growth (albeit over a much larger base than in previous years) is forecast to continue moderating, persisting at 6.6% growth in 2018, and dropping to 6.2% growth in 2019. While China's transition from rapid industrial growth presents some uncertainty over the anticipated strength of global demand for raw materials, China's demand for mining products is anticipated to remain strong over the longer-term.

Developments in Advanced Economies

Economic activity in advanced economies is forecast to nudge upward 0.1 percentage points in 2018, to 2.4%, and then contract to 2.1% in 2019. The economic growth of every country in the IMF's advanced economies grouping is forecast to plateau or reduce in 2019 except in the United Kingdom – whose growth has been stagnant in recent years.

Consistent with this broader trend, Canada's growth trajectory was revised down by the IMF with real GDP projected to slow to 2.1% in 2018, then to 2% in 2019. This represents a 1/3 drop in projected growth over two years. The IMF links concerns over weak external competitiveness, sluggish labor productivity growth, and population aging to limit potential growth over the medium term to about 1.75%, significantly lower than Canada's historical average.



A New Gold employee leads visitors from a local Indigenous community on a tour of the Underground Maintenance Shop at New Afton Mine in Kamloops, British Columbia.

Underscoring the above are worrisome economic trends. At the time of writing, data indicated that:

- Canada's share of non-energy exports to the US are in a 16-year decline, averaging 0.5% annually
- Foreign direct investment (FDI) to Canada is down 26% since 2010, now at 1/3 peak levels of 2007
- Canadian capital investment is now under 10% of GDP, its lowest level since the global financial crisis
- Investment per Canadian worker is only 70% of the OECD average, and 59% of that in the US

The above underscores the need for immediate action by Canadian governments to quell increasing investment leakage and minimize the impacts of projected low-growth scenarios.

Canadian Mining Industry Outlook

The Canadian mining industry's economic prospects are uncertain over the short term. Domestically, legislative and regulatory processes with implications for project permitting and costs persist, while recent supply chain failures have damaged Canada's reputation as a reliable trade partner. Internationally, these challenges are amplified by an increasingly unpredictable trade relationship with the US, whose comprehensive tax reform has significantly enhanced that jurisdiction's investment competitiveness over Canada's.

As the middle classes of the world's most populous countries continue to emerge, and as their consumption patterns more closely resemble those of western industrialized countries, growth in mineral and metal demand is poised to continue. The degree to which Canada participates in this longer-term growth trajectory is contingent on the establishment of a competitive domestic business environment.

One significant growth opportunity for Canada's mining sector is the global transition to a lower carbon future. Minerals and metals are the building blocks of lower carbon technologies, and a 2017 [World Bank report](#) concluded that the increased use of wind, solar and energy storage technologies will heighten the demand for many mining products.

For example, [Clean Energy Canada](#) highlights the opportunity that a lower carbon economy presents to Canada and its mining industry, noting that Canada has rich deposits in many of the minerals and metals needed in renewable energy technologies.

Noting that Canada is home to 14 of the 19 metals and minerals needed to make a solar PV panel, the think-tank highlights MAC's *Towards Sustainable Mining® (TSM®)* initiative, and the fact that Canada hosts some of the lowest carbon-intensive mines in the world thanks to the energy mix and company adoption of lower emitting technologies at their sites.

As a leading producer of responsibly sourced mineral and metal products globally, Canada has an opportunity to become the world's leading supplier of inputs integral to a lower carbon economy. Critical to realizing this potential is reconciling ongoing environmental, Indigenous, transportation, tax and other mineral policies and regulations with the need for domestic business competitiveness and certainty.

MINING'S CONTRIBUTION TO THE CANADIAN ECONOMY

Mining contributes significantly to the Canadian economy. The direct and indirect wages and employment of approximately 634,000 people across the country (of which 426,000 are direct jobs), taxes and royalties collected by governments, and the capital expenditures required for project development and operation are only some examples of its important contributions. Beyond its direct economic impact, the industry also supports many firms and sectors that supply miners with the goods and services they need to operate.

Contribution to Canada's GDP

Real GDP is used by policy makers, financial institutions and other businesses to help determine the economic health of the nation. Since real GDP measures the volume of goods and services produced, an increase in its value is a sign of a healthy economy while a decline indicates that the economy is not functioning to its full capacity.

Historically, the value of minerals and metals to Canada's economy has ranged between 2.7% and 4.5% of the country's real GDP. In 2017, the industry's contribution remained within this range at 3.3%.

2017 Contribution

The extractive industry, which combines mineral extraction with oil and gas extraction, contributed \$152.1 billion, or 8.6%, to Canada's real GDP in 2017 (*see Figure 1*). By this measure – up 1.1% year-over-year – the extractive industry is the fourth largest of Canada's 18 industries, surpassed only by the services, real estate, and manufacturing sectors.

The mining industry as a whole goes beyond extraction to include mineral manufacturing and needs to be carved

out from the broader mining and oil and gas category. The mining industry's 2017 contribution to real GDP is detailed in *Figure 2*, which divides industry activity into four stages:

- **Stage 1**, extraction of minerals (metals, non-metals, and coal): \$24.6 billion
- **Stage 2**, primary metal manufacturing (smelting, refining, rolling, extruding, alloying, and casting of primary metals): \$14.9 billion
- **Stage 3**, non-metallic mineral product manufacturing (abrasives, lime, cement, glass, and ceramics): \$5.9 billion
- **Stage 4**, fabricated metal product manufacturing (forging, stamping and heat-treating to produce reinforcing bars, fabricated wire, cutlery, tools, and hardware): \$12.9 billion

MINING'S DIRECT CONTRIBUTION TO 2017 REAL GDP TOTALED \$58.4 BILLION, A 1.4% INCREASE YEAR-OVER-YEAR, WHILE THE SECTOR'S CONTRIBUTION TO NOMINAL GDP TOTALED \$72 BILLION, AN 11% INCREASE YEAR-OVER-YEAR.

The difference between real and nominal GDP is that real GDP is only calculated in terms of expenditure, whereas nominal GDP is calculated by using current dollars, and is produced in terms of income and expenditure. In short, real GDP is better at illustrating the performance of a sector over time, whereas nominal GDP is useful to illustrate an industry's contribution to the economy in a given year. Accordingly, mining's nominal GDP for 2017 increased year-over-year by 11% from \$64-\$72 billion dollars, largely due to rising prices over the course of 2017. *See Figure 3* and read about GDP for more information.

MINING IN THE PROVINCES AND TERRITORIES

Year-over-year, mineral production values were projected to increase for 2017 in eight of Canada's 13 provinces and territories. The production values for five jurisdictions were projected to decrease, however, three remained roughly consistent year-over-year. British Columbia posted the largest gain in absolute value, exceeding \$2.5 billion. The Northwest Territories also increased by approximately \$800 million year-over-year. Ontario experienced the single largest absolute drop in production value year-over-year, falling from \$10.5 billion to \$9.8 billion. Overall, total production value is up year-over-year by 7.7%, or more than \$3 billion.

Regional Distribution of Mining

[Figure 4](#) illustrates the geographical location of Canada's mining clusters and active mineral development regions ([details in Annex 1](#)). The Northwest Territories are the country's dominant source of diamonds. Leading in the production of gold are Ontario and Quebec. Saskatchewan produces all of Canada's uranium and has world-class potash reserves. British Columbia is prominent in steelmaking coal production. Newfoundland and Labrador and Quebec produce virtually all of Canada's iron ore. Several provinces also have strong copper and nickel production. (For detailed mineral production by province and territory, [see Annex 2](#) and [Annex 3](#).)

As home to Rio Tinto Alcan, and to significant mining research and education facilities, Montreal holds considerable global expertise in aluminum smelting.

The global emergence of the oil sands over the past two decades has transformed Edmonton and Calgary into centres of expertise in this area, and Saskatoon has risen to the forefront of the uranium and potash sectors.

Regional Value of Mining

The value of Canadian mineral production increased by 7.7% in 2017, rising more than \$3 billion from 2016 levels ([see Figure 5](#)).

CANADIAN MINES IN 2017

Total mining establishments: 1,189
Metals: 63
Non-metals: 1,126

PROVINCES WITH THE MOST METAL MINES

Quebec: 21
Ontario: 17
British Columbia: 8

MAIN TYPES OF NON-METAL MINES

Sand and gravel quarries: 721
Stone quarries: 293
Peat mines: 62

Mining also has significant ties to Canada's major cities. Some of the largest Canadian and international mining companies are headquartered or have a significant presence in urban centres such as Vancouver (Goldcorp, Teck Resources Limited), Saskatoon (Cameco Corporation, PotashCorp), Toronto (Barrick Gold Corporation, Vale, Glencore), and Montreal (ArcelorMittal, Iron Ore Company of Canada, Rio Tinto Alcan).

Vancouver is the global centre of expertise for mineral exploration. Some 700 exploration companies are located in British Columbia, most of which are in the greater Vancouver area.

Toronto is the global centre for mining finance. The Toronto Stock Exchange has the most listed mining companies globally, and the city itself is home to several dozen mining company head offices, as well as several hundred mining suppliers, consulting firms, and service providers.

VALUE OF MINING IN 2017

Canada-wide: \$43.9 billion

TOP 4 PROVINCES

1. Ontario: \$9.9 billion
2. British Columbia: \$8.8 billion
3. Quebec: \$8.6 billion
4. Saskatchewan: \$5.7 billion

A correlation exists between production values and expenditures on resource development. The top four provinces by production value in 2017 – Saskatchewan, Ontario, Quebec, and British Columbia – also led in expenditures on mineral resource development ([see Figure 6](#)). Of the \$7.8 billion invested in mine complex development in Canada, combined spending across these four provinces exceeded \$5.8 billion (75% of the total) and ranged from \$896 million to \$1.9 billion, with Saskatchewan leading in expenditure. This suggests that these four provinces will remain vital to Canada's mineral production well into the future.

The three territories together received 22% (\$570 million) of total 2017 Canadian spending on exploration and deposit appraisal (the first two columns of [Figure 6](#)). This amount, more than three times the territories' share of production value (7%), reflects global interest in Canada's northern mineral potential. On certain measures, this interest is materializing into wealth development as the territories also accounted for 13% (\$990 million) of total mine complex development expenditure.

The majority of this investment (67%) went to Nunavut, where Agnico Eagle is developing its Meliadine mine, and Amaruk satellite deposit. Overall territorial exploration and deposit appraisal is mixed, showing signs of recovery in the Yukon but not in the Northwest Territories and Nunavut:

- \$81.3 million in the Northwest Territories, down from \$90 million in 2017
- \$110.7 million in Nunavut, down consecutively from \$215.1 million in 2015
- \$172 million in Yukon, up from \$90.4 million in 2016

TAXES AND OTHER PAYMENTS TO GOVERNMENTS

Each year, Canadian governments receive considerable taxes and royalties as a result of mining activity. Specifically, these payments come from the first three stages of activity – extraction, smelting, and processing ([see Figure 2](#)).

Payments to Governments

Canada's payment disclosure legislation, the *Extractive Sector Transparency Measures Act*, which came into force in 2015, requires companies to disclose the payments they make to governments that exceed a \$100,000 threshold. Ultimately, this creates greater transparency of the taxes, royalties and other forms of disbursement that companies pay to governments, at home and abroad. Although the legislation came into force in 2015, the publication of tax payments began in 2017.

According to the [Natural Resource Governance Institute](#), in 2017, extractive sector companies reported payments totalling more than \$9.3 billion to Canadian governments. These payments, to Indigenous, municipal, provincial and federal governments, are generally royalty or tax payments sourced from over 1,800 projects across the country.

EXTRACTIVE SECTOR PAYMENTS TO CANADIAN GOVERNMENTS TOTALED MORE THAN \$9.3 BILLION IN 2017.

INDIRECT CONTRIBUTIONS TO MINING INDUSTRY SUPPLIERS

The mining industry's economic impact goes far beyond its direct contribution to the GDP. For instance, mining accounts for approximately half of Canada's rail-freight revenues and tonnage annually, typically exceeding \$6 billion in expenditure (details in Section 2).

Organizations such as CN Rail, CP Rail, and the Ports of Montreal, Quebec and Vancouver depend on a vibrant mining industry. Further, specialists in legal, environmental, taxation, engineering and other skillsets support the industry's many requirements to locate, develop, construct, operate, and reclaim a mine.

Supply relationships like these create mutual synergies. For instance, supplier companies play a crucial role in introducing and spreading innovative technologies and ideas within the mining industry.

InfoMine, a mining database, reported in 2018 that more than 3,700 firms provide technical, legal, financial, accounting, environmental and other expertise to the Canadian mining industry. Most of these suppliers are located in Ontario and British Columbia, followed by Alberta, Quebec, Saskatchewan and Manitoba. In 2016, InfoMine reported that Australia's identified mining supply sector surpassed that of Canada's, bumping Canada to third place. In 2017, this gap expanded with Australia adding more than 200 firms to its list. In 2018, Canada was trailing by nearly 800 firms, only having added 2 firms year-over-year. This is one of many indicators suggesting that Canada's attractiveness as a destination for mineral investment is eroding. (See Section 3 of this report for more discussion on investment trends.)

NUMBER OF MINING SUPPLIERS IN LEADING COUNTRIES

United States: 5,999
Australia: 4,549
Canada: 3,772
Brazil: 3,653
Chile: 1,827

Source: InfoMine

Tax Policy

Canada's mining tax regime has been falling behind international competitors for years. Budgets 2012 and 2013 reduced or eliminated several direct and indirect mining related tax credits. In areas such as dividend withholding tax and corporate restructuring rules, other jurisdictions have amended their fiscal regimes to better attract FDI while Canada has not. Most recently, the *Tax Cuts and Jobs Act* reforms have significantly reduced Canada's mining tax competitiveness vis-à-vis the US.

Essential to understanding the impact of recent US tax changes is appreciating the broader package of reforms, and not focusing exclusively on changes to the headline CIT rate. [Figure 7](#) provides an overview of several measures that enhance the competitiveness of the US mining tax regime over that of Canada, including:

- A lower aggregate CIT rate
- A 100% immediate depreciation rate for eligible capital investment
- Favorable treatment for high margin exports (amounting to ~8% tax reduction)
- A resource allowance of up to 50%

The cumulative competitiveness increase of these measures is significant. [Figure 8](#) models the implications of the new US tax regime against the status quo tax system in Canada on the same copper mine. It illustrates an approximate 40% to 50% reduction in the effective tax rate for the same mine in the US compared to Canada.

MAC advocated for government action to reduce Canada's waning international mining tax competitiveness. For example, to be competitive with the new US tax rate for exporters (16.06%), federal and provincial governments would need to reduce their corporate income tax rate to 8% respectively or reinstate a resource allowance of 33%. Specifically, governments should consider:

- Reducing the headline CIT rate to achieve equivalency with the US rate for exporters or reinstate a 33% resource allowance
- Reversing, reinstating and enhancing mining tax reforms from Federal Budgets 2012 and 2013, including augmenting the ACCA to enable immediate depreciation
- Exempting corporations from dividend withholding tax when companies have paid sufficient corporate income tax
- Enabling corporate reorganizations performed by Canadian or foreign groups to be tax free
- Modernizing the tax treatment of Qualified Environmental Trusts (QETs) by extending the carryback period from three to seven years, allowing reclamation to be deducted at the consolidated level when incurred regardless of which mine is being reclaimed, and by making QETs tax-exempt until the distribution of funds

In November, the 2018 Fall Economic Statement proposed several measures that will enhance the investment competitiveness of Canada's mining and metal manufacturing sectors, including:

- The Accelerated Investment Incentive, which will enable miners to write off three times the eligible cost of newly acquired assets in the year the investment is made
- Extending the Mineral Exploration Tax Credit (METC) for a five-year term, bringing greater investment certainty for early stage mineral exploration
- Allowing businesses to immediately write-off the full cost of clean energy equipment

MAC welcomed the above measures as an important boost to Canadian mining competitiveness, and will remain engaged in pursuit of further reforms to further enhance investment competitiveness. ■



Rio Tinto, Iron Ore Canada, Newfoundland and Labrador.

FIGURE 1

CANADA'S REAL GROSS DOMESTIC PRODUCT, BY INDUSTRY, 2007-2017

[Return to text](#)


(\$ millions)	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
All industries	1,468,927	1,478,592	1,429,913	1,476,176	1,524,395	1,552,003	1,589,454	1,631,228	1,649,263	1,673,141	1,761,730
Agriculture	16,619	18,083	17,592	17,291	17,637	17,813	20,938	19,900	20,637	21,482	18,482
Forestry and logging	4,457	4,165	3,286	3,794	4,173	4,093	4,209	3,963	4,254	4,287	4,395
Fishing, hunting and trapping	1,064	1,103	1,074	1,141	1,121	1,138	1,159	1,283	1,340	1,278	980
Support activities for agriculture and forestry	2,057	2,064	2,148	2,215	2,225	2,117	2,324	2,394	2,474	2,587	2,587
Mining (including milling) and quarrying, and oil and gas extraction	112,438	108,866	100,068	104,795	111,115	108,281	113,901	120,482	122,751	124,871	152,084
Support activities for mining and oil and gas extraction	10,669	11,471	8,314	10,290	12,204	12,445	12,581	13,964	8,989	6,472	7,923
Electric power, gas and water utilities	35,753	37,068	34,888	35,375	36,476	36,124	36,127	36,174	35,946	36,123	39,099
Construction	102,098	104,738	98,211	105,559	109,208	117,567	122,475	125,225	120,114	116,739	124,958
Manufacturing	187,791	177,371	152,564	159,596	165,154	167,793	166,662	172,316	172,563	174,033	183,132
Trade, wholesale	79,666	78,942	73,615	79,144	85,194	87,920	91,657	95,269	96,164	97,247	102,303
Trade, retail	77,269	79,656	77,683	80,009	80,843	81,119	85,637	88,805	90,591	92,957	96,516
Transportation and warehousing	62,645	62,619	60,198	62,620	65,077	65,915	67,177	69,614	72,334	74,814	79,497
Information and cultural industries	48,668	49,025	48,302	49,327	49,954	50,350	49,893	50,010	49,965	50,211	52,731
Finance and insurance	97,528	96,050	95,249	97,260	100,546	102,164	106,052	109,211	114,972	120,350	123,579
Real estate and rental and leasing	168,568	172,618	177,200	182,930	188,680	194,632	200,043	206,041	212,994	219,389	228,902
Community, business and personal services	199,343	203,556	199,763	199,209	204,847	210,206	215,497	220,704	223,354	224,694	202,201
Public administration	92,264	96,296	101,505	104,310	106,165	105,283	104,876	105,578	105,930	107,375	109,391
Health care and social assistance	96,254	98,424	100,702	102,232	103,998	105,614	105,712	107,270	109,478	112,507	116,485
Educational services	75,833	78,541	79,699	81,294	82,003	83,546	84,858	85,419	86,887	88,312	116,485

Source: Statistics Canada, CANSIM Table 379-0031.

Note: Values at Basic Prices in 2007 Constant Dollars.

FIGURE 2

CANADA'S REAL GROSS DOMESTIC PRODUCT, MINING, MINERAL MANUFACTURING, AND OIL AND GAS, 2007-2017

[Return to text](#)



(\$ millions)	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Metal mines	16,630	17,153	13,316	13,805	16,158	16,249	17,566	18,456	19,161	19,448	17,352
Non-metal mines	5,329	5,035	3,436	4,439	4,759	4,206	4,284	4,486	4,698	4,591	5,843
Coal mines	1,632	1,719	1,438	1,631	1,594	1,620	1,760	1,669	1,455	1,473	1,399
Total Mining	23,591	23,907	18,190	19,875	22,511	22,075	23,610	24,611	25,314	25,512	24,594
Primary metal manufacturing	15,602	15,248	11,483	12,836	13,598	13,466	13,001	13,868	12,943	13,884	14,911
Fabricated metal product manufacturing	14,361	13,102	11,141	11,592	12,547	13,466	13,783	14,042	13,559	12,591	12,929
Non-metallic mineral product manufacturing	6,504	6,235	5,287	5,417	5,524	5,648	5,544	5,827	5,689	5,634	5,930
Total Mineral Manufacturing	36,467	34,585	27,911	29,845	31,669	32,580	32,328	33,737	32,191	32,109	33,770
Oil and gas extraction	88,847	84,959	81,878	84,920	88,604	86,206	90,291	95,871	97,437	99,359	112,553
Petroleum and coal products manufacturing	7,155	7,036	7,468	7,044	6,728	6,782	6,741	6,666	6,620	6,513	7,113
Support activities for mining and oil and gas	10,669	11,471	8,314	10,290	12,204	12,445	12,581	13,964	8,989	6,472	7,923
Total Oil and Gas and Associated Manufacturing	106,671	103,466	97,660	102,254	107,536	105,433	109,613	116,501	113,046	112,344	127,589

Source: Statistics Canada, CANSIM Table 379-0031.

Note: Values at Basic Prices in 2007 Constant Dollars.



FIGURE 3

NATURAL RESOURCES SATELLITE ACCOUNT, INDICATORS, ANNUAL (DOLLARS X 1,000,000)

[Return to text](#)


Mining Industry Nominal GDP

Indicators	Commodities	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2016 - 2017	% diff.
Gross value added	Total commodities	46,502	48,579	33,422	43,329	54,095	46,934	43,711	43,308	43,502	43,075	49,231	6,156	13%
Gross value added	Extraction	23,347	25,877	17,533	25,336	32,892	26,444	24,862	23,888	24,547	24,609	28,270	3,661	13%
Gross value added	Coal	1,669	3,881	3,242	3,989	5,575	3,704	2,726	1,998	1,872	1,659	3,115	1,456	47%
Gross value added	Metallic minerals	16,198	13,218	8,210	13,056	16,766	14,132	14,105	13,568	13,470	14,134	15,173	1,039	7%
Gross value added	Non-metallic minerals	5,480	8,778	6,081	8,291	10,551	8,608	8,031	8,322	9,205	8,816	9,982	1,166	12%
Gross value added	Services	3,861	4,684	3,472	4,550	6,127	6,269	5,873	5,368	5,217	4,825	6,125	1,300	21%
Gross value added	Primary manufacturing	19,294	18,018	12,417	13,443	15,076	14,221	12,976	14,052	13,738	13,641	14,836	1,195	8%
Gross value added	Primary metallic minerals products	12,435	11,733	7,191	8,157	9,605	8,538	7,432	8,312	8,043	7,915	8,549	634	7%
Gross value added	Primary non-metallic minerals products	6,859	6,285	5,226	5,286	5,471	5,683	5,544	5,740	5,695	5,726	6,287	561	9%
Gross value added	Total commodities	18,380	17,534	15,537	16,527	18,664	20,226	20,731	21,455	21,876	21,667	22,782	1,115	5%
Gross value added	Services and custom work	2,128	2,026	1,933	1,980	2,115	2,165	1,973	2,072	2,114	2,076	2,245	169	8%
Gross value added	Secondary metal products	3,083	3,303	2,093	2,559	2,788	2,941	2,948	3,307	2,947	3,001	3,366	365	11%
Gross value added	Tertiary metal products	11,014	10,491	9,191	9,294	10,463	11,604	12,358	12,452	12,636	12,212	13,130	918	7%
Gross value added	Miscellaneous metal products	2,155	1,714	2,320	2,694	3,298	3,516	3,452	3,624	4,179	4,378	4,041	-337	-8%
Total	Total commodities	64,882	66,113	48,959	59,856	72,759	67,160	64,442	64,763	65,378	64,742	72,013	7,271	10%

Source: Statistics Canada.

Table 388-0010 - Natural resources satellite account, indicators, annual (dollars unless otherwise noted).



FIGURE 3 CONTINUED

NATURAL RESOURCES SATELLITE ACCOUNT, INDICATORS, ANNUAL (DOLLARS X 1,000,000)

[Return to text](#)



Mining Industry Real GDP														
Indicators	Commodities	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2016 - 2017	% diff.
Gross value added	Total commodities	46,503	47,223	36,234	39,935	43,998	43,653	42,816	44,473	44,927	44,865	45,818	953	2%
Gross value added	Extraction	23,347	23,993	18,238	19,967	22,589	22,130	22,602	23,610	24,796	24,780	24,353	-427	-2%
Gross value added	Coal	1,669	1,758	1,472	1,668	1,629	1,658	1,780	1,536	1,421	1,426	1,393	-33	-2%
Gross value added	Metallic minerals	16,197	16,957	13,164	13,647	15,973	16,063	16,361	17,165	18,240	18,385	17,240	-1,145	-7%
Gross value added	Non-metallic minerals	5,481	5,278	3,602	4,652	4,987	4,409	4,461	4,909	5,135	4,969	5,720	751	13%
Gross value added	Services	3,861	4,251	3,080	3,813	4,523	4,612	4,340	4,018	3,804	3,324	4,070	746	18%
Gross value added	Primary manufacturing	19,295	18,979	14,916	16,155	16,886	16,911	15,874	16,845	16,327	16,761	17,395	634	4%
Gross value added	Primary metallic minerals products	12,436	12,403	9,341	10,442	11,060	10,954	10,419	11,277	10,901	11,372	11,651	279	2%
Gross value added	Primary non-metallic minerals products	6,859	6,576	5,575	5,713	5,826	5,957	5,455	5,568	5,426	5,389	5,744	355	6%
Gross value added	Total commodities	18,378	16,688	14,604	15,851	17,580	18,734	19,446	20,182	19,574	18,992	19,701	709	4%
Gross value added	Miscellaneous metal products	2,155	1,709	2,013	2,372	3,003	3,220	3,191	3,202	3,200	3,054	2,673	-381	-14%
Gross value added	Secondary metal products	3,081	3,264	2,190	2,729	2,871	2,950	3,180	3,516	3,201	3,259	3,657	398	11%
Gross value added	Services and custom work	2,128	1,867	1,727	1,825	2,045	2,197	2,263	2,377	2,325	2,276	2,417	141	6%
Gross value added	Tertiary metal products	11,014	9,848	8,674	8,925	9,661	10,367	10,812	11,087	10,848	10,403	10,954	551	5%
Total	Total commodities	64,881	63,911	50,838	55,786	61,578	62,387	62,262	64,655	64,501	63,857	65,519	1,662	3%

Source: Statistics Canada.

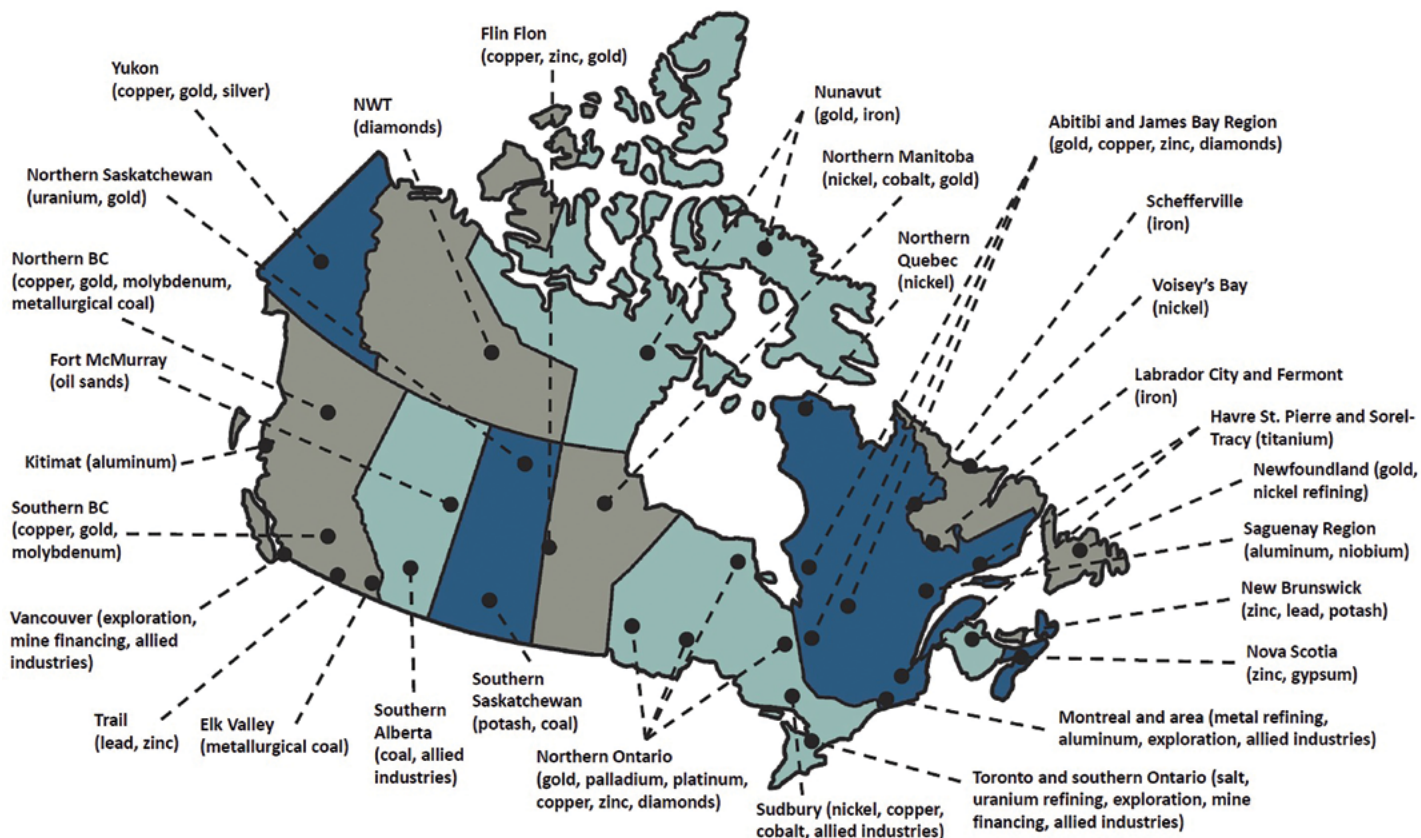
Table 388-0010 - Natural resources satellite account, indicators, annual (dollars unless otherwise noted).



FIGURE 4

CANADIAN MINING INDUSTRY CLUSTERS

[Return to text](#)



Source: The Mining Association of Canada.

FIGURE 5

VALUE OF CANADIAN MINERAL PRODUCTION BY PROVINCE AND TERRITORY, 2008 AND 2017^p

[Return to text](#)



Province/Territory	2008			2017 ^p		
	(\$ current millions)	(%)	RANK	(\$ current millions)	(%)	RANK
Ontario	8,947.7	19.8	1	9,862.5	22.5	1
British Columbia	7,087.6	15.7	3	8,835.8	20.1	2
Quebec	5,801.3	12.8	4	8,609.5	19.6	3
Saskatchewan	8,603.9	19.0	2	5,718.2	13.0	4
Newfoundland and Labrador	5,315.8	11.8	5	2,926.6	6.7	5
Alberta	3,588.5	7.9	6	2,443.9	5.6	6
Northwest Territories	2,123.5	4.7	7	2,070.2	4.7	7
Manitoba	1,687.0	3.7	8	1,655.7	3.8	8
Nunavut	12.7	...	12	844.4	1.9	9
New Brunswick	1,537.0	3.4	9	392.8	0.9	10
Yukon	207.6	0.5	11	300.9	0.7	11
Nova Scotia	307.0	0.7	10	237.4	0.5	12
Prince Edward Island	3.2	...	13	6.0	...	13
Canada	45,222.7	100.0		43,903.8	100.0	

Sources: Natural Resources Canada; Statistics Canada.

^p Preliminary; ... Amount too small to be expressed.

Note: This table includes the production of coal but excludes the production of petroleum and natural gas. Numbers may not add to totals due to rounding. As of reference year 2017, Statistics Canada has ceased the collection of the cement data. Values for cement production have been removed from 2008 numbers.



FIGURE 6

TOTAL MINERAL DEVELOPMENT EXPENDITURES, BY STAGE AND PROVINCE AND TERRITORY, 2017^P

[Return to text](#)

(\$ millions)

Province/Territory	Exploration	Deposit Appraisal	Mine Complex Development	Total
Newfoundland and Labrador	35.9	1.3	512.2	549.4
Nova Scotia	5.0	14.4	183.2	202.6
New Brunswick	13.1	1.2	16.7	31.0
Quebec	365.7	414.2	1,381.2	2,161.1
Ontario	379.8	230.7	1,919.7	2,530.2
Manitoba	24.9	13.7	174.1	212.7
Saskatchewan	159.4	30.5	1,607.0	1,796.9
Alberta	4.3	32.7	93.9	130.9
British Columbia	182.4	79.0	896.8	1,158.2
Yukon	109.4	80.6	14.2	204.3
Northwest Territories	84.0	6.0	309.1	399.1
Nunavut	117.0	173.8	667.0	957.8
Canada	1,481.0	1,078.1	7,775.0	10,334.2

Source: Natural Resources Canada, based on the Federal-Provincial-Territorial Survey of Mineral Exploration, Deposit Appraisal and Mine Complex Development Expenditures.

^P Preliminary.

Note: Includes on-mine-site and off-mine-site activities. Includes field work, overhead costs, engineering, economic, pre-feasibility, feasibility, and environmental studies, and land access costs. Expenditures for mine complex development include machinery and equipment and non-residential construction.

FIGURE 7

COMPARATIVE ANALYSIS OF CANADA AND US MINERAL TAX TREATMENT

[Return to text](#)



		Canada	USA
Tax Rate:	Federal	15,0%	21,0%
	Province / State (deductible)	11,5%	6,0%
	Total	26,5%	25,7%
Tax rate on export (FDII - high margin goods or services)		26,5%	16,1%
Depreciation rate		25% DB	100%
Resources Allowance / Percentage Depletion		N/A	up to 50%
R&D Credits		all	incremental
Interest deduction		Thin cap rules	30% EBITDA
Loss carry forward			
	pre-2018 losses	100% income	100% income
	pre-2017 losses	100% income	80% income

Source: The Mining Association of Canada.



FIGURE 8

CANADA V USA: A TAX COMPARISON

[Return to text](#)


		USA	Canada		USA	Canada
Revenue		1,000 \$	1,000 \$		2,000 \$	2,000 \$
Deductible costs		(800) \$	(800) \$		(800) \$	(800) \$
Taxable income before percentage depletion		200 \$	200 \$		1,200 \$	1,200 \$
Percentage depletion / Lesser of		USA	Canada		USA	Canada
50% of mining profit	100 \$			600 \$		
15% of gross mining revenue ¹	150 \$	(100) \$	N/A	300 \$	(300) \$	N/A
		100 \$	200 \$		900 \$	1,200 \$
Resource allowance at 33 1/3%		USA	Canada		USA	Canada
		N/A	(67) \$		N/A	(400) \$
		100 \$	133 \$		900 \$	800 \$
Taxable income		USA	Canada		USA	Canada
Federal tax		21.0%	15.0%		21.0%	15.0%
State (deductible) / Provincial tax		6.0%	11.5%		6.0%	11.5%
		25.7%	26.5%		25.7%	26.5%
Income tax payable		USA	Canada		USA	Canada
		26 \$	35 \$		232 \$	212 \$
Effective tax rate		12.9%	17.7%		19.3%	17.7%

Source: Mining Association of Canada.

1) Percentage of gross mining revenue varies with the ore mined.

2) Taxpayers can deduct the highest between depletion and the percentage depletion. Depletion is computed on capitalized development costs.

THE ACTIVITIES: PRODUCTION, PROCESSING AND TRANSPORTATION

CANADA'S STRENGTH IN MINING RESTS ON THE ABILITY TO PRODUCE AND PROCESS MINERALS COMPETITIVELY AND TO TRANSPORT PRODUCTS EFFICIENTLY TO DOMESTIC AND INTERNATIONAL MARKETS. THESE PRODUCTION, PROCESSING AND TRANSPORTATION ACTIVITIES FORM THE BASE THAT ALLOWS THE INDUSTRY TO STAY GLOBALLY COMPETITIVE AND EXPAND ITS CANADIAN INVESTMENTS.

PRODUCTION OF KEY MINERALS

Richly endowed with natural resources, Canada ranks among the top five countries in the global production of 16 major minerals and metals ([details in Annex 4](#)):

- First in potash
- Second in uranium and niobium
- Third in nickel, gemstones, indium, aluminum, and platinum group metals
- Fourth in cobalt, cadmium, graphite, and sulphur
- Fifth in diamonds, titanium, gold, and mica

While Canada produces some 60 different minerals and metals, its status as a top-five producer has slipped and shifted over the past 15 years. Today, Canada no longer holds this position as a producer of copper, zinc, molybdenum, lead and cadmium, having been surpassed by other countries at different times. Over the past five years, Canada has lost ranking for seven out of 16 commodities for which it had been a top-five producer. Notable, however, is that Canada has become a top-five producer over the same time period of four commodities for which it previously was not on the charts. These include mica, indium, gemstones and graphite. Also notable is that Canada is third in the world for diamonds, according to value, despite being fifth in production.

PRODUCTION VALUES

In 2017, the value of Canadian mineral production increased for the first time in four years, rising 7.7% (or by more than \$3 billion) to \$43.9 billion ([see Figure 9](#)). Values increased across metal, non-metal and coal streams, though coal accounted for the largest increase, rising \$2.2 billion. Increases are indicative of steady upward mobility in commodity prices over the course of 2017.

Canada's top 10 minerals and metals ([see Figure 10](#)) each had production values of more than \$1.6 billion in 2017, with five (gold, potash, copper, iron ore and coal) at more than \$3 billion each. Values for seven out of the 10 commodities are projected to increase in 2017, with coal leading the charge with a 77% (\$2.7 billion) increase year-over-year, followed by diamonds with a nearly \$1 billion increase, and then potash with an 18%, or \$682 million increase. Together, the top 10 minerals and metals represented \$37.4 billion (87%) of Canada's total mineral production value in 2017. [See Annex 5](#) for a complete set of production volumes and values.

On the petroleum front, synthetic crude oil accounted for 30.3% of Canada's crude oil production volume in 2017, up modestly over 2016 ([see Figure 11](#)). Indicative of an increase in oil prices, the absolute value of synthetic crude oil production increased from \$19.3 billion to \$25.4 billion year-over-year.

PROCESSING OF MINERALS

Canada has a large mineral-processing industry, with 31 facilities - comprised of non-ferrous metal smelters, refineries and conversion facilities – in seven provinces ([see Figure 12](#)).

CANADA'S MINERAL-PROCESSING FACILITIES

- **New Brunswick:** 1 smelter
- **Quebec:** 9 smelters, 4 refineries, 2 secondary smelters
- **Ontario:** 2 secondary smelters, 3 refineries, 3 smelter/refineries, 1 conversion facility
- **Manitoba:** 1 smelter/refinery, 1 refinery
- **Alberta:** 1 refinery
- **British Columbia:** 1 smelter, 1 secondary smelter, 1 smelter/refinery, 1 processing plant
- **Newfoundland and Labrador:** 1 refinery

Canada's integrated smelters and refineries were built in proximity to world-class mines, most located inland, without access to low-cost marine transport. As local ore reserves increasingly become depleted (discussed in Section 3) and the production of base metal concentrate declines, smelters and refineries are transitioning from integrated production to the more expensive custom treatment of concentrates imported from other countries. Additionally, they are also using more secondary raw materials and scrap feed.

The quantity and value of refined metal production in Canada has become irregular due to the depletion of reserves and greater dependence on imported concentrates. [Figure 13](#) shows that the production volumes for refined metals over the past 10 years have been mixed. Nickel, lead, cobalt and aluminum have increased, while copper, cadmium and zinc have decreased.

The competitiveness of Canada's mineral-processing industry depends largely on the ability to secure reliable sources of feedstock from domestic mines – a supply that, in recent years, has gone into decline. Importing feedstock from abroad greatly influences the cost and profitability of domestic refining and smelting operations.

If the industry is to remain competitive, enhancing domestic levels of mineral production through requisite investment in exploration and development is essential.

Other factors also influence the competitiveness of Canada's mineral-processing industry. Canada's processing facilities operate in a global arena, where China and other countries are expanding their capacity and competing fiercely for raw materials. The cost of electricity is also a factor in some Canadian jurisdictions. Given the energy-intensive nature of these value-added processes, high-cost power jurisdictions dampen the competitiveness of existing operations and can deter future investment. Finally, the age of some Canadian operations, and their ability to meet potential regulatory requirements, also affects their viability.

In the face of these combined factors, the downstream Canadian mining industry risks being left behind. At stake are the benefits Canada has historically derived from a robust value-added mineral-processing and manufacturing sector, such as stable, long-term, and high-paying employment. For example, primary metal manufacturing accounted for nearly 46,000 jobs in 2017. Adding non-metallic mineral product manufacturing increases that number by 50,000 jobs. Both sectors combined account for almost one quarter of the industry's overall direct employment for the year. While significant, these numbers have been in decline. Since 2007, employment in primary metal manufacturing has dropped by more than 25,000 jobs.

TRANSPORTATION OF MINING PRODUCTS

Canada's logistics supply chain is critical to the flow of mined and refined products to both domestic and international markets. The mining industry is the largest industrial customer group of Canada's transportation sector, providing it with considerable tonnage, especially in select bulk commodities such as iron ore, coal, potash, and sulphur.

Rail

As the largest shipper by both freight revenue and volume shipped, the mining industry is the Canadian rail system's most significant customer. In 2017, shipments of coal, iron ore, potash and other minerals and metals represented 53.3% of total Canadian rail freight revenue ([see Figure 14](#)).

Canada's rail freight system operates primarily as a dual monopoly, shared by CN and CP – Canada's only Class I railways. Mining operations, in addition to communities and businesses, are frequently captive to only one railway given the remoteness of their locations.

In 2008, the *Canada Transportation Act* (CTA) was amended to better protect shippers from potential abuse of market power by railways. The changes, supported by MAC and the Canadian mining industry, improved the balance between rail customers' interests (lower rates, better service) and those of rail companies (higher rates, more profit) by strengthening the ability to arbitrate disputes over rail fees and ancillary charges. While these measures were an improvement, challenges have persisted in the relationship between railways and rail customers, with the former seeking deliberately to decrease the accessibility and functionality of the remedies that shippers have recourse to in the CTA.

In light of numerous challenges, and as a follow-up to these legislative changes, the federal government launched the Rail Freight Service Review in 2010, aimed at identifying service problems, examining best practices, and recommending remedies to improve service. Despite the resulting recommendations, the federal government's commitment to table legislation to enact a shipper's right to a service-level agreement fell short, as specific service provisions were not legislated in the *Fair Rail Freight Service Act*.

The inadequacy of this legislation resulted in continued rail service failures across all shipping sectors. The government responded with the *Fair Rail for Grain Farmers Act*, which enacted narrow grain-sector-specific legislative measures without any consultation. The scale of this issue garnered national media attention, and in June 2014, then-Minister of Transport, the Honourable Lisa Raitt, launched the 2015 statutory review of the *Canada Transportation Act* ahead of schedule.

Transportation Modernization Act

In spring 2017, and building on *Transportation 2030: A Strategic Plan for the Future of Transportation in Canada*, the Minister of Transport, the Honourable Marc Garneau, tabled Bill C-49, the *Transportation Modernization Act*.

While the package of reforms went further than those of Minister Garneau's predecessors, they still fell short of rebalancing the position of railways and customers in the rail freight market. On the backdrop of a costly and reputationally damaging supply chain disruption in winter 2018, MAC, in partnership with seven other resource shipping associations, advanced two recommendations to improve the bill. The first was to give shippers a right to a costing assessment in the context of a Final Offer Arbitration (FOA), one of the remedies under the CTA. The second was to give the Canada Transportation Agency

unilateral "own-motion" powers to investigate service disruptions in the rail freight market— with the aim of expeditiously advancing solutions to reduce economic harm.

For decades, the one useful remedy for captive shippers was FOA. For a FOA to work properly, there has to be reasonable access to information on both sides of an arbitration, including with respect to costing. Without such information, shippers are negotiating in the dark, and arbitrators are unable to assess the reasonableness of bids. For many years, shippers requested such information during a FOA and the railways complied, leading to fair processes and reasonable outcomes. But that changed about a decade ago when railways started objecting to this information being shared, leaving shippers at a major disadvantage and effectively nullifying the FOA remedy.

MAC's amendment would have made the provision of costing information a mandatory input into a FOA process, restoring the remedies to function as originally designed. The amendment was rejected on the basis of a false premise, and the own-motion powers proposal was reduced in scope, requiring the Agency to seek permission from the Minister instead of being able to act independently as a third-party regulator should be.

At the time of writing, MAC is unsurprised that none of bill's new tools had been used since C-49's enactment, despite their having been lauded by decision-makers as key solutions to the challenges shippers face. Meanwhile, service challenges have been mounting in recent weeks, and shippers across the supply chain are growing increasingly concerned that a supply chain disruption could occur again this winter, as occurred last. Unfortunately, shippers will have little recourse, and the window to affect change has closed for now.

Trucking

Trucking plays a smaller yet important role in moving mining products. This, for the most part, has to do with the sheer volume of mined materials needing shipment, the remote location of many mining operations, and the factors that determine the economic viability of freight shipment by rail versus truck.

According to the federal government's 2016 report, *Transportation in Canada*, trucks carried more than \$223 billion in Canadian exports in 2016, 10% of which (\$21.9 billion) were mining-related products. Trucks also carried \$295 billion in imports to Canada, 9% of which (\$25 billion) were mining-related products.

Another key role trucking plays in the mining industry is the delivery of mining supply inputs to mine sites, such as fuel for operations. Mining sites that do not have access to rail rely on truck and marine shipping for these essential materials.

A 2016 report prepared for the *Canadian Trucking Alliance* indicates a two-fold demographic problem facing the trucking industry over the next decade. Firstly, truck drivers are among the oldest workforce in Canada, with 22% of drivers being between 55 and 64 years of age, with only 15% being between 25 and 34. The shortfall of truck drivers in Canada is estimated to reach 34,000 by 2024, though other plausible factors could increase this number to 48,000. Overcoming this shortfall – or preventing it – is a complex task, however immigration and improved recruitment strategies can and must play a role.

The Government of Canada is undertaking a consultation to “update the National Occupational System (NOC) and the associated Career Handbook”. The Express Entry program links Canada’s immigration system with the NOC, as it allows people classified as “federal skilled workers” to apply for expedited permanent residence to Canada. Modifying the NOC to allow for Transportation Truck Driver access to the Express Entry immigration option would help mitigate the truck driver shortage, improving the productivity of Canada’s economy.

Marine

Mining is also a leading customer of Canadian ports. The Port of Montreal handles large volumes of iron ore and salt, as well as other mineral products such as fertilizer, ores, gypsum, and scrap metal. Total mined products account for approximately 3 million tonnes annually, or ~50%, of the port’s dry bulk cargo shipments for the year. Generally, these arrive by ship as inbound cargo and are then transported by rail or truck to the region’s smelting and refining facilities.

Beyond Montreal, the mining industry is a major contributor to Canada’s St. Lawrence Seaway. Shipments of iron ore, coke and coal represent ~30% of total seaway traffic, with iron ore accounting for the single-largest share of any commodity shipped. Total mining products account for ~40% of total volume.

Steelmaking coal accounts for ~30% of the total volume handled at the Port of Vancouver annually, which moves shipments to China, Japan, and other Asian markets. Fertilizer/potash represents another 10% of the port’s volume, and minerals and ores another 13%.

All told, mining products account for more than 50 million tonnes, or roughly 45% of the port’s volume.

The International Maritime Organization (IMO) is the global body that regulates pollution and safety practices at sea. The evolution of the International Maritime Solid Bulk Cargoes Code has implications for the way mining companies ship their products. (See Section 6 of this report for more discussion.)

Pipelines

The North American energy landscape is changing rapidly. Historically, Canadian oil companies shipped the majority of their product to the US, which was reliant on imports to meet its oil demand. However, hydraulic fracturing to produce oil and gas from shale and tight rock formations is transforming the US into a self-sufficient energy producer. Even in a low price environment, this development has drastically reduced the country’s needs for imported oil. Meanwhile, growth in global oil demand has shifted to Asia, with China surpassing the US as the world’s largest oil importer.

This shift in demand is challenging Canadian oil companies because existing transportation infrastructure is impeding their ability to access global markets. It is important to note that there are costs associated with the inadequacy of Canada’s existing pipeline network. Declining US demand, together with insufficient pipeline capacity and transportation bottlenecks in the US Midwest, are driving down the price for Canadian crude oils relative to other crude oils. In November 2018, Canadian heavy oil slumped below at \$13-per-barrel compared to US Brent and West Texas Intermediate benchmarks, which remained above \$50-per-barrel. Rachel Notley, Alberta’s Premier, has estimated the price decline to be costing Alberta oil producers, in aggregate, in excess of \$80 million a day. When tallied, and if the price decline persists, economic losses approaching \$30 billion could accrue over the course of the year.

To address this situation, Canada must develop new pipeline and port infrastructure to reach markets in Asia, the US Gulf Coast, eastern Canada, and the US seaboard markets. The first step is constructing the Trans Mountain Expansion Pipeline as expeditiously as possible. ■

FIGURE 9

VALUE OF CANADIAN MINERAL PRODUCTION, 1999–2017^p

[Return to text](#)



\$ billions	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017 ^p
Metals	9.7	11.0	10.4	10.4	9.7	12.4	14.6	21.1	26.2	22.6	15.5	21.4	25.6	23.6	23.5	24.2	23.1	23.3	24.0
Non-metals	6.1	6.2	6.3	6.5	7.4	8.7	8.8	8.6	9.8	17.7	10.2	13.2	16.2	14.9	13.9	14.1	14.8	12.1	13.6
Coal	1.5	1.4	1.6	1.6	1.5	1.6	2.9	2.9	2.7	5.0	4.4	5.5	7.5	5.9	4.9	3.9	3.1	4.0	6.2
Total Mineral Production	17.3	18.6	18.2	18.5	18.6	22.7	26.3	32.6	38.7	45.3	30.1	40.1	49.3	44.4	42.3	42.2	41.0	39.4	43.9

Sources: Natural Resources Canada; Statistics Canada.

^p Preliminary.

Note: This table includes the production of coal but excludes the production of petroleum and natural gas. Numbers may not add to totals due to rounding.



FIGURE 10

CANADA'S TOP TEN METALLIC AND NON-METALLIC MINERAL PRODUCTS, BY VALUE OF PRODUCTION, 2006 AND 2016^P

[Return to text](#)



	Unit of Measure	2007		2017 ^P	
		Quantity (\$ millions)	\$ Value (\$ millions)	Quantity (\$ millions)	\$ Value (\$ millions)
Gold	000 kg	102	2,461	164	8,690
Potash (K ₂ O) ¹	kt	11,085	2,815	12,214	4,571
Copper	000 t	578	4,418	584	4,669
Iron Ore	kt	32,774	2,503	49,009	3,814
Nickel	000 t	245	9,795	201	2,694
Coal	kt	69,131	2,735	59,893	6,238
Diamonds	000 ct	17,144	1,800	22,724	2,619
Sand and gravel	kt	243,096	1,497	290,613	2,539
Stone	kt	149,982	1,403	155,254	1,604

Sources: Natural Resources Canada; Statistics Canada.

^P Preliminary.

Note:

¹ Shipments of potash to Canadian potassium sulphate plants are not included in this table. As of 2017, Statistics Canada is no longer conducting the monthly survey of cement, and values are no longer included in Canada's mineral production. Cement production has also been excluded from 2007 values for comparability with 2017 data.

FIGURE 11

PRODUCTION OF SYNTHETIC CRUDE OIL BY OIL SANDS MINING PLANTS, ALBERTA AND CANADA, BY QUANTITY AND VALUE, 1998-2017

[Return to text](#)



	Synthetic Crude Oil (000's of m3)	Total Crude Oil and Equivalents	Synthetic Crude as % of Total	Synthetic Crude Oil (\$000)	Total Crude Oil and Equivalents (\$000)	Synthetic Crude as % of Total
ALBERTA						
1998	17,870.8	94,676.2	18.9	2,313,518	9,734,475	23.8
1999	18,766.9	89,065.5	21.1	3,252,547	13,727,829	23.7
2000	18,608.0	89,136.1	20.9	5,188,916	21,687,681	23.9
2001	20,260.6	89,364.5	22.7	4,995,003	17,734,825	28.2
2002	25,494.6	89,885.1	28.4	6,455,743	19,778,759	32.6
2003	25,028.8	95,311.4	26.3	6,777,342	22,187,602	30.5
2004	26,661.9	101,007.0	26.4	8,570,468	27,767,704	30.9
2005	21,932.5	98,878.7	22.2	9,213,624	33,282,754	27.7
2006	28,764.2	106,017.8	27.1	14,831,145	38,498,843	38.5
2007	39,900.2	108,853.3	36.7	18,012,945	42,130,415	42.8
2008	38,020.7	108,322.4	35.1	25,214,415	62,941,690	40.1
2009	44,330.8	112,937.7	39.3	19,043,537	43,934,049	43.3
2010	46,110.5	119,559.3	38.6	23,473,269	54,005,153	43.5
2011	49,375.1	129,183.4	38.2	30,518,182	69,033,911	44.2
2012	52,455.2	143,873.9	36.5	28,588,084	69,346,737	41.2
2013	54,328.1	154,324.2	35.2	34,382,129	79,535,264	43.2
2014	55,345.9	168,971.7	32.8	35,467,401	94,140,139	37.7
2015	56,646.4	179,262.9	31.6	21,512,827	57,544,954	37.4
2016	54,072.0	179,202.5	30.2	19,276,126	51,957,648	37.1
2017	59,560.6	196,698.9	30.3	25,368,232	71,038,745	35.7
CANADA						
1998	17,870.8	128,400.3	13.9	2,313,518	12,940,149	17.9
1999	18,766.9	122,287.0	15.3	3,252,547	18,698,282	17.4
2000	18,608.0	127,769.2	14.6	5,188,916	30,523,595	17
2001	20,260.7	128,951.0	15.7	4,995,003	24,911,953	20.1
2002	25,494.6	136,969.8	18.6	6,455,743	29,956,080	21.6
2003	25,028.8	144,813.2	17.3	6,777,342	33,610,498	20.2
2004	26,661.9	149,159.6	17.9	8,570,468	40,639,940	21.1
2005	21,932.5	146,207.9	15.0	9,213,624	49,159,801	18.7
2006	28,764.2	161,434.0	17.8	14,831,145	63,649,683	23.3
2007	39,900.2	160,448.3	24.9	18,012,945	62,919,592	28.6
2008	38,020.7	158,950.4	23.9	25,214,415	91,757,005	27.5
2009	44,330.8	158,100.4	28.0	19,043,537	61,558,676	30.9
2010	46,110.5	165,335.3	27.9	23,473,269	75,174,373	31.2
2011	49,375.1	175,312.1	28.5	30,518,182	95,496,704	32.3
2012	52,455.2	189,133.7	27.7	28,588,084	94,076,834	30.4
2013	54,328.1	202,292.6	26.9	34,382,129	106,507,173	32.3
2014	55,345.9	218,050.8	25.4	35,467,401	122,128,728	29.0
2015	56,646.4	224,157.5	25.3	21,512,827	72,081,704	29.8
2016	54,072.0	225,089.3	24.0	19,276,126	65,410,168	29.5
2017	59,560.6	243,808.3	24.4	25,368,232	88,202,203	28.8

Sources: Natural Resources Canada; Statistics Canada.



FIGURE 12

NON-FERROUS SMELTERS AND REFINERIES IN CANADA, 2017

[Return to text](#)


Owner/Operator	Operation	Type of facility	Location	Outputs
Newfoundland and Labrador				
Vale Newfoundland and Labrador Limited	Long Harbour	(Ref.)	Long Harbour	Ni, Cu, Co
New Brunswick				
Glencore Canada Corporation	Brunswick	(Sm.)	Belledune	Pb, Ag, Bi
Quebec				
Rio Tinto Aluminum Inc./Aluminium Austria Metall Québec/Hydro Aluminium a.s./Société générale de financement du Québec/Marubeni Québec Inc.	Alouette	(Sm.)	Sept-Îles	Al
Alcoa Corporation	Baie-Comeau	(Sm.)	Baie-Comeau	Al
Rio Tinto Aluminum Inc.	Grande-Baie	(Sm.)	Grande-Baie	Al
Rio Tinto Aluminum Inc.	Laterrière	(Sm.)	Laterrière	Al
Rio Tinto Aluminum Inc.	Vaudreuil Works	(Ref.)	Jonquière	Alumina
Rio Tinto Aluminum Inc.	Arvida	(Sm.)	Arvida	Al
Rio Tinto Aluminum Inc.	Alma	(Sm.)	Alma	Al
Alcoa Corporation	Deschambault	(Sm.)	Deschambault	Al
Alcoa Corporation/Rio Tinto Aluminum Inc.	Bécancour	(Sm.)	Bécancour	Al
Glencore Canada Corporation	CCR	(Ref.)	Montréal-Est	Cu, Au, Ag, Se, Te, Ni, PGM
Terrapure Environmental	Sainte-Catherine	(Ref.), (Sec. Sm.)	Sainte-Catherine	Recycled Pb
Glencore Canada Corporation	General Smelting Company of Canada	(Sec. Sm.)	Lachine	Recycled Pb
Glencore Canada Corporation/Noranda Income Fund	Canadian Electrolytic Zinc Limited (CEZinc)	(Ref.)	Valleyfield	Zn, Cd, S*
Glencore Canada Corporation	Horne	(Sm.)	Rouyn-Noranda	Cu, Au, Ag

Source: Natural Resources Canada.

Note: Included are operations that produced in 2014.

(Sm.) Smelter.

(Ref.) Refinery.

(Sec. Sm.) Secondary smelter.

(Pl.) Plant.

(Con. Fac) Conversion facility.

S* Sulphuric acid.

FIGURE 12 CONTINUED

NON-FERROUS SMELTERS AND REFINERIES IN CANADA, 2017

Owner/Operator	Operation	Type of facility	Location	Outputs
Ontario				
Royal Canadian Mint	Ottawa	(Ref.)	Ottawa	Au, Ag, Cu, PGM
Cameco Corporation	Port Hope	(Con. Fac.)	Port Hope	U
Vale Canada Limited	Port Colborne	(Ref.)	Port Colborne	Electrolytic Co, PGM, Co oxide
Tonolli Canada Ltd.	Mississauga	(Sec. Sm.)	Mississauga	Recycled Pb
Real Alloy Canada Ltd.	Mississauga	(Sec. Sm.)	Mississauga	Recycled Zn
Asahi Refining Canada Ltd.	Brampton	(Sm.), (Ref.)	Brampton	Au, Ag, Recycled Pb
Glencore Canada Corporation	Sudbury	(Sm.), (Pl.)	Sudbury	Ni, Cu, Co, Au, Ag, PGM
Vale Canada Limited	Copper Cliff Complex	(Sm.), (Ref.), (Pl.)	Sudbury	Ni, Au, Ag, Se, Te, PGM, S*
Cameco Corporation	Blind River	(Ref.)	Blind River	U
Manitoba				
Vale Canada Limited	Thompson	(Sm.), (Ref.)	Thompson	Ni, Cu, Co
HudBay Minerals Inc.	Flin Flon	(Ref.)	Flin Flon	Zn
Alberta				
Sherritt International Corporation/General Nickel Company S.A. (The Cobalt Refinery Company Inc.)	The Cobalt Refinery Company Inc.	(Ref.)	Fort Saskatchewan	Ni, Co, Cu sulphide, ammonium sulphate
British Columbia				
Teck Resources Limited	Trail	(Sm.), (Ref.), (Pl.)	Trail	Zn, Pb, Bi, Cd, In, Ge, Au, Ag, S*
Metalex Products Ltd.	Richmond	(Sec. Sm.)	Burnaby	Recycled Pb
Rio Tinto Alcan Inc.	Kitimat	(Sm.)	Kitimat	Al

Source: Natural Resources Canada.

Note: Included are operations that produced in 2014.

(Sm.) Smelter.

(Ref.) Refinery.

(Sec. Sm.) Secondary smelter.

(Pl.) Plant.

(Con. Fac.) Conversion facility.

S* Sulphuric acid.

FIGURE 13

CANADIAN PRODUCTION OF SELECTED REFINED METALS, 2004-2017^P

[Return to text](#)



Metals	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017 ^P
Aluminum	2,592,160	2,894,204	3,051,128	3,082,625	3,120,148	3,030,269	2,963,210	2,987,964	2,780,556	2,967,364	2,858,238	2,880,035	3,208,707	3,211,882
Cadmium	1,880	1,727	2,090	1,388	1,409	1,299	1,357	1,240	1,286	1,313	1,187	1,159	2,305	1,802
Cobalt	4,673	4,618	4,555	4,883	4,899	4,358	4,145	5,317	5,322	4,012	4,527	5,359	5,584	6,469
Copper	526,955	515,223	500,463	453,453	442,050	335,896	319,618	273,761	275,990	321,511	325,352	330,902	314,074	327,113
Lead	241,169	230,237	250,464	236,688	259,094	258,854	273,017	282,589	279,150	281,781	281,456	268,863	273,299	276,079
Nickel	151,518	139,683	146,899	153,647	167,732	116,909	105,413	142,445	146,850	152,728	149,486	149,717	158,381	154,080
Zinc	805,438	724,035	824,464	802,103	764,310	685,504	693,014	662,151	648,619	651,638	649,217	683,118	685,409	603,947

Sources: Natural Resources Canada; Statistics Canada.

^P Preliminary.

FIGURE 14

CRUDE MINERALS AND PROCESSED MINERAL PRODUCTS TRANSPORTED BY CANADIAN RAILWAYS, 2004-2017^P

[Return to text](#)



(million tonnes)	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017 ^P
Total Freight Volume ¹	260.7	258.7	255.7	244.4	212.9	235.4	250.8	253.5	268.0	277.9	287.6	281.7	295.1
Total Crude Minerals	112.8	108.0	112.0	111.9	85.0	107.6	109.8	103.4	112.0	112.0	123.2	120.5	128.2
Total Processed Mineral Products	27.3	27.9	27.7	27.6	21.7	24.6	26.5	27.3	28.3	28.1	28.7	28.3	29.0
Total Crude and Processed Minerals	140.1	135.9	139.8	139.4	106.7	132.3	136.4	130.7	140.3	140.1	151.9	148.8	157.2
Crude Minerals and Processed Mineral Products as a Percentage of Total Freight Volume	53.7	52.5	54.7	57.1	50.1	56.2	54.4	51.5	52.4	50.4	52.8	52.8	53.3

Sources: Natural Resources Canada; Statistics Canada.

^P Preliminary.

Note:

¹Total freight volume reflects revenue freight, which refers to a local or interline shipment from which earnings accrue to a carrier. Total crude minerals include coal, but not oil and gas. Totals may not add due to rounding. Values for 2005 to 2016 have been revised.



— SECTION 3 —

THE MONEY: RESERVES, PRICES, FINANCING, EXPLORATION AND INVESTMENT

THE FINANCIAL HEALTH OF THE MINERAL EXPLORATION AND MINING SECTOR CAN BE MEASURED BY EXPLORATION AND DEPOSIT APPRAISAL AND BY CAPITAL SPENDING, BOTH OF WHICH ARE AFFECTED BY MINERAL AND METAL PRICES. GAUGING SPENDING LEVELS ALSO HELPS TO PREDICT THE FUTURE OF CANADA'S MINERAL PRODUCTION.

CANADIAN RESERVES

The past 30 years have seen marked declines in proven and probable Canadian mineral reserves in all major base metals (*see Figure 15* and *Annex 6*). Since 1980, the most dramatic declines have been in lead (99.6%) and zinc (92%). Copper (45%) and nickel (69%) reserves have also fallen significantly, as have silver (89%).

Recent years have shown fluctuating growth for certain commodities. Since 2009, gold, silver and copper reserves have fluctuated, with gold at historic highs and copper at heights not seen since the early 1990s. Zinc, lead and nickel, on the other hand, have ebbed downward, with current levels suggesting continued decline.

Consistent investment over time and access to large tracks of land to explore are needed to reverse the long-term decline in proven and probable reserves. To ensure the Canadian mining industry maintains its competitive advantage in this crucial area, the federal and provincial governments should continue to invest in geoscience and strengthen policies that provide incentives for exploration spending within Canada's borders. For example, the federal government's recent five-year renewal of the Mineral Exploration Tax Credit is a very welcome development for the mineral exploration sector.

MINERAL AND METAL PRICES

Mineral and metal prices are affected daily by global economic events. Prices for mined products are driven largely by the strength and performance of major economies. China, in particular, buys approximately

50% of the world's base metals, up from just 5% in the 1980s. Additionally, as a means of controlling exports of key commodities, China stockpiles iron ore, aluminum, copper, nickel, tin, zinc, oil and other commodities when prices are low, making it difficult for analysts to accurately forecast how supply and demand dynamics are likely to affect prices for minerals.

Figure 16 illustrates the strong growth, on an annual basis, in mineral prices from 2000 to 2007, the dramatic decline for most metals in late 2008, the robust rebound of prices through 2011, and the subsequent downward pressure on many minerals and metals during the recent downturn. More recently, after two years of upward momentum across a number of minerals and metals, a number of prices for key materials are down year-to-date. The most dramatic decline is that of zinc, down nearly 25%, or \$0.42 per pound, though still enjoying relatively strong prices compared to earlier lows. Uranium, on the other hand, after having struggled with downward price pressure for several years, is up more than \$5.50 per pound (*see Figure 17*).

The general consensus is that demand for mineral and metal products should be favourable over the medium to long term, despite volatility. Rising incomes and increased prosperity in developing countries due to industrialization and urbanization will continue to drive global demand, as will the transition to a lower carbon future. With the gradual emergence of India and its demand for minerals and metals – which some speculate will overtake China by 2050 – the mining industry should enjoy favourable commodity prices despite anticipated periods of market volatility.

FINANCING

Canada is the leading global centre for mining finance. The Toronto Stock Exchange (TSX) and TSX Venture Exchange (TSX-V) list 50% of the world's publicly traded mining companies, which combined accounted for more mining equity capital raised (38% of the global total) than any other exchange in the last five years. In 2017, 1,211 of the firms listed on the TSX were mining companies. Together, they had a combined market value of \$313.8 billion and raised \$8.53 billion in equity. TSX-listed mining companies mainly deal in gold, copper, uranium, silver, diamonds, zinc, nickel, lithium, iron ore, zinc and molybdenum.

The TSX-V gives emerging companies efficient access to capital while offering investors a regulated market for venture investments. In 2018, the 997 mining companies listed on the TSX-V had a combined quoted market value of \$22.9 billion and raised \$3.2 billion in equity capital for the year. While junior mining companies have faced challenges in raising capital in recent years, this indicates improvement in access to capital to finance exploration activities. For more information, please visit the TSX at www.tsx.com/listings/listing-with-us/sector-and-product-profiles/mining.

TSX-LISTED MINING COMPANIES - 2017

On the TSX: 1,211

- Senior TSX companies: 224
- TSX-V companies: 987

Global Financing

The global mining industry raised \$24.2 billion in equity in 2017, up \$2.5 billion year-over-year. As [Figure 18](#) shows, while this level of equity is substantially lower than during peak levels of the super-cycle in 2009, it has increased consecutively over the past three years, and also represents an eight-fold increase over the \$3.1 billion raised in 2000.

In 2017, 59% of all global mining equity financings were done on the two exchanges, representing over 35% of the equity capital raised globally for the same year – a 6% drop year-over-year.

Also noteworthy is that the TSX and TSX-V's share of global mining equity raised in 2017 (\$8.5 billion) represented a \$900 million drop in absolute value compared to the previous year. While a number of factors likely contributed

to this, it suggests a modest loss of market share for mining and exploration financing at a time when investment in the sector globally is on the rise.

The large proportion of public financing conducted on the TSX reflects the exchange's appeal to both junior and senior companies. The TSX-V's unique ability to efficiently handle equity financings in the \$1 million to \$5 million range is one reason why Canadian companies lead the exploration business.

TSX-listed mining companies also have a strong global focus. As of January 2018, TSX and TSX-V companies were involved in 5,667 mineral projects worldwide ([see Figure 19](#)), with more than half of them in Canada. Most of the projects involve exploration, and very few will turn into operating mines. However, the locations do illustrate the prime areas of mining interest, and the broad international reach of the exchange.

EXPLORATION

The goal of exploration is to locate large, high-grade reserves with minimal disturbance to the ground and the environment. Technological advances, including GPS surveying, airborne technologies and down-hole seismic imaging, have enabled companies to locate new deposits previously beyond discovery using traditional methods. Like research and development, exploration requires healthy levels of investment over the long term in order to achieve success.

Exploration and subsequent mine development are required to maintain healthy reserve levels. If this does not happen, the value-added aspects of Canada's mining industry – such as smelting, refining and manufacturing – will diminish over time, and national and regional economies that benefit from strength in sectors such as manufacturing will weaken.

Exploration and Deposit Appraisal in Canada

The financial health of the mineral exploration sector can be measured by spending on exploration and deposit appraisal. Gauging spending levels also assists in predicting the future of Canada's mineral production. Natural Resources Canada (NRCan), which provides the numbers below, defines the two kinds of spending as follows:

- **Exploration expenditures:** Spending on activities up to and including the first delineation of a previously unknown mineral deposit.

- **Deposit appraisal expenditures:** Spending on activities that bring a delineated deposit to the stage of detailed knowledge required for a production feasibility study.

The two expenditures combined are generically called “exploration spending.”

After six consecutive years of declining exploration expenditure, the industry witnessed a long-sought reversal of this trend in 2017. Rising by 30% year-over-year, exploration investment increased from \$1.6 billion to \$2.1 billion (*see Figure 20*). Looking ahead, investment intentions suggest a further increase in exploration spending in 2018 of 6%, or \$2.23 billion.

Financing for Junior Mining Sector

A major issue for junior mining companies is the persistent challenge of raising capital.

Indicative of this dampened financial investment climate is the reversal in exploration and deposit appraisal expenditures. For example, in 2007, junior companies accounted for the majority (67%) of expenditure on these activities, with majors accounting for the balance (*see Figure 21*). From 2007 until 2015, juniors accounted for less each year, and the majors’ share grew to 63%. The three consecutive years from 2016 to 2018 are indicative of a return toward normalcy as junior companies’ absolute share of exploration and deposit appraisal improved.

Allocation of Investment by Minerals and Metals

Precious metals attracted the lion’s share of Canadian exploration spending again in 2017, accounting for 65% overall (*see Figure 22*) – a 5% increase over 2016. In 2017, spending intentions were \$1.4 billion, a 48% increase year-over-year.

While base metal exploration’s share of total investment remained consistent year-over-year at ~14%, the absolute value of dollars invested in base metal exploration increased by 40%, from \$209 million to \$294 million. While it is positive that base metal exploration investment didn’t contract further year-over-year, this trend reinforces the ongoing depletion of Canadian base metal reserves, the replenishment of which is not keeping pace with global demand for these highly important metals. Without sustained and effective exploration, Canadian base metal production will outstrip reserve additions, reducing the competitiveness of our smelters and refineries.

In absolute terms, it is noteworthy that exploration and deposit appraisal expenditures were up year-over-year for all targets save two: uranium and non-metals (excluding diamonds). For the former, part of the challenge has been

the stubbornly low price for uranium despite projected increases in the number of nuclear reactors slated to come online in support of carbon-free electricity. As above noted, however, prices for uranium have increased in 2018, suggesting this target may attract more exploration and deposit appraisal investment in next year’s set of numbers.

International Exploration

Globally, Canada has been a top destination for mineral exploration investment for the past 37 years. Canada dropped to second place in 1992 for non-ferrous exploration budgets, surpassed by Australia. In 2004, Canada regained the top position where it has remained ever since, despite forfeiting market-share.

SNL Metals & Mining, in its 2018 edition of the *State of Mineral Finance*, assessed that global exploration expenditures from 2012-2017 declined over 65% from a peak of US \$20.5 billion in 2012 to US \$6.9 billion in 2016. The report confirmed a trend reversal in 2017 as expenditures increased approximately 15% compared to 2016 (to US \$7.9 billion). Canada and Australia continued to lead global activity in 2017, accounting for 13.8% and 13.5% of expenditures, respectively. Of note is Canada’s long-term decline in the share of global exploration spending, from 20.5% in 2008 to 13.8% in 2017.

When exploration budgets factor in iron ore, SNL data indicate that Canada no longer attracts the single-largest share of total global mineral exploration budgets, conceding first place to Australia. Australia’s attractiveness as a destination for investment has increased recently with its introduction of a flow-through share mechanism to bolster investment in early stage exploration. Part of the challenge in Canada is regulatory uncertainty, as companies will not invest where they do not believe they can permit a mine. At the time of writing, many regulatory review processes remained ongoing, with significant decisions laying ahead. Another challenge for junior companies in recent years has been raising capital to finance exploration activities. The government’s decision to extend the Mineral Exploration Tax Credit for five years, discussed further below, will help address this challenge and bring more predictability for explorers seeking to raise capital.

Only a handful of major discoveries and projects will come into production within the next five years, and many new developments will be smaller scale. The industry is still paying for the period of low exploration spending in the 1990s and early 2000s when the last super-cycle began. The dramatic rise in spending during the 2000s, in tandem with rising metal prices, was offset to some extent by the rising costs of drilling, assaying, geosciences expertise, fuel

and other inputs. Regulatory and infrastructure challenges are also contributing factors in lengthening the time it takes for new discoveries to develop into producing mines. The decrease in global exploration spending in recent years will result in a further decline in the rate at which major discoveries are made.

INVESTMENT

Capital Spending

Capital spending is a barometer of how confident managers and investors are about current production capacity and future demand. Capital spending enables improvements such as:

- New mine construction and increases to existing mine capacity
- Process and technology improvements
- Modernization and expansion of smelters and refineries
- New product lines
- Mill improvements
- Energy retrofits
- Environmental improvements

Government and business capital spending also open up new regions for development. The extension of the Highway 37 transmission line in northeastern British Columbia is a good example of a long-term strategic infrastructure investment. Notably, this capital cost of \$400 million will enhance the economics of an estimated \$15 billion in mineral projects, with one already built – the \$450 million, 300-person Red Chris mine owned by Imperial Metals – and others in development. Similarly, the extension of the Monts Otish Highway in northern Quebec will improve future prospects for the development of gold, diamond and copper projects in the surrounding region.

Most recently, the federal government announced \$155 million for the T'licho Road and \$90 million to extend a section of the McKenzie Valley Highway in the Northwest Territories, and \$360 million for the Yukon Resource Gateway to expand several road networks in the Yukon. These projects will enhance the economics of several mining projects, such as Fortune Minerals' Nico project in the Northwest Territories, Goldcorp's Kaminak Gold project, and Western Copper and Gold's Casino project in the Yukon. In addition, this investment in infrastructure will reduce exploration costs, improving land access.

Mining Industry Capital Investment

In 2017, capital spending in the Canadian mining industry accounted for 4.4% of Canada's total at \$11.7 billion, down 0.5% year-over-year. This amount is down 16% from the previous year and marks the fifth consecutive year that capital spending has fallen ([see Figure 23](#)). For 2018, capital investment intentions project a sixth consecutive annual drop to \$11.1 billion. This is particularly concerning given mineral and metal prices for a number of commodities have been rising, despite volatility, since January 2016.

Although capital spending covers all four stages of the industry, some 90% is typically invested in the first two stages, extraction (Stage 1) and smelting/refining (Stage 2). Within Stage 1, approximately two-thirds of capital spending goes towards construction and one-third towards machinery and equipment. Within Stage 2, the ratio is reversed, with about one-fifth of spending directed to construction and the rest to machinery and equipment.

Spending on repairs, most of which falls into the machinery and equipment category, is not included in [Figure 23](#) as this data lags behind capital expenditure data by one year. Adding 2016 repair costs (about \$3.9 billion) to 2017 capital (\$11.6 billion) and exploration (\$2.1 billion) spending produced roughly \$17.2 billion in Canadian mineral development investment in 2017.

Current and Future Investments

Healthier commodity prices have returned a cautious optimism to the global mining industry, which could lead mining companies to make new and significant investments. However, there are also recent indicators that Canada's competitiveness as a destination for mineral investment is eroding, just as an upturn in the industry is underway:

- Capital investment in the mining sector has declined each year since 2012, with investment intentions for 2018 in line with this trend. Only four new mining projects were submitted to the federal environmental assessment registry under the *Canadian Environmental Assessment Act* (CEAA 2012) in 2016 – all of them gold.
- The size of Australia's mining supply sector surpassed Canada's in 2015.
- Over the last five years, Canada has lost more ground than it has gained in the commodities for which it is a top-five global producer.

Beyond the above quantitative metrics, qualitative indicators from MAC member companies suggest that Canada's competitiveness is declining compared to other jurisdictions.

Mining companies are assessing other jurisdictions outside of our own as alternative destinations for developing projects.

The recent edition of NRCan's annual report, [*Natural Resources: Major Projects Planned and Under Construction – 2018 to 2028*](#), presents a grim picture of major mining project investment in Canada, indicating that the total value of projects planned and under construction from 2018 to 2028 has reduced by 55% since 2014, from \$160 billion to \$72 billion.

Although mineral prices were in decline in recent years, they account for only part of the drop in mineral investment. In 2016, the year in which Canada's total mining project investment decreased by approximately \$50 billion, Australia's capital expenditure rose for 18 consecutive months, according to the Minerals Council of Australia. This suggests that more than just mineral pricing determines where companies invest, and that they are increasingly more confident in Australia than in Canada as a destination.

Mining Industry Competitiveness and Federal Public Policy

MAC maintains that federal regulatory policies have dampened Canada's competitiveness as a destination for mineral investment. Reviews of federal environmental legislation, the pan-Canadian climate change policy, long-standing transportation challenges, and tax competitiveness concerns all contribute to the uncertain policy landscape in Canada. MAC has remained very engaged in many of these policy consultations and is cautiously optimistic that a number of the key considerations we have made have been taken into account by decision makers. Nevertheless, the Canadian mining industry is awaiting the outcomes of these major government decisions in policy areas of concern – all of which are critically important to maintaining our competitiveness.

Recent announcements by the federal government have provided cause for cautious optimism, and MAC welcomed the measures included in the 2018 Fall Economic Statement as an important boost to Canadian mining competitiveness. Key measures proposed that will enhance the investment competitiveness of Canada's mining and metal manufacturing sectors, include:

- The Accelerated Investment Incentive, which will enable miners to write off three times the eligible cost of newly acquired assets in the year the investment is made.

- Extending the Mineral Exploration Tax Credit for a five-year term, bringing greater investment certainty for early stage mineral exploration.
- Allowing businesses to immediately write-off the full cost of clean energy equipment.

At the same time, federal, provincial and territorial governments have also acknowledged the issue of declining competitiveness and have, collectively, committed to develop a strategy for addressing it. The Canadian Minerals and Metals Plan will be launched in 2019, and the industry is hopeful that it will include new measures to boost support and renew interest in Canada as a destination for mineral exploration and mining investment.

While more work is needed to improve Canada's mining tax competitiveness, these measures are both timely, important and substantial. Critical to Canada taking full advantage of these measures to attract investment is achieving greater clarity in the regulatory environment.

Mining is a significant engine of the Canadian economy and supports many other important sectors, including construction, manufacturing and transportation. While Canada remains one of the top mining countries, its leadership in this arena is not guaranteed. If Canada loses its competitiveness, this will translate into an increasing amount of exploration and mining investments flowing offshore, job losses, deteriorating trade balances and, overall, a weakening of our economic strength. ■

FIGURE 15

CANADIAN RESERVES OF SELECTED METALS, 1980 - 2016 ^P

[Return to text](#)



Metal Contained in Proven and Probable Mineable Ore¹ in Operating Mines² and Deposits Committed to Production³

Year	Copper (000 t)	Nickel (000 t)	Lead (000 t)	Zinc (000 t)	Molybdenum (000 t)	Silver (t)	Gold (t)
1980	16,714	8,348	9,637	27,742	551	33,804	826
1985	14,201	7,041	8,503	24,553	331	29,442	1,373
1990	11,261	5,776	5,643	17,847	198	20,102	1,542
1995	9,250	5,832	3,660	14,712	129	19,073	1,540
2000	7,419	4,782	1,315	8,876	97	13,919	1,142
2003	6,037	4,303	749	6,251	78	9,245	1,009
2004	5,546	3,846	667	5,299	80	6,568	787
2005	6,589	3,960	552	5,063	95	6,684	958
2006	6,923	3,940	737	6,055	101	6,873	1,032
2007	7,565	3,778	682	5,984	213	6,588	987
2008	7,456	3,605	534	5,005	222	5,665	947
2009	7,290	3,301	451	4,250	215	6,254	918
2010	10,747	3,074	400	4,133	254	6,916	1,473
2011	10,570	2,936	247	4,812	256	6,954	2,225
2012	10,364	2,617	126	4,163	256	5,598	2,148
2013	10,777	2,682	116	3,532	145	5,013	2,140
2014	10,214	2,287	88	2,972	121	5,498	2,070
2015	9,937	2,725	83	3,009	101	5,345	1,984
2016 ^P	9,101	2,604	40	2,231	98	3,626	1,910

Source: Natural Resources Canada, based on company reports and the Federal-Provincial/Territorial Annual Survey of Mines and Concentrators.

¹No allowance is made for losses in milling, smelting and refining. Excludes material classified as "resources."

²Includes metal in mines where production has been suspended temporarily.

³Excludes metal in placer deposits because reserves data are generally unavailable.

^P Preliminary.

Note: One tonne (t) = 1.1023113 short tons = 32 150.746 troy oz.

FIGURE 16

METAL PRICES, 2001-2017

[Return to text](#)


Prices	Aluminum US ¢/lb	Copper US ¢/lb	Gold US \$/tr. oz	Iron Ore ¹ US \$/DMT	Nickel US \$/lb	Silver US ¢/tr. oz	Uranium US \$/lb	Zinc US ¢/lb
2018 (May)	\$99.92	\$313.42	\$1,324.98	\$71.20	\$6.18	\$1,666.40	\$21.61	\$149.61
2017	\$89.25	\$279.86	\$1,257.56	\$71.76	\$4.72	\$1,706.58	\$21.66	\$131.13
2016	\$72.12	\$214.20	\$1,326.03	\$56.67	\$4.62	\$1,928.50	\$23.00	\$103.79
2015	\$75.41	\$249.52	\$1,160.11	\$55.21	\$5.36	\$1,571.67	\$36.46	\$81.50
2014	\$84.62	\$311.13	\$1,266.12	\$96.84	\$7.65	\$1,907.15	\$33.21	\$98.05
2013	\$83.70	\$332.29	\$1,411.06	\$135.36	\$6.81	\$2,385.81	\$38.17	\$86.64
2012	\$91.59	\$360.58	\$1,668.81	\$128.53	\$7.89	\$3,121.17	\$48.40	\$88.35
2011	\$108.77	\$400.10	\$1,568.58	\$167.79	\$10.38	\$3,526.42	\$56.37	\$99.47
2010	\$98.55	\$341.74	\$1,224.66	\$146.72	\$9.89	\$2,019.67	\$46.84	\$97.99
2009	\$75.50	\$233.67	\$972.98	\$79.99	\$6.64	\$1,469.43	\$46.06	\$75.06
2008	\$116.68	\$315.47	\$871.67	\$61.57	\$9.57	\$1,499.90	\$61.71	\$85.01
2007	\$119.65	\$322.83	\$696.66	\$36.63	\$16.88	\$1,341.47	\$99.33	\$147.03
2006	\$116.55	\$304.85	\$604.34	\$33.45	\$11.00	\$1,156.96	\$49.61	\$145.15
2005	\$86.10	\$166.84	\$444.88	\$28.11	\$6.69	\$733.96	\$28.67	\$62.66
2004	\$77.82	\$129.96	\$409.21	\$16.39	\$6.27	\$669.05	\$18.60	\$47.51
2003	\$64.92	\$80.68	\$363.51	\$13.82	\$4.37	\$491.07	\$11.55	\$37.75
2002	\$61.23	\$70.72	\$309.97	\$12.68	\$3.07	\$462.52	\$9.88	\$35.31
2001	\$66.46	\$72.74	\$269.98	\$12.99	\$2.77	\$441.43	\$8.82	\$41.27

Source: Market Insider

¹April 2010 marked the end of the 40-year global benchmarking system for sale of iron ore under contract prices. Thus, new historical data based on U.S. \$/dmt will have to be utilized.



FIGURE 17

MONTHLY METAL PRICES 2018

[Return to text](#)



(\$ current)

	Aluminum US ¢/lb	Gold US\$/tr. oz	Silver US\$/tr. oz	Copper US\$/lb	Nickel US\$/lb	Zinc US\$/lb	Iron Ore US\$/DMT	Uranium US\$/lb
Jan-18	\$110.89	\$1,333.22	\$17.18	\$3.53	\$6.45	\$1.72	\$76.15	\$23.31
Feb-18	\$108.56	\$1,329.55	\$16.60	\$3.50	\$6.80	\$1.77	\$75.92	\$21.80
Mar-18	\$104.46	\$1,326.52	\$16.49	\$3.40	\$6.69	\$1.64	\$72.57	\$21.86
Apr-18	\$113.31	\$1,334.22	\$16.63	\$3.43	\$6.97	\$1.59	\$64.62	\$20.76
May-18	\$114.84	\$1,307.15	\$16.49	\$3.42	\$7.18	\$1.53	\$66.72	\$22.05
Jun-18	\$111.70	\$1,281.82	\$16.51	\$3.48	\$7.57	\$1.54	\$65.01	\$23.14
Jul-18	\$103.28	\$1,235.30	\$15.74	\$3.13	\$6.90	\$1.33	\$63.56	\$23.78
Aug-18	\$103.61	\$1,201.87	\$14.99	\$3.02	\$6.70	\$1.26	\$67.87	\$26.20
Sep-18	\$102.91	\$1,197.47	\$14.28	\$3.03	\$6.26	\$1.22	\$68.28	\$27.17
Oct-18	\$102.04	\$1,216.36	\$14.58	\$3.11	\$6.15	\$1.34	\$70.79	\$27.67
Nov-18	\$97.52	\$1,223.58	\$14.39	\$3.10	\$5.62	\$1.30	\$74.27	\$28.95
% Change- to-date	-12.05%	-8.22%	-16.24%	-12.33%	-12.77%	-24.67%	-2.48%	24.21%

Source: Market Insider.

FIGURE 18

MINING EQUITY RAISED - ROLE OF TORONTO STOCK EXCHANGE, 2000-2017

[Return to text](#)



(US\$ billions)

Equity Raised	2000	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Worldwide	3.1	50.3	46.6	65.9	29.6	31.7	14.8	15	14.40	19.8	22.7	24.2
TSX exchanges	1.1	17.6	8.3	22.2	17.8	12.5	10.3	6.9	8.9	6.8	9.4	8.5
% of worldwide total on TSX and TSX-V	36	35	18	34	60	39	70	46	62	34	41	35

Source: Gamah International, compiled by Toronto Stock Exchange.
Note: All values as at December 31, 2015.



FIGURE 19

GEOGRAPHIC REACH OF TSX-LISTED COMPANIES, JANUARY 2018

[Return to text](#)



Location of Mineral Projects	Number	Percent
Canada	3,048	54
Latin America	1,113	20
United States	643	11
Africa	372	7
Asia/Russia/Middle East	251	4
United Kingdom and Europe	240	4
Total	5,667	100

Source: InfoMine, TSX/TSX-V Market Intelligence Group, compiled by the Toronto Stock Exchange.

FIGURE 20

MINERAL EXPLORATION AND DEPOSIT APPRAISAL EXPENDITURES, BY PROVINCE AND TERRITORY, 2006 - 2018 ¹

[Return to text](#)



(\$ millions)

Province/Territory	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017 ^P	2018 ¹	% change from 2017 to 2018
Newfoundland and Labrador	148.0	146.7	54.9	105.2	156.8	199.9	117.2	80.7	47.4	25.4	36.7	38.5	4.9%	32.52%
Nova Scotia	23.5	21.4	9.0	16.7	13.7	14.6	12.3	7.0	10.1	5.3	19.4	17.3	-10.8%	51.43%
New Brunswick	35.8	32.7	8.1	17.1	27.1	28.0	27.6	29.0	8.6	14.2	14.3	18.1	26.6%	34.90%
Quebec	476.4	526.1	379.3	511.6	833.9	620.7	381.8	317.4	259.5	297.4	576.5	656.7	13.9%	38.78%
Ontario	571.7	799.3	536.2	853.4	1,067.7	961.5	562.0	468.1	440.2	394.3	526.2	593.0	12.7%	23.58%
Manitoba	102.6	152.1	97.8	83.5	140.0	105.6	61.4	28.0	46.9	47.3	38.5	54.7	42.1%	24.50%
Saskatchewan	314.0	430.7	311.0	299.4	334.6	411.1	221.7	245.2	257.0	228.7	189.9	165.1	-13.1%	-19.54%
Alberta	11.8	20.8	8.3	15.2	47.3	35.2	38.9	26.1	18.5	16.7	27.5	39.7	44.4%	49.06%
British Columbia	470.6	435.4	217.1	374.4	645.1	734.1	493.0	448.9	346.3	231.5	257.7	290.9	12.9%	7.16%
Yukon	144.7	134.0	90.9	156.9	331.7	233.2	100.6	107.1	92.2	90.4	165.1	172.3	4.4%	6.59%
Northwest Territories	193.7	147.7	44.1	81.7	93.8	108.7	77.9	101.7	100.9	73.0	90.0	81.3	-9.7%	-3.26%
Nunavut	338.0	432.6	187.6	256.7	535.7	422.5	257.6	158.0	215.0	204.5	169.3	110.7	-34.6%	-25.37%
Total	2,830.8	3,279.5	1,944.4	2,771.9	4,227.4	3,875.1	2,352.0	2,017.4	1,842.4	1,628.8	2,111.3	2,238.2	6.01%	15.48%

Source: Natural Resources Canada, based on the Federal-Provincial/Territorial Survey of Mineral Exploration, Deposit Appraisal and Mine Complex Development Expenditures.

^P Preliminary; ¹ Intentions.

Note: Includes on-mine-site and off-mine-site activities. Includes field work, overhead costs, engineering, economic and pre- or production feasibility studies, environment, and land access costs. Numbers may not add to totals due to rounding.



FIGURE 21

MINERAL EXPLORATION AND DEPOSIT APPRAISAL EXPENDITURES, BY COMPANY TYPE, 2007 - 2018 ⁱ

[Return to text](#)

Type of Company	2007	%	2008	%	2009	%	2010	%	2011	%	2012	%
Junior	1,904.4	67.3	2,117.8	64.6	1,110.7	57.1	1,547.0	55.8	2,049.1	48.5	1,847.0	47.7
Senior	926.5	32.7	1,161.7	35.4	833.7	42.9	1,224.9	44.2	2,178.3	51.5	2,028.1	52.3
Total	2,830.8		3,279.5		1,944.4		2,771.9		4,227.4		3,875.1	
Type of Company	2013	%	2014	%	2015	%	2016	%	2017 ^P	%	2018 ⁱ	%
Junior	963.6	41.0	814.3	40.4	577.7	31.4	633.9	38.9	964.1	48.2	1,025.5	45.8
Senior	1,388.4	59.0	1,203.2	59.6	1,264.7	68.6	994.9	61.1	1,147.7	57.4	1,212.7	54.2
Total	2,352.0		2,017.4		1,842.4		1,628.8		2,000.5		2,238.2	

Source: Natural Resources Canada, based on the Federal-Provincial-Territorial Survey of Mineral Exploration, Deposit Appraisal and Mine Complex Development Expenditures.

^PPreliminary; ⁱIntentions.

Note: Includes on-mine-site and off-mine-site activities. Includes field work, overhead costs, engineering, economic and pre- or production feasibility studies, environment, and land access costs.

Totals may not add due to rounding.

FIGURE 22

MINERAL EXPLORATION AND DEPOSIT APPRAISAL EXPENDITURES, BY TARGET, 2008 AND 2017 ^P

[Return to text](#)

	2007		2016 ^P	
	\$ millions	% of Total	\$ millions	% of Total
Precious metals	842.1	25.7	1,375.8	65.17
Base metals	1,161.4	35.4	294.0	13.93
Uranium	409.0	12.5	135.4	6.41
Coal	51.9	1.6	54.0	2.56
Non-metals (excluding diamonds)	179.4	5.5	57.5	2.72
Other metals	189.6	5.8	88.9	4.21
Diamonds	221.6	6.8	78.8	3.73
Iron ore	224.4	6.8	26.8	1.27
Total	3,279.5	100.0	2,111.2	100.0

Source: Natural Resources Canada, based on the Federal-Provincial/Territorial Survey of Mineral Exploration, Deposit Appraisal and Mine Complex Development Expenditures.

^PPreliminary.

Note: Includes on-mine site and off-mine site activities. Includes field work, overhead costs, engineering, economic and pre- or production feasibility studies, environment, and land access costs. Totals may not add due to rounding.

FIGURE 23

CAPITAL EXPENDITURES IN THE CANADIAN MINING INDUSTRY, 2009 - 2018 ⁱ

[Return to text](#)



(\$ millions)	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Stage 1 - Total Mineral Extraction	6,194	9,054	12,163	16,916	15,086	11,115	10,188	9,637	8,200	8,085
Metal ore mineral extraction	3,537	5,504	8,108	11,020	9,174	5,298	4,881	5,137	5,504	5,690
Non-metallic mineral extraction	2,297	2,853	3,083	4,812	5,243	5,433	5,078	4,294	2,361	1,891
Coal mining	361	697	972	1,085	668	384	230	206	335	504
Stage 2 - Primary Metal Manufacturing	948	1,823	2,936	3,864	3,458	3,332	3,219	2,329	1,902	1,693
Stage 3 - Non-Metallic Mineral Product Manufacturing	581	765	672	572	459	976	1,136	1,196	855	611
Stage 4 - Fabricated Metal Product Manufacturing	750	608	729	536	574	640	735	746	703	694
Total Mining and Mineral Processing	8,473	12,250	16,500	21,888	19,577	16,062	15,279	13,908	11,660	11,083
Non-conventional oil extraction (oil sands)	10,249	17,113	22,163	26,246	29,029	35,711	23,420	16,596	12,829	10,209

Source: Statistics Canada, CANSIM Table 029-0046.

ⁱ Preliminary; Intentions.

Note: Includes capital construction and machinery and equipment. As of 2014, capital expenditures on non-residential construction and on machinery and equipment exclude expenditures related to intellectual property, including mineral exploration activities. Historical values have been revised to reflect these methodological changes. Totals may not add due to rounding.



THE PEOPLE: EMPLOYMENT, COSTS AND INNOVATION

THE CANADIAN MINING INDUSTRY ACCOUNTS FOR ONE IN EVERY 29 JOBS ACROSS CANADA AND, PROPORTIONALLY, IS THE LARGEST INDUSTRIAL EMPLOYER OF INDIGENOUS CANADIANS.

MINING INDUSTRY EMPLOYMENT

According to Statistics Canada data, the mining industry directly employed 426,000 people in 2017, accounting for roughly one in every 43 Canadian jobs ([see Figure 24](#)). When indirect jobs are included, the industry's employment reach increases significantly. According to Natural Resources Canada estimates, the mining industry indirectly employed an additional 208,000 individuals in 2017. Together, the industry's direct and indirect employment exceeds 634,000 jobs, accounting for one in every 29 jobs in Canada.

Overall Employment Numbers

In 2017, 107,000 (52%) of those directly employed in mining worked in Stage 1, mineral extraction ([see Figure 24](#)). This included approximately 40,000 workers in metal mining, 25,000 workers in non-metal mining and 5,000 workers in coal mining ([see Figure 24](#)), with services accounting for the balance.

In the oil sands extraction sector, recent data show that Suncor and Syncrude directly employ approximately 14,000 and 5,000 people, respectively, in mining and oil and gas activities. These figures do not include indirect employees, which number in the thousands. Other oil sands mining companies, such as Canadian Natural Resources Limited and Imperial, increase these numbers further.

Employment statistics for mining and oil sands can change rapidly because of the cyclical reality of commodity markets and fluctuating prices, globalization and other trends. Recent mergers and acquisitions have changed the landscape of Canadian mining. Some companies have been acquired or no longer report separate employment figures.

ACCORDING TO NATURAL RESOURCES CANADA, THE MINING INDUSTRY INDIRECTLY EMPLOYED AN ADDITIONAL 208,000 INDIVIDUALS IN 2017, BRINGING TOTAL EMPLOYMENT TO 634,000 JOBS.

Other companies report global figures without disaggregating for the Canadian component of their operations.

For example, Statistics Canada reported that employment in mining, quarrying, and oil and gas extraction rebounded in 2017 – after two years of losses – rising by 10,000 jobs (or 5.2%), with just under half of the increase taking place in Alberta (+4,700 or +4.8%). Increases were also reported in British Columbia (+1,600 or +9.0%), Quebec (+1,400 or +8.5%) and Ontario (+1,200 or +5.0%), where the rise was concentrated in the metal mining industry. In 2018, due to pipeline constraints and the significant price discount at which Canadian oil is selling, there is high likelihood that Alberta's share of employment growth year-over-year will be constrained and potentially reverse.

Women in Mining

Women continue to be underrepresented in the mining labour force. According to the Mining Industry Human Resources Council's (MiHR) *2018 edition of the Canadian Mining Labour Market Outlook*, women accounted for only 16% of mining's labour force in 2016 – down 1% from 2011. This remains significantly lower in relation to the Canadian

labour force as a whole, where according to 2016 census data, women represent 48% of the national workforce.

Although the representation of women has remained relatively unchanged, there is indication of a momentum shift. For the selected occupations, women's representation has increased across all industries in recent years, from 27% in 2011 to 31% in 2016 ([see Figure 25](#)). However, the mining industry has yet to realize these gains since the share in these occupations has remained constant, at 12% in both 2011 and 2016. This trend points to potential opportunities for the mining industry to increase its representation among the selected occupations. Overall, the findings from MiHR's previous research remain constant — the industry continues to struggle with underrepresentation of women.

Concerted efforts by both industry and government are underway to attract and retain talented women in the mining industry. Developed on the foundation of a 2014-2016 research initiative – Strengthening Mining's Talent Alloy: Exploring Gender Inclusion – MiHR's Gender Equity in Mining Works (GEM Works) program offers comprehensive training to help establish Change Agents within an organization and ultimately eliminate unintentional barriers to gender inclusion found in dated policies, procedures and practices. Validated through industry leading labour market research and funded through Employment and Social Development Canada's Sectoral Initiatives Program and the Department of Status of Women, the driving intent of GEM Works is to provide mining companies with tangible tools and training to increase the participation of women in the sector.

Following a successful launch of the pilot program in 2016, the number of active sites who have adopted and/or continue to use GEM Works training has increased. To learn more about this important work, visit MiHR's [website](#).

Employment of Indigenous People

Proportionally, the mining industry is the largest private sector employer of Indigenous Canadians. According to MiHR research, Indigenous people represented more than 7% of the mining workforce in Canada in 2016, up from roughly 5% in 2011. Most of the Indigenous people in the mining industry are either Métis or First Nations, though Inuit employment in the sector has been growing as mining opportunities in Inuit regions have increased in recent years. Indigenous people are better represented in the mining industry (7.4%) than in all other industries (3.9%). Interestingly, the share of the mining workforce that is Métis nearly doubles the share found in all industries ([see Figure 26](#)).

Indigenous people in Canada comprise three main groups: First Nations, Métis and Inuit. In 2016, they accounted for 5% of the total population, up from about 4% in 2006, and 3% in 1996. Since 2006, the Indigenous population in Canada has grown by 43% – more than four times the rate of the non-Indigenous population – and is expected to reach more than 2.5 million over the next two decades.

THE PROPORTION OF ABORIGINAL WORKERS IN THE MINING INDUSTRY IS WELL ABOVE THAT OF INDIGENOUS WORKERS IN THE CANADIAN WORKFORCE.

A critical challenge is to ensure that this new cohort of Indigenous Canadians has the opportunity to participate meaningfully in the Canadian workforce and is provided with training and educational opportunities to advance and thrive. Approximately one in four Indigenous people of working age are not participating in the labour force. Since attaining an appropriate level of education is an important factor to entering the labour force, training to develop the requisite skills for meaningful participation is critical for accessing well-paying mining jobs.

Fortunately, the mining industry has proven an effective vehicle not just for Indigenous employment, but also for skills training and upward mobility. For example, Indigenous people in the mining workforce are increasingly pursuing formal education credentials. In 2006, 30% had no certificate, diploma or degree; by 2016, that rate fell to 22%. From 2006 to 2016, the share of Indigenous people in the mining workforce with a college, CEGEP or other non-university certificate or diploma rose by three percentage points, as did the rate for those with a university certificate, diploma or degree at bachelor level or above.

Potential for increased Indigenous employment remains strong. Most Indigenous communities are located within 200 kilometres of some 180 producing mines and more than 2,500 exploration properties. Also, many mines and projects are located on traditional lands. Indigenous people across the country are, therefore, ideally situated to access employment opportunities (and other benefits) in the mining industry. To learn more about how mining demonstrates opportunities for inclusive growth, see Section 5.

New Canadians and Visible Minority Workers

Census data from 2016 demonstrate that immigrants and visible minorities in Canada each make up one-fifth of the country's total population. Of the visible minority population, 30% were born in Canada. Statistics Canada projects that the immigrant share of Canada's population could reach between 25% and 30% by 2036; Canada's visible minority population is expected to be even higher, between 31% and 38%.

According to MiHR research, in 2016, the representation of immigrants (13%) and visible minorities (9%) in the mining workforce were both lower relative to all industries (23% and 21% respectively). Concurrently, the share of the mining workforce that are immigrants has been modestly increasing, from 12% in 2006 to 13% in 2016 ([see Figure 27](#)). Similarly, the share of visible minorities in mining is smaller relative to immigrants, but this gap is closing; the share of visible minorities in the mining workforce grew from 7% in 2006 to 9% in 2016.

Given an aging Canadian population, the need for new immigrants is increasing. Thus, appealing to this demographic is important to the medium- and longer-term sustainability of the mining sector workforce.

Need for Workers and Skills

The mining industry, both in Canada and abroad, faces a number of human resources challenges. MiHR's 2019 edition of the *Canadian Mining Labour Market Outlook*, estimates that the Canadian mining industry will need to hire 97,450 new workers over the next decade to 2029. These new hires are required to replace retirees and fill new positions to meet baseline production targets ([see Figure 28](#)). In its report, MiHR also forecasts contractionary and expansionary hiring scenarios. Notably, even in a contractionary scenario, the hiring forecast predicts that new hires will be necessary to meet labour demand.

This workforce shortage is compounded by the wave of the industry's skilled core of workers who are retiring. By 2029, MiHR forecasts that more than 60,000 employees will retire from the sector, which represents over 25% of the industry's current workforce by MiHR definitions. This will result in a significant loss of industry knowledge and experience.

This shift in demographics will lead to an entirely new set of challenges, with relatively inexperienced workers replacing those far more seasoned, particularly in the high turnover trades and production occupations. This places an additional onus on industry to work collaboratively with government and educational institutions to ensure that

new entrants to the sector have the skills required for high-demand jobs within mining. In addition, companies need to ensure that new employees have opportunities to learn from those with significant experience both during training programs and on the job.

The mining industry comprises 70 core mining occupations and needs new workers for all of them. Among those required are geoscientists, metallurgists, mining engineers and geologists, as well as workers skilled in computer technology, information management, mechanical repair, and heavy equipment operation in addition to other areas. Because today's mining industry relies on advanced technologies, much of the demand is for highly skilled workers.

It is also important to note that competition for skilled workers is fierce both within Canada and globally. In fact, companies in other countries are actively recruiting Canadian graduates and workers, making retention challenging and recruitment highly competitive.

Various actions have been proposed to address the mining skills shortage in Canada:

- Promote the industry to women, youth, Indigenous people and non-traditional worker groups.
- Develop programs that bring back retired workers, retain older workers and increase mentoring.
- Improve educational programs and employer-provided training.
- Introduce standards for key occupations to facilitate domestic worker mobility and skills recognition.

The federal government has taken some steps to help address this problem, such as the expansion of the Youth Employment Strategy, the proposed Post-Secondary Industry Partnership and Co-operative Placement Initiative, and continued funding for the Aboriginal Skills and Employment Training Strategy (ASETS). MAC supports an expansion of this program, which has proved to be a valuable source of funding for Aboriginal skills training initiatives.

MiHR has also benefited from programmatic support, specifically in developing critical research to inform industry actions to address its human resources challenges and meet its employment needs. Ensuring MiHR can continue to produce crucial research and deliver strategic programs is essential for supporting the industry's workforce needs and meeting its commitments to diversity.

WORKPLACE SAFETY AND HEALTH

In mining, safety comes first. As a core industry value and practice, Canadian mining companies invest significant time and effort in developing and maintaining a positive safety culture in all aspects of their operations, diligently working with their employees, contractors and communities to reach the goal of “zero harm.”

All mine sites have on-site professionals dedicated to safety and health in the workplace. Larger mines have numerous specialized safety trainers on site; smaller mines often contract out safety training to specialist companies.

Labour unions and industry associations have played a key role in improving worker safety and health by encouraging the sharing of best practices, developing industry standards and providing third-party verification of safety programs. MAC members, through the *Towards Sustainable Mining®* (TSM®) initiative, for example, make commitments in safety and health, crisis management and communications planning protocols to ensure that key mining risks are managed responsibly at our members’ facilities (see Section 5 of this report for more on TSM.)

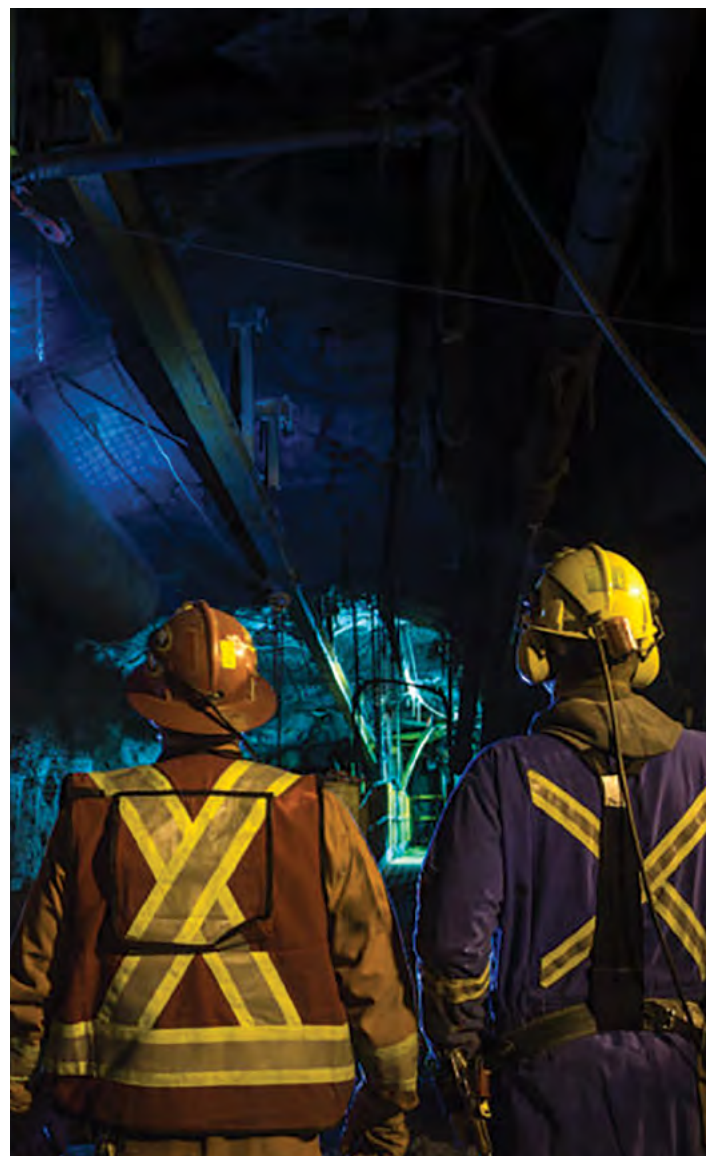
The John T. Ryan Trophies

Mining Safety Appliances (MSA) Canada began sponsoring a mine safety trophy in 1941. Named the John T. Ryan Trophies in honour of the company’s co-founder, the trophies have since become the most prestigious safety awards in the Canadian mining industry. They are still sponsored by MSA Canada and are presented nationally and regionally in three mining categories: metal mines, coal mines and select mines. The trophies are awarded annually by the Canadian Institute of Mining, Metallurgy and Petroleum to the Canadian metalliferous mine, coal mine and select mines that had the lowest accident frequency per 200,000 hours worked during the previous year.

Mining safety statistics can be an invaluable tool for tracking the effectiveness of safety programs and driving improvements, whether for a safety manager working on site or for industry discussions on safety regulations. Ensuring that safety statistics are useful requires that not only are existing figures and analyses made easily accessible, but that the people and organizations compiling statistics understand the information needs of safety professionals.

In 2018, the following MAC members were recipients of John T. Ryan Trophies, in the following categories:

- **New Gold’s New Afton Mine** – Regional Metal BC / Yukon
- **Cameco’s Cigar Lake Mine** – Regional Metal Prairies and Territories
- **Glencore’s Sudbury INO Nickel Rim South Mine** – Regional Metal Ontario
- **Goldcorp’s Éléonore Mine** – Regional Select Quebec and Maritimes
- **DeBeers’ Victor Mine** – Regional Select East



Underground Mining at the Ekati Diamond Mine. Photo credit: Dominion Diamond Mines.

KEY COSTS

Mining companies have limited control over the revenue side of their statement of return because mineral prices are generally set through international trading and exchanges. To remain competitive, companies rigorously work to control their costs.

Wages

The Canadian mining industry boasts the highest wages and salaries of all industrial sectors in Canada (see [Annexes 7](#) and [8](#) for details). The average annual pay for a mining worker in 2017 exceeded \$117,000, which surpassed the average annual earnings of workers in forestry, manufacturing, finance and construction by a range of \$28,000 to \$45,000.

This wage gap has remained relatively consistent in recent years. In remote regions or in situations where workers rotate, higher wages help to attract and retain them.

Overall Production Costs

Mining operations incur significant production costs. The industry's three main production costs – wages, energy (fuel and electricity), and materials and supplies – totalled \$4.8 billion, \$2.6 billion and \$7.7 billion, respectively, in 2016, the most recent year for which data are available (see [Figure 29](#)). Together, these figures constitute a 1% decrease in the cost of mining in Canada year-over-year for operational expenditures.

Remote and Northern Regions

Lack of infrastructure, sparse or no population, and often extreme seasonal temperatures make remote and northern regions in Canada high-cost jurisdictions in which to build and operate a mine. Frequently, companies that seek to develop mining projects in remote and northern regions must build the infrastructure they require for operation. Historically, this infrastructure has included the following: power generation and transmission; transportation infrastructure such as ports, road and railways; and airstrips and on-site accommodation for fly-in/fly-out employees.

These additional costs constitute a northern premium that companies and industries operating in centrally located jurisdictions generally do not incur. The mining cost differential can be significant between jurisdictions that lack infrastructure and those that have better access to a mode of transport for mining resupply and bringing product to market, a community where workers can live, and access to the power grid. A company's requirement to build infrastructure in the North that would already be built and accessible in the south accounts for a large portion of the increased costs.

To better understand these costs, MAC and industry partners undertook a study that compared the costs of operating in a remote and northern region relative to the costs of operating a comparable mine in a centrally located jurisdiction. The study determined that for base and precious metals, the premium associated with developing a remote and northern mine ranges from 2 to 2.5 times the cost of a comparable mine in a southern region. Furthermore, the report determined that 70% of this cost increase is related directly to infrastructure investment.

The future of mining lies increasingly in remote and northern Canada. At the same time, mining development is helping the government achieve its stated economic, Indigenous reconciliation and climate change goals in these regions. For this reason, MAC is encouraged by recent federal infrastructure investment decisions that recognize northern challenges and opportunities, such as the Trade and Transportation Corridors Initiative (TTCI), which dedicates \$400 million for trade-enabling infrastructure in the territories. MAC also supports the Investing in Canada Plan, which allocates funding on a per-capita "plus" model. These are creative and much-needed investments in Canada's north. Beyond these programmatic developments, positive funding decisions in support of the Yukon Resource Gateway (\$360 million) and the T'licho Road (\$155 million) and a section of the McKenzie Valley Highway (\$90 million) in the Northwest Territories will increase project viability and community connectivity, reduce costs and remoteness and, ultimately, lessen territorial reliance on Ottawa.

While MAC welcomed the creation of the Canada Infrastructure Bank (CIB), we are concerned that it will not be a viable vehicle for northern infrastructure investment. Given the success of the initiative, MAC recommends that government renew the TTCI fund in Budget 2019, including the \$400 million allocation for Arctic infrastructure. Over the medium term, MAC recommends government establish a specific allocation for Canada's Arctic within the CIB that has flexible criteria shaped in recognition of unique Arctic realities, or develop a stand-alone Arctic specific fund to advance clean energy and development priorities in the region.

INNOVATION, RESEARCH AND DEVELOPMENT

Innovation is a broad theme, and relevant statistics are not always current or easy to compare. The information presented below indicates that Canadian mining embraces innovation, but that Canada faces a challenge in facilitating a robust environment in which to foster innovation and enhance research and development (R&D).



Innovation at work at Goldcorp Inc.'s all electric Borden Mine.

GOLDCORP'S BORDEN MINE ELECTRIFICATION PROJECT

Canada's mining industry is committed to innovation and environmental sustainability, and these two priorities are being realized at Goldcorp's Borden project, which aims to be the country's first all-electric underground mine.

"Sustainability is increasingly important in our industry, and the concept of an all-electric mine, complete with electric-powered trucks to operate within it, is an exciting game changer for the sector," said Brent Bergeron, Goldcorp Inc.'s Executive Vice President for Corporate Affairs and Sustainability. "This initiative showcases how serious we are when it comes to innovation, in addition to being a partner in the fight against climate change."

Not only does this project, which aims to start commercial production in 2019, showcase how a Canadian mining company can lead the way in reducing carbon emissions, but it also serves as an important example on how the industry can be a leader for change when it comes to the resource economy. In its all-electric focus, the Borden mine will eliminate the use of vehicles powered by fossil fuels, which will have a positive impact in eliminating greenhouse gas emissions.

"We are proud to be part of a project that could have lasting impacts on the future of the mining industry," concluded Bergeron. "Innovation, clean technology and environmental sustainability are key parts of our business, and we are looking forward to seeing what other projects come to fruition with this goal in mind in the years to come."

VALE'S \$1 BILLION CLEAN AER PROJECT

Mining provides the minerals and metals that are essential to the household items Canadians use every day, and it is important that the process of extracting these resources is done in the most environmentally respectful way. Vale, one of the world's most significant producers of nickel and a MAC member, has been prioritizing this goal through its Clean AER Project.

"Vale has operated in communities across Canada for over 100 years and so it is important to us that we have initiatives in place that promote sustainable mining practices," explained Dave Stefanuto, Vale's vice-president of North Atlantic Projects. "Our \$1 billion Clean AER Project, focused on reducing sulfur dioxide emissions by 85% and metals particulate by 40%, is just one example of how innovation and reducing our environmental footprint can go hand in hand."

These emission reductions reflect how seriously companies in Canada are taking the call to mine responsibly, particularly when it comes to the environment. As a member of MAC, Vale follows the *Towards Sustainable Mining* program, a set of principles that focus on the need to mine in the most socially, economically and environmentally sustainable ways. The Clean AER Project is one example that shows the innovation taking place in ensuring Canada's mining industry is at the forefront of mining responsibly. "This project has reduced emissions so significantly that Vale's iconic Superstack will no longer be required and construction of two smaller and more efficient stacks is underway," said Stefanuto. "We will continue to look for innovative ways to reduce our environmental footprint in Sudbury and in the other communities we operate in."

While the industry invests millions of dollars each year in R&D, Canada underperforms compared to its peers. At risk is Canada's ability to attract new investment as other jurisdictions offer more attractive innovation environments.

Canada's Approach to Innovation

MAC and its members are committed to ongoing improvement and are continually innovating to protect the environment and reduce their energy use and GHG emissions. Over the past two decades, mining companies have focused on improving energy efficiency and reduced emissions at their operations through measures such as MAC's mandatory *TSM* initiative and through innovations at the mine-site level.

To remain sustainable, progressive and profitable, the industry must innovate and collectively challenge existing ways of thinking. Through innovation investment from industry and governments, the Canadian mining industry can address these critical business challenges and continuously improve the sector's environmental and health and safety performance. This will help ensure that Canada's mining sector can maintain and grow its immense socio-economic contributions to communities across the

country, while meeting Canadians' evolving expectations about the industry.

Canada's current innovation system comprises in excess of 7,000 funding programs, the vast majority of which support university research and not innovation. As a nation, Canada has made significant progress in fundamental research yet continues to lag far behind other OECD countries when it comes to innovation, business investments in innovation and business productivity.

While many sectors of Canada's economy have benefitted from significant innovation investments by governments, including through the innovation superclusters program, the minerals industry is notable in the lack of any substantial, strategic and long-term government investment in innovation. While companies invest significantly in their own projects, the existing funding apparatus does not complement many industry priorities, and, therefore, opportunities to leverage greater value for innovation investments are lost. ■

FIGURE 24

MINERALS SECTOR EMPLOYMENT, BY SUBSECTOR AND PRODUCT GROUP, 2017

[Return to text](#)


Subsector/Commodity group	(000 jobs)
Direct	426
Primary	204
Extraction	107
Coal	5
Metallic minerals	40
Non-metallic minerals	25
Services	37
Primary manufacturing	97
Primary metallic mineral products	46
Primary non-metallic mineral products	50
Downstream	222
Secondary metal products	27
Tertiary metal products	132
Miscellaneous metal products	38
Services and custom work	26
Indirect	208
Total minerals sector	634

Source: Statistics Canada. Table 38-10-0285-01 Natural resources satellite account, indicators. Indirect employment is a Natural Resources Canada estimate based on Statistics Canada data.

FIGURE 25

REPRESENTATION OF WOMEN IN MINING INDUSTRY AND ALL INDUSTRIES, SELECTED OCCUPATIONS AND ALL OCCUPATIONS (2011 & 2016)

[Return to text](#)


	2016	2011
Mining Industry / Selected Occupations	0.12372316 %	0.12 %
Mining Industry / All Occupations	0.160904827 %	0.17 %
All Industries / Selected Occupations	0.313121909 %	0.27 %
All Industries / All Occupations	0.47810073 %	0.48 %

Source: Mining Industry Human Resources Council, Statistics Canada (2016 Census), 2018.



FIGURE 26

REPRESENTATION OF INDIGENOUS PEOPLES IN THE WORKFORCE, MINING INDUSTRY AND ALL INDUSTRIES, 2016

[Return to text](#)



Aboriginal Status	All Industries	Mining Industry
Indigenous	3.9%	7.4%
Métis	1.7%	3.2%
First Nations	2.0%	3.4%
Inuk (Inuit)	0.1%	0.6%
Indigenous responses not included elsewhere	0.1%	0.1%
Multiple Indigenous responses	0.0%	0.1%

Source: Mining Industry Human Resources Council, Statistics Canada (2016 Census), 2018.

FIGURE 27

REPRESENTATION OF NEW CANADIANS AND VISIBLE MINORITIES IN THE MINING WORKFORCE (2006, 2011, 2016)

[Return to text](#)



Diversity Status	2006	2011	2016
Immigrant	12%	14%	13%
Visible Minority	7%	9%	9%

Source: Mining Industry Human Resources Council, Statistics Canada (2006 Census, 2011 NHS, 2016 Census), 2018.

FIGURE 28

CUMULATIVE HIRING REQUIREMENTS* BY FORECAST SCENARIO (2019–2029)

[Return to text](#)


	Net Change in Employment	Replacement Requirements		Cumulative Hiring Requirements
		Retirement	Non-Retirement	
Contractionary	-30,150	56,240	23,790	49,890
Baseline	11,930	60,200	25,320	97,450
Expansionary	45,210	63,440	26,580	135,230

Source: Mining Industry Human Resources Council, Statistics Canada (2016 Census), 2018.

FIGURE 29

SELECTED COSTS OF PRODUCTION IN THE MINERAL INDUSTRY¹, 2016

[Return to text](#)


By Industry	Establishments Surveyed	Wages for Production and Related Workers	Fuel and Electricity	Materials and Supplies	Value of Production
	(number)	(\$000)	(\$000)	(\$000)	(\$000)
Metal Ore Mining	63	2,845,554	1,521,683	5,517,460	22,692,149
Nonmetallic Mining and Quarrying	1,124	1,366,406	739,204	1,612,338	9,944,967
Coal	18	582,671	301,791	632,311	3,751,352
Total Mineral Industry	1,205	4,794,631	2,562,678	7,762,109	36,388,468

Sources: Natural Resources Canada; Statistics Canada.

¹Excludes the oil and gas extraction industry.

Note: Value of Production vs. Mineral Production: Value of Production is for mining activity only and wouldn't include all costs related to shipping etc. that are included in Value of Shipments (or Mineral Production).

Numbers may not add due to rounding.



THE ENVIRONMENT: SUSTAINABLE DEVELOPMENT AND SOCIAL RESPONSIBILITY

THE CANADIAN MINING INDUSTRY IS COMMITTED TO RESPONSIBLE ENVIRONMENTAL STEWARDSHIP AND IS FOCUSED ON SUPPORTING THE TRANSITION TO A LOWER CARBON FUTURE AND BEING A CONSTRUCTIVE PARTNER IN ADDRESSING CLIMATE CHANGE, REDUCING FOOTPRINTS AND ENHANCING SOCIAL AND ENVIRONMENTALLY RESPONSIBLE PRACTICES.

Environmental and social considerations are increasingly well integrated into mine planning and management. Furthermore, resource development and environmental conservation are not mutually exclusive, but can be achieved by effective regulation and responsible sustainability practices. In Canada, mining companies are required to plan for closure well before entering into production. Not only are closure plans required by law in Canada, but companies must also provide financial assurance to ensure that appropriate funding is available for effective mine closure and reclamation. Reclamation, one of the most important aspects in the mine closure process, specifically focuses on restoring mined lands to their original state.

MAC's *Towards Sustainable Mining*® (*TSM*®) initiative is committed to responsible mining and serves as an example of how resource development can co-exist with environmental conservation, and how partnerships can be fostered between mining companies and communities. *TSM*, first established in 2004 and mandatory for all MAC members, is focused on enabling mining companies to meet society's needs for minerals, metals and energy products in the most socially, economically and environmentally responsible way. Sustainability has long been a point of focus for Canada's mining sector, and this emphasis has steadily been on the rise over the past several years.

ENVIRONMENTAL STEWARDSHIP

The Canadian mining industry has made significant progress in its environmental performance by participating in a host of sustainability programs and initiatives.

Internationally, an array of sustainability and social license initiatives affect the Canadian mining industry. Companies seeking project financing are required to apply rigorous environmental and social standards set by organizations such as the International Finance Corporation, Export Development Canada, the World Bank and commercial banks that have adopted the Equator Principles, a framework used by financial institutions to determine, assess and manage environmental and social risk in projects. Companies dealing in dangerous substances abide by the Basel Convention and the International Cyanide Management Code (as well as Canada's own *Transportation of Dangerous Goods Act*). The practices of many companies are guided by the United Nations Global Compact, the Extractive Industries Transparency Initiative, the Kimberley Process, ISO 14001 certification and other sustainability programs. For a more detailed overview of how MAC member companies apply international standards and programs, [see Figure 30](#).

Domestically, companies are engaged in a variety of stewardship programs, including *TSM*, the Mine Environment Neutral Drainage Program (MEND) and the National Orphaned/Abandoned Mines Initiative (NOAMI).

Towards Sustainable Mining

TSM is an award-winning performance system that helps mining companies evaluate and manage their environmental and social responsibilities. *TSM* is MAC's commitment to responsible mining and every member company commits to implementing it for their Canadian facilities as a condition of membership. Several companies also voluntarily apply it at their international sites.

Since its establishment in 2004, participation in *TSM* has grown steadily and the Québec Mining Association has adopted the initiative for their members.

In recent years, *TSM*'s positive reputation has been attracting international attention. In 2015, the Finnish Mining Association (FinnMin) adopted *TSM* for its members' operations, the first national mining association outside of Canada to do so. Since then, the Cámara Argentina de Empresarios Mineros, the Botswana Chamber of Mines and the Chamber of Mines of the Philippines have adopted *TSM* and are at various stages of implementing the program. In 2018, Confederación nacional de empresarios de la minería y de la metalurgia, the national mining association in Spain, became the latest national mining association to join *TSM*.

How TSM Works

TSM includes a set of tools and indicators that drive performance and ensure key mining risks are managed responsibly at mining facilities. By adhering to the *TSM Guiding Principles*, mining companies demonstrate leadership by:

- Engaging with and supporting local communities
- Driving world-leading environmental practices
- Committing the resources and leadership to promote the safety and health of employees

TSM's core strengths are focused on:

- **Accountability.** *TSM* reporting at the facility level of their Canadian operations is mandatory for members.
- **Transparency.** Annual reporting is conducted against the *TSM* indicators with independent verification.
- **Credibility.** *TSM* includes ongoing consultation with a national Community of Interest (COI) Advisory Panel to improve industry performance and shape *TSM* for continual advancement.
- **Driving performance.** *TSM* includes a requirement to demonstrate measurable continual sustainability improvement.

Currently, *TSM* sets out performance indicators and targets in seven areas:

- Tailings management
- Energy use and greenhouse gas emissions management
- Aboriginal and community outreach

- Crisis management and communications planning
- Biodiversity conservation management
- Safety and health
- Preventing forced and child labour

Over the course of 2017 and 2018, water experts from across the industry have worked diligently to develop a set of performance indicators to measure water governance, operational water management, watershed-level planning and water performance and reporting at the mine-site level. The new *Water Stewardship Protocol* will be phased-in over the next few years, with public reporting scheduled to begin in 2021.

Each year, MAC produces a *TSM Progress Report* detailing the facility-level performance of participating companies. *TSM* assessments take place at the facility level to ensure that management systems are in place, with results externally verified every three years. In 2017, 67 facilities reported their 2017 results.

Below is a summary of results for three areas that pertain to environmental stewardship: tailings management, biodiversity conservation management, and energy use and greenhouse gas emissions management. For a more complete overview of industry performance, please refer to the *2018 TSM Progress Report*, which is available on the MAC website.

Tailings Management

Tailings facilities are necessary components of mining activity, and it is crucial that they be managed responsibly to protect human safety and the environment. Overall, the industry's performance in tailings management has improved significantly over the years ([see Figure 31](#)). This is largely due to senior executives recognizing the importance of managing a facility's most significant environmental and safety risks. While the 2017 *TSM* results show a decline in performance, on an aggregate basis, for Indicators 3 and 4 of the *Tailings Management Protocol*, this drop is partially attributable to facilities new to *TSM* who are still working to align their systems with the program criteria. In addition, seven facilities (including six closed sites), that previously reported Level As were downgraded to Level Cs for Indicator 3 and Level Bs for Indicator 4 during external verification. MAC has been engaged with the two companies responsible for the seven facilities and been assured that action is underway to bring their performance back to previous levels.

Following the tailings breach at the Mount Polley Mine in August 2014, MAC initiated internal and external reviews of its *TSM Tailings Management Protocol* and Guides. Both reviews confirmed the strength of the existing *Tailings Management Protocol* and Guides while also identifying opportunities to incorporate proven and emerging best practices for tailings management. The review has resulted in significant revisions to the *TSM Tailings Management Protocol*, *A Guide to the Management of Tailings Facilities* and *Developing an Operation, Maintenance and Surveillance Manual for Tailings and Water Management Facilities*. The revised Protocol and Guides are available at www.mining.ca/tailings-management and reporting against the new Protocol will begin in 2020.

Beyond *TSM*, oil sands operators are making measured progress in tailings management. The Oil Sands Tailings Consortium (OSTC) was founded in 2010 when seven of Canada's largest oil sands mining companies agreed to share tailings research and technology in a unified effort to advance tailings management. In March 2012, the OSTC became part of Canada's Oil Sands Innovation Alliance (COSIA), which is discussed in more detail below.

PROMISING TECHNOLOGY FOR OIL SANDS TAILINGS

Managing tailings in the oil sands is a key environmental priority for the mining industry. Oil sands operators are committed to developing technologies to speed-up reclamation outcomes. One example is Permanent Aquatic Storage Structure treatment process (PASS), developed by Suncor Energy. This technology involves adding a coagulant and a flocculant to fluid tailings, which allows water quality to be improved and improves consolidation that accelerates water release. Other innovative examples include Syncrude's centrifuge technology and Canadian Natural's Atmospheric Fines Drying process, both of which accelerate the release of water from tailings, enhancing the drying process.

These innovative technologies and processes are expected to accelerate the rate of reclamation and, in the years ahead, help to ensure the industry is reclaiming the landscape in a progressive manner. Suncor, Syncrude and Canadian Natural are sharing intellectual property and industry best practices with the broader oil sands mining industry through their collaboration with member companies in COSIA.

Biodiversity Conservation Management

Mining, conducted in consultation with communities of interest, can co-exist with biodiversity conservation. Adopting responsible practices for biodiversity conservation management through all stages of a mine's life cycle is an industry priority. The *TSM Biodiversity Conservation Management Protocol* confirms that mining facilities have made formal commitments to manage biodiversity at their sites, that action plans for significant biodiversity aspects are implemented, and that biodiversity conservation reporting systems are in place to inform decision making and to publicly communicate the performance of facilities.

Figure 32 demonstrates that MAC members have continued to make significant improvements across the three indicators:

- 75% have senior management commitment to biodiversity conservation in place.
- 69% have implemented a biodiversity conservation management system.
- 66% report publicly on biodiversity conservation activities and performance.

Energy Use and Greenhouse Gas (GHG) Emissions Management

Improving energy efficiency and reducing GHG emissions are priorities for the Canadian mining industry to limit impacts on the environment, address climate change, and help reduce operational costs at mine sites.

The *TSM Energy Use and GHG Emissions Management Protocol* confirms whether a facility has established a comprehensive system for energy use and GHG emissions. For this Protocol, a facility must show its management system includes assigned accountability from senior management, and that it has a process in place to ensure energy data are reviewed regularly and are well integrated into operator actions. Facilities are also expected to provide energy awareness training, and have systems in place to track and report energy use and GHG emissions data for both internal and external reporting. Finally, in *TSM's* spirit of continuous improvement, this Protocol seeks to confirm that facilities establish and meet targets for their energy use and GHG emissions performance.

The requirements to obtain a Level A in this *TSM* Protocol are more stringent than those for obtaining ISO 50001 certification. While ISO is a more broadly recognizable program globally, this comparison helps contextualize the

extent of the commitment that MAC members make in pursuit of energy and GHG management excellence. Of the facilities participating in *TSM*:

- 84% have comprehensive energy use and GHG emissions management systems.
- 96% have implemented energy use and GHG emissions management reporting systems.
- 54% have established and met performance targets.

The percentage of facilities that have achieved a Level A or higher has increased since 2013, the year in which the Protocol went through a substantial revision when the number of indicators was condensed from six to three. This change acknowledged that in the mining sector facilities produce GHGs primarily through the burning of fossil fuels for energy and, thus, GHG emissions are controlled by managing energy consumption. [Figure 33](#) shows performance for the three indicators of the *TSM Energy Use and GHG Emissions Management Protocol*.

Since 2015, mining companies pursuing energy management best practices to increase energy efficiency and reduce GHG emissions through the *TSM* initiative became eligible for funding from the Canadian Industry Program for Energy Conservation (CIPEC), a division of Natural Resources Canada. This is a significant endorsement of *TSM* and a powerful recognition of the program's effectiveness in improving energy management practices at Canadian mining operations.

CLIMATE CHANGE AND THE MINING INDUSTRY

MAC and its members are committed to supporting the transition to a lower carbon future, and to being a constructive partner with the Government of Canada on this important issue. To assist government in the development of an effective pan-Canadian climate change policy, MAC released these [Principles for Climate Change Policy Design](#) in April 2016.

The Principles specifically focused on:

- **Establishing a broad-based carbon price** that is applicable to all sectors of the Canadian economy.
- **Being revenue neutral** by investing revenues generated through carbon pricing into the development of lower emission technologies to manage the transition to a lower carbon future, including climate adaptation, and to ensure a level playing field for trade-exposed industries that are emission intensive.
- **Addressing competitiveness and carbon leakage concerns** across all sectors to prevent declines in investment, employment, tax revenues and trade.
- **Being predictable, flexible and sensitive to changing economic conditions and geographic circumstances**, to enable consumers and industry to adapt and to treat regions fairly, particularly Canada's north.
- **Being simple, complementary and effective** to ensure that a national climate change regime works in tandem with existing provincial schemes, avoids duplication, and is simple to understand and administer.
- **Supporting investments in the development and implementation of technologies that lower emissions** through capital investments, which could include public-private partnerships.
- **Recognizing early action**, acknowledging that some companies have been proactive in reducing their climate footprints and that several provinces have already established climate change mitigation regimes.

Mining Sector Emissions Profile

According to the Canadian Energy and Emissions Data Centre, direct emissions from Canada's operating metal and non-metal mines accounted for just 0.8% of the country's total GHG emissions in 2016 ([see Figure 34](#)).

Despite lacking federally regulated targets, many extraction operations have improved their capabilities in compressed air, ventilation, metering and energy management, and have been doing so for years. Canadian mining companies are also involved in innovative initiatives to find non-diesel alternatives for large mobile equipment (see the Borden Mine case study in Section Four). Investment in these areas is a priority for the industry as older and deeper mines require more energy to access and extract the same amount of ore.

Oil sands production has a track record of continuous improvement in emissions reduction. Between 1990 and 2012, GHG emissions associated with every barrel of oil sands crude produced decreased by 28%. For oil sands mining, GHG emissions reductions have been driven by innovations such as hydrotransport and efficiency improvements in bitumen extraction, upgrading, and natural-gas-fired cogeneration for electricity and steam.

LOW CARBON EXTRACTION AT SUNCOR'S FORT HILLS MINE

While Suncor's Oil Sands Base plant uses a first generation extraction process called Naphthenic Froth Treatment, the company's new Fort Hills mine uses a process called Paraffinic Froth Treatment (PFT). The bitumen product they obtain using this partial upgrading process has been upgraded to a better quality as it removes up to 10% of the asphaltenes — which is essentially composed of low-value heavy hydrocarbon molecules and undesirable particulates. Rejecting the portions of heavy hydrocarbon closer to source reduces both the diluent required for transportation and the energy and hydrogen needed to refine the bitumen into fuels. This higher quality oil sands product can be processed at a wider range of refineries. As a result of this technology, the GHG emissions for the average barrel extracted at Fort Hills are on par with the average crude refined in the U.S.

Despite reductions in the energy intensity of each barrel of oil produced, the absolute level of GHG emissions has grown as oil sands production volumes have increased.

Federal Climate Change Policy

MAC is engaged in several concurrent policy and regulatory initiatives pertaining to climate change, among which include:

- Proposed regulations for a Clean Fuel Standard (CFS)
- Federal Backstop and Output-Based Pricing System
- Proposed Regulations for Stationary Diesel Engines
- Proposed enhanced GHG reporting requirements

While these initiatives each require independent consideration, how they interrelate must also be assessed. It is critical that they work harmoniously to create a consistent, complementary and coordinated approach.

In Canada's growing patchwork of climate change initiatives, provincial and federal policies are increasingly likely to target the same GHG emissions. What concerns MAC is a potential scenario whereby existing or developing regulatory initiatives result in double regulation of the same emissions in one or more respects. The mining industry is concerned that some of these initiatives may

duplicate or conflict with what provincial governments are already doing. This duplication would increase overall costs, create additional reporting and compliance burden, frustrate private sector innovation, and generally blunt the incentive for corporations to take action, all without achieving significant additional GHG emissions reductions.

MAC believes that carbon pricing is the simplest and most cost-effective way to lower GHG emissions and recommends that the government:

- Make carbon pricing the core of its climate policy, which should be backed by robust protections for EITE sectors and should also be sensitive to remote and northern regions.
- Clearly demonstrate complementarity before adopting non-pricing climate change policies and regulations (such as the CFS) to avoid cumulative effects. This demonstration should include a robust and publicly-disclosed economic impact assessment.

Output-Based Pricing System (OBS)

MAC has been working constructively with the federal government on the proposed output-based standards for mining, smelting, and iron ore pelletizing. To date, we are pleased to see some of our priorities recognized in the changes proposed by Environment and Climate Change Canada, including reducing stringency, disaggregating from the proposed single standards, and enabling facilities that emit between 10-50kt GHG to opt-in to the OBS program in 2019. MAC will continue to work to ensure the OBS for mining and metal manufacturing facilities recognize factors such as remoteness, supply chain exposure, and have appropriate product and facility level aggregation.

Clean Fuel Standard (CFS) Regulation

While MAC supports the federal government's efforts to identify opportunities to meaningfully reduce GHG emissions, elements of the proposed CFS regulation are problematic. MAC recommended the government begin with the transportation sector first – like other jurisdictions where such standards have been deployed – but the decision to proceed with the broader liquid fuels stream first (including industrial consumers) is likely to adversely affect the industry, due to a number of different factors.

MAC supports a CFS on liquid fuels for the transportation sector (exempting heavy industry) and if the government chooses to pursue a broader scope, the incorporation of robust EITE protections under any CFS regulation will be critical.

Climate Change Policy in the North

Northern energy costs are compounded by the infrastructure deficit in the territories and remote regions of the provinces. The extremely limited reach of transmission and distribution infrastructure means mines and development projects are off-grid and dependent almost exclusively on diesel. Beyond the cost of fuel itself, the cost per unit of delivered fuel is inflated significantly by associated investments essential to supporting the mines' energy supply chain. Fuel-switching opportunities are also limited and are contingent on geographical considerations.

High energy costs in the North have long served as a strong incentive to maximize energy and fuel efficiency, but evidence suggests that the proverbial "low-hanging" fruit are gone, meaning future improvements will be incremental and gradual barring a technological breakthrough. Moreover, fuel switching opportunities in remote and northern Canada are limited and contingent on geographical considerations. Together, the infrastructure deficit and the state of currently available technologies do not provide sufficient options to displace diesel (and associated emissions) in the timeframe needed, nor on the scale required, to avoid companies absorbing the carbon price almost exclusively as a cost of business. Further, extreme temperatures have not demonstrated the viability of the CFS for an industrial application in a pan-Canadian context.

The purpose of pricing carbon or establishing a CFS is not to penalize companies, but to price pollution as Canada works to meet its targets. Policies that fail to take into account competitiveness concerns will drive away investment and exacerbate an already challenging business situation for many companies operating in the North. MAC recommends that any climate change plan or policy must be sensitive to the geographical realities of remote and northern regions. Accommodating for remote and northern limitations in a manner that does not unduly penalize the firm is critical for any northern climate change scenario to have the intended effect.

Mining and Natural Gas

Mining companies that have had access to natural gas have been using it to power operations for decades. Recent developments in natural gas have increased its viability and generated interest from other miners across the industry. Technological advances in gas extraction have boosted supply through new finds and increased access to known deposits. Due to market developments in North America, gas prices remain low compared to Europe and Asia. As a cleaner fuel, gas also has a smaller GHG footprint than diesel fuel. This places natural gas in a good position to help miners reduce their carbon emissions when it is viable to fuel switch.

One example is ArcelorMittal, a MAC member piloting a project to switch to natural gas for its Port Cartier operation. The pilot projects the displacement of 4.7 million litres of heavy fuel oil in 2018, mitigating 4,800 tonnes of CO₂ equivalent. If successful and deployed permanently, the fuel-switching project will reduce emissions by an estimated 50,000 tonnes of CO₂ equivalent annually. In addition, Western Copper and Gold intends to power its Yukon-based Casino project, which is still at the permitting stage, with natural gas. This would be a first for mining in the territories.

For many mines, however, there are other considerations. Given that natural gas prices are subject to volatility – such as winter price spikes – questions over the viability of switching require detailed analysis. In many situations, mining companies face similar challenges in accessing natural gas as they do with other diesel-replacing alternatives. In remote areas, particularly in the North, no direct transmission or distribution pipeline network exists – and building one would be capital-intensive. Maritime transportation of natural gas is also expensive as it requires ships and unloading and storage facilities – a compounded challenge as very little port infrastructure currently exists, and all-weather road systems are scarce.

MINERS PUT ENERGY INTO RENEWABLE POWER

Sitting on a plateau 600 metres high on the Ungava Peninsula in northern Quebec, Glencore's Raglan Mine is well situated to take advantage of the power of wind. In 2014, the company did exactly that when it completed its construction of a 120-metre-high wind turbine and storage facility, the largest in Quebec.

The project, a private-public partnership between Raglan Mine, TUGLIQ Energy and the federal and provincial governments, was unprecedented in scale, and was specially designed for severe Arctic climate conditions.

In its inaugural year, the 3-megawatt wind turbine and storage facility saved 2.1 million litres of diesel and reduced GHG emissions by 5.85 kilotons. Based on these results, Glencore estimates that it will save more than \$40 million in fuel-related costs over the projected 20-year life of the wind turbine. This successful pilot project could have transformative impacts across northern Canada, helping to pave the way for the more widespread adoption of greener energy alternatives.

Natural gas technologies, however, continue to improve and incrementally enhance the fuel's usability for miners. Some natural gas generation technologies have been designed to retrofit existing diesel systems, making a fuel switch less capital intensive. From an end-use perspective, progress has also been made towards the development of liquid natural gas engines for heavy vehicles where potential fuel savings and emissions mitigation are significant.

Mining and Renewable Energy

Renewable energy technologies and their economics continue to improve. Renewable power is appealing to mining companies because it has the potential to reduce energy costs and environmental impacts, enhance energy security and address climate change.

Given the heightened cost of powering mining operations, companies are giving the benefits of renewable energy technologies greater consideration. The levelized cost of electricity for wind, solar photovoltaic, concentrated solar power and some biomass technologies has steadily decreased, enhancing their competitiveness, particularly for off-grid generation. According to the International Renewable Energy Agency, prices of solar photovoltaic modules have fallen by about 80% since the end of 2009, while wind turbine prices have fallen by 30–40%.

While cost competitiveness improvements in renewable energy are both welcome and attractive, they do not account for additional capital costs associated with remote development. The technology improvements also vary based on the quality of the renewable resource. Just as miners need to go where the viable deposits are located, renewable energy generation is contingent on the strength and reliability of the renewable asset. This restriction prevents renewable energy generation from becoming an industry-wide energy solution, no matter how improved the technology is.

But for mines that have access to a viable renewable asset, diversifying energy portfolios with a reliable intermittent power source that simultaneously offsets their reliance on diesel has benefits that may merit the investment. Recent examples include IAMGOLD's Rosebel Mine in Suriname, and Glencore's Raglan Mine in Quebec.

Rio Tinto's and Dominion Diamond Corporation's Diavik Diamond Mine in the Northwest Territories provides one concrete example on how Canada's mining companies prioritize innovative and environmentally responsible ways to extract minerals and metals. The wind farm at the award-winning Diavik Diamond Mine was first introduced in 2012 and has seen impressive results.

This \$31 million project is Rio Tinto's first wind generation facility and also holds the distinction of being the first large-scale wind farm in Canada's Northwest Territories. It uses leading edge cold climate technology to overcome the problem of industrial lubricants freezing in sub-Arctic conditions. As a renewable energy source, the wind farm is exceeding targets and providing around 10% of the mine's power needs. In addition to its role in producing much needed power, the wind farm also reduces Diavik's seasonal winter road fuel haul by approximately 100 loads.

THE CLEAN ENERGY ECONOMY

There is a natural synergy between mining and clean technology. Raw materials are transformed into technology that, having gone full circle, assist mining operations in reducing environmental footprints and enhancing efficiency and reliability. These same raw materials are also enabling the world to transition to a low carbon future.

Promising technology areas include low carbon energy, energy storage, carbon capture and storage, green buildings and materials, clean vehicles and renewable energy.

A cleaner society depends on metals and minerals for building blocks. Hybrid vehicles, for example, draw energy from nickel hydride batteries. Catalytic converters, which reduce air pollution from vehicles, require platinum, rhodium and cerium. Rechargeable batteries are made from lithium, and solar cells require gallium, indium and germanium. The average electric car contains 75 kilograms of copper wiring, nearly three times as much as a conventional vehicle. Water purification systems rely on nickel and rare earth elements. The fuel efficiency of aircraft has improved by 70% over the past 40 years because of materials like aluminum, and next-generation technologies will be based on even lighter composites.

As primary materials, mining products will remain fundamental to the Canadian economy as it transitions towards a lower carbon future. There is no green economy without the mining industry, and as our industry continues to improve its environmental performance, so will its products continue to shape our world.

Recycling and E-Waste

E-waste is one of the fastest-growing waste streams in the world and includes items such as mobile devices, computers, monitors, televisions and DVD players, among other electronic equipment. The lifespan of computers in developing countries, for example, has dropped significantly in recent years, and mobile devices frequently have a lifespan of less than two years. As consumers and businesses favour disposable technology and a shorter

life cycle for electronics, the amount of e-waste generated is increasing. For example, according to recent data by Statistics Canada, 76% of Canadians of all ages owned a smart phone, suggesting the technology to be ubiquitous across the country.

COAL'S ROLE IN A SUSTAINABLE SOCIETY

About 770 kilograms of steelmaking coal (metallurgical coal not thermal coal) are required to produce 1 tonne of steel, and more than 700 million tonnes of steelmaking coal are used each year in global steel production. Steel is used to create the infrastructure and other materials Canadians use every day. For example, steel is crucial for:

- **Public transportation.** Approximately 30,000 tonnes of steelmaking coal was required to build Vancouver's Canada Line. This 19-kilometre rapid transit line currently accommodates more than three million passenger trips through Vancouver per month.
- **Personal recreation.** Approximately 1.1 kilograms of steelmaking coal is required to build the average bicycle frame.
- **Alternative energy.** Approximately 100 tonnes of steelmaking coal is necessary to produce the steel to build the average wind turbine.

Source: Teck Resources Limited

A large portion of e-waste can be recycled, components of which can be recovered as "urban ore." E-waste recycling involves reprocessing obsolete or unwanted electronics that have exhausted their reuse potential and would otherwise be disposed of in landfills. From 50,000 mobile phones, Electronics Product Stewardship Canada estimates that approximately 1 kilogram of gold, 400 grams of palladium, 10 kilograms of silver, and 420 kilograms of copper can be recycled. By recycling these items, valuable materials are kept out of landfills and can produce new products using resources that do not need to be mined.

For example, Glencore's Horne smelter, located in Rouyn-Noranda, Canada, has been recovering copper and precious metals from end-of-life electronics for over 30 years. The smelter receives end-of-life electronics from North America, Europe, Asia and South America. The materials are sampled

for accurate value determination and processed to produce copper anodes. These are shipped to a Montreal refinery for further refinement into saleable products.

It is estimated that the world's supply of end-of-life electronics offers a material resource of 40 million tonnes annually, from which a variety of component materials can be recycled. Propelling these efforts internationally is the Basel Convention, which controls the export of hazardous waste and requires e-waste to be treated as close to its origins as possible. The Convention, which entered into force in 1992, now has 186 parties, 53 of which are signatories, including Canada and the European Union.

While e-waste recycling programs have increased across Canada in recent years, more awareness is needed among Canadians of the options available for recycling old electronics. As well, the future of metal and e-waste recycling in Canada depends partly on how far government regulations go in requiring manufacturers and consumers to take responsibility for the life cycle of the products they use.

INDIGENOUS RELATIONS AND BENEFIT AGREEMENTS

Proportionally, the mining industry is the largest private sector employer of Indigenous peoples in Canada. This can be partly attributed to the nearness of 1,200 Indigenous communities to mining operations. Most of these communities are located within 200 kilometres of approximately 180 producing mines and more than 2,500 active exploration properties. This geographical proximity serves as a foundation for relationship building between industry and Indigenous communities. ([See Section 4](#) of this report for more discussion.)

Over the past decade, the Canadian mining industry has increasingly embraced the signing of impact benefit agreements (IBAs) or other agreements (such as community and impact benefit agreements, community benefit agreements, and community participation agreements) between mining companies and Indigenous peoples and collectives. Such agreements have helped solidify local support for mining projects, provided a local work force, and facilitated Indigenous participation in the mining sector and the benefits that flow from it. While earlier agreements typically contained provisions for employment and training, more recent IBAs promote business opportunities through set-aside contracts and joint ventures. They also consider social and cultural matters, provide for environmental monitoring, set up funding arrangements and dispute resolution mechanisms, and include direct payment and resource-sharing arrangements, among other provisions.

Since the groundbreaking 1974 Strathcona Agreement, hundreds of bilateral agreements (IBAs or other agreements at the exploration stage) have been signed, including 455 since the year 2000 (Source: NRCan).

Progressive agreements, such as the Ekati mine project agreement in the Northwest Territories and the Raglan Agreement in Quebec, have provided Indigenous communities with jobs, skills training, profit-sharing and environmental benefits. In addition to these agreements, the industry has taken proactive policy positions on issues such as resource revenue-sharing, which supports greater participation of Indigenous peoples, communities, businesses and governments in the mining industry.

Agreements between Vale and Labrador's Innu and Inuit people include sections on training, employment, contracting, financial benefits, environmental matters and dispute settlement. In the partnership between the Government of British Columbia and the Stk'emlupsemc of the Secwepemc Nation (SSN), the provincial government shares revenues from New Gold's New Afton mine directly with the SSN, in addition to New Afton's separate agreement with the same bands. This government-to-government agreement broke new ground in Indigenous and natural resources public policy, providing the confidence and mutual benefit needed for mining projects to move forward.

Since then, other revenue-sharing agreements have been struck between the Government of British Columbia and First Nations communities across the province. This year, the Ktunaxa Nation Council and Teck Resources have concluded one of the most comprehensive agreements of its kind in Canada. Spanning approximately 40 years and all five operations in the Elk Valley region, the agreement sets out commitments for both parties in the areas of consultation and engagement, environment and land stewardship, employment and business opportunities for Ktunaxa citizens, and cultural resources management.

While the relationship between mining companies and Indigenous Canadians has largely been positive, several public policy issues currently create uncertainty for both groups. Mining companies operating in Canada have seen an increasing level of complexity related to the Crown's duty to consult. This complexity is largely reflected in the different policy responses by federal, provincial and territorial governments as to what the actual "trigger" is for consultation, how the consultation process will unfold, who will lead the process, what procedural aspects are delegated to companies, and what support exists for the

parties involved. Added to this is the frequent duplication and lack of coordination of effort by both levels of government on consultation activities for the same project.

The Supreme Court of Canada, in its recent decision on the Tsilhqot'in First Nation's claim, recognized Indigenous title, a first in Canadian law. It also provided clarity on the criteria needed to demonstrate title and the rights and obligations that flow from that, and, in the process also identified where title was found not to exist. The Court clearly recognizes that, in some circumstances, the right to title can be limited by the Crown. So, there is no absolute veto under Canadian law, even in the case where title has been proven. But for the Crown to place limits on Indigenous title, it has to demonstrate both a compelling public interest for the project and ensure that future Indigenous generations will not be deprived of the benefit of the land were the project to go ahead – a very significant test. At its core, the decision embodies the balancing act between empowering and limiting the authority of both Indigenous peoples and governments. The Canadian mining industry believes it is a significant decision that provides much more clarity going forward.

The federal government has committed to the implementation of the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP) in a manner that fits within Canada's Constitutional and legal framework. This work is part of ongoing efforts by the federal government to renew Canada's relationship with Indigenous peoples and the recognition of Section 35 rights through the development of the *Recognition and Implementation of Indigenous Rights Framework*. UNDRIP's principle of Free, Prior and Informed Consent (FPIC), in this context, is generally understood to refer to a process of continuous engagement. Several MAC members, who are also members of the International Council on Minerals and Metals (ICMM), have committed to "work toward obtaining the consent of Indigenous peoples" consistent with ICMM's Indigenous Peoples and Mining Position Statement.

The Canadian mining sector has a proven track record of working towards and maintaining positive and respectful relationships with affected Indigenous communities. Building constructive relationships with Indigenous communities, pursuing understanding and shared commitments through formal agreements is of great importance to our industry and is considered a best practice.

Engagement with Indigenous peoples and other communities of interest (COI) is a core component of MAC's TSM initiative. Each year, MAC members are evaluated

against the *TSM Aboriginal and Community Outreach Protocol*. To achieve a Level A, which equates to good practice, *TSM* requires facilities to have formal systems in place to establish who they should be speaking with about their operations and how to best engage with them. Facilities must also establish two-way dialogue with COI, have systems in place to receive and respond to concerns, and keep the public apprised of their activities and performance. Facilities are also required to publicly report on their engagement with communities. MAC is currently undertaking a review of this Protocol to ensure that it reflects current best practices with respect to community engagement and Indigenous relations and drives performance improvements at the mine-site level.

REGULATORY ENVIRONMENT

Developing and operating a mine in Canada requires compliance with a multitude of federal and provincial or territorial legislative and regulatory requirements. Some of these requirements are specific to mining, while many more apply generally to environmental protection, and the health and safety of workers and the public. To deal with this complexity, Canadian companies, as well as domestic and foreign investors, rely on governments to provide clear information about requirements, approval processes, timelines and responsibilities.

New mines and major expansions must undergo federal reviews and approvals in addition to the review and permitting requirements of their provincial jurisdiction, which is the primary regulator. New mining projects and major expansions are subject to the *Canadian Environmental Assessment Act* (CEAA 2012) and, depending on the details of the project and the mine site, they may require approvals under other federal legislation, such as the *Fisheries Act* and the *Navigation Protection Act*. All three federal Acts were amended in 2012. As a result of these reforms, mining projects disproportionately made up the vast majority of the Canadian Environmental Assessment Agency's case load ([see Figure 35](#)).

In 2016, the federal government initiated reviews of the three federal Acts, and, in February 2018, tabled in Parliament Bill C-68 and Bill C-69. Bill C-68 proposes to make amendments to the *Fisheries Act* and Bill C-69 proposes an *Impact Assessment Act* to replace CEAA 2012 and proposes amendments to the *Navigation Protection Act* to create the *Canadian Navigable Waters Act*. Both Bills are being considered by the Senate of Canada. If passed by this Parliament, they would come into force no earlier than mid-2019.

MAC has participated actively in the legislative review process and is a member of the Multi-Interest Advisory Committee, which was formed to assist in the review.

The mining industry has a keen interest in supporting the responsible management of species at risk in Canada. This is demonstrated through commitments made as part of *TSM* as well as the substantial investments made with respect to wildlife monitoring and research studies. MAC actively participates in the Species At Risk Advisory Committee and the National Boreal Caribou Knowledge Consortium. MAC also participated on the National Advisory Panel for the Pathway to 2020, which completed its mandate in early 2018.

For the mining industry to thrive in Canada, the process for reaching a decision on whether a mine can be built, and under what conditions, needs to be determined through a timely, coordinated and seamless process that continues to be grounded in meaningful consultation. In turn, this will help restore and preserve Canada's reputation as an attractive jurisdiction for mineral investment and sustainable mining development.

Beyond the federal environmental assessment review, in 2018 the government completed amendments to a key *Fisheries Act* regulation related to mining: The *Metal and Diamond Mining Effluent Regulations* (MDMER). These amendments were the outcome of a three-year review that concluded in 2015. These amendments expand the scope of the previous *Metal Mining Effluent Regulations* to include diamond mines. The new requirements will come into force in stages. Some, including the application to diamond mines and amended requirements for environmental monitoring came into force immediately. Others, including more stringent requirements for effluent quality, will take effect in 2021. ■

FIGURE 30

MAC MEMBER COMPANY APPLICATION OF INTERNATIONAL STANDARDS AND PROGRAMS

[Return to text](#)



INTERNATIONAL INITIATIVES																				
MAC MEMBER COMPANY APPLICATION OF INTERNATIONAL STANDARDS AND PROGRAMS *Applied at international facilities. **TSM is applied at international facilities, but results are not reported publicly. ***Applies only to select international facilities.	Industry Sustainability Initiatives		Management System Standards	International Voluntary Initiatives					Reporting, Disclosure and Transparency Standards					Financing Standards	Listed on Socially Responsible Investing Indices	Commodity Specific Standards				
	MAC Towards Sustainable Mining*	ICMM Sustainable Development Framework	WGC Conflict Free Gold Standard	ISO 14001: EMS Standard	OHSAS 18001	UN Global Compact	Extractive Industries Transparency Initiative	Voluntary Principles on Security and Human Rights	OECD Guidelines for Multinational Enterprises	AA 1000	Global Reporting Initiative	Carbon Disclosure Project	Water Disclosure Project	Carbon Pricing Leadership Coalition	IFC Social and Environmental Performance Standards	Dow Jones Sustainability Index	Jantzi Social Index	Responsible Jewellery	International Cyanide Code	Kimberley Process
COMPANIES/BUSINESS UNITS HEADQUARTERED IN CANADA WITH INTERNATIONAL OPERATIONS:																				
Agnico Eagle Mines Ltd.	✓		✓							✓	✓	✓			✓			✓	✓	
Barrick Gold Corporation		✓	✓	✓		✓	✓	✓	✓	✓		✓	✓		✓				✓	
IAMGOLD Corporation	✓		✓				✓		✓		✓	✓			✓		✓			
Kinross Gold Corporation			✓	✓	✓	✓	✓				✓	✓	✓		✓		✓		✓	
HudBay Minerals Inc.	✓			✓	✓		✓	✓	✓		✓	✓	✓		✓ ***					
First Quantum Minerals Inc.	✓					✓	✓	✓				✓			✓					
Teck Resources Limited **	✓	✓		✓		✓	✓		✓		✓	✓	✓	✓	✓	✓				
Vale (Base Metals)				✓	✓	✓	✓				✓	✓	✓	✓	✓					
New Gold Inc.**	✓		✓	✓	✓	✓		✓			✓	✓	✓						✓	
Eldorado Gold			✓	✓	✓	✓					✓	✓	✓						✓	
Goldcorp**	✓	✓	✓		✓	✓	✓				✓	✓	✓		✓				✓	
Lundin				✓	✓	✓		✓	✓	✓	✓	✓	✓							
Excellon	✓																			
Sherritt						✓	✓	✓	✓		✓				✓ ***					
COMPANIES HEADQUARTERED OUTSIDE OF CANADA WITH CANADIAN OPERATIONS:																				
Glencore		✓		✓	✓	✓	✓				✓	✓	✓		✓	✓				
De Beers Canada Inc.**	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓			✓			✓	✓	
Newmont Mining Corporation		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓		✓	
Rio Tinto		✓		✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓		✓	✓	
ArcelorMittal				✓	✓		✓				✓									

Sources: MAC Member Companies, TSM Progress Report 2018.






FIGURE 31

TSM TAILINGS MANAGEMENT

[Return to text](#)

TAILINGS MANAGEMENT ASSESSMENTS PERCENTAGE OF FACILITIES AT A LEVEL A OR HIGHER 2006, 2016 AND 2017

Level A  Level AA  Level AAA 



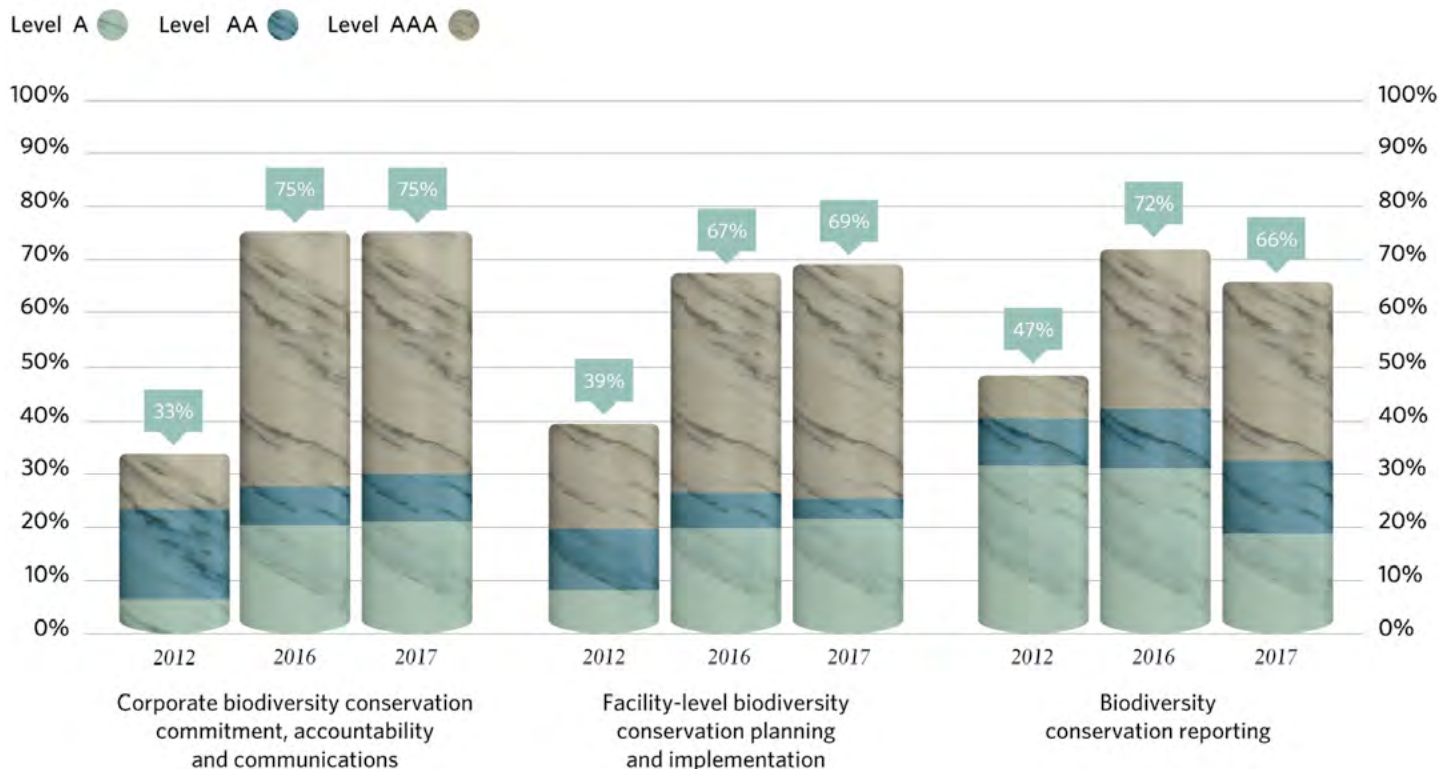
Sources: MAC Member Companies, TSM Progress Report 2018.

FIGURE 32

TSM BIODIVERSITY CONSERVATION MANAGEMENT

[Return to text](#)

BIODIVERSITY CONSERVATION MANAGEMENT ASSESSMENTS PERCENTAGE OF FACILITIES AT A LEVEL A OR HIGHER 2012, 2016 AND 2017



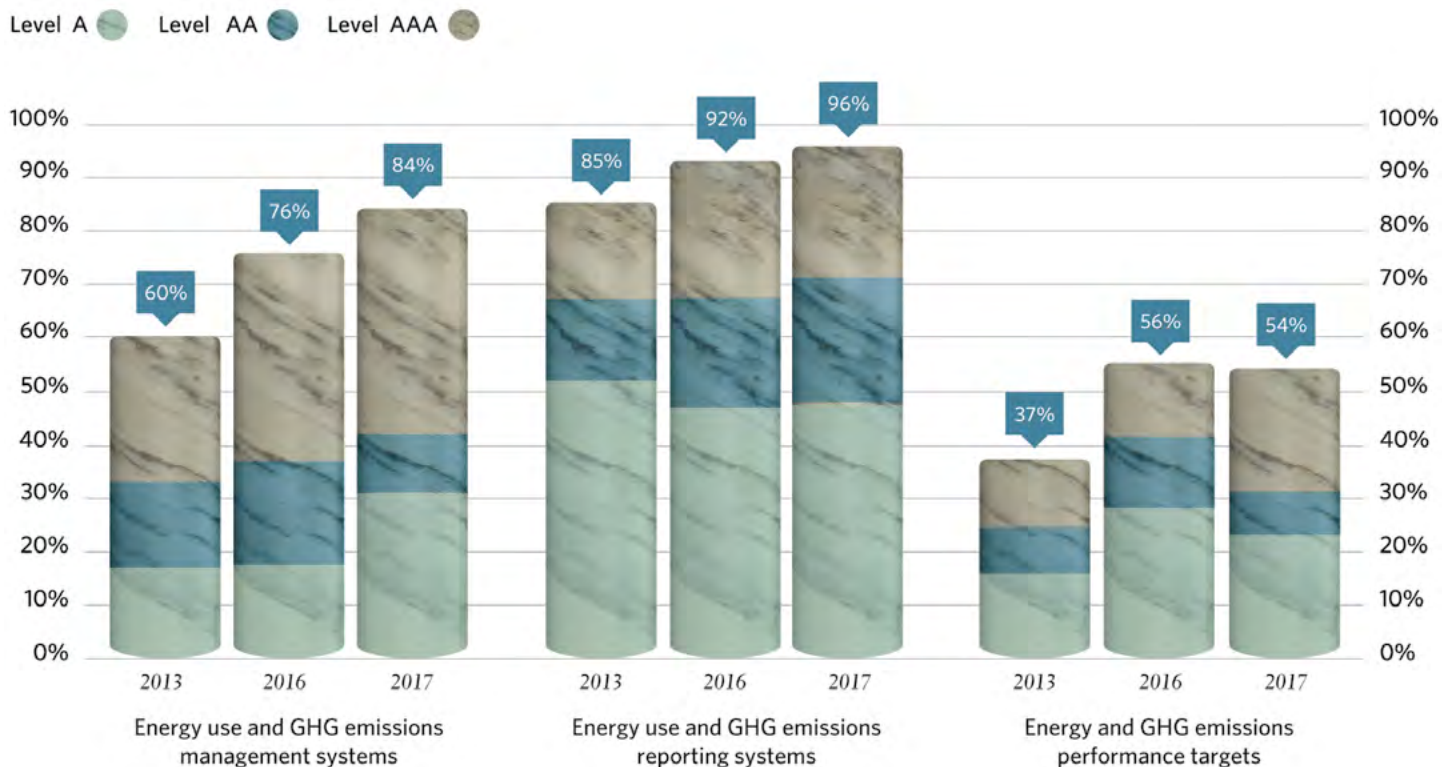
Sources: MAC Member Companies, TSM Progress Report 2018.

FIGURE 33

TSM ENERGY USE AND GHG EMISSIONS MANAGEMENT

[Return to text](#)

ENERGY USE AND GHG EMISSIONS MANAGEMENT ASSESSMENTS PERCENTAGE OF FACILITIES AT A LEVEL A OR HIGHER 2013, 2016 AND 2017



Sources: MAC Member Companies, TSM Progress Report 2018.

FIGURE 34

MINING INDUSTRY ENERGY AND GHG EMISSIONS DATA, 1990 AND 2014 -2016

[Return to text](#)



	1990	2014	2015	2016
Canadian economy				
Canadian energy use (PJ)	9,608	11,787	11,924	11,903
Energy used by broader industry (PJ)	2,400	3,614	3,656	3,502
Canadian GHG emissions (mt)	613	732	741	737
Direct GHG emissions by all industries (mt)	104.1	147.8	149.6	143.2
Metal and non-metal mining				
Total energy use (PJ)	143	150	150	153
Share of Canadian energy use (%)	1.48	1.28	1.26	1.28
Total GHG emissions (Mt CO ₂ e)	5.93	6.1	6.1	6.05
Share of Canadian GHG emissions (%)	0.97	0.83	0.82	0.82

Source: Canadian Industrial Energy End-Use Data Analysis Centre (CIEEDAC) Report, 2017.

Note: Total includes direct and indirect emissions.

MAC has sought to include coal and oil sands mining data into the above calculations to provide a more representative, mining sector-wide statistic; however, CIEEDAC does not have access to oil sands mining or coal mining energy and emissions data to augment the non-metal mining data set.

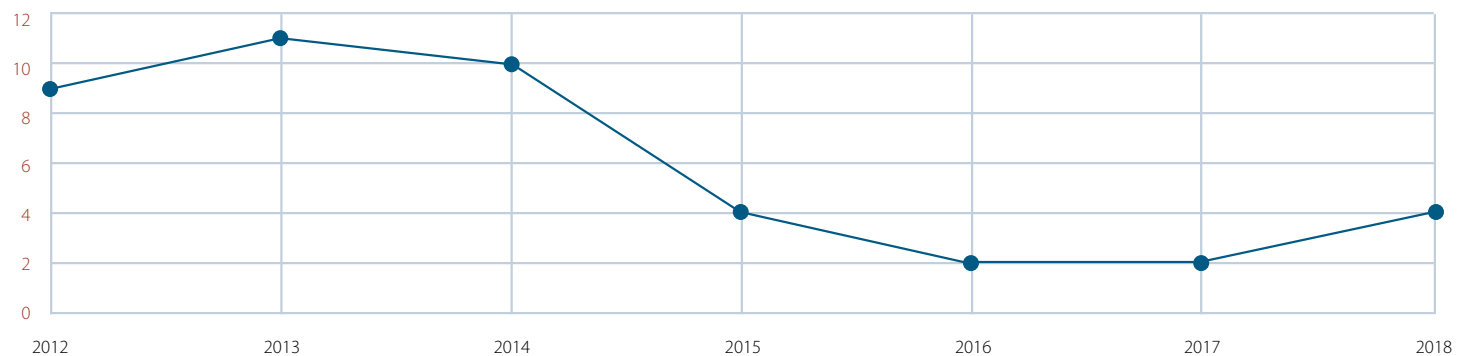
FIGURE 35

ENVIRONMENTAL ASSESSMENTS UNDER CEAA 2012-2018

[Return to text](#)



CEAA REGISTRY



Note: 2012 and 2018 not complete years.

Source: Canadian Environmental Assessment Agency.



THE WORLD: INTERNATIONAL MARKET ACTIVITIES AND DEVELOPMENTS

CANADIAN EXPLORATION AND MINING COMPANIES HAVE A SIGNIFICANT PRESENCE OUTSIDE CANADA'S BORDERS, AND CANADA IS REGARDED AS A GLOBAL LEADER FOR RESPONSIBLE MINING. BEYOND BEST PRACTICES, HOWEVER, WORLD MARKET CONDITIONS SHAPE THE INDUSTRY, AS DO GLOBAL TRADE AND INVESTMENT POLICIES.

CANADIAN MINING'S INTERNATIONAL PRESENCE

Canadian mining companies operate in more than 100 countries around the world. According to Natural Resources Canada, 651 Canadian companies held mining assets abroad (CMAA) valued at \$164 billion in 2016 – the most recent year for which data is available. While down in value 3.1% year-over-year, these assets account for two-thirds of total Canadian mining assets, and represent the second highest year on record as values peaked in 2015 ([see Figure 36](#)). By comparison, this figure is nearly twice that of Canadian mining assets at home, which amounted to \$94.1 billion.

As geographic indicators, Latin America and Africa, respectively, were the top two continental destinations for Canadian international mining assets. The value of Canadian mining assets in Africa specifically experienced a modest decline (5.5%) in 2016. The most notable changes occurred in:

- **Democratic Republic of the Congo (-\$1.3 billion):** Lundin Mining recorded an impairment loss as a result of a definitive agreement to sell its indirectly held interest in the Tenke Fungurume copper-cobalt mine, which was completed in April 2017.
- **Mali (+\$308 million):** B2Gold has a majority interest in the Fekola Gold project, which started production at the end of 2017.
- **South Africa (+\$401.5 million):** Platinum Group Metals was ramping up the Maseve platinum mine.

In Latin America, which accounted for 54% of CMAA, increases in assets held in Panama, Brazil and Peru were offset by declines in Chile and Mexico. This resulted in a consistent overall value for the region compared to the previous year at \$88 billion in 2016. Notable developments occurred in:

- **Brazil (+\$808.1 million):** Wheaton Precious Metals (formerly Silver Wheaton), a precious metals streaming company, increased its interest in Vale's Salobo copper-gold mine again in 2016.
- **Chile (-\$1.6 billion):** Yamana Gold recorded an impairment loss in 2016 at its El Peñón gold-silver mine.
- **Mexico (-\$1.1 billion):** Aurcana sold its La Negra silver mine to a foreign interest. Yamana Gold sold its Mercedes gold mine to Premier Gold Mines, another Canadian company, but the asset was recorded at a lower value. Primero Mining recorded an impairment loss at its San Dimas gold mine.
- **Panama (+\$1.3 billion):** First Quantum Minerals continued to develop its Cobre Panama copper mine, which was reported to be 46% complete at the end of 2016 and is scheduled to commence production in 2018. Capital expenditures for the project are anticipated to total \$7.3 billion.
- **Peru (+\$531.8 million):** Franco-Nevada acquired a precious metals stream from Glencore's Antapaccay copper mine.

There are significant annual investments associated with these assets. In fact, companies listed on the Toronto Stock Exchange (TSX) and the Venture Exchange (TSX-V) raised \$930 million for African mining projects in 2017 and \$4.4 billion in equity capital for Latin American mining projects for the same year. Despite these investments, Canadian mining companies are facing increased competition from other mining jurisdictions operating internationally, including Australia and China.

Canadian Direct Investment Abroad

Canadian Direct Investment Abroad (CDIA), and mining's share of it, is an indicator of the industry's international presence. CDIA was projected at \$1.12 trillion in 2017 ([see Figure 37](#)). Of that, the mining sector accounted for \$82.7 billion, or 7%, of the total. While this total is down 9% year-over-year, it remains a significant contributor, and is subject to modest fluctuations on occasion.

The Value of Company Expenditures in Host Countries

Beyond measuring inflows and outflows of industry capital, the impact of a mine's horizontal value chain on local communities and host countries' national GDP is considerable. This value chain significantly exceeds the taxes and royalties paid to governments, and can help reshape the dialogue around resource nationalism by more clearly identifying mining's vast economic contributions.

It has been estimated that approximately 80% of all money spent in building and operating a mine is spent in the host country through wages, local procurement and payments to various levels of government. This estimate is supported by research conducted by MAC in 2018. Using methodology developed by the World Gold Council, MAC surveyed its members on their 2017 expenditures related to mining activities outside of Canada. The purpose of this study was to better understand the Canadian mining sector's overall contributions to economic development around the world, beyond focusing exclusively on taxes and royalties.

Ten MAC member companies – representing 53 producing mines and non-producing operations, that together employ 73,500 employees and contractors – provided

information on their expenditures related to employee salaries, payments to suppliers, community investment, taxes and royalties, and payments to providers of capital.

The data provided by these 53 operations reveal results similar to those in the World Gold Council's 2014 report, *Responsible gold mining and value distribution*, which showed that the majority of expenditures associated with mining activities are spent in host countries. For MAC's survey, the reported expenditures totalled US\$18.6 billion, with US\$16.5 billion (89%) being spent within the host country, though there is a range from 41% expenditure in Mauritania to 98% expenditure in Chile.

The survey also found that the largest beneficiaries within host countries are companies that supply equipment and services to mining operations, accounting for 60% of the total. The second largest beneficiaries are payments to employees, accounting for 26% of the total, followed by combined payments to governments and communities accounting for 9% of the total. [Figure 38](#) summarizes the consolidated survey data for 24 national jurisdictions and demonstrates that the broader economic contributions mining generates extend far beyond taxes and royalties.

Local Procurement and the Sustainable Development Goals

The positive economic impacts created when Canadian mining companies procure goods and services in their host countries and communities can be game-changers for economic and social development. While civil society and the public at large have tended to focus heavily on the level of tax paid by mining companies, procurement is the single-largest payment type a mining operation will make over its lifespan.

Therefore, recognition of the role that local procurement can play in helping to achieve Sustainable Development Goals (SDGs) is increasing. As discussed in the joint report, [Mapping Mining to the Sustainable Development Goals: An Atlas](#), local procurement can contribute meaningfully to a number of SDGs as shown below.

1 NO POVERTY

Local procurement creates revenue and jobs for the countries that host mining.

8 DECENT WORK AND ECONOMIC GROWTH

Local procurement creates jobs with learning opportunities and more balanced growth in host countries.

9 INDUSTRY, INNOVATION AND INFRASTRUCTURE

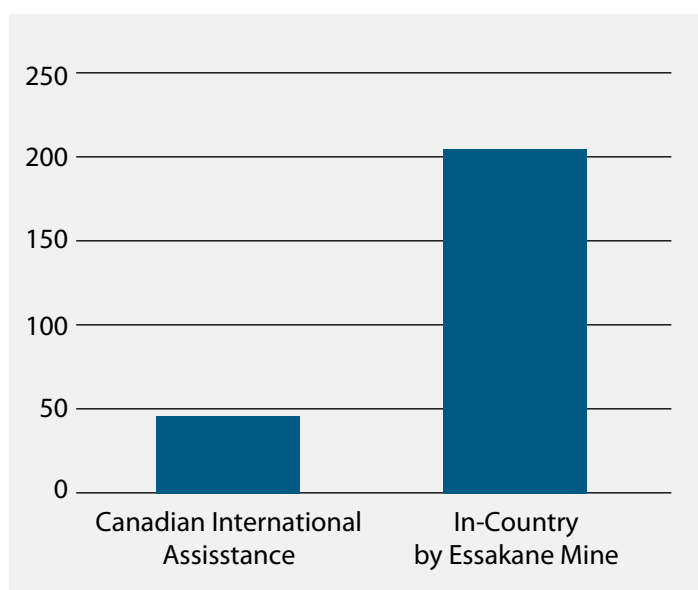
Local procurement increases skills and transfers technology to less developed countries.

10 REDUCED INEQUALITIES

Local procurement helps ensure the benefits of mining are more shared across the economy.

Organizations such as Mining Shared Value – a non-profit initiative of Engineers Without Borders Canada – are promoting awareness of the power of local procurement. For example, a single mine operated by one of MAC's members can spend hundreds of millions of dollars on procurement in a host country. This often represents several times the amount of official development assistance the Canadian government may provide to that country. The example below shows the scale of economic contributions by a single mine – IAMGOLD's Essakane operation in Burkina Faso – compared to Canada's aid contributions to the same country.

2015 SPENDING IN BURKINA FASO (\$ MILLION CAD)



This graph was contributed by Mining Shared Value, a non-profit initiative of Engineers Without Borders Canada that works to improve the development impacts of mineral extraction by promoting local procurement by the global mining industry.

CANADA'S MINERAL TRADE

Despite showing a trade deficit in the third and fourth stages of mining in 2016, the sector as a whole maintained a surplus of \$19.9 billion ([see Figure 39](#)). Approximately a five-fold increase from a decade earlier, this surplus indicates a healthy global demand for Canadian mineral products.

Exports

At \$83.5 billion, exports of mineral products for the first three stages of mining remained robust in 2017 and are on par with pre-recession levels. Stage 4 exports totalled \$14 billion, down 6% year-over-year. Combined, the exports for the four stages reached \$97.5 billion, or 19% of the total value of Canada's exports ([see Figure 39](#)).

The value of Canada's mineral and metal exports increased by approximately 8% between 2008 and 2017 ([see Figure 40](#)).

Over half of Canada's mineral and metal exports by value were destined for the US in 2017, with iron and steel, aluminum, gold, silver, platinum, potash, copper, zinc and nickel holding the largest values ([see Annex 9](#)). The European Union is a leading destination for Canadian gold, iron ore, nickel and diamonds. Other destinations, including China, buy significant volumes of copper, iron ore, coal and potash.

Imports

Total imports for the first three stages of mining increased by 10% year-over-year, coming in at \$45.4 billion. Notable is that Stage 2 imports accounted for approximately \$1 billion of this increase. In recent years, this number has fluctuated, underscoring the competitiveness challenges that Canada's smelters and refineries face on the global stage. Combined, the four stages totalled \$81.6 billion in imports ([see Figure 40](#)). Of Canada's total mineral imports by value in 2017, nearly 50% came from the US, which roughly equalized the balance of trade between the two countries for minerals and metals ([see Annex 10](#)). The reliance on the US market for the import and export of minerals and metals underscores the need to diversify trade.

THE MINING SECTOR IN CANADA IS ONE OF THE FEW SECTORS THAT CONSISTENTLY MAKES A POSITIVE CONTRIBUTION TO CANADA'S BALANCE OF TRADE.

CANADA'S TRADE POLICIES

Free trade, investment and taxation agreements help facilitate the trade of mining products and investment flows. These agreements reduce barriers for investment, enhance transparency and advance cooperation. The reduction and elimination of tariffs increases the competitiveness of Canadian mineral products in foreign jurisdictions by levelling the playing field from a cost standpoint, thus enabling companies to capture greater market share.

Investment agreements, complete with dispute resolution mechanisms, provide mining investors with greater certainty over the investments that companies make in foreign jurisdictions. Labour mobility and regulatory cooperation mechanisms enable companies to secure the key skills they need for project development and operation, and promote dialogue through the complex process of obtaining regulatory approvals.



Logging reverse circulation chips from exploration at Kisladag, Eldorado Gold's gold mine in western Turkey.

However, international agreements do not alone facilitate trade. Trade-enabling transportation infrastructure is essential for companies to get their goods to market. Beyond infrastructure expansion, the efficient operation of Canadian modes of transportation, such as rail, is critical. Further, the efforts of Canada's Trade Commissioner Service, and other outward looking programs, including Export Development Canada, are critical supports for Canadian companies operating abroad.

Part of maintaining Canada's global leadership is ensuring that Canadian mining and supply sectors have access to modern and comprehensive trade and investment vehicles to meet the world where it does business. MAC is pleased to see the Government of Canada pursuing a robust trade agenda, and supports participation in the following engagements.

Investor State Dispute Settlement (ISDS) Mechanisms

ISDS protections are critically important to the Canadian mining industry due to unique factors that define mineral

investments. First, mining companies must go to where commercially developable mineral and metal deposits are located. While Canada is rich in many minerals and metals, a significant number of our members also have operations overseas, with particularly high concentrations in some countries. For example, nearly 70 per cent of foreign-owned mining companies operating in Mexico are based in Canada. On the macro level, Canadian mining companies possess \$163 billion in assets in more than 100 countries around the world.

These operations are more vulnerable than those of other sectors due to the tremendous up-front capital costs involved with mineral development. It is common for an average mine's initial capital expenditure to exceed \$1 billion before any minerals are produced or processed. After production begins, mines typically operate for several years to recover capital before any profit is realized. In the event of an interruption of mineral production beyond the miner's control, that investment is as immobile as it is grounded in the host country.

ISDS mechanisms provide a strong enforcement tool that helps to ensure that Canadian investors, businesses and their workers will be treated fairly overseas and can continue to bring the international dollars home. While a last resort for companies, this mechanism is an essential part of modernized Canadian trade and investment agreements, including Canada's own FIPA model. It is critical that it remains so in agreements going forward.

Canada, US, Mexico Free Trade Agreement

On November 30th, 2018, Canada, the US and Mexico signed the Canada, United States and Mexico Free Trade Agreement (CUSMA).

CUSMA is based on the North American Free Trade Agreement which originally came into effect on January 1st, 1994. The present agreement was the result of more than a year of negotiations including threats of tariffs by the US against Canada.

MAC appreciates the negotiations were protracted and welcomes the reduction in business uncertainty that the signing of the agreement brings. MAC was disappointed, however, that the United States-Mexico-Canada Agreement (USMCA) did not include an ISDS mechanism. ISDS protections are critically important to the Canadian mining industry due to the unique factors that define mineral investments, and MAC supports their continued inclusion in trade agreements ongoing, as well as Canada's continued pursuit of FIPA with key partners.

While Canadian investors in the US will no longer have recourse to ISDS mechanisms, the signing and subsequent coming into force of the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (discussed below) will have ISDS provisions that Canadian investors will have recourse to for investments in Mexico.

Comprehensive and Progressive Agreement for Trans-Pacific Partnership

MAC supports the government's ratification of the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP), a new free trade agreement between Australia, Brunei, Canada, Chile, Japan, Malaysia, Mexico, New Zealand, Peru, Singapore and Vietnam. Once the CPTPP enters into force it will be one of the largest free trade agreements in the world and will provide enhanced market access to key Asian markets.

From 2014 to 2016, Canada's exports of metals and minerals to CPTPP countries were worth, on average, \$6.8 billion per year. Metals and minerals exports currently face tariffs in a number of CPTPP markets, including Australia (up to 5%), Japan (up to 11.7%), Malaysia (up to 50%), New Zealand (up to 10%) and Vietnam (up to 40%). These tariffs will be fully eliminated under the CPTPP.

In January 2017, the US withdrew from the TPP. Historically, Canada has had close trade ties with the US, so the value of the TPP for Canadian mining companies was focused on the expansion of trade relationships with a broader consortium of countries whose economies are growing rapidly, and whose future anticipated growth is strong. Even without the participation of the US, the CPTPP has strategic value for Canadian mining companies by expanding their access to growing markets.

Trade Relations with China

China is the single largest consumer of raw materials. Recent estimates suggest that China accounts for 54% of aluminum, 48% of copper, 50% of nickel, and 45% of all steel (and, therefore, a significant percentage of steelmaking coal) consumed globally. China is also a major consumer of precious metals, buying or mining 23% and 15% of the world's gold and silver supply, respectively. The country also consumes 13% of the world's uranium production, a number poised to increase given the number of nuclear reactors under construction or being commissioned.

China is Canada's third-largest market for the export of minerals and metals after the US and the European Union, with an export value exceeding \$4.6 billion in 2017, or approximately 5% of our overall total.



Two El Limon Mine employees at the portal to B2Gold's Santa Pancha underground mine.

With 18 countries having free trade agreements in place with China, and 22 more countries in various stages of negotiation and pre-negotiation discussions, many nations have acknowledged that their economic futures are inexorably tied to it. Given this reality and China's importance to Canada's future, MAC has encouraged the federal government to continue enhancing economic and diplomatic relations with the aim of launching free trade negotiations.

A free-trade agreement (FTA) with China is a significant opportunity for Canada to capture greater Chinese market share for raw materials. Further, Canada possesses a North American advantage in that the Ports of Metro Vancouver and Prince Rupert are, on average, three days closer to multiple Asian ports, including Chinese ports, than our American and Mexican competitors.

Mercosur

Mercosur is a South American sub-regional common market trade bloc whose current full members are Argentina, Brazil, Paraguay and Uruguay. On March 9th, 2018 in Asuncion, Paraguay, negotiations toward a comprehensive Canada-Mercosur FTA were launched.

MAC has supported the government's efforts to reassess the viability of a FTA with Mercosur, and participated in consultations on the matter. Combined, the assets of Canadian companies operating in Brazil and Argentina account for 5% and 8%, respectively, of the value of Canadian mining assets abroad.

Beyond investments and assets, MAC and its members are exporting best practices in mining sustainability to Mercosur countries.

The most significant recent example of this is in Argentina, where the Cámara Argentina de Empresarios Mineros (CAEM) adopted MAC's *Towards Sustainable Mining*® (TSM®) initiative. Argentina's adoption of TSM is an important step forward in cooperation on responsible mining standards between Canada and a major mining jurisdiction in Latin America.

Pacific Alliance

The Pacific Alliance is a regional initiative created in 2011 by Chile, Colombia, Mexico and Peru that seeks the free movement of goods, services, capital and people. Each of the above countries are significant destinations for Canadian mineral investment, and closer trade ties with this alliance is something that MAC supports.

With a combined GDP of \$2.5 trillion, and 223 million inhabitants, the Pacific Alliance constitutes an important market for Canada. The Alliance's overarching goals are to foster the free movement of goods, services, capital and people and to promote greater competitiveness and economic growth for member countries.

In June 2017, Canada was among the first countries invited to become an Associated State of the Pacific Alliance, along with Australia, New Zealand and Singapore.

THE CANADIAN INVESTMENT REGIME

Foreign investment gives Canadian businesses easier access to new technologies and ideas, and enhances connectivity to larger markets and production chains. Ensuring that two-way flows of capital remain fair and open is essential. Negotiating safeguards for industry investment abroad, while enabling foreign investment into Canada, are key.

Foreign Investment Promotion and Protection Agreements (FIPA)

A FIPA is a bilateral agreement aimed at protecting and promoting foreign investment through legally binding rights and obligations. At the time of writing, Canada had 37 FIPAs in force, had signed two others yet to come into force, concluded negotiations with six additional countries,

and remains engaged in ongoing negotiations with 14 other countries.

While the enforcement components of FIPAs are rarely used, such as ISDS discussed above, the mere existence of a FIPA provides foreign governments with a set of rules and expectations for fairness and transparency, and gives investors additional confidence. At the time of writing, the department of Global Affairs Canada is reviewing their FIPA program, a component of which includes consulting with stakeholders. MAC will remain engaged in this process, and underscores the importance of the continued inclusion of robust ISDS mechanisms in these agreements going forward.

Investment in Latin America

Eight of Canada's 37 active FIPAs are with Latin American countries, reflecting the industry's presence in the region, as well as the continent's mineral wealth and potential. As of 2017, Canadian companies held \$88 billion in assets in Latin America, nearly half of the total value of Canada's overseas mineral assets.

Investment in Africa

Since 2010, the Canadian government has concluded, signed or brought 12 FIPA negotiations into force with African countries. A further three FIPA negotiations are currently ongoing with African countries. In recent years, many African countries have been seeking to benefit from their natural resource endowments, and have become more open to new mining investments and the expansion of existing mining projects. Some of the major resources mined in Africa include iron ore, diamonds, gold, platinum, uranium, copper and coal.

While significant opportunities for strong partnerships exist between mining companies and their host countries, challenges must be overcome to ensure projects can develop in ways that enable the host community, country and company to benefit.

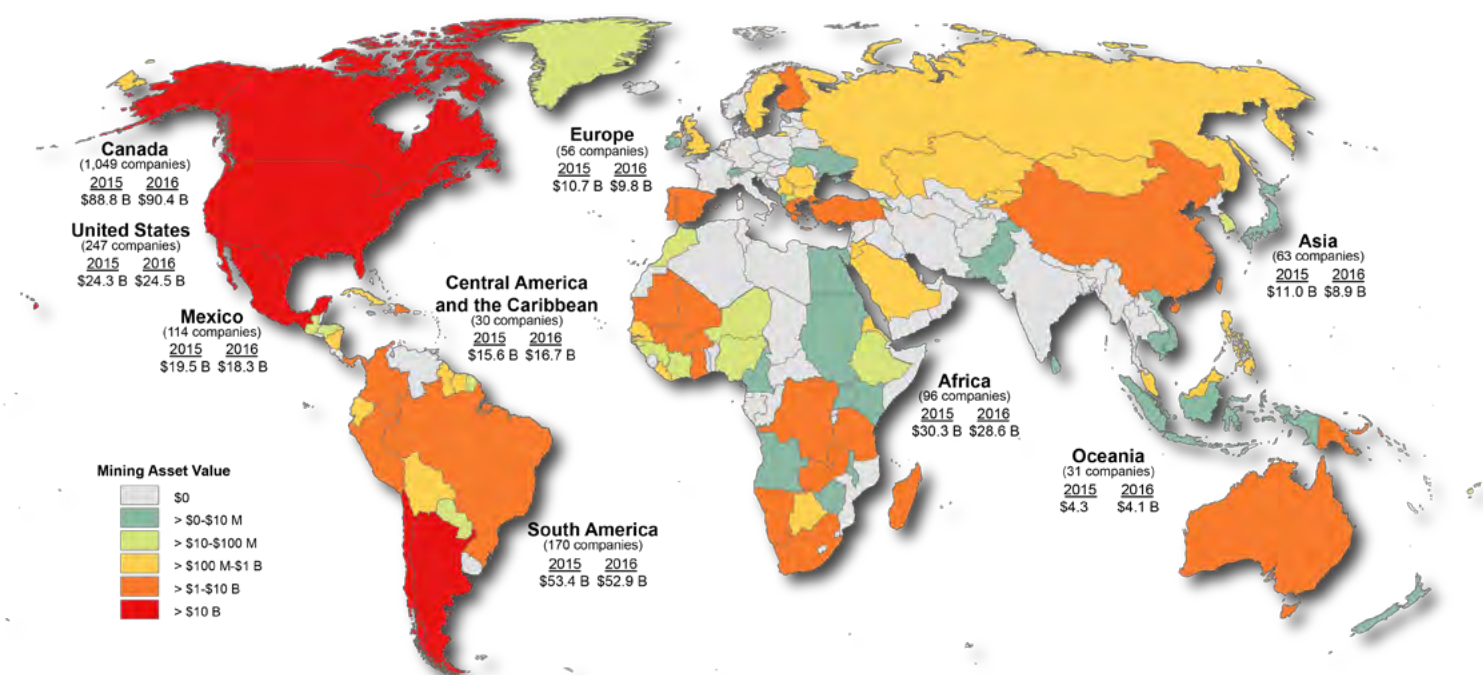
Foreign Direct Investment in Canada

Canada relies heavily on foreign direct investment (FDI), and the mining industry and downstream value-added manufacturing activities accounted for approximately \$46 billion, or 6%, of FDI in 2017. When isolated from this total, 2017 mining FDI into Canada totalled \$28 billion, approximately 3.5% of Canada's overall total ([see Figure 37](#)). ■

FIGURE 36

THE GEOGRAPHICAL DISTRIBUTION OF CANADA'S MINING ASSETS, 2016

[Return to text](#)



Source: Minerals and Metals Sector, Natural Resources Canada.

FIGURE 37

CANADIAN MINERAL INDUSTRY DIRECT INVESTMENT ABROAD AND FOREIGN DIRECT INVESTMENT STOCKS, 1999-2017^P

[Return to text](#)



(\$ millions)

Year	Total, all industries		Mining (except oil and gas)		Non-metallic mineral product manufacturing		Primary metal manufacturing		Fabricated metal product manufacturing	
	Canadian direct investment abroad	Foreign direct investment in Canada	Canadian direct investment abroad	Foreign direct investment in Canada	Canadian direct investment abroad	Foreign direct investment in Canada	Canadian direct investment abroad	Foreign direct investment in Canada	Canadian direct investment abroad	Foreign direct investment in Canada
1999	290,730	252,563	23,878	5,520	3,048	4,867	9,859	3,732	4,570	2,162
2000	356,506	319,116	23,666	5,535	2,621	5,009	11,662	4,593	4,881	2,214
2001	399,253	340,429	23,666	7,122	3,257	5,425	14,393	4,266	6,091	2,468
2002	435,494	356,819	22,779	6,069	3,028	5,682	13,281	4,064	5,582	2,442
2003	412,217	373,685	22,374	5,666	2,632	6,276	x	4,428	5,464	2,681
2004	448,546	379,450	22,481	8,611	2,105	6,108	x	5,200	4,624	2,748
2005	452,195	397,828	23,025	10,291	2,237	3,659	x	4,484	4,707	2,198
2006	518,839	437,171	23,849	22,375	6,439	6,243	26,255	9,563	4,458	2,941
2007	515,294	512,266	25,045	23,502	5,590	6,525	26,438	29,126	3,251	3,125
2008	641,920	550,539	27,189	9,544	6,787	7,768	30,828	41,879	3,775	2,920
2009	630,818	573,901	38,801	12,219	6,212	8,158	24,132	37,899	3,420	2,473
2010	637,285	592,406	46,706	16,140	5,953	7,276	4,227	34,201	2,293	2,157
2011	675,020	603,455	54,541	14,701	6,384	8,067	5,636	33,784	2,262	2,968
2012	704,335	633,778	63,782	18,622	5,305	7,881	3,172	32,542	2,010	3,153
2013	778,371	688,873	77,108	21,898	5,835	7,092	4,715	27,954	2,270	3,270
2014	845,203	744,671	78,744	36,871	1,155	7,718	7,299	28,986	3,925	3,504
2015	1,043,822	782,912	82,379	21,064	2,867	8,421	4,442	14,923	3,385	2,384
2016	1,083,730	808,738	86,048	24,357	1,669	7,924	5,966	8,803	4,813	1,894
2017	1,121,102	824,035	82,689	28,242	1,612	8,209	3,080	9,761	4,418	1,915

Source: Statistics Canada, CANSIM Table 376-0052.

^P Preliminary.



FIGURE 38

MINING COMPANY INVESTMENT IN HOST COUNTRIES - 2017

[Return to text](#)


Country	Total in-country expenditures (US\$m)	Total Expenditure (US\$m) ¹	As a % of total expenditures	Payments to governments (US\$m) ²	Payments to Suppliers (US\$m)
Argentina	\$726,122,821.56	\$830,837,490.19	87%	\$5,260,000.00	\$415,068,943.13
Australia	\$141,513,000.00	\$141,513,000.00	100%	\$10,928,000.00	\$86,542,000.00
Bolivia	\$58,019,394.94	\$58,019,394.94	100%	\$21,530,000.00	\$17,069,864.70
Brazil	\$556,220,000.00	\$664,520,000.00	84%	\$5,320,000.00	\$474,500,000.00
Burkina Faso	\$290,702,560.48	\$440,362,560.48	66%	\$56,260,000.00	\$192,214,625.19
Canada	\$3,889,418,621.53	\$4,085,701,002.90	95%	\$334,944,284.00	\$2,427,537,282.77
Chile	\$336,741,001.00	\$344,771,001.00	98%	\$20,356,666.00	\$249,924,335.00
Dominican Republic	\$392,099,378.77	\$608,598,757.55	64%	\$53,650,000.00	\$181,860,000.00
Finland	\$239,068,983.23	\$253,158,116.00	94%	\$16,610,000.00	\$190,101,197.23
Ghana	\$238,580,000.00	\$304,780,000.00	78%	\$30,080,000.00	\$154,500,000.00
Greece	\$220,747,274.02	\$245,725,451.22	90%	\$330,000.00	\$177,287,390.29
Guatemala	\$59,955,033.29	\$65,398,908.00	92%	\$12,881,503.00	\$29,268,171.55
Mauritania	\$271,000,000.00	\$660,150,000.00	41%	\$13,200,000.00	\$215,600,000.00
Mexico	\$2,742,143,948.72	\$2,935,836,911.09	93%	\$16,030,000.00	\$1,435,183,092.03
Papua New Guinea	\$256,203,000.00	\$376,701,000.00	68%	\$3,180,000.00	\$74,532,250.00
Peru	\$621,024,556.67	\$636,686,740.67	98%	\$29,740,000.00	\$456,328,872.66
Romania	\$21,507,800.57	\$24,899,305.71	86%	\$230,000.00	\$19,085,025.78
Russia	\$461,520,000.00	\$526,820,000.00	88%	\$163,620,000.00	\$208,200,000.00
Saudi Arabia	\$127,035,000.00	\$143,570,000.00	88%	\$-	\$63,515,000.00
Suriname	\$281,936,421.00	\$407,655,362.10	69%	\$100,290,000.00	\$145,000,000.00
Turkey	\$258,362,000.00	\$292,392,000.00	88%	\$38,850,000.00	\$185,950,000.00
USA	\$3,627,901,714.00	\$3,703,106,714.00	98%	\$520,591,000.00	\$2,211,464,500.00
Zambia	\$745,720,000.00	\$851,780,000.00	88%	\$62,740,000.00	\$559,210,000.00
Total	\$16,563,542,509.79	\$18,602,983,715.85	112%	\$1,516,621,453.00	\$10,169,942,550.33

Source: Mining Association of Canada.

Note:

¹ Includes in-jurisdiction payments to providers of capital.

² Includes royalties and land use, income and other taxes, employee taxes, other payments.

³ Contractor salaries are included as payments to suppliers.

* Information not available.

FIGURE 38 CONTINUED

MINING COMPANY INVESTMENT IN HOST COUNTRIES - 2017

[Return to text](#)

Country	Payments to employees	Communities (US\$m)	Payments to providers of capital	Total mineral revenue	Number of employees and contractors ³
Argentina	\$244,119,811.44	\$3,161,352.00	0	\$22,178,000,000.00	6,429
Australia	\$43,955,000.00	\$88,000.00	0	\$170,500,000.00	329
Bolivia	\$19,419,530.24	\$-	0	\$85,887,382.53	596
Brazil	\$75,000,000.00	\$1,400,000.00	0	\$447,000,000.00	3,709
Burkina Faso	\$42,000,000.00	\$227,935.29	0	\$547,300,000.00	3,234
Canada	\$1,115,081,758.76	\$11,855,296.00	\$5,960.80	\$4,375,887,837.00	13,673
Chile	\$64,700,000.00	\$1,760,000.00	0	\$52,000,000.00	2,787
Dominican Republic	\$58,974,000.00	\$1,614,000.00	0	\$1,419,353,915.00	4,793
Finland	\$31,777,000.00	\$580,786.00	0	\$249,300,000.00	957
Ghana	\$53,100,000.00	\$900,000.00	0	\$317,600,000.00	1,899
Greece	\$41,252,508.76	\$1,877,374.97	0	\$53,481,725.04	492
Guatemala	\$13,666,259.74	\$4,139,099.00	0	\$87,011,504.00	559
Mauritania	\$40,400,000.00	\$1,800,000.00	0	\$298,400,000.00	4,917
Mexico	\$1,075,032,571.69	\$4,812,100.00	0	\$2,414,181,486.50	2,950
Papua New Guinea	\$178,068,000.00	\$422,750.00	0	\$-	2,862
Peru	\$80,296,484.01	\$8,909,200.00	0	\$1,019,715,024.89	2,849
Romania	\$2,036,780.73	\$155,994.06	0	\$-	318
Russia	\$88,900,000.00	\$800,000.00	0	\$726,900,000.00	2,620
Saudi Arabia	\$63,515,000.00	\$5,000.00	0	\$371,000,000.00	216
Suriname	\$35,846,421.00	\$800,000.00	0	\$385,610,000.00	1,709
Turkey	\$32,690,000.00	\$872,000.00	0	\$337,900,000.00	1,609
USA	\$894,420,514.00	\$1,425,700.00	0	\$1,676,800,000.00	9,858
Zambia	\$120,950,000.00	\$2,820,000.00	0	\$-	4,211
Total	\$4,415,201,640.37	\$50,426,587.32	\$5,960.80	\$37,213,828,874.96	73,576

Source: Mining Association of Canada.

Note:

¹ Includes in-jurisdiction payments to providers of capital.

² Includes royalties and land use, income and other taxes, employee taxes, other payments.

³ Contractor salaries are included as payments to suppliers.

* Information not available.



FIGURE 39

BALANCE OF CANADA'S MINERAL TRADE, 2017

[Return to text](#)


Stage	Domestic Exports (\$ thousands)	Total Exports (\$ thousands)	Total Imports (\$ thousands)	Balance of Trade (\$ thousands)
Stage I	29,916,881	29,964,026	9,271,015	20,693,011
Stage II	36,669,840	37,118,129	13,794,946	23,323,183
Stage III	16,877,042	17,977,087	22,315,507	-4,338,420
Stage IV	14,002,728	16,449,482	36,237,396	-19,787,914
Total	97,466,491	101,508,724	81,618,864	19,889,860

Sources: Natural Resources Canada; Statistics Canada.

Note: Total exports represents the sum of domestic exports and re-exports. Re-exports are the goods of foreign origin that have not been materially transformed in Canada. This includes foreign goods withdrawn for export from bonded customs warehouses. Totals may not add due to rounding. As of 2014, Natural Resources Canada no longer includes nitrogen within the minerals and metals trade statistics. Historical data have been revised to reflect this change.

FIGURE 40

VALUE OF CANADA'S MINING AND MINERAL PROCESSING INDUSTRY TRADE, 2003-2017

[Return to text](#)


Year	Domestic Exports (\$ thousands)	Total Exports (\$ thousands)	Imports (\$ thousands)	Balance of Trade (\$ thousands)
2003	45.6	47.0	45.0	2.1
2004	53.7	55.5	51.9	3.6
2005	61.0	63.2	56.3	6.8
2006	71.4	74.2	61.6	12.5
2007	80.1	83.6	62.2	21.4
2008	90.2	93.0	68.7	24.3
2009	62.7	65.0	54.7	10.3
2010	80.2	83.2	66.1	17.1
2011	95.9	100.3	76.7	23.6
2012	88.1	91.1	75.5	15.6
2013	86.9	90.0	73.4	16.6
2014	89.6	93.2	79.9	13.4
2015	92.0	96.2	80.9	15.3
2016	88.7	92.9	77.0	15.9
2017	97.5	101.5	81.6	19.9

Sources: Natural Resources Canada; Statistics Canada.

Note: Total exports represents the sum of domestic exports and re-exports. Re-exports are the goods of foreign origin that have not been materially transformed in Canada. This includes foreign goods withdrawn for export from bonded customs warehouses. Totals may not add due to rounding. As of 2014, Natural Resources Canada no longer includes nitrogen within the minerals and metals trade statistics. Historical data have been revised to reflect this change.

[Return to text](#)


COMPANY	MINE SITE	ACTIVITY TYPE	LOCATION	COMMODITY
Newfoundland and Labrador				
Rambler Metals and Mining PLC	Nugget Pond	(C.)	Snook's Arm	Cu, Au
Rambler Metals and Mining PLC	Ming	(U.)	Baie Verte	Cu, Au, Ag, Zn
Anaconda Mining Inc.	Point Rousse	(P, C.)	Baie Verte	Au
Vale Newfoundland and Labrador Limited	Voisey's Bay	(P, C.)	Voisey's Bay	Ni, Cu, Co
Iron Ore Company of Canada (IOC)	Carol Lake	(P, C.)	Labrador City	Fe
Atlantic Minerals Limited	Lower Cove	(P)	Lower Cove	Limestone, dolomite
Tata Steel Minerals Canada	DSO	(P)	Schefferville	Fe
Nova Scotia				
Nova Scotia Power Inc.	Glen Morrison	(P)	Cape Breton	Limestone
Antigonish Limestone Ltd.	Southside Antigonish Harbour	(P)	Southside Antigonish Harbour	Limestone
Mosher Limestone Company Limited	Upper Musquodoboit	(P)	Upper Musquodoboit	Limestone, gypsum
Lafarge Canada Inc.	Brookfield	(P, Plant)	Brookfield	Limestone
National Gypsum (Canada) Ltd.	East Milford	(P)	Milford	Gypsum
The Canadian Salt Company Limited	Pugwash	(U.)	Pugwash	Salt
Compass Minerals Canada Corporation	Amherst (Nappan)	(Solution mining)	Nappan	Salt
Pioneer Coal Ltd.	Stellarton	(P)	Stellarton	Coal (thermal)
Maritime Dufferin Gold Corp.	Dufferin	(P, C.)	Port Dufferin	Au
Atlantic Gold Corp.	Moose River Consolidated	(P, C.)	Upper Musquodoboit	Gold
Kameron Collieries ULC	Donkin	(U.)	Cape Breton	Coal (metallurgical, thermal)
New Brunswick				
Le Groupe Berger Ltée	Baie-Sainte-Anne	(P)	Baie-Sainte-Anne	Vermiculite, perlite
Graymont Inc.	Havelock	(P, Plant)	Havelock	Lime, limestone
Brookville Manufacturing Company	Brookville	(P, Plant)	Saint John	Dolomitic lime
Elmtree Resources Ltd.	Sormany	(P, Plant)	Sormany	Limestone
Trevali Mining Corp.	Caribou	(P, U, C.)	Bathurst	Zn, Pb, Ag, Cu, Au
Quebec				
Rio Tinto Fer et Titane inc.	Tio	(P)	Havre-Saint-Pierre	Ilmenite
ArcelorMittal Mines Canada Inc.	Mont-Wright	(P, C.)	Fermont	Fe
ArcelorMittal Mines Canada Inc.	Fire Lake	(P)	Fermont	Fe
Magris Resources Inc.	Niobec	(U, C.)	Saint-Honoré-de-Chicoutimi	Nb
Glencore Canada Corporation	Raglan	(U, C.)	Katinniq	Ni, Cu, Co, PGM
Canadian Royalties Inc.	Nunavik	(P, U, C.)	Kangisujuaq	Ni, Cu, Co, PGM
Goldcorp Inc.	Éléonore	(U, C.)	Opinaca Reservoir	Au
Metanor Resources Inc.	Bachelor Lake	(U, C.)	Desmaraisville	Au, Ag
Nystar NV	Langlois	(U, C.)	Lebel-sur-Quévillon	Zn, Cu, Au, Ag
Monarques Gold Corp.	Beaufor	(U)	Val-d'Or	Au, Ag
Glencore Canada Corporation	Bracemac-McLeod	(U, C.)	Matagami	Zn, Cu, Au, Ag
Agnico Eagle Mines Limited	Goldex	(U, C.)	Val-d'Or	Au, Ag
Monarques Gold Corp.	Camflo	(C.)	Malartic	Au, Ag
Agnico Eagle Mines Limited and Yamana Gold Inc.	Canadian Malartic	(P, C.)	Malartic	Au, Ag
Agnico Eagle Mines Limited	Lapa	(U)	Rivière-Héva	Au

COMPANY	MINE SITE	ACTIVITY TYPE	LOCATION	COMMODITY
Agnico Eagle Mines Limited	LaRonde	(U, C.)	Preissac	Au, Zn, Cu, Pb, Ag
IAMGOLD Corporation	Westwood-Doyon	(U, C.)	Cadillac	Au, Cu, Ag, Zn
Hecla Mining Company	Casa Berardi	(U, C.)	North of La Sarre, Casa Berardi Twp.	Au, Ag
K+S Windsor Salt Ltd	Seleine	(U.)	Îles-de-la-Madeleine	Salt
Le Groupe Berger Ltée	Saint-Modeste	(P)	Saint-Modeste	Vermiculite, perlite
Graymont Inc.	Marbleton	(P, Plant)	Marbleton	Limestone, lime
Graymont Inc.	Bedford	(P, Plant)	Bedford	Limestone, lime
OMYA (Canada) Inc.	Saint-Armand	(P, Plant)	Saint-Armand	Calcium carbonate
CRH plc	Joliette	(P, Plant)	Joliette	Limestone
Graymont Inc.	Joliette	(P, Plant)	Joliette	Lime, limestone
Imerys Mica Suzorite, Inc.	Lac Letondal	(P)	Parent, Suzor Twp.	Mica
Imerys Graphite and Carbon	Lac-des-Îles	(P, Plant)	Saint-Aimé-du-Lac-des-Îles	Graphite
Abcourt Mines Inc.	Sleeping Giant	(C.)	North of Amos	Au, Ag
Abcourt Mines Inc.	Elder	(U.)	Rouyn-Noranda	Au, Ag
Ciment Québec inc.	Quebec	(P, Plant)	Québec City	Limestone
Ciment Québec inc.	Saint-Basile	(P, Plant)	Saint-Basile	Limestone
Graymont Inc.	Les Carrières Calco	(P, Plant)	St-Marc-des-Carrières	Calcium carbonate
Stornoway Diamond Corporation	Renard	(P, U, C.)	Mistissini	Diamonds
Carrière d'Acton Vale Itée	Acton Vale	(P, Plant)	Acton Vale	Calcium carbonate
Lafarge Canada Inc.	St-Constant	(P, Plant)	St-Constant	Limestone
Demix Agrégats	Laval	(P, Plant)	Laval	Limestone
Ciment Québec inc.	Laval	(P, Plant)	Laval	Limestone
Colacem Canada inc.	Kilmar	(P, Plant)	Calumet	Limestone
Ressources Nottaway Inc.	Veza	(U.)	North of Amos	Au, Ag
Ontario				
Detour Gold Corporation	Detour Lake	(P, C.)	Matagami	Au
Kirkland Lake Gold Ltd.	Holt	(U, C.)	Timmins	Au
Kirkland Lake Gold Inc.	Macassa	(U, C.)	Kirkland Lake area	Au, Ag
McEwen Mining Inc.	Black Fox	(P, U, C.)	Matheson	Au
Kirkland Lake Gold Inc.	Taylor	(U.)	Cochrane	Au
Alamos Gold Inc.	Young-Davidson	(U, C.)	Kirkland Lake area	Au
Glencore Canada Corporation	Nickel Rim South	(U.)	Sudbury	Ni, Cu, Co, PGM, Au
Vale Canada Limited	Garson	(U.)	Sudbury	Ni, Cu, Co, PGM, Au, Ag, Se, Te
Vale Canada Limited	Stobie	(U.)	Sudbury	Ni, Cu, Co, PGM, Au, Ag, Se, Te
Vale Canada Limited	Clarabelle	(C.)	Sudbury	Ni, Cu, Co, PGM, Au, Ag, Se, Te
Vale Canada Limited	Copper Cliff North	(U.)	Sudbury	Ni, Cu, Co, PGM, Au, Ag, Se, Te
Goldcorp Inc.	Hoyle Pond	(U.)	South of Porcupine	Au
Tahoe Resources Inc.	Bell Creek	(U, C.)	Timmins	Au
Vale Canada Limited	Creighton	(U.)	Sudbury	Ni, Cu, Co, PGM, Au, Ag, Se, Te
Goldcorp Inc.	Dome	(U, C.)	Timmins	Au
Goldcorp Inc.	Hollinger	(P)	Timmins	Au
Vale Canada Limited	Coleman/McCreedy East	(U.)	Sudbury	Ni, Cu, Co, PGM, Au, Ag, Se, Te
Glencore Canada Corporation	Fraser	(U.)	Sudbury	Ni, Cu, Co, PGM
Glencore Canada Corporation	Strathcona	(C.)	Sudbury	Ni, Cu, Co, PGM, Au, Ag, Se, Te
Glencore Canada Corporation	Kidd Creek	(U, C.)	Timmins	Cu, Zn, Ag, Se, Te, In, Cd
KGHM Polska Miedz S.A.	Levack/Morrison	(U.)	Sudbury	Cu, Ni

COMPANY	MINE SITE	ACTIVITY TYPE	LOCATION	COMMODITY
Vale Canada Limited	Totten	(U.)	Worthington	Ni, Cu, Co, PGM, Au
Tahoe Resources Inc.	Timmins West	(U.)	Timmins	Au
Alamos Gold Inc.	Island Gold	(U., C.)	Dubreuilville	Au
Wesdome Gold Mines Ltd.	Mishi	(P., C.)	Timmins	Au
Wesdome Gold Mines Ltd.	Eagle River	(U., C.)	Wawa	Au
Barrick Gold Corporation	Hemlo (Williams)	(P., U., C.)	Marathon	Au
North American Palladium Ltd.	Lac des Iles	(P., U., C.)	Thunder Bay	PGM, Ni, Au, Cu, Co
Goldcorp Inc.	Musselwhite	(U., C.)	Thunder Bay	Au, Ag
Goldcorp Inc.	Red Lake	(U., C.)	Balmertown	Au, Ag
Canadian Wollastonite	St. Lawrence	(P.)	Kingston	Wollastonite
OMYA (Canada) Inc.	Tatlock	(P.)	Tatlock	Calcium carbonate
Lafarge Canada Inc.	Bath	(P.)	Bath	Limestone
ESSROC Canada Inc.	Picton	(P.)	Picton	Limestone
CRH plc	Ogden Point	(P.)	Ogden Point	Limestone
Unimin Canada Ltd.	Blue Mountain	(P., Plant)	Blue Mountain	Nepheline syenite
St. Marys CBM (Canada) Inc.	Bowmanville	(P.)	Bowmanville	Limestone
CGC Inc.	Hagersville	(U., Plant)	Hagersville	Gypsum
E.C. King Contracting Ltd. (Miller Paving Co.)	Owen Sound	(P.)	Owen Sound	Dolomitic lime
MarFred Minerals Ltd.	Tracey Lake	(U.)	North Williams	Barite
St Marys CBM (Canada) Inc.	St Marys	(P.)	St. Marys	Limestone
Compass Minerals Canada Corporation	Goderich	(U., Plant)	Goderich	Salt
IMERYS Talc	Penhorwood	(P.)	Penhorwood	Talc
K+S Windsor Salt Ltd.	Windsor	(solution mining)	Windsor	Salt
K+S Windsor Salt Ltd.	Ojibway	(U.)	Windsor	Salt
De Beers Canada Inc.	Victor	(P., Plant)	James Bay Lowlands	Diamonds
Miller Minerals (Miller Paving Co.)	Bucke	(P.)	New Liskeard	Limestone
Carmeuse Lime (Canada) Limited	Dundas	(P.)	Dundas	Dolomitic lime
Lafarge Canada Inc.	Dundas	(P.)	Dundas	Limestone
Carmeuse Lime (Canada) Limited	Beachville	(P., Plant)	Ingersoll	Limestone, lime
Compass Minerals Canada Corporation	Goderich	(solution mining)	Goderich	Salt
Boreal Agrominerals Inc.	Spanish River Carbonite	(P.)	Northwest of Sudbury	Vermiculite
Lafarge Canada Inc.	Meldrum Bay	(P., Plant)	Manitoulin Island	Limestone, dolomite
New Gold Inc.	Rainy River	(P., U., C.)	Fort Frances	Au, Ag, Ni, Cu, Co
Manitoba				
Tantalum Mining Corporation of Canada Limited	Tanco	(U., C.)	Lac-du-Bonnet	Cs
Vale Canada Limited	Thompson	(P., U., C.)	Thompson	Ni, Cu, Co, PGM
Vale Canada Limited	Birchtree	(U.)	Thompson	Ni, Cu, Co, PGM
HudBay Minerals Inc.	Snow Lake	Cu, Zn, Au, Ag	Snow Lake	Cu, Zn
HudBay Minerals Inc.	Lalor Lake	(U.)	Snow Lake	Cu, Zn, Au, Ag
HudBay Minerals Inc.	Reed	Cu, Zn, Au, Ag	Snow Lake	Cu, Zn
HudBay Minerals Inc.	777	(U.)	Flin Flon	Cu, Zn, Au, Ag
HudBay Minerals Inc.	Flin Flon	Cu, Zn, Au, Ag	Flin Flon	Cu, Zn
Graymont Inc.	Faulkner	(P., Plant)	Faulkner	Limestone, lime
CertainTeed Gypsum Canada, Inc.	Amaranth	(P.)	Harcus	Gypsum
ERCO Worldwide	Hargrave	(U., Plant)	Virden	Sodium chlorate

COMPANY	MINE SITE	ACTIVITY TYPE	LOCATION	COMMODITY
Saskatchewan				
SSR Mining Inc.	Santoy	(U.)	Santoy Lake	Au
SSR Mining Inc.	Seabee	(U., C.)	Laonil Lake	Au, Ag
Cameco Corporation	Cigar Lake	(U.)	Wollaston Lake	U
Cameco Corporation	McArthur River	(U.)	North of Key Lake	U
Cameco Corporation	Key Lake	(C.)	North of Highrock Lake	U
Potash Corporation of Saskatchewan Inc.	Rocanville	(U., Plant)	Rocanville	Potash
The Mosaic Company	Esterhazy (K-1 and K-2)	(U., Plant)	Esterhazy	Potash, salt
Compass Minerals Canada Corporation	Wynyard (Big Quill)	(P, U., Plant)	Wynyard	Potassium sulphate
Canadian Clay Products Inc.	Wilcox	(P)	Wilcox	Clay, bentonite
The Mosaic Company	Belle Plaine	(U., Plant)	Belle Plaine	Potash, salt
Potash Corporation of Saskatchewan Inc.	Lanigan	(U.)	Lanigan	Potash
The Mosaic Company	Colonsay	(U., Plant)	Colonsay	Potash, salt
Potash Corporation of Saskatchewan Inc.	Allan	(U., Plant)	Allan	Potash
Potash Corporation of Saskatchewan Inc.	Patience Lake	(U., Plant)	Blucher	Potash
Saskatchewan Mining and Minerals Inc.	Chaplin Lake	(P, Plant)	Chaplin	Sodium sulphate
Potash Corporation of Saskatchewan Inc.	Cory	(U., Plant)	Cory	Potash
Agrium Inc.	Vanscoy	(U., Plant)	Vanscoy	Potash, salt
Compass Minerals Canada Corporation	Unity	(solution mining)	Unity	Salt
Westmoreland Coal Company	Estevan	(P)	Bienfait	Coal (thermal)
Westmoreland Coal Company	Poplar River	(P)	Coronach	Coal (thermal)
K+S Potash Canada	Bethune	(U., Plant)	Bethune	Potash
Alberta				
K+S Windsor Salt Ltd	Lindbergh	(solution mining)	Elk Point	Salt
Hammerstone Corporation	Steepbank	(P)	North of Fort McMurray	Limestone
Hammerstone Corporation	Muskeg Valley	(P)	North of Fort McMurray	Limestone
Rio Petro Ltd.	Sunnynook	(solution mining)	Cessford	Salt
Suncor Energy Inc.	Fort McMurray West	(P)	Fort McMurray	Limestone
Calcium Incorporated	Calling Lake	(solution mining)	Calling Lake	Salt
Tiger Calcium Services Inc.	Mitsue	(solution mining)	Slave Lake	Salt
Graymont Inc.	Summit	(P, Plant)	Coleman	Limestone, lime
Graymont Inc.	Exshaw (Gap)	(P, Plant)	Exshaw	Limestone, lime
Lafarge Canada Inc.	Exshaw	(P, Plant)	Exshaw	Limestone
Burnco Rock Products Ltd.	Clearwater	(P, Plant)	Clearwater River	Limestone
Lehigh Cement Company	McLeod	(P)	Cadomin	Limestone
Westmoreland Coal Company	Sheerness	(P)	Hanna	Coal (thermal)
Westmoreland Coal Company	Paintearth	(P)	Forestburg	Coal (thermal)
Westmoreland Coal Company	Genesee	(P)	Genesee	Coal (thermal)
Transalta Corporation	Highvale	(P)	Seba Beach	Coal (thermal)
Westmoreland Coal Company	Coal Valley	(P)	Edson	Coal (thermal)
Teck Resources Limited	Cardinal River (Cheviot)	(P)	Hinton	Coal (metallurgical)
Suncor Energy Inc.	Millennium and Steepbank	(P)	Fort McMurray	Upgraded crude oil
Shell Canada Energy	Jackpine	(P)	Fort MacKay	Upgraded crude oil
Syncrude Canada Ltd.	Aurora North and South	(P)	Fort MacKay	Upgraded crude oil
Syncrude Canada Ltd.	Mildred Lake	(P)	Fort MacKay	Upgraded crude oil
Shell Canada Energy	Muskeg River	(P)	Fort MacKay	Upgraded crude oil
Canadian Natural Resources Ltd.	Horizon	(P)	Fort MacKay	Upgraded crude oil

COMPANY	MINE SITE	ACTIVITY TYPE	LOCATION	COMMODITY
British Columbia				
New Gold Inc.	New Afton	(U., C.)	Kamloops	Au, Ag, Cu
Copper Mountain Mining Corporation	Copper Mountain	(P, C.)	Princeton	Cu, Au, Ag
Teck Resources Limited	Highland Valley Copper	(P, C.)	Logan Lake	Cu, Mo
Imperial Metals Corporation	Mount Polley	(P, C.)	Northeast of Williams Lake	Au, Cu
Taseko Mines Limited	Gibraltar	(P, C.)	North of Williams Lake	Cu, Mo
Centerra Gold Inc.	Mt Milligan	(P, C.)	Fort St. James	Cu, Au
Imperial Metals Corporation	Red Chris	(P)	Kinaskan Lake	Au, Ag, Cu
Georgia-Pacific Canada, Inc.	4J	(P)	Canal Flats	Gypsum
Baymag Inc.	Mount Brussilof	(P)	Mount Brussilof	Magnesite (fused), magnesia (products)
CertainTeed Gypsum Canada, Inc.	Elkhorn	(P)	Windermere	Gypsum
Lafarge Canada Inc.	Falkland	(P, Plant)	Falkland	Gypsum
Absorbent Products Ltd.	Bud	(P)	Princeton	Calcium, clay
Absorbent Products Ltd.	Red Lake	(P)	Kamloops	Diatomite, bentonite, leonardite
Imperial Limestone Co. Ltd.	Van Anda	(P)	Texada Island	Limestone
Texada Quarrying Ltd. (Lafarge Canada Inc.)	Texada	(P)	Texada Island	Limestone
Fireside Minerals Ltd.	Fireside	(P)	Fireside	Barite
Teck Resources Limited	Coal Mountain	(P)	Sparwood	Coal (metallurgical, thermal)
Teck Resources Limited	Line Creek	(P)	Sparwood	Coal (metallurgical, thermal)
Teck Resources Limited	Elkview	(P)	Sparwood	Coal (metallurgical)
Teck Resources Limited	Fording River	(P)	Elkford	Coal (metallurgical)
Teck Resources Limited	Greenhills	(P)	Sparwood	Coal (metallurgical)
Conuma Coal Resources Ltd.	Brule	(P)	Tumbler Ridge	Coal (metallurgical)
Brucejack	Pretium Resources Inc.	(U., C.)	Stewart	Au, Ag
Wolverine	Conuma Coal Resources Ltd.	(P, U)	Tumbler Ridge	Coal (metallurgical)
Yukon				
Capstone Mining Corporation	Minto	(P, C.)	Pelly Crossing	Cu, Au, Ag
Northwest Territories				
Diavik Diamond Mines Inc.	Diavik	(U., Plant)	Lac de Gras	Diamonds
Dominion Diamond Corporation	Ekati	(U., Plant)	Lac de Gras	Diamonds
De Beers Canada Inc.	Gahcho Kue	(P, Plant)	Lac de Gras	Diamonds
Nunavut				
ArcelorMittal Mines Canada Inc.	Mary River	(P)	Pond Inlet	Fe
Agnico Eagle Mines Ltd.	Meadowbank	(P, C.)	Baker Lake	Au
TMAC Resources Inc.	Hope Bay	(U., C.)	Cambridge Bay	Au

Source: Natural Resources Canada.

(P.) Open-Pit, (U.) Underground, (C.) Concentrator

Note: Excluded operations are clay products, peat, and most construction materials (most stone, sand and gravel).

Included are operations that produced during 2017.

ANNEX 2

MINING ESTABLISHMENTS IN CANADA, BY MINERAL, PROVINCE OR TERRITORY, 2016

[Return to text](#)


	NL	PE	NS	NB	QC	ON	MB	SK	AB	BC	YT	NT	NV	TOTAL
Metals														
Iron Ore	1	-	-	-	1	-	-	-	-	-	-	-	1	3
Gold & Silver Ore	1	-	-	-	14	12	-	1	-	-	-	-	1	29
Lead-zinc Ore	-	-	-	1	-	-	-	-	-	-	-	-	-	1
Nickel-copper Ore	1	-	-	-	2	3	1	-	-	-	-	-	-	7
Copper, copper-zinc Ore	1	-	-	-	2	1	1	-	-	8	1	-	-	14
Uranium	-	-	-	-	-	-	-	5	-	-	-	-	-	5
Other Metals	-	-	-	-	2	1	1	-	-	-	-	-	-	4
TOTAL METALS	4	-	-	1	21	17	3	6	-	8	1	-	2	63
Non-metals														
Diamonds	-	-	-	-	1	1	-	-	-	-	-	4	-	6
Gypsum	-	-	-	1	-	-	-	-	-	1	-	-	-	2
Peat	1	1	1	22	24	-	5	1	6	1	-	-	-	62
Potash	-	-	-	1	-	-	-	9	-	-	-	-	-	10
Salt	-	-	2	-	1	4	-	3	1	-	-	-	-	11
Sand and gravel	1	1	6	12	72	257	14	58	214	85	1	-	-	721
Stone	2	-	18	9	94	113	8	-	24	25	-	-	-	293
Shale, Clay and other refractory minerals	-	-	1	-	4	2	-	1	1	2	-	-	-	11
Other nonmetals	-	-	-	-	3	2	-	1	-	3	1	-	-	10
TOTAL NON-METALS	4	2	28	45	199	379	27	73	246	117	2	4	-	1126

Sources: Natural Resources Canada; Statistics Canada.

- Nil

ANNEX 3

CANADIAN PRODUCTION OF LEADING MINERALS BY PROVINCE AND TERRITORY, 2017^P

[Return to text](#)


	GOLD		COAL		COPPER		POTASH (K ₂ O) ¹		IRON ORE	
	KILOGRAMS	\$000	KILOTONNES	\$000	TONNES	\$000	KILOTONNES	\$000	KILOTONNES	\$000
Newfoundland	664	35,141	-	-	36,696	293,495	-	-	21,432	1,732,828
Prince Edward Island	-	-	-	-	-	-	-	-	-	-
Nova Scotia	-	-	x	x	-	-	-	-	-	-
New Brunswick	-	-	-	-	-	-	-	-	-	-
Quebec	56,073	2,965,543	-	-	35,797	286,305	-	-	24,930	1,831,021
Ontario	72,863	3,853,526	-	-	168,884	1,350,736	-	-	-	-
Manitoba	4,477	236,755	-	-	38,337	306,621	-	-	-	-
Saskatchewan	2,562	135,489	x	x	-	-	12,214	4,570,601	-	-
Alberta	32	1,666	x	x	-	-	-	-	-	-
British Columbia	13,355	706,298	x	x	287,812	2,301,922	-	-	-	-
Yukon	3,055	161,547	-	-	16,306	130,417	-	-	-	-
Northwest Territories	-	-	-	-	-	-	-	-	-	-
Nunavut	11,232	594,035	-	-	-	-	-	-	2,647	249,771
Canada	164,313	8,690,001	59,893	6,238,177	583,833	4,669,497	12,214	4,570,601	49,009	3,813,620

	NICKEL		DIAMONDS		SAND AND GRAVEL ²		STONE		ZINC	
	TONNES	\$000	000 CARATS	\$000	KILOTONNES	\$000	KILOTONNES	\$000	TONNES	\$000
Newfoundland	51,479	690,746	-	-	1,692	7,289	7,526	63,660	-	-
Prince Edward Island	-	-	-	-	116	1,624	x	x	-	-
Nova Scotia	-	-	-	-	3,449	29,799	9,028	99,962	-	-
New Brunswick	-	-	-	-	2,295	12,414	7,254	57,683	33,921	127,339
Quebec	48,102	645,435	1,524	169,161	16,129	96,351	42,449	491,446	88,542	332,385
Ontario	79,375	1,065,055	700	389,837	89,454	608,708	68,874	700,297	70,180	263,456
Manitoba	21,834	292,974	-	-	15,041	137,440	6,785	61,550	124,118	465,937
Saskatchewan	-	-	-	-	11,024	98,263	-	-	-	-
Alberta	-	-	-	-	119,040	1,240,638	4,685	54,282	-	-
British Columbia	-	-	-	-	31,418	298,835	7,755	67,878	-	-
Yukon	-	-	-	-	709	2,937	x	x	-	-
Northwest Territories	-	-	20,500	2,059,633	246	4,624	843	5,900	-	-
Nunavut	-	-	-	-	-	-	-	-	-	-
Canada	200,791	2,694,210	22,724	2,618,631	290,613	2,538,920	155,254	1,603,511	316,760	1,189,117

Sources: Natural Resources Canada; Statistics Canada.

^P Preliminary; - Nil; x Confidential.

¹ Excludes shipments to Canadian potassium sulphate plants.

² Mineral production of sand and gravel for Nunavut is included in totals for the Northwest Territories.

Note: As of reference year 2017, Statistics Canada has ceased the collection of cement data.



ANNEX 4

CANADA'S WORLD ROLE AS A PRODUCER OF CERTAIN IMPORTANT MINERALS, 2017^P

[Return to text](#)


			RANK OF FIVE LEADING COUNTRIES				
		WORLD	1	2	3	4	5
			Canada	Russia	Belarus	China	Germany
Potash (K ₂ O equivalent) (mine production)	000 t	42,000	12,000	7,200	6,400	6,200	2,900
	% of world total		28.6	17.1	15.2	14.8	6.9
			Kazakhstan	Canada	Australia	Namibia	Niger
Uranium (metal content) (2015)	t	62,366	24,575	14,039	6,315	3,654	3,479
(mine production)	% of world total		39.4	22.5	10.1	5.9	5.6
			Brazil	Canada			
Niobium (mine production)	t	64,000	57,000	6,000			
	% of world total		89.1	9.4			
			Russia	Botswana	Canada	Angola	South Africa
Gemstones	000 t	73,000	23,500	14,000	13,000	8,100	6,700
	% of world total		31.5	19.2	17.8	11.1	9.2
			Indonesia	Philippines	Canada	New Caledonia	Australia
Nickel (mine production)	000 t	2,100	400	230	210	210	190
	% of world total		19.0	11.0	10.0	10.0	9.0
			South Africa	Russia	Canada	Zimbabwe	United States
Platinum group metals (metal content)	kg	410,000	218,000	102,000	31,000	27,000	16,900
	% of world total		53.2	24.9	7.6	6.6	4.1
			Congo	Russia	Australia	Canada	Cuba
Cobalt (mine production) ²	t	110,000	64,000	5,600	7,300	4,300	4,200
	% of world total		58.2	5.1	6.6	3.9	3.8
			China	Russia	Canada	India	UAE
Aluminum (primary metal)	000 t	60,000	32,600	3,600	3,210	3,200	2,600
	% of world total		54.3	6.0	5.4	5.3	4.3
			China	South Korea	Canada	Japan	Belgium
Indium	000 t	720	310	215	70	70	20
	% of world total		43.1	29.9	9.7	9.7	.8

			RANK OF FIVE LEADING COUNTRIES				
		WORLD	1	2	3	4	5
			China	United States	Russia	Canada	UAE
Sulphur, elemental (mine production)	000 t	83,000	17,800	9,660	7,000	5,300	5,300
	% of world total		21.4	11.6	8.4	6.4	6.4
<i>Canada third, by value</i>			Russia	D.R.C	Botswana	Australia	Canada
Diamonds (precious) (2015)	000 carats	134,071	40,322	23,207	20,501	13,958	13,036
	% of world total		30.1	17.3	15.3	10.4	9.7
			South Africa	China	Australia	Mozambique	Canada
Titanium concentrate (Ilmenite)	000 t	5,860	1,300	800	720	490	475
	% of world total		22.2	13.7	12.3	8.4	8.1
			South Africa	Australia	china	Mozambique	Canada
Gold (mine production)	t	6,200	1,300	900	800	550	475
	% of world total		21.0	14.5	12.9	8.9	7.7
			China	South Korea	Japan	Canada	Kazakhstan
Cadmium (metal)	t	23,000	8,200	3,600	2,200	1,700	1,500
	% of world total		35.7	15.7	9.6	7.4	6.5
			China	India	Brazil	Canada	Mozambique
Graphite	000 t	1,200	780	150	95	30	23
	% of world total		65.0	12.5	7.9	2.5	1.9
			Finland	Turkey	United States	China	Canada
Mica (natural)	000 t	1,130,000	65,000	40,000	31,700	25,000	22,000
	% of world total		5.8	3.5	2.8	2.2	1.9
<i>Canada sixth</i>			Finland	Ireland	Germany	Sweden	Belarus
Peat	000 t	26,200	7,500	4,300	3,400	2,100	1,500
	% of world total		28.6	16.4	13.0	8.0	5.7
<i>Canada tenth</i>			Chile	Peru	China	United States	Australia
Copper (mine production)	000 t	19,700	5,330	2,390	1,860	1,270	920
	% of world total		27.1	12.1	9.4	6.4	4.7
<i>Canada eighth</i>			Australia	Brazil	China	India	Russia
Iron ore (mine production) (usable ore)	000 t	2,400	880	440	340	190	100
	% of world total		36.7	18.3	14.2	7.9	4.2

			RANK OF FIVE LEADING COUNTRIES				
		WORLD	1	2	3	4	5
<i>Canada seventh tied with Saudi Arabia</i>			China	Russia	India	United States	Indonesia
Nitrogen (fixed)--ammonia	000 t	150,000	46,000	13,000	11,000	12,500	5,000
	% of world total		30.7	8.7	7.3	8.3	3.3
			China	United States	India	Canada	Germany
Salt (mine production)	000 t	280,000	68,000	43,000	26,000	13,000	13,000
	% of world total		24.3	15.4	9.3	4.6	4.6
<i>Canada ninth</i>			China	Peru	India	Australia	United States
Zinc (mine production)	000 t	13,200	5,100	1,400	1,300	1,000	730
	% of world total		38.6	10.6	9.8	7.6	5.5
<i>Canada ninth tied with Russia</i>			China	Chile	United States	Peru	Mexico
Molybdenum (mo content) (mine production)	t	290,000	130,000	58,000	44,600	26,000	12,000
	% of world total		44.8	20.0	15.4	9.0	4.1
<i>Canada not on the list</i>			Mexico	Peru	China	Russia	Poland
Silver	t	25,000	5,600	4,500	2,500	1,600	1,400
	% of world total		22.4	18.0	10.0	6.4	5.6
<i>Canada twelfth</i>			China	India	United States	Australia	Indonesia
Coal (primary) (2015)	000 t	7,268,552	3,242,479	707,617	671,842	503,274	460,482
	% of world total		44.6	9.7	9.2	6.9	6.3
<i>Canada fourteenth</i>			China	Russia	United States	Norway	France
Silicon	000 t	7,200	4,800	750	405	380	110
	% of world total		66.7	10.4	5.6	5.3	1.5
<i>Canada seventeenth</i>			China	United States	India	Russia	Brazil
Lime	000 t	350,000	230,000	18,000	16,000	11,000	8,3000
	% of world total		65.7	5.1	4.6	3.1	2.4
<i>Canada twenty-first</i>			China	United States	Iran	Thailand	Turkey
Gypsum (mine production)	000 t	260,000	130,000	17,000	16,000	11,000	9,000
	% of world total		50.0	6.5	6.2	4.2	3.5
<i>Canada thirteenth</i>			United States	Italy	Malaysia	France	Turkey
Sand and Gravel (Industrial)	000 t	210,000	105,000	13,900	10,400	8,800	8,000
	% of world total		50.0	6.6	5.0	4.2	3.8

			RANK OF FIVE LEADING COUNTRIES				
WORLD			1	2	3	4	5
			China	Vietnam	Russia	Bolivia	Austria
Tungsten (mine production)	t	95,000	79,000	7,200	3,100	1,100	950
% of world total			83.2	7.6	3.3	1.2	1.0
<i>Canada not on the list</i>			China	Australia	United States	Peru	Russia
Lead (mine production)	000 t	4,700	2,400	450	313	300	250
% of world total			51.1	9.6	6.7	6.4	5.3

Sources: U.S. Geological Survey (USGS); International Energy Association; Kimberley Process.
n.a. Not applicable.

ANNEX 5

MINERAL PRODUCTION OF CANADA, 2010-2017^P

[Return to text](#)


METALLIC MINERALS		2010		2011		2012		2013		2014		2015		2016		2017 ^P	
	Unit	(quantity)	(\$000)	(quantity)	(\$000)	(quantity)	(\$000)	(quantity)	(\$000)	(quantity)	(\$000)	(quantity)	(\$000)	(quantity)	(\$000)	(quantity)	(\$000)
Antimony	t	x	x	x	x	x	x	148	1,562	4	45	1	5	0	3	0	3
Bismuth	t	91	1,759	136	3,346	110	2,370	103	2,006	4	97	2	29	2	31	2	33
Cadmium	t	2,403	9,644	1,516	4,135	247	500	160	316	129	276	68	102	60	113	59	129
Cesium	t	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Cobalt	t	2,644	125,144	3,741	146,768	3,698	114,604	4,005	118,114	3,907	137,844	4,339	156,720	4,216	149,145	3,866	276,995
Copper	t	507,883	3,941,677	553,725	4,831,801	560,476	4,453,541	620,989	4,695,298	654,468	4,983,772	697,322	4,905,661	679,524	4,379,532	583,833	4,669,497
Gold	kg	102,147	4,143,067	101,975	5,087,438	106,373	5,704,878	131,404	6,141,048	151,472	6,817,154	160,751	7,667,339	161,497	8,590,179	164,313	8,690,001
Ilmenite	000 t	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Indium	kg	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Iron Ore	000 t	36,178	5,314,154	35,705	5,505,772	38,892	4,875,068	42,063	5,348,433	43,173	4,173,516	46,220	2,854,585	46,731	3,165,022	49,009	3,813,620
Iron, remelt	000 t	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Lead	t	62,397	138,022	62,548	166,003	62,014	127,438	22,895	50,506	3,579	8,288	3,699	8,485	12,020	29,785	13,137	39,648
Lithium	t	x	x	x	x	x	x	x	x	x	x	-	-	-	-	-	-
Molybdenum	t	8,524	x	8,543	x	8,936	x	7,956	186,788	9,358	259,876	2,505	48,846	2,783	53,105	5,286	106,729
Nickel	t	156,270	3,509,833	211,417	4,787,323	203,970	3,546,420	218,026	3,372,864	218,233	4,069,165	225,351	3,408,431	230,210	2,926,428	200,791	2,694,210
Niobium (Columbium)	t	4,298	x	4,551	x	4,705	x	4,916	x	5,774	x	5,385	x	6,099	x	6,981	x
Platinum group	kg	9,864	260,304	22,337	749,572	22,490	644,195	25,465	767,363	31,386	1,058,992	33,248	1,059,512	31,471	947,560	27,278	993,885
Selenium	t	97	8,001	128	17,500	145	16,656	138	10,411	142	8,879	156	6,575	175	3,886	49	2,170
Silver	t	570	381,086	582	658,514	657	659,005	620	489,872	472	320,274	371	239,656	385	282,666	345	247,502
Tantalum	t	-	-	-	-	-	-	40	12,698	-	-	-	-	-	-	-	-
Tellurium	t	8	1,913	9	3,167	10	1,540	8	895	8	1,066	10	990	18	870	17	763
Tungsten	t	364	7,370	2,466	73,707	2,554	88,436	3,017	86,293	2,708	84,331	2,289	62,339	-	-	-	-
Uranium	t	9,927	1,230,182	9,017	1,307,174	9,520	1,197,441	7,889	806,418	9,780	933,583	13,279	1,609,476	14,133	1,248,600	9,501	585,040
Zinc	t	609,567	1,356,287	591,004	1,281,887	601,514	1,171,147	412,277	811,361	322,605	771,026	275,410	632,892	301,210	832,545	316,760	1,189,117
Total, Metallic Minerals		..	21,358,783	..	25,569,557	..	23,558,411	..	23,497,305	..	24,225,029	..	23,125,240	..	23,302,112		24,032,382



MINERAL PRODUCTION OF CANADA, 2010-2017^P

NON-METALLIC MINERALS		2010		2011		2012		2013		2014		2015		2016		2017 ^P	
	Unit	(quantity)	(\$000)	(quantity)	(\$000)	(quantity)	(\$000)	(quantity)	(\$000)	(quantity)	(\$000)	(quantity)	(\$000)	(quantity)	(\$000)	(quantity)	(\$000)
Barite	000 t	21	6,500	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Carbonatite	000 t	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Cement ¹	000 t	11,523	1,512,624	11,914	1,587,136	12,553	1,621,476	12,022	1,618,827	12,136	1,692,131	12,334	1,689,851	11,820	1,615,674
Chrysotile	000 t	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Clay products ²	000 t	..	148,907	..	135,422	..	136,502	..	122,577	..	118,012	..	124,446	..	140,122	..	151,018
Diamonds	000 ct	11,804	2,377,147	10,752	2,509,232	10,529	2,005,764	10,600	1,964,125	12,012	2,236,043	11,677	2,148,583	13,315	1,888,732	22,724	2,618,631
Gemstones	t	35	4,966	42	2,941	178	3,217	554	4,607	6,919	5,991	8,233	7,953	154	5,852	70	4,472
Graphite	000 t	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Gypsum ³	000 t	3,046	47,771	2,449	34,632	1,832	24,987	1,837	25,872	1,793	25,474	1,726	19,675	1,679	17,655	2,738	39,323
Lime	000 t	1,863	288,787	1,937	294,909	1,965	316,322	1,856	308,127	1,995	344,816	1,852	335,489	1,807	330,366	1,827	300,615
Magnesite	000 t	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Marl	000 t	x	x	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mica	000 t	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Nepheline syenite	000 t	603	57,304	602	58,377	586	61,892	646	72,911	654	83,805	614	97,880	571	81,219	625	59,963
Peat	000 t	1,286	260,664	1,139	213,359	1,277	238,018	1,173	213,798	1,178	249,078	1,297	257,030	1,452	330,653	1,671	343,111
Phosphate	000 t	x	x	x	x	x	x	x	x	-	-	-	-	-	-	-	-
Potash (K ₂ O) ⁴	000 t	9,700	5,061,927	10,686	7,569,282	8,976	6,342,562	10,196	5,768,609	10,818	5,581,264	11,462	6,132,751	10,790	3,735,632	12,214	4,570,601
Potassium sulphate	000 t	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Pumice	000 t	x	x	x	x	x	x	x	x	x	x	x	x	5	273	x	x
Quartz (silica) ³	000 t	1,503	66,372	1,620	84,280	1,517	85,256	2,331	80,064	2,011	90,441	2,053	107,377	2,256	95,614	2,515	117,988
Salt	000 t	10,278	602,607	12,757	697,404	10,820	487,686	12,244	655,848	14,473	752,321	14,343	791,980	10,252	445,891	11,250	458,306
Sand and gravel	000 t	211,342	1,573,968	222,288	1,560,213	239,307	1,822,978	241,113	1,941,867	223,407	1,831,464	228,030	1,884,531	280,550	2,398,633	290,613	2,538,920
Soapstone, talc, pyrophyllite	000 t	100	26,125	116	25,244	130	30,249	175	34,223	90	38,985	175	50,335	199	55,513	225	53,908
Sodium sulphate	000 t	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Stone ³	000 t	170,664	1,637,757	161,729	1,591,511	152,977	1,559,358	147,746	1,509,427	147,739	1,541,321	158,034	1,687,916	160,016	1,664,188	155,254	1,603,511
Sulphur, elemental	000 t	6,247	298,990	5,970	637,250	5,594	581,611	5,624	342,937	5,252	326,335	5,187	423,452	4,746	193,877	4,930	175,961
Sulphur, in smelter gas	000 t	610	70,903	638	116,022	665	132,230	677	129,197	590	100,125	558	114,383	635	110,307	534	74,162
Titanium dioxide	000 t	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Tremolite	000 t	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wollastonite	000 t	-	-	-	-	-	-	-	-	-	-	-	-	x	x	x	x
Zeolite	000 t	x	x	x	x	x	x	x	x	-	-	-	-	x	x	0	0
Total, Nonmetallic Minerals (Including Cement¹)		..	14,699,276	..	17,839,820	..	16,471,421	..	15,476,804	..	15,778,620	..	16,519,513	..	13,724,154
Total, Nonmetallic Minerals (Excluding Cement¹)		..	13,186,652	..	16,252,684	..	14,849,945	..	13,857,977	..	14,086,489	..	14,829,662	..	12,108,480	..	13,633,196



MINERAL FUELS		2010		2011		2012		2013		2014		2015		2016		2017 ^P	
	Unit	(quantity)	(\$000)	(quantity)	(\$000)	(quantity)	(\$000)	(quantity)	(\$000)	(quantity)	(\$000)	(quantity)	(\$000)	(quantity)	(\$000)	(quantity)	(\$000)
Coal	000 t	68,152	5,540,967	67,113	7,471,408	66,471	5,880,836	68,751	4,886,804	69,035	3,896,746	61,985	3,126,266	61,332	4,009,353	59,893	6,238,177
Total Mineral Fuels		68,152	5,540,967	67,113	7,471,408	66,471	5,880,836	68,751	4,886,804	69,035	3,896,746	61,985	3,126,266	61,332	4,009,353	59,893	6,238,177

MINERAL FUELS		2010		2011		2012		2013		2014		2015		2016		2017 ^P	
	Unit	(quantity)	(\$000)	(quantity)	(\$000)	(quantity)	(\$000)	(quantity)	(\$000)	(quantity)	(\$000)	(quantity)	(\$000)	(quantity)	(\$000)	(quantity)	(\$000)
Total, Nonmetallic Minerals (Including Cement¹)		..	41,599,026	..	50,880,785	..	45,910,667	..	43,860,914	..	43,900,395	..	42,771,019	..	41,035,618
Total, Nonmetallic Minerals (Excluding Cement¹)		..	40,086,402	..	49,293,649	..	44,289,191	..	42,242,087	..	42,208,264	..	41,081,168	..	39,419,944	..	43,903,755

Sources: Natural Resources Canada; Statistics Canada.

^P Preliminary; x Confidential; - Nil; .. Not available.

Note:

¹As of reference year 2017, Statistics Canada has ceased the collection of cement data. NRCAN is no longer deducting the quantity and value of gypsum, sand and gravel, silica, and stone used in the manufacture of cement products from the totals for gypsum, sand and gravel, silica, and stone.

²Production values for bentonite and diatomite have been included in clay products.

³Shipments of gypsum, silica and stone to Canadian cement, lime and clay plants are not included in this table.

⁴Shipments of potash to Canadian potassium sulphate plants are not included in this table. Numbers may not add due to rounding.

ANNEX 6

CANADIAN RESERVES OF SELECTED MAJOR METALS, 1978-2016^P

[Return to text](#)


METAL CONTAINED IN PROVEN AND PROBABLE MINEABLE ORE¹ IN OPERATING MINES² AND DEPOSITS COMMITTED TO PRODUCTION

Year	Copper (000 t)	Nickel (000 t)	Lead (000 t)	Zinc (000 t)	Molybdenum (000 t)	Silver (t)	Gold ³ (t)
1978	16,184	7,843	8,930	26,721	464	30,995	505
1979	16,721	7,947	8,992	26,581	549	32,124	575
1980	16,714	8,348	9,637	27,742	551	33,804	826
1981	15,511	7,781	9,380	26,833	505	32,092	851
1982	16,889	7,546	9,139	26,216	469	31,204	833
1983	16,214	7,393	9,081	26,313	442	31,425	1,172
1984	15,530	7,191	9,180	26,000	361	30,757	1,208
1985	14,201	7,041	8,503	24,553	331	29,442	1,373
1986	12,918	6,780	7,599	22,936	312	25,914	1,507
1987	12,927	6,562	7,129	21,471	231	25,103	1,705
1988	12,485	6,286	6,811	20,710	208	26,122	1,801
1989	12,082	6,092	6,717	20,479	207	24,393	1,645
1990	11,261	5,776	5,643	17,847	198	20,102	1,542
1991	11,040	5,691	4,957	16,038	186	17,859	1,433
1992	10,755	5,605	4,328	14,584	163	15,974	1,345
1993	9,740	5,409	4,149	14,206	161	15,576	1,333
1994	9,533	5,334	3,861	14,514	148	19,146	1,513
1995	9,250	5,832	3,660	14,712	129	19,073	1,540
1996	9,667	5,623	3,450	13,660	144	18,911	1,724
1997	9,032	5,122	2,344	10,588	149	16,697	1,510
1998	8,402	5,683	1,845	10,159	121	15,738	1,415
1999	7,761	4,983	1,586	10,210	119	15,368	1,326
2000	7,419	4,782	1,315	8,876	97	13,919	1,142
2001	6,666	4,335	970	7,808	95	12,593	1,070
2002	6,774	4,920	872	6,871	82	11,230	1,023
2003	6,037	4,303	749	6,251	78	9,245	1,009
2004	5,546	3,846	667	5,299	80	6,568	787
2005	6,589	3,960	552	5,063	95	6,684	965
2006	6,923	3,940	737	6,055	101	6,873	1,032
2007	7,565	3,778	682	5,984	213	6,588	987
2008	7,456	3,605	636	5,005	222	5,665	947
2009	7,290	3,301	451	4,250	215	6,254	918
2010	10,747	3,074	400	4,133	254	6,916	1,473
2011	10,570	2,936	247	4,812	256	6,954	2,225
2012	10,364	2,617	126	4,163	256	5,598	2,148
2013	11,198	2,673	116	3,532	145	5,212	2,158
2013	10,777	2,682	116	3,532	145	5,013	2,140
2014	10,214	2,287	88	2,972	121	5,498	2,070
2015	9,937	2,725	83	3,009	101	5,345	1,984
2016 ^P	9,101	2,604	40	2,231	98	3,626	1,910

Source: Natural Resources Canada, based on company reports and the Federal-Provincial/Territorial Annual Survey of Mines and Concentrators.

¹No allowance is made for losses in milling, smelting and refining. Excludes material classified as "resources."

²Includes metal in mines where production has been suspended temporarily.

³Excludes metal in placer deposits because reserves data are generally unavailable.

^PRevised; ^PPreliminary.

Note: One tonne (t) = 1.1023113 short tons = 32 150.746 troy oz.

ANNEX 7

EMPLOYMENT COUNT AND ANNUAL COMPENSATION IN THE CANADIAN MINING, SMELTING AND REFINING INDUSTRIES, 2007-2017

[Return to text](#)



	Number of Employees	Compensation per Job
Metal Mines		
2007	27,020	101,875
2008	28,480	108,464
2009	23,955	126,947
2010	25,520	125,829
2011	28,220	123,332
2012	31,005	122,291
2013	32,860	142,937
2014	34,050	142,474
2015	31,355	133,799
2016	31,510	130,906
2017	34,050	130,791
Non-metal Mines		
2007	18,970	74,893
2008	20,985	80,468
2009	19,360	81,499
2010	20,825	83,930
2011	21,615	88,192
2012	20,890	91,784
2013	24,620	88,265
2014	29,575	80,301
2015	32,755	77,086
2016	27,685	99,458
2017	29,260	100,092
Coal Mines		
2007	4,935	110,541
2008	5,315	114,275
2009	5,515	116,476
2010	6,325	107,232
2011	6,495	121,897
2012	6,525	131,956
2013	8,895	127,662
2014	7,515	127,382



2015	7,030	149,533
2016	7,115	141,055
2017	7,700	141,786
Smelting and Refining²		
2007	60,850	92,420
2008	62,780	88,243
2009	49,610	89,777
2010	53,815	91,753
2011	59,080	90,848
2012	50,025	98,989
2013	48,260	105,466
2014	47,155	104,360
2015	44,075	113,811
2016	43,330	112,815
2017	44,315	114,377
Total Mining, Smelting and Refining		
2007	111,775	92,531
2008	117,560	92,931
2009	98,440	98,690
2010	106,485	99,309
2011	115,410	100,041
2012	108,445	106,247
2013	114,635	114,235
2014	118,295	110,778
2015	115,215	110,990
2016	109,640	116,474
2017	115,325	117,429

Sources: Statistics Canada; Natural Resources Canada.

¹Compensation for Smelting and Refining and Total based on weighted average.

²Comprised of NAICS 3311, NAICS 3313, and NAICS 3314.

ANNEX 8

TOTAL COMPENSATION PER JOB, BY SELECT CANADIAN INDUSTRIAL SECTOR, 2007-2017

[Return to text](#)


	Forestry (\$)	Mining, Smelting and Refining ¹ (\$)	Manufacturing (\$)	Construction (\$)	Finance and Insurance (\$)
2007	64,322	92,531	61,503	65,095	64,929
2008	65,878	92,931	63,121	67,044	63,586
2009	65,009	98,690	62,659	66,816	63,606
2010	66,300	99,309	63,217	67,103	64,045
2011	68,864	100,041	65,081	68,944	65,872
2012	72,926	106,247	67,427	71,252	69,776
2013	78,101	114,235	69,278	67,604	71,031
2014	81,124	110,778	71,582	69,863	74,143
2015	82,419	110,990	74,455	71,931	79,360
2016	82,583	116,474	75,511	71,543	82,405
2017	81,708	117,429	75,260	72,305	88,826

Sources: Statistics Canada; Natural Resources Canada.

¹Based on a weighted average of NAICS 212, 3311, 3313, and 3314.



ANNEX 9

DOMESTIC EXPORTS OF MINERALS AND MINERAL PRODUCTS, BY COMMODITY AND COUNTRY OF DESTINATION, 2017

[Return to text](#)

METALS	U.S.A. (\$)	European Union (EU-28) (\$)	China (\$)	Japan (\$)	Other Countries (\$)	Total (\$)
Aluminum	11,113,575,983	135,302,207	263,821,332	328,633,486	899,982,198	12,741,315,206
Antimony	461,522	428,063	—	—	18,781	908,366
Barium	—	—	—	—	7,140	7,140
Beryllium	117,989	—	—	—	—	117,989
Bismuth	364,268	3,657	—	88,988	15,503	472,416
Cadmium	266,008	1,827,233	1,967,097	180,070	440,805	4,681,213
Calcium metals	1,544,454	1	130	903	321,985	1,867,473
Chromium	12,055,677	7,840	—	—	132,479	12,195,996
Cobalt	97,175,456	63,928,693	4,750,223	191,615,467	207,901,193	565,371,032
Copper	3,849,733,688	821,758,184	936,130,873	766,237,440	847,076,426	7,220,936,611
Gold	4,021,877,346	12,551,150,429	455,062,793	110,631,838	1,479,813,727	18,618,536,133
Iron and steel	12,959,444,484	224,198,908	166,589,978	15,538,917	1,552,474,323	14,918,246,610
Iron ore	126,786,176	2,180,303,235	553,505,576	609,759,833	1,090,920,628	4,561,275,448
Lead	827,094,584	9,735,170	12,300,624	2,985,756	31,852,962	883,969,096
Lithium	30,556	894,221	5,940,772	—	—	6,865,549
Magnesium and magnesium compounds	45,320,336	71,977	196,800	2,630	444,751	46,036,494
Manganese	1,002,473	25,775	102,907	—	662,165	1,793,320
Mercury	638,548	90,734	40	—	3,532	732,854
Molybdenum	71,837,841	53,685,637	—	14,767	9,614,051	135,152,296
Nickel	956,068,245	1,073,566,440	383,262,754	173,830,715	1,189,524,376	3,776,252,530
Niobium	99,308,687	75,036,473	55,498,096	2,868,594	37,990,084	270,701,934
Platinum group metals	527,957,071	134,888,243	5,463,820	9,893,966	135,058,756	813,261,856
Rare earth metals	135,795	4,329	—	—	44,819	184,943
Selenium	1,323,436	337,967	8,122,008	—	2,444,436	12,227,847
Silicon	161,519,346	519,254	409,829	31,001	17,933,852	180,413,282
Silver	969,575,133	31,844,924	8,709,447	14,681,524	17,682,244	1,042,493,272
Tantalum	2,763,107	75,941	—	2,218	104,790	2,946,056
Tellurium	—	—	—	—	—	—
Tin	39,505,753	1,622,459	33,862	—	1,828,846	42,990,920
Titanium metal	43,216,916	36,302,581	2,123,677	1,924,668	11,756,351	95,324,193
Tungsten	14,979,571	5,451,401	785,423	43,243	960,572	22,220,210
Uranium and thorium	1,137,018,063	293,672,864	23,622,131	10,889,296	165,350,921	1,630,553,275
Vanadium	136,284,977	301,984,281	45,668,904	26,537,599	11,417,543	521,893,304
Zinc	1,806,238,146	11,382,514	58,474,969	411,847	186,845,674	2,063,353,150
Zirconium	1,037,575	4,774,555	6,579,921	79,618	338,612	12,810,281
Other metals	4,111,110,413	758,832,685	64,962,685	76,945,676	915,800,169	5,927,651,628
Grand Total	43,137,369,623	18,773,708,875	3,064,086,671	2,343,830,060	8,816,764,694	76,135,759,923

DOMESTIC EXPORTS OF MINERALS AND MINERAL PRODUCTS, BY COMMODITY AND COUNTRY OF DESTINATION, 2017

NON-METALS	U.S.A. (\$)	European Union (EU-28) (\$)	China (\$)	Japan (\$)	Other Countries (\$)	Total (\$)
Abrasives	355,316,251	14,350,390	5,071,459	8,878,953	25,350,105	408,967,158
Barite and witherite	40,288	77	—	—	—	40,365
Boron	1,234,385	627,689	2,037,181	1,793	1,903,906	5,804,954
Bromine	—	6,755	—	—	1,604	8,359
Cement	999,245,079	7,102,547	2,958,904	382,705	9,356,521	1,019,045,756
Chlorine and chlorine compounds	121,904,032	620,175	60,540	23,313	165,241	122,773,301
Chrysotile (Asbestos)	1,444,252	92,372	614	21,542	1,373,409	2,932,189
Clay and clay products	17,372,294	11,091,834	1,174,101	89,925	10,876,476	40,604,630
Diamonds	80,101,042	1,327,271,023	1,688,064	370,325	1,228,867,027	2,638,297,481
Dolomite	22,490,135	—	5,824	—	4,759,159	27,255,118
Fluorspar	6,335,105	151,970	1,507,606	19,550	8,782,864	16,797,095
Glass and glassware products	599,461,546	32,261,288	6,712,320	1,296,418	32,067,041	671,798,613
Granite	35,200,304	1,243,442	511,563	202,294	1,750,746	38,908,349
Graphite	48,937,363	6,545,531	3,124,306	1,303,231	12,313,355	72,223,786
Gypsum	90,239,263	422,558	50,899	2,189	1,587,870	92,302,779
Iodine	2,417,917	644,610	—	—	886,774	3,949,301
Lime	59,419,605	—	19,410	—	15,547	59,454,562
Limestone flux and other limestone	15,348,546	608,827	3,570	—	7,334,151	23,295,094
Marble, travertine and other calcareous stones	42,668,062	917,233	2,223,420	—	738,870	46,547,585
Mica	10,646,752	1,107,466	122,441	2,260,307	2,905,056	17,042,022
Mineral pigments	128,291,430	878,421	549,532	88,658	7,211,714	137,019,755
Nepheline syenite	128,670,442	1,482,624	1,816,635	1,887,266	5,994,812	139,851,779
Pearls	1,129,742	41,454	90	—	352,603	1,523,889
Peat	444,321,686	879,950	429,478	11,089,272	18,138,964	474,859,350
Phosphate and phosphate compounds	85,423,356	1,157,739	1,263,815	903,760	14,385,853	103,134,523
Potash and potassium compounds	2,809,198,104	54,527,833	504,326,980	193,794	1,717,659,434	5,085,906,145
Salt and sodium compounds	603,830,870	5,760,912	2,141,543	34,180,124	33,705,425	679,618,874
Sand and gravel	99,939,638	4,914	—	—	1,933,176	101,877,728
Sandstone	398,538	—	783,734	—	39,504	1,221,776
Silica and silica compounds	78,472,653	4,269,450	619,653	170,139	2,616,914	86,148,809
Slate	4,965,277	5,022,327	—	125,845	—	10,113,449
Sulphur and sulphur compounds	198,923,788	494,021	126,142,099	493	219,131,662	544,692,063
Talc, soapstone and pyrophyllite	56,336,576	17,217	700,322	—	36,131	57,090,246
Titanium oxides	305,082,151	15,906,568	1,578,045	8,258	62,776,228	385,351,250
Other non-metals	777,558,457	18,892,993	8,270,321	3,217,873	46,945,535	854,885,179
Other structurals	227,250,543	8,005,587	2,025,375	88,529	27,897,119	265,267,153
Total Non-metals	8,459,615,472	1,522,407,797	677,919,844	66,806,556	3,509,860,796	14,236,610,465



MINERAL FUELS	U.S.A. (\$)	European Union (EU-28) (\$)	China (\$)	Japan (\$)	Other Countries (\$)	Total (\$)
Coal	480,913,200	871,310,430	932,475,797	1,693,925,269	3,113,984,444	7,092,609,140
Coke	721,058	122	—	—	789,795	1,510,975
Total Mineral Fuels	481,634,258	871,310,552	932,475,797	1,693,925,269	3,114,774,239	7,094,120,115
Total Mining Domestic Exports	52,078,619,353	21,167,427,224	4,674,482,312	4,104,561,885	15,441,399,729	97,466,490,503

Sources: Natural Resources Canada; Statistics Canada.

- Nil.

Note: Stages 1 to 4

ANNEX 10

TOTAL IMPORTS OF MINERALS AND MINERAL PRODUCTS, BY COMMODITY AND COUNTRY OF IMPORT, 2017

[Return to text](#)


METALS	U.S.A.	European Union (EU-28)	China	Mexico	Other Countries	Total
Aluminum	3,485,223,421	319,750,387	694,066,216	35,959,924	2,555,539,507	7,090,539,455
Antimony	1,647,182	617,653	17,216,204	76,741	1,557,666	21,115,446
Barium	5,592,979	820,098	1,220,296	—	54,185	7,687,558
Beryllium	874,690	4,272	81,128	191,646	16	1,151,752
Bismuth	562,061	95,548	1,067,684	92,989	91,302	1,909,584
Cadmium	3,256,580	3,756,266	15,117,088	2,011	37,079,668	59,211,613
Calcium metals	45,996,354	6,707,375	1,083,405	59,088	2,148,229	55,994,451
Chromium	7,891,369	7,660,775	5,518,785	438,511	95,698,236	117,207,676
Cobalt	39,139,717	16,428,021	279,227	229	35,523,472	91,370,666
Copper	1,827,064,570	230,945,010	167,962,502	128,647,406	1,299,766,115	3,654,385,603
Gallium	—	—	—	—	—	—
Germanium	8,844,316	177,244	333,895	249	4,146,870	13,502,574
Gold	1,571,307,353	24,764,393	2,005,219	170,519,020	7,266,746,289	9,035,342,274
Hafnium	—	—	—	—	—	—
Indium	—	—	—	—	—	—
Iron and steel	13,801,169,463	2,632,232,616	3,455,743,578	1,251,133,635	3,747,547,167	24,887,826,459
Iron ore	715,829,892	3,468,467	8,907	464	10,160,235	729,467,965
Lead	189,290,663	13,776,003	9,482,600	11,190,420	137,575,788	361,315,474
Lithium	128,736,131	9,816,117	18,611,598	241,799	46,519,154	203,924,799
Magnesium and magnesium compounds	58,384,087	13,788,415	205,568,459	1,363,593	27,452,670	306,557,224
Manganese	106,317,711	15,008,908	48,424,696	7,761,433	212,962,840	390,475,588
Mercury	1,043,959	7,123,720	815,926	9,251,555	2,454,114	20,689,274
Molybdenum	48,783,314	9,099,809	2,674,741	4,109,704	26,638,911	91,306,479
Nickel	464,818,440	188,894,922	11,819,203	3,582,763	106,660,230	775,775,558
Niobium	15,469,352	310,830	68,742	—	38,352,793	54,201,717
Platinum group metals	184,550,045	71,987,140	2,468,195	248,523	251,782,740	511,036,643
Rare earth metals	411,820	199,019	2,133,757	—	90,949	2,835,545
Rhenium	—	—	—	—	—	—
Selenium	481,517	492,807	51,789	87,265	681,773	1,795,151
Silicon	10,099,946	953,049	2,982,532	—	52,527,706	66,563,233
Silver	337,522,078	296,997,368	76,988,614	240,509,542	1,054,495,478	2,006,513,080
Strontium	27,522	309,026	—	416,190	115	752,853
Tantalum	1,042,584	103,573	84,566	—	992,907	2,223,630
Tellurium	337,175	490,033	4,390,314	—	3,368,412	8,585,934
Thallium	4,147	—	—	—	—	4,147
Tin	32,205,776	813,311	13,760,267	404,202	42,584,029	89,767,585
Titanium metal	170,365,425	20,543,119	23,458,597	77,669	96,729,721	311,174,531
Tungsten	17,852,547	2,186,441	5,108,935	—	2,914,926	28,062,849
Uranium and thorium	68,689,097	18,348,182	833,015	3	291,536,119	379,406,416
Vanadium	1,337,970	6,896,524	18,954,271	—	32,896,572	60,085,337



TOTAL IMPORTS OF MINERALS AND MINERAL PRODUCTS, BY COMMODITY AND COUNTRY OF IMPORT, 2017

Zinc	722,204,459	29,236,783	4,594,474	106,869,368	183,994,389	1,046,899,473
Zirconium	52,495,629	860,270	174,585	—	2,122,203	55,652,687
Other metals	5,943,090,923	1,410,694,504	2,666,494,157	1,640,761,918	2,792,201,891	14,453,243,393
Grand Total	30,069,962,264	5,366,357,998	7,481,648,167	3,613,997,860	20,463,595,387	66,995,561,676

NON-METALS	U.S.A.	European Union (EU-28)	China	Mexico	Other Countries	Total
Abrasives	222,544,958	118,514,602	52,470,084	10,741,618	118,481,474	522,752,736
Arsenic	435	3,949	53,611	—	24,108	82,103
Barite and witherite	6,910,827	422,110	2,757,570	—	21,127,472	31,217,979
Boron	33,062,004	2,437,886	377,705	1	14,332,859	50,210,455
Calcium (Industrial minerals)	—	—	—	—	—	—
Cement	525,513,255	71,935,322	143,114,186	8,593,412	128,742,198	877,898,373
Chlorine and chlorine compounds	102,932,938	10,172,369	12,858,364	2,238,138	5,775,785	133,977,594
Chrysotile (Asbestos)	134,164,335	8,000,825	10,127,950	593,062	17,390,943	170,277,115
Clay and clay products	321,015,122	316,835,420	548,217,822	69,413,044	197,048,773	1,452,530,181
Diamonds	103,933,873	50,371,785	3,628,507	—	380,650,599	538,584,764
Dolomite	22,625,636	13,163	171,514	—	27,707	22,838,020
Feldspar	1,012,346	374	—	—	32,309	1,045,029
Fluorspar	21,550,587	1,572,832	2,274,042	30,618,985	16,518,621	72,535,067
Glass and glassware products	2,397,378,987	313,884,617	726,795,916	282,748,831	207,951,199	3,928,759,550
Granite	15,748,902	18,952,393	30,395,818	67,168	65,944,698	131,108,979
Graphite	127,027,113	122,934,516	222,658,345	12,954,937	45,941,685	531,516,596
Gypsum	183,934,439	7,373,855	631,913	3,620,096	212,141	195,772,444
Iodine	6,582,268	1,560,035	57,812	161	6,341,713	14,541,989
Lime	61,433,936	325,554	37,311	—	25,448	61,822,249
Limestone flux and other limestone	38,148,545	1,078,319	2,277,657	3,373	602,601	42,110,495
Marble, travertine and other calcareous stones	16,414,926	43,687,252	43,622,644	2,382,167	45,760,512	151,867,501
Mica	4,273,428	1,471,205	452,367	1,644	1,875,511	8,074,155
Mineral pigments	161,331,310	46,228,474	9,166,163	1,369,867	19,344,942	237,440,756
Nepheline syenite	450,691	182	—	—	32,237	483,110
Olivine	2,897,421	2,906,308	10,491,115	59,009	2,879,186	19,233,039
Pearls	13,211,625	2,991,961	27,976,125	120,467	9,240,013	53,540,191
Peat	12,555,177	2,068,003	235,458	129	4,443,554	19,302,321
Perlite	13,092,588	434	122	—	—	13,093,144
Phosphate and phosphate compounds	621,064,272	23,592,447	13,060,866	1,066,774	46,849,780	705,634,139
Potash and potassium compounds	83,839,501	8,597,132	7,442,928	664,654	19,535,530	120,079,745
Salt and sodium compounds	525,606,351	41,436,980	71,625,825	31,421,487	107,349,764	777,440,407
Sand and gravel	21,209,548	155,656	1,582,955	98,962	371,585	23,418,706
Sandstone	1,198,986	97,146	104,496	—	5,096,534	6,497,162



TOTAL IMPORTS OF MINERALS AND MINERAL PRODUCTS, BY COMMODITY AND COUNTRY OF IMPORT, 2017

Silica and silica compounds	403,366,268	25,286,522	23,803,152	5,196,010	14,534,636	472,186,588
Slate	1,275,907	130,947	4,745,758	5,810	2,177,185	8,335,607
Sulphur and sulphur compounds	28,295,113	543,717	1,103,435	131	305,160	30,247,556
Talc, soapstone and pyrophyllite	15,728,927	1,167,368	133,527	—	141,673	17,171,495
Titanium oxides	205,801,716	16,890,691	35,395,865	21,309,073	16,216,998	295,614,343
Vermiculite	—	—	—	—	—	—
Other non-metals	1,139,179,439	121,038,131	47,713,205	22,576,973	109,006,018	1,439,513,766
Other structurals	120,514,011	27,056,736	54,968,093	2,734,431	40,645,857	245,919,128
Total Non-metals	7,716,827,711	1,411,737,218	2,112,530,226	510,600,414	1,672,979,008	13,424,674,577

MINERAL FUELS	U.S.A.	European Union (EU-28)	China	Mexico	Other Countries	Total
Coal	765,981,855	5,010,409	459,390	269,960	179,694,976	951,416,590
Coke	225,584,318	617,711	562	—	21,007,345	247,209,936
Total Mineral Fuels	991,566,173	5,628,120	459,952	269,960	200,702,321	1,198,626,526

Total Mining Imports	38,778,356,148	6,783,723,336	9,594,638,345	4,124,868,234	22,337,276,716	81,618,862,779
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Sources: Natural Resources Canada; Statistics Canada.
- Nil.



THE CANADIAN MINING INDUSTRY AT A GLANCE

	2005	2007	2009	2013	2014	2015	2016	2017
Mining industry GDP (\$ billion)	40.0	41.9	32.0	57	55.6	57.6	97.1	97
Percentage of total Canadian GDP (%)	3.8	3.4	2.7	3.5	3.4	3.4	3.3	3.3
Value of mineral production (\$ billion)	27.4	40.6	32.2	44.7	42.8	40.8	43.9	43.9
Synthetic crude production value (\$ billion)	9.2	18.0	n/a	35.5	21.5	19.6	25.3	25.3
Synthetic crude production (million cubic metres)	21.9	39.9	n/a	55.3	56.6	54.1	59.7	59.7
Number of mining establishments	859	766	961	1209	n.a	1201	1126	1126
Mineral extraction employment	47,000	53,000	52,000	60,215	60,565	71,380	70,000	70,000
Total direct and indirect mining industry employment	353,000	360,000	308,000	376,000	560,000	596,000	634,000	634,000
Mineral exploration/appraisal spending (\$ billion)	1.3	2.8	1.9	1.9	1.7	1.6	2.2	2.2
Mining industry capital expenditures (\$ billion)	7.4	10.1	9.8	15.07	15.3	n.a	11.1	11.1
Oil sands capital expenditures (\$ billion)	9.8	16.8	10.6	25.1	23.4	n.a	10.2	10.2
Stock of foreign mining direct investment (\$ billion)	n/a	n/a	n/a	21.1	10.4	35.5	28.2	28.2
Stock of Canadian mining direct investment abroad (\$ billion)	56.4	57.3	64.5	n/a	62.6	90.8	82.7	82.7

n/a—not available



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