

FACTS & FIGURES OF THE CANADIAN MINING INDUSTRY

F&F 2015



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 2014, though some from prior years and some from 2015. Dollar amounts are expressed in Canadian dollars unless noted otherwise.

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THE DOCTOR CAN SEE YOU NOW.

Superconducting magnets made from titanium and copper allow doctors to see the inner workings of the human body. Magic? No, mining. Canada is one of the world's top mining countries, and our minerals and metals are found in products of all kinds.

MINING.CA

CANADIAN MINING
Part of our natural heritage.

A message from The Mining Association of Canada.

CANADA'S METALS AND MINERALS ARE FREQUENT FLYERS.

Modern aircraft design is about strength, durability and weight. Minerals and metals allow next generation planes to save fuel, fly further, and improve comfort. Canada is one of the world's top mining countries, and our minerals and metals are found in products of all kinds.

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FORECAST: SUNSHINE WITH ENERGY ON THE WAY.

Metals and minerals have been used throughout history to capture light. Today they play a critical role as a conductive agent in solar panels. Canada is one of the world's top mining countries, and our minerals and metals are found in products of all kinds.

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THE WINDS OF CHANGE.

Nickel, steel making coal, copper and zinc are all critical to the efficiency of the turbines and towers of today's wind farms. Canada is one of the world's top mining countries, and our minerals and metals are found in products of all kinds.

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QUICK. WHAT'S YOUR IMAGE OF A MINER?

From economists to welders to engineers, mining jobs are just as diverse as the minerals and metals we mine. More than 375,000 people work directly in Canada's mining and mineral processing industries, and many more work indirectly in mining. Mining is also proportionally the largest private sector employer of Aboriginal people in Canada.

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MINING OUR GREATEST NATURAL RESOURCE: CANADIAN MINDS.

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YES. THIS WAS ONCE A MINE.

Wit's Lake is nestled deep in a reclaimed landscape in the oil sands region of northern Alberta. This wetland area features willow-lined shores when waterfowl nest, a lush forest and grassy islands. Abundant raspberries feed visiting bears. For Canada's mining companies, reclaiming the land we borrow is not just a legal obligation, it's a responsibility we take as seriously as creating jobs, building vibrant communities and generating billions of dollars in tax revenues.

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YES. THIS WAS ONCE PART OF A MINE.

This beautiful sunset shot was taken at Wapreaw lookout, a former tailings pond. Canada's mining companies are required by law to reclaim all lands disturbed by mining. Reclamation involves removing hazardous materials, reshaping the land, restoring topsoil, and planting native grasses, trees, or ground cover. While we end up here, along the way mining generates billions in tax revenues, creates thousands of jobs, and helps to build vibrant communities.

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SUMMARY OF ECONOMIC CONTRIBUTION AND KEY ISSUES

THE GLOBAL MINING SECTOR IS STRUGGLING THROUGH A SIGNIFICANT DOWNTURN IN COMMODITY PRICES, TRIGGERED BY ECONOMIC VOLATILITY AND THE CONSEQUENCES OF AN OVER-SUPPLIED MARKET RESULTING FROM THE LENGTHY UPSWING OF THE PAST DECADE. AS A CYCLICAL INDUSTRY, THE CANADIAN MINING INDUSTRY HAS NAVIGATED MANY DOWNTURNS IN COMMODITY PRICES; AND CANADIAN COMPANIES ARE ADEPT AND EXPERIENCED AT CONTROLLING COSTS AND STEERING THROUGH UNCERTAINTY. NEVERTHELESS, THE DOWNWARD PRESSURE ON MINERAL PRICES IS REAL AND COMPANIES ARE FEELING IT. IT IS DURING A DOWNTURN, HOWEVER, THAT INDUSTRY AND GOVERNMENTS SHOULD BE THINKING ABOUT, AND PLANNING FOR, THE NEXT UPSWING. CANADA'S ABILITY TO TAKE ADVANTAGE OF THE RETURN OF STRONG COMMODITY PRICES, WHICH SOME ANALYSTS PREDICT COULD BEGIN AS EARLY AS 2016, WILL PARTLY DEPEND ON THE POLICY DECISIONS MADE NOW.

ECONOMIC CONTRIBUTION

The mining industry, even in a significant downturn, contributes greatly to Canada's economic strength. The industry employs more than 375,000 workers across the country in mineral extraction, smelting, fabrication and manufacturing. Proportionally, the mining industry is also the largest private sector employer of Aboriginal peoples in Canada and employment is poised to increase. The industry's \$57 billion contribution to Canada's gross domestic product in 2014 included \$24 billion in mineral extraction, and \$33 billion in mineral processing and manufacturing.

Internationally, Canada is one of the leading mining countries and one of the largest producers of minerals and metals. The industry accounted for 18.2% of the value of Canadian goods exports in 2014, selling a diversified array of minerals abroad. Exports of aluminum, copper, gold, iron and steel, iron ore, nickel, silver, uranium, zinc, diamonds, potash and coal ranged from \$500 million to \$11.9 billion, respectively.

Canada remained the world's top destination for non-ferrous exploration spending in 2014, but experienced a 22% decrease in allocations year-over-year. This marks the third consecutive year that Canada's share of international exploration investment has fallen, which is indicative of the

fierce competition for global mineral investment, and the financing challenges junior companies are facing. Canadian exploration spending is focused in many regions, and more than 800 Canadian companies are exploring in over 100 countries.

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 were home to 57% of the world's publicly listed mining companies in 2013, and accounted for 62% of the global mining equity raised in 2014. 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 global centre for oil sands expertise and Saskatoon for uranium and potash.

Other evidence of the industry's vast economic reach is that mining accounts for over one-half of all rail-freight revenues of Canada's major railways, CN and CP. As well, more than 3,700 suppliers provide expertise to the industry, making significant indirect economic contributions across Canada. A recent survey commissioned by the Canadian Association of Mining Equipment and Services for Export indicates that 913 companies in Ontario alone identify as mining suppliers. Together, they provide 68,000 additional jobs across the

province, and generate 1% of provincial GDP and \$1.5 billion in government tax revenue.

Mining and its related industries are important contributors to federal, provincial and territorial coffers. According to a recent MAC study, the industry's payments to governments totalled \$71 billion in taxes and royalties over the decade leading through to 2012. Beyond contributions to governments, the average annual pay for a mining worker in 2014 exceeded \$100,000, which surpassed the average annual earnings of workers in forestry, manufacturing, finance and construction by a range of \$21,000 to \$33,000.

In 2013, the most recent year for which data are available, Canadian mining companies invested \$677 million in research and development (R&D). Mining's investment surpassed that of the machinery sector, the pharmaceutical sector and the wood products and paper sector. The same year, the industry employed over 4,500 people in R&D. This is more than the pharmaceutical and forestry sectors, both of which receive extensive financial and policy support from the government.

KEY ISSUES FOR THE CANADIAN MINING INDUSTRY

According to recent MAC research, there is over \$140 billion in potential mineral project investments over the next decade in Canada, depending on market realities. This would translate into multiple billions worth of investments in most of Canada's provinces and territories, namely British Columbia, Alberta, Saskatchewan, Ontario, Quebec, Newfoundland and Labrador, Nunavut and the Northwest Territories. These projects may face obstacles and delays, but the figure does suggest the scale of mining-related jobs, supply contracts and tax revenues if these projects come to production. The future of these projects is shaped by many issues, domestic and global, of which five are particularly relevant.

State of the global mining 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 are driven by global supply and demand. Recent uncertainty over the short-term global economic outlook – such as concerns over Eurozone contagion, the softening of Chinese growth, uncertainty over the strength of the US economic recovery, and increased supply for some commodities – caused downward pressure on commodity prices in recent years. Some operations have been put on care and maintenance, and job losses have occurred.

Despite challenges, the prevailing view is that the Canadian mining sector's economic prospects remain strong over the medium to longer term. Given the long-term growth projections for China, India and other emerging countries, and assuming a positive investment environment, demand for minerals and metals is likely to increase. This is especially true as the consumption patterns of middle classes of developing economies continue to more closely resemble those of industrialized countries.

Canadian investment competitiveness. While elements of Canada's mining tax regime are attractive, recent changes from the 2012 and 2013 federal budgets (being phased in over time) will make it more costly for companies to both develop projects and expand existing mines. This is particularly true for remote and northern regions. Innovation and productivity also impact Canadian competitiveness, and the industry faces several challenges in this regard. Challenges in discovering new



Photo: IAMGOLD, Westwood Gold Mine, Quebec

deposits, operating deeper mines, increasing energy costs and navigating complex regulatory requirements are all obstacles that need to be addressed.

Canadian regulatory burden. New mines and major expansions must undergo federal reviews and approvals in addition to the review and permitting requirements of their provincial or territorial jurisdiction. Most major mining projects in provinces are subject to the *Canadian Environmental Assessment Act* (CEAA 2012) as well as parallel provincial assessments 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. A review of the Metal Mining Effluent Regulations (MMER) was announced at the same time and multi-stakeholder consultations concluded in 2015, but resulting amendments have not yet been published in Canada Gazette Part 1 for public comment. CEEA 2012 came into force in July 2012, and its Regulations Designating Physical Activities were amended in October 2013. Amendments to the *Fisheries Act* came into force in November 2013. Amendments to the *Navigable Waters Protection Act*, changing it to the *Navigation Protection Act*, came into force in April 2014. Based on experience to date, there has been a slight increase in the number of federal approvals required for mining projects and a significant change in the processes to obtain those approvals. A recent review of the CEEA registry indicates the number of mining projects requiring review is significantly higher than other industrial sectors. In addition to the uncertainty created by these legislative changes, the new government has promised in its platform to review CEEA 2012, the *Fisheries Act*, and the *Navigation Protection Act*. The uncertainty and difficult transition that was created by the 2012 legislative changes points to the importance of consultation with affected stakeholders, transition planning, adequate capacity within departments to manage implementation, and consideration of interaction among various federal regulatory requirements and between federal and provincial processes.

Need for strategic infrastructure investment. The mining industry is the largest customer group of Canada's transportation sector. It is, therefore, important that the sector move products to market efficiently, at competitive prices and on modern infrastructure such as ports, highways and railways. Capital spending opens up new regions for development by enhancing the economic viability of a host of projects. Conversely, Canada's vast geography, and the substantial cost required to overcome it, can be a barrier to developing remote and northern mining projects.

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

Mineral investment can help governments and communities achieve public social and economic policy objectives for these regions. Given this benefit, MAC recommends that government seriously consider how it

can advance this nation-building opportunity, specifically through tax incentives, infrastructure investments, and public-private partnerships.

The human resources challenge. According to the Mining Industry Human Resources Council (MiHR), the Canadian mining industry will require 106,000 new workers over the next decade. This deficit is compounded by the approaching retirement of the industry's skilled core of workers. By 2025, MiHR forecasts that more than 51,000 employees will retire from the sector. As Canada's largest private sector employer of Aboriginal people on a proportional basis, the industry is in a good position to increase Aboriginal employment if the right training and skills programs are developed and maintained. Most Aboriginal communities are located within 200 kilometres of a producing mine or an exploration property. Addressing the human resources challenge will take a large and coordinated effort by the industry, educational institutions and all levels of government in the coming years.



Photo: Suncor Energy, Fort McMurray, Alberta



MINING

ONE INDUSTRY, MANY APPLICATIONS

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.”

The mining industry is crucial to the everyday life of all Canadians. Mined products are required to build highways, electrical and communication networks, housing, vehicles, electronics and many other items essential to modern life.

Clean energy and “green” products also rely on 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. 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, its opportunities, challenges, investments and needs are inseparable from those of broader society. Thanks to the industry’s innovation and investment, Canada has benefited from low-cost mineral and metal products, good jobs, greater wealth and responsible stewardship of natural resources.

SOME CONSUMER PRODUCTS THAT RELY ON MINING

- Batteries (nickel, cadmium, lithium, cobalt)
- Circuitry (gold, copper, aluminum, steel, lithium, titanium, silver, cobalt, tin, lead, zinc)
- Computer and TV screens (silicon, boron, lead, barium, strontium, phosphorus, indium)
- Energy (coal, uranium, oil sands)
- Musical instruments (copper, silver, steel, nickel, brass, cobalt, copper, iron, aluminum)
- Sports equipment (graphite, aluminum, titanium, calcium carbonate, sulphur)
- Vehicles and tires (steel, copper, zinc, barium, graphite, sulphur, bromine, iodine)



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

The Bank of Canada downgraded its 2015 global economic growth forecast, from 3.3% in April to 3.1% in July, due to faltering economic growth in the United States and China early in the year. Looking forward, the Bank of Canada anticipates growth to rebound at 3.6% and 3.7%, respectively, for 2016 and 2017, which is consistent with earlier projections. Comparable, though less rosy, are global growth forecasts, which the World Bank downgraded from 3.0% at the beginning of the year to 2.8% in June. The International Monetary Fund (IMF) projected a more promising picture of global growth in 2015, at 3.5%, but also downgraded expected growth to 3.3% in July.

Not taken into account in these revisions was the extreme global financial market volatility in late August. This market flux wiped trillions of dollars from balance sheets, placed further downward pressure on commodity prices from perceived faltering demand, and fueled significant speculation over the stability of the global economy. At the time of writing, due in part to significant Chinese market stimulus measures, the market freefall had begun to stabilize, with equities recovering some lost ground. However, analysts' views were mixed as to whether the market correction had run its course, or may persist.

EMERGING ECONOMIES

Emerging market demand has continued to slide, but performance has been uneven across countries. From 2010 through 2014, GDP growth from the IMF's Emerging Market and Developing Economies has fallen significantly, from 7.6% to 4.6%, and is forecast to be significantly lower in 2015, at 4.2%, than in previous years. Looking forward through 2015, both Brazil and Russia forecast negative GDP growth at 1.5% and 3.4%, respectively. Meanwhile, China's growth is forecast to shrink to an annual 6.8% in 2015 and 6.3% in 2016 as that economy rebalances to follow a more sustainable growth path. This will lead to uncertainty over the strength of demand for materials given that China is currently the world's largest market for mined products. In contrast, however, India is forecast to grow by an annual 7.5% in both 2015 and 2016, leaping forward from the 5.0% growth forecasted for 2014.

As overall emerging country growth slows, recently strong economies have become less able to pick up the slack in global economic growth resulting from underperforming advanced economies. While some positive signs have come from advanced economies, without broader economic revitalization in other countries and regions, the slower pace of global economic growth is likely to persist, or further decline.

PERFORMANCE OF ADVANCED ECONOMIES

Uncertainty over the performance of several of the world's advanced economies continues, affecting the short-term global economic outlook. Concerns over the length of the recession in Europe, mixed views on the effectiveness of Japanese economic reforms, and uncertainty over the strength of the US economic recovery have contributed to weak market confidence and investor hesitancy.

Modest indicators of incremental yet uneven economic progress have continued year-over-year in the European

Union. Eurostat – the European Commission’s statistics office – reported growth of 0.4% for the first quarter of 2015 for the 28-country union. Year-on-year basis growth rates for the second and third quarters are forecasted at 1.5% and 2.1%, respectively. While there is room for more growth, these numbers indicate measured improvement, and are the highest estimates since spring 2011. While still high, improvement was also seen in Europe’s seasonally adjusted unemployment rate, dropping from 10.2% in June

2.8% in 2016. Robust job creation, high corporate profits, favourable financing conditions and pent-up demand all point to higher GDP growth for the world’s largest economy. These positive indicators, however, suggest that a benchmark interest rate hike by the Federal Reserve is likely. While the increase may send momentary ripples through the economy, both at home and abroad, normalizing the interest rate is seen as a step towards a return to economic health and normalization, even if it signals an end to the era of free money.



Photo: Goldcorp, Porcupine Operation, Ontario

2014 to 9.6% year-over-year. On both measures, however, large discrepancies exist across member states. For example, the lowest unemployment rates were recorded in Iceland (4.2%), Germany (4.7%) and the United Kingdom (5.4%), and the highest rates were in Greece (25.6%) and Spain (22.5%). Despite challenges, these trends are seen by some as both consistent and important – if small – steps towards broader economic recovery and stability across the economic union.

Japan, the world’s third-largest economy, expanded 1% in the first months of 2015, up from an initial estimate of 0.6%. The data is elevating prospects of a continuing recovery from the recession that befell the country last year. As the country pursues the government’s policy mix of aggressive monetary easing, fiscal spending and structural reforms, analysts remain uncertain as to the plan’s likelihood for long-term success. While it has raised expectations for better times ahead – supported by recent growth – a ballooning debt of approximately 230% of GDP, and serious demographic issues, means Japan’s challenges remain significant.

Meanwhile, economic performance in the United States is beginning to pick up. Moody’s forecast for US growth is 2.4% in 2015, and the investor service projects it will rise to

IMPACTS ON THE MINING INDUSTRY

Given the market-driven nature of mineral and metal pricing, both global and Canadian mining industries are affected by ongoing global economic uncertainty. In 2014, the combined value of the top 40 global mining companies shrank by \$156 billion, or roughly 14%, according to PwC. This slide is only half that of 2013, due largely to aggressive industry-wide cost-control practices. Although profits increased in 2014, when adjusted for impairments, the minerals industry saw a decline in adjusted net profit by a further 9%. This decline is in addition to the 72% drop in aggregate net profits from 2013, resulting in the lowest level of aggregate net profits in a decade. On the exploration side of the business, access to capital has been particularly challenging for junior mining companies. (See Section 3 of this report for more information.)

Commodity price fluctuations have correlated with global economic volatility in recent years. From winter 2011 highs, the monthly average price of both nickel and copper has trended downward, losing approximately 60% and 50% of their respective value in markets at the time of writing. The minerals industry has seen similar trends with subtle variations for silver, uranium and potash. Beyond gold’s \$700 per ounce fall, iron ore and coal have experienced the most dramatic swings, both suffering a loss in value exceeding two-thirds since 2011. More recently, the price for oil fell 60% between June 2014 and January 2015, and on August 17, 2015, the West Texas Intermediate benchmark price closed at a new six-and-a-half year low – below US\$42 per barrel – which prompted analysts to say downward pressure could see prices fall even further.

Globally, of the top 40 companies in 2014, it is notable that 13 are members of the Mining Association of Canada (MAC). With a shift in focus, many mining companies are re-evaluating their stated positions on the development of new projects, both at home and abroad, and are adopting strategies to reduce costs and maximize cash flows. Despite these adjustments, downward pricing trends in

certain commodities are beginning to put pressure on the profitability of extracting them.

Looking forward, the Canadian mining industry's economic prospects will likely be strong over the long term, even if the interim period presents challenges. The prevailing view is that the longer-term fundamentals are solid, and that the current period of heightened volatility will pass. 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 is likely to return.

This opportunity cannot be taken for granted, however, nor can the robust economic contributions of the sector to Canadians and the Canadian economy. Decisions regarding regulatory, tax and mineral policy made now will significantly affect Canada's readiness to capitalize on and benefit from these opportunities when they arrive.



Photo: Agnico Eagle Mines Limited, Meadowbank Mine, Nunavut

MINING'S CONTRIBUTION TO THE CANADIAN ECONOMY

Mining contributes significantly to the Canadian economy. The wages and employment of approximately 375,000 people across the country, taxes and royalties collected by governments, and the capital expenditures required for project development and operation are only some examples of its contributions. Beyond its direct economic impact, the industry also supports many firms and sectors that supply mining with the goods and services it needs to function.

CONTRIBUTION TO CANADA'S GDP

Historically, the value of minerals and metals to Canada's economy has ranged between 2.7% and 4.5% of the country's GDP. In 2014, the industry's contribution remained within this range at 3.5%.

2014 CONTRIBUTION

The extractive industry, which combines mineral extraction with oil and gas extraction, contributed \$115.3 billion, or 7.3%, to Canada's GDP in 2014 (see Figure 1). By this measure, the extractive industry is the fourth largest of Canada's 18 industries, surpassed only by the services, real estate and manufacturing sectors, which rank first, second and third, respectively.

The mining industry as a whole goes beyond extraction to include mineral manufacturing. The mining industry's 2014 contribution to GDP is detailed in Figure 2, which divides industry activity into four stages:

- **Stage 1**, extraction of minerals (metals, non-metals and coal): \$23.9 billion
- **Stage 2**, primary metal manufacturing (smelting, refining, rolling, extruding, alloying and casting of primary metals): \$14.6 billion
- **Stage 3**, non-metallic mineral product manufacturing (abrasives, lime, cement, glass, ceramics): \$5.3 billion
- **Stage 4**, fabricated metal product manufacturing (forging, stamping and heat-treating to produce reinforcing bars, fabricated wire, cutlery, tools, hardware): \$13.2 billion

The output of these four stages in 2014 totalled \$57 billion. By comparison, according to Statistics Canada, the oil and gas extraction sector contributed \$96.5 billion to the GDP. The Canadian Association of Petroleum Producers indicated that on a barrel-per-day basis, approximately 28% of oil extracted in 2014 was from oil sands mining, the extractive process for which is essentially a surface mining operation. Support activities for mining and oil and gas contribute an additional \$11 billion to the GDP.

MINING IN THE PROVINCES AND TERRITORIES

Mineral production values were down in nine of Canada's 13 provinces and territories year-over-year, but exhibit marked increases over the longer term. For example, the 2014 value of mineral production in Saskatchewan was \$7.1 billion. Although down slightly this year, this value represents a more than 200% increase over the last decade, indicating significant growth over time. Similar growth over the last decade was experienced by Ontario, Saskatchewan, British Columbia, Quebec, and Newfoundland and Labrador.

REGIONAL DISTRIBUTION OF MINING

Figure 3 illustrates the geographical location of Canada's mining expertise (details in Annex 1). The Northwest Territories is 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 metallurgical coal production. Newfoundland and Labrador and Quebec produce virtually all of Canada's iron ore. Several provinces have strong copper and nickel production. (For detailed mineral production by province and territory, see Annex 2 and Annex 3.)

CANADIAN MINES IN 2014

Total mining establishments: 1,209

Metals: 77

Non-metals: 1,132

PROVINCES WITH THE MOST METAL MINES

Quebec: 26

Ontario: 19

British Columbia: 9

MAIN TYPES OF NON-METAL MINES

Sand and gravel quarries: 834

Stone quarries: 267

Peat mines: 64

Mining also has significant ties to Canada's major cities. Some of the largest Canadian and international mining companies are headquartered or have 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 1,200 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.

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

Canadian mineral production rose by 2.5% in 2014, a slight increase over 2013.

VALUE OF MINING IN 2014

Canada-wide: \$44.7 billion

TOP 4 PROVINCES

1. Ontario: \$10.9 billion

2. Quebec: \$8.7 billion

3. Saskatchewan: \$7.1 billion

4. British Columbia: \$6.9 billion

Over the past decade, Newfoundland and Labrador, Saskatchewan and British Columbia have seen their respective shares of Canada's mineral production value grow most significantly (see Figure 4). For example, the national share of Newfoundland and Labrador, an important nickel and iron ore producer, has also risen fourfold over that time period.

A correlation exists between production values and expenditures on resource development. The top four provinces by production value in 2014 – Ontario, Quebec, Saskatchewan and British Columbia – also led in expenditures on mineral resource development (see Figure 5). Of the \$10.3 billion invested in mine complex development in Canada, combined spending across these four provinces exceeded \$8.6 billion (84% of the total) and ranged from \$900 million to \$4.1 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 18% of total 2014 Canadian spending on exploration and deposit appraisal (the first two columns of Figure 5). This amount, more than three times the territories' share of production value (6.6%), reflects global interest in Canada's northern mineral potential. Despite such interest, however, overall territorial exploration investment has decreased significantly in recent years, by nearly 65% since 2011. This third consecutive annual decrease reflects market realities and ongoing regulatory challenges, and has implications for

both junior mining firms in those regions as well as for territorial economies. (See Section 5 of this report for more information.)

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

In 2012 (the most recent year in which data are available), the mining industry, including oil sands mining, paid an estimated \$6.6 billion to federal and provincial/territorial governments (see Figure 6). This total consisted of:

- \$3.0 billion in royalties
- \$1.2 billion in corporate income tax
- \$2.3 billion in personal income tax

Approximately 40% of this amount went to the federal government and 60% to provincial/territorial governments.

Including the fourth stage of mining would add another \$1.9 billion to the amount industry paid governments in 2012, bringing the total to \$8.5 billion.

It is also worth noting that the oil sands industry pays the Alberta government large sums, as high as \$2 billion in some years, in the form of land sales payments. These sums are not included in Figure 6.

Also noteworthy, from a payment disclosure standpoint, is the Canadian government's resource revenue transparency legislation, which came into force in July 2015. The practical effect of the new law means that companies will disclose the payments they make to governments that exceed a \$100,000 threshold, creating greater transparency over the taxes, royalties and other forms of disbursement that companies pay. (See Section 6 of this report for more discussion on the industry's efforts to advance this legislation, and the importance miners place on financial transparency.)

MINING PAYMENTS TO CANADIAN GOVERNMENTS TOTALLED \$71 BILLION OVER THE YEARS SPANNING 2003 TO 2012.

INDIRECT CONTRIBUTIONS TO MINING INDUSTRY SUPPLIERS

The mining industry's economic impact goes far beyond its direct contribution to 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.

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 2014 that more than 3,700 firms in Canada provide technical, legal, financial, accounting, environmental and other expertise to the mining industry. Most of these suppliers are located in Ontario and British Columbia, followed by Alberta, Quebec, Saskatchewan and Manitoba. A recent study by the Canadian Association of Mining Equipment and Services for Export found that 913 companies identify as mining suppliers in Ontario alone. Together, they provide 68,000 additional jobs across the province, and generate 1% of provincial GDP and \$1.5 billion in government tax revenue. Similar indirect contributions are made to the governments of other mining provinces.

From 2009 to 2014, \$166 billion of global mining equity was raised by the TSX and the TSX Venture Exchange – more than any other stock exchange in the world. Several



Photo: Vale, Totten Mine, Ontario

thousand Canadian brokers, analysts, exchange workers, consultants, trade finance experts and securities lawyers both support and benefit from the mining industry. (See Section 3 of this report for a discussion on the Canadian investment services sector as a mining supplier.)

TAX POLICY

NUMBER OF MINING SUPPLIERS IN LEADING COUNTRIES

United States: 5,776

Canada: 3,698

Brazil: 3,487

Australia: 2,974

Chile: 1,847

Source: InfoMine

The Canadian mining industry supports the federal government's reduction of the federal corporate tax rate to 15% – the lowest corporate tax rate in the G7, thus increasing Canada's global attractiveness as a business destination.

Industry is also pleased with the extension of both the Mineral Exploration Tax Credit and the super-flow-through share provision in the 2015 federal budget. Both measures are essential to assisting financing and exploration efforts in these challenging financial times, and are key to addressing Canada's declining base metal reserves.

Other recent federal mining tax reforms, however, will make it more costly for companies to develop projects and operate, particularly in remote and northern regions, and might push investment to more competitive jurisdictions. The 2012 and 2013 federal budgets initiated a trend in reduced government tax support to the Canadian mining industry as result of the following actions:

- The elimination of the corporate Mineral Exploration and Development Tax Credit
- The elimination of the Atlantic Investment Tax Credit for resources
- The elimination of the Accelerated Cost of Capital Allowance
- The reduction of the Scientific Research and Experimental Development Tax Incentive Program

- The rendering of pre-production expenses ineligible for Canadian Exploration Expenses deductions

On the backdrop of a volatile commodities market, and given the already heightened level of remote and northern exploration and rising development and operational costs, these measures have pushed development further away for some projects.

Knowing that any reduction in mining and mineral-related investment will be associated with a reduction in regional and national social and economic benefits, these tax reforms will arguably make it more difficult for governments to achieve certain stated public policy objectives. This is particularly true for Canada's remote and northern regions, where operating costs are significantly higher and infrastructure is acutely lacking. Having greater access to tax incentives and other government support would help Canada unlock the mineral potential in these areas, and would enable the federal government to meet its socio-economic objectives for these regions.



Photo: Syncrude Canada, Oil Sands Facility, Alberta

FIGURE 1

CANADA'S REAL GROSS DOMESTIC PRODUCT BY INDUSTRY, 2008-2014

(\$ millions)	2008	2009	2010	2011	2012	2013	2014
All industries	1,480,703	1,436,282	1,483,155	1,527,201	1,558,434	1,589,449	1,629,062
Agriculture	19,954	18,927	18,730	18,895	19,240	21,784	20,415
Forestry and logging	3,950	3,124	3,608	3,834	3,810	3,991	3,910
Fishing, hunting and trapping	1,087	1,066	1,131	1,108	1,134	1,121	1,180
Mining (including milling) and quarrying, and oil and gas extraction	108,856	99,540	103,584	108,088	109,950	113,936	120,431
Support activities for mining and oil and gas extraction	11,487	8,361	10,328	12,207	11,225	11,152	12,132
Electric power, gas and water utilities	37,064	35,999	36,851	37,749	37,873	39,245	39,433
Construction	98,958	95,461	102,771	106,101	113,007	115,072	115,833
Manufacturing	176,417	152,580	159,994	164,814	168,660	167,855	173,310
Trade, wholesale	79,124	74,028	79,555	85,285	86,677	87,855	91,944
Trade, retail	80,415	78,503	81,032	82,240	83,900	86,341	89,504
Transportation and warehousing	62,560	59,693	61,990	64,064	64,891	65,658	68,449
Information and cultural industries	49,325	49,352	50,351	50,838	51,542	52,132	52,112
Finance and insurance	97,211	95,881	98,394	101,367	103,275	107,315	110,969
Real estate and rental and leasing	172,849	177,812	183,097	189,610	194,903	200,481	206,301
Community, business and personal services	203,592	200,258	200,226	205,540	209,172	213,146	217,578
Public administration	99,975	104,216	107,371	108,859	109,105	109,084	110,215
Health care and social assistance	99,879	101,990	102,877	105,173	107,126	108,834	110,658
Educational services	78,000	79,491	81,265	81,429	82,944	84,447	84,688

Source: Statistics Canada, CANSIM Table 379-0031.

Note: Values at Basic Prices in 2007 Constant Dollars.

FIGURE 2

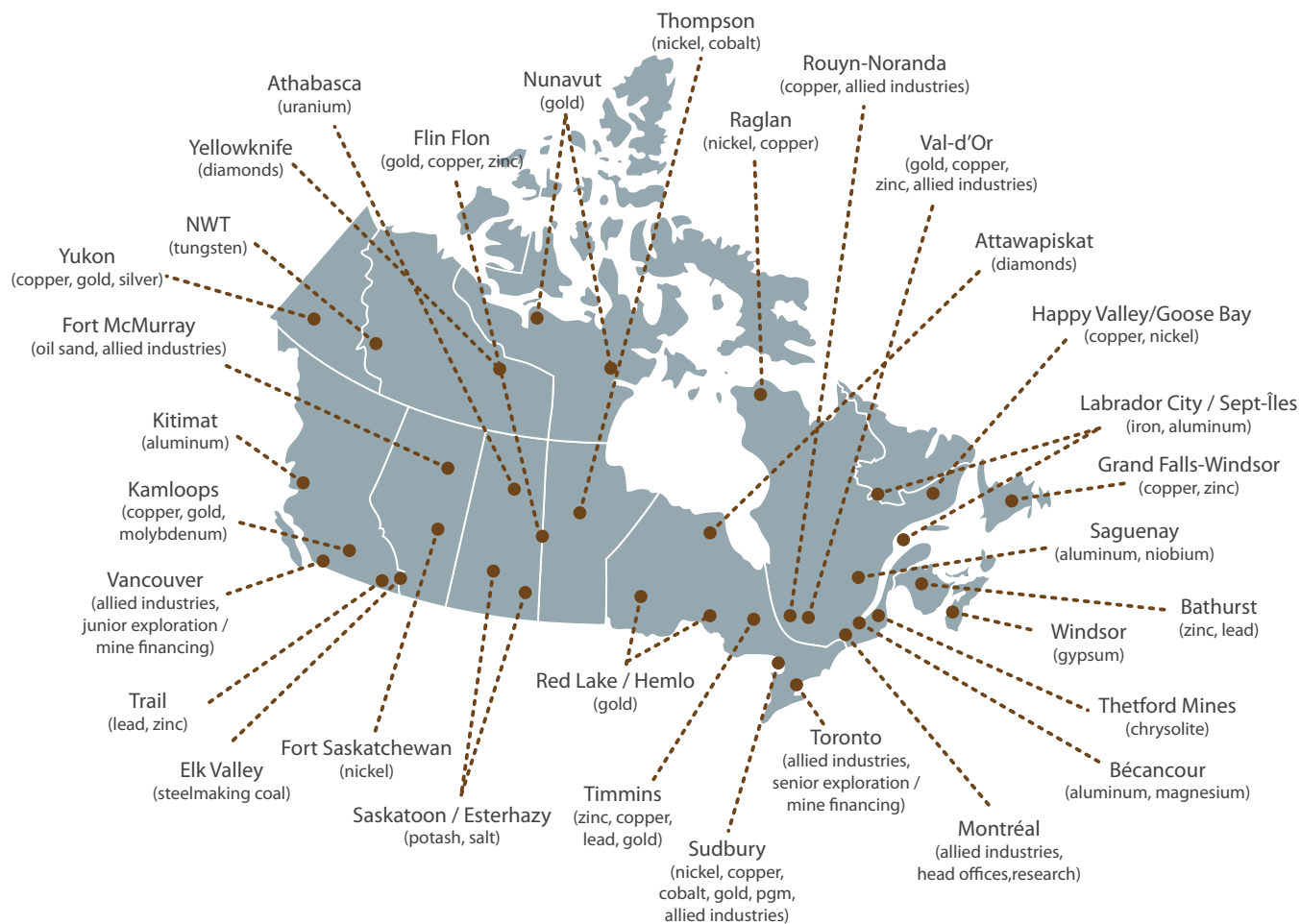
REAL GROSS DOMESTIC PRODUCT, MINING AND MINERAL MANUFACTURING, 2008-2014

(\$ millions)	2008	2009	2010	2011	2012	2013	2014
Metal mines	16,999	13,187	13,876	15,941	15,772	16,181	17,353
Non-metal mines	5,036	3,473	4,477	4,811	4,410	4,597	4,854
Coal mines	1,704	1,432	1,627	1,589	1,699	1,825	1,723
Total Mining	23,739	18,092	19,980	22,341	21,881	22,603	23,930
Primary metal manufacturing	15,096	11,433	13,266	13,911	14,205	14,275	14,650
Fabricated metal product manufacturing	13,084	11,182	11,611	12,556	13,384	13,013	13,229
Non-metallic mineral product manufacturing	6,206	5,150	5,275	5,344	5,366	5,117	5,345
Total Mineral Manufacturing	34,386	27,765	30,152	31,811	32,955	32,405	33,224
Oil and gas extraction	85,117	81,448	83,604	85,747	88,069	91,333	96,501
Petroleum and coal products manufacturing	6,994	7,410	6,955	6,663	6,805	6,738	6,669
Support activities for mining and oil and gas	11,487	8,361	10,328	12,207	11,225	11,152	12,132
Total Oil and Gas and Associated Manufacturing	103,598	97,219	100,887	104,617	106,099	109,223	115,302

Source: Statistics Canada, CANSIM Table 379-0031.
Note: Values at Basic Prices in 2007 Constant Dollars.

FIGURE 3

CANADIAN MINING INDUSTRY CLUSTERS



Source: Natural Resources Canada.

FIGURE 4

VALUE OF CANADIAN MINERAL PRODUCTION BY PROVINCE AND TERRITORY, 2004 AND 2014^P

Province/Territory	(\$ millions)	2004 (%)	Rank	(\$ millions)	2014 ^P (%)	Rank
Ontario	7,122.6	29.2	1	10,999.3	24.6	1
Quebec	4,012.2	16.5	2	8,737.2	19.5	2
Saskatchewan	3,037.9	12.5	4	7,131.5	15.9	3
British Columbia	3,740.0	15.3	3	6,984.3	15.6	4
Newfoundland and Labrador	770.4	3.2	9	3,160.1	7.1	5
Alberta	1,210.8	5.0	6	2,805.2	6.3	6
Northwest Territories	2,112.5	8.7	5	1,886.3	4.2	7
Manitoba	1,210.3	5.0	7	1,381.7	3.1	8
New Brunswick	35.5	0.1	12	642.1	1.4	9
Nunavut	62.0	0.3	11	428.8	1.0	10
Yukon	778.6	3.2	8	380.6	0.9	11
Nova Scotia	285.6	1.2	10	204.3	0.5	12
Prince Edward Island	3.1	...	13	4.2	...	13
Total Canada	24,381.6	100.0		44,745.6	100.0	

Sources: Natural Resources Canada; Statistics Canada.

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

Notes: 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 5

TOTAL CAPITAL EXPENDITURES FOR MINERAL RESOURCE DEVELOPMENT, BY PROVINCE AND TERRITORY, 2014^p

Province/Territory / (\$)	Exploration	Deposit Appraisal	Mine Complex Development	Total Expenditures
Newfoundland and Labrador	34,391,349	42,291,047	353,149,242	429,831,638
Nova Scotia	6,911,808	379,000	15,867,977	23,158,785
New Brunswick	14,598,229	11,397,665	104,092,716	130,088,610
Quebec	148,743,582	123,536,510	2,234,470,262	2,506,750,354
Ontario	238,711,670	268,624,677	1,304,690,731	1,812,027,078
Manitoba	27,026,034	100,000	246,006,111	273,132,145
Saskatchewan	172,544,151	60,261,089	4,186,613,146	4,419,418,386
Alberta	4,314,891	18,170,846	97,574,415	120,060,152
British Columbia	140,285,178	273,951,652	927,572,469	1,341,809,299
Yukon	39,463,427	67,588,000	34,194,997	141,246,424
Northwest Territories	30,850,175	64,984,286	421,129,095	516,963,556
Nunavut	82,737,157	61,840,304	396,619,839	541,197,300
CANADA	940,577,651	993,125,076	10,321,981,000	12,255,683,727

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 6

DIRECT REVENUES TO CANADIAN GOVERNMENTS FROM THE MINERAL SECTOR, 2003–2012

Revenues (\$ millions)	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Total
Royalties/Mining Taxes	586	1,336	1,576	2,640	3,967	5,279	2,187	3,176	3,880	3,060	27,687
Corporate Income Tax	1,773	1,943	2,393	4,005	4,213	3,204	1,083	2,408	2,437	1,244	24,702
Personal Income Tax	1,732	1,732	1,731	1,784	1,970	2,047	1,687	1,861	1,987	2,277	18,808
TOTAL	4,090	5,011	5,700	8,429	10,150	10,529	4,957	7,445	8,304	6,581	71,197
-of which federal	2,609	2,760	2,799	3,707	4,005	3,547	1,905	2,963	3,045	2,471	29,811
-of which provincial	1,481	2,251	2,901	4,722	6,145	6,982	3,052	4,482	5,259	4,110	41,385
Provincial share (%)	36.2	44.9	50.9	56.0	60.5	66.3	61.6	60.2	63.3	62.5	58.1

Source: ENTRANS Policy Research Group study for the Mining Association of Canada.

Note: Most royalty estimates are provided on a fiscal year basis, while the estimates for corporate and personal income taxes are for calendar (taxation) years. The federal share includes federal corporate income and capital taxes, federal personal income taxes paid by mining employees and mining royalties generated in the Northwest Territories and Nunavut. The provincial share includes all royalties and mining taxes to provinces and to the Yukon, provincial corporate income and provincial personal income taxes paid by mining employees.

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 14 major minerals and metals (details in Annex 4):

- First in potash
- Second in uranium and niobium
- Third in cobalt, aluminum, tungsten and platinum group metals
- Fourth in nickel, salt, sulphur and titanium
- Fifth in diamonds, cadmium and gold

In 2014, Canada regained a top five position in the production of gold, cadmium, salt and niobium, and jumped ranks for nickel and platinum group metals. In contrast, Canada no longer holds a top five position in the production of silver, zinc, copper or molybdenum, having been surpassed by other countries, including Australia, Russia, the United States, China, Mexico and Peru. However, for these and other major minerals and metals, Canada still remains in the top 10 in global production.

PRODUCTION VALUES

In 2014, the value of Canadian mineral production increased slightly – by 2.5% – to \$44.7 billion. This suggests a settling in contrast to the decline from its record high of \$50.9 billion in 2011 (see Figure 7). Metal and non-metal values increased by 4.7% and 4.5%, respectively,

while coal production values decreased sharply by 20%. At \$24.6 billion and \$16.2 billion for metal and non-metal production, respectively, the 2014 totals mark an almost twofold increase over the past decade.

Canada's top 10 minerals and metals (see Figure 8) each had

CANADIAN MINERAL PRODUCTION IN 2014

Metals: \$24.6 billion
Non-metals: \$16.2 billion
Coal: \$3.9 billion
TOTAL: \$44.7 billion

production values of more than \$1.5 billion in 2014, with five (gold, potash, copper, iron ore and nickel) over \$4 billion each. Values for six out of the 10 commodities increased in 2014, with gold leading the charge with a \$1 billion (15.7%) increase year-over-year, followed by copper and nickel. Year-over-year volume production increases for gold, copper and nickel reflect this as well (see Annex 5). This reverses a three-year trending decline in production value. In contrast, potash and coal fell for the third consecutive year, and iron ore for the second. Together, the top 10 minerals and metals represent \$37.7 billion – virtually the same amount year-over-year – and 84% of Canada's total mineral production value in 2014.

The following paragraphs discuss market developments surrounding a few key minerals.

URANIUM

In September 2014, Japan's Nuclear Regulation Authority (NRA) approved the reactivation of two reactors at the Sendai plant in southern Japan. On August 11, 2015, the first of these reactors was restarted and resumed operation. The second reactor is scheduled to restart in October. These reactors – along with the majority of Japan's other 46 nuclear reactors – have been idle since the 2011 earthquake and tsunami. Meanwhile, 25 other plants have applied to restart under the new regime, with a total of five restart approvals granted by the NRA at the time for writing. These recent approvals indicate the country is taking concrete steps to resume nuclear power generation.

Following the Fukushima incident, global sentiment about nuclear energy shifted, and some countries expressed their intention to phase out nuclear power. Meanwhile, other countries continued to pursue the expansion of their nuclear power generating capacity. Given the carbon-free and high-energy density of uranium as a source for power, some countries may revisit their decisions in light of increasing calls for action to address climate change, as well as concern over air pollution and energy security.

As of August 2015, 30 countries were safely operating 389 nuclear power reactors, while 14 countries were constructing an additional 67 new nuclear plants, of which 25 are in China and nine are in Russia. Some analysts have suggested that 260 new reactors could be built worldwide by 2030.

Canada, notably Saskatchewan, is a major player in the world uranium industry. Cameco's McArthur River mine in northern Saskatchewan is the world's largest and highest-grade uranium deposit, with an average ore grade of 21% and annual production of around 8,200 tonnes of uranium oxide. A positive outlook in world uranium demand bodes well for Canada's prominence in this mining sector. Recent bi-lateral trade agreements, including the Canada-India Nuclear Cooperation Agreement, and the Canada-European Union Comprehensive Economic and Trade Agreement have opened up new markets in Canada and abroad for uranium miners. For example, on April 15, 2015, in the presence of Canadian Prime Minister Stephen Harper and Indian Prime Minister Narendra Modi, Cameco and India's Department of Atomic Energy signed a \$350 million long-term uranium supply contract.

OIL SANDS

The development of western Canada's oil sands is one of the world's biggest economic stories in recent decades. Technological advances, combined with elevated crude oil prices, made the oil sands economically viable to develop, boosting production from 100,000 barrels a day in 1980 to more than two million barrels a day in 2014. While higher oil prices did usher in an era of significant growth in production value, the recent 60% plunge in crude oil prices has had a dampening effect on the sector, with some companies revisiting investment decisions, and all operators aggressively controlling costs and maximizing operational efficiencies.

Canada has the third-largest oil reserves in the world, and 97% (168 billion barrels) of Canada's reserves (173 billion barrels) are in the oil sands. The majority (81%) of world oil reserves are owned or controlled by national governments. Only 20% of total world oil reserves are accessible for private sector investment, 56% of which are found in Canada's oil sands. Given this ratio, foreign direct investment in this sector has been increasing, and foreign interest is anticipated to continue in the coming years.

In a recent RBC Dominion Securities report, analysts conclude that output from the oil sands will continue to expand through to 2020, albeit at a muted pace due to low oil prices. The report forecasts the majority of growth will remain in-situ focused, followed by brownfield mine expansions, with only relatively modest growth expected from greenfield mining projects before 2020. RBC predicts growth to 3.48 million barrels a day, down by 600,000 barrels from the growth RBC forecast in its 2014 report.

Synthetic crude oil accounted for nearly 25% of Canada's crude oil production volume (29% by value) in 2014, up from 15% a decade earlier (see Figure 9). The absolute value of this increase is considerable – from \$9.2 billion in 2005 to \$35.4 billion in 2014. Currently, all of this crude oil production is in Alberta, though reserves in Saskatchewan have attracted interest in recent years with the issue of special exploratory permits for provincial Crown land.

POTASH

Potash plays a central role in helping feed the world's growing population, as approximately 95% of world potash production is used as fertilizer. According to the Food and Agriculture Organization of the United Nations, agricultural production needs to increase by 70% by 2050 to meet the rising demand for food. This rising demand is linked to projections of global population reaching 9.6 billion by 2050. These trends indicate that fertilizer made from potash

will play an even greater role in increasing crop yields to meet food demand.

Since Russia's Uralkali quit the Belarusian Potash partnership, uncertainty in the global trade of potash has increased, causing speculation about what market impacts may result. When Uralkali decided to produce at full capacity in 2013, analysts forecasted potash prices might drop by 25% to \$300 per tonne. A complete breakdown in potash pricing, as some had feared in 2013, never materialized. Belarus, for example, recently signed a deal to sell potash to China for \$315 per tonne, 3.2% higher than the \$305 per tonne price in 2014. At the time of writing, year-over-year monthly average prices had edged upward, from \$287 per tonne in August 2014 to \$307 per tonne for August 2015.

With 10 world-class potash mines in production, Saskatchewan is the world's second-largest producer and exporter of the product. Saskatchewan's position as a world leader will likely be reinforced by the emergence of BHP Billiton as a major player in the province, which is moving into the third year of a three-year commitment to invest US\$2.6 billion to develop the Jansen Potash Project. Analysts estimate that after \$3.8 billion is spent by the end of 2016, another \$10 to \$11 billion will be required for construction. Robust mining investments such as this contribute significantly to local, provincial and national economies.

PROCESSING OF MINERALS

Canada has a large mineral-processing industry, with 31 non-ferrous metal smelters, refineries and conversion facilities in seven provinces (see Figure 10). Some of these facilities contain both a smelter and a refinery.

Canada's integrated smelters and refineries were built in proximity to world-class mines, 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 have become irregular due to the depletion of reserves and greater dependence on imported concentrates. Figure 11 shows that the production volumes for refined metals over the past 10 years have been mixed. Lead and aluminum have held steady, while copper, nickel, cobalt, cadmium and zinc have decreased.

CANADA'S MINERAL-PROCESSING FACILITIES

- **New Brunswick:** 1 smelter
- **Quebec:** 9 smelters, 3 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

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 is essential.

Other factors 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 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 70,000 jobs in 2014. Adding non-metallic mineral product manufacturing increases that number by an additional 53,000 jobs. Both sectors combined account for almost one-third of the industry's overall employment for the year. While significant, these numbers have been in decline. Over the last 20 years, dating from 1995, combined employment in both sectors has dropped by 18%, or 26,000 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.

The fallout of the Lac-Mégantic disaster has been a watershed in rail management and regulation. The response to the derailment has resulted in additional restrictions on the transportation of dangerous goods, which affect both railways and shippers. Additionally, Transport Canada, the Canadian Transportation Agency and the House of Commons Standing Committee on Transportation, Infrastructure and Communities have undertaken policy, regulatory and legislative reviews and consultations on the adequacy of Canada's third-party liability and dangerous goods regimes.

SAFE TRANSPORTATION OF DANGEROUS GOODS

On June 18, 2015, the *Safe and Accountable Rail Act* received Royal Assent. This legislation addressed the Lac-Mégantic disaster, delivering on an October 2013 Throne Speech commitment to "require shippers and railways to carry additional insurance" for the movement of dangerous goods. The legislation enacted:

- A new liability and compensation regime for federally regulated railways, including minimum insurance requirements
- A compensation fund financed by levies on crude oil shippers
- Increased information-sharing provisions
- Stronger oversight powers for the Minister and Transport Canada inspectors

The government's goal in pursuing legislative change was to strengthen the third-party railway liability insurance regime to reduce taxpayers' exposure to financial damages from future rail accidents. To achieve this, the reforms standardize the insurance requirements for railways, and also for shippers of select dangerous goods.

Recognizing the role it has to play in ensuring the safe movement of dangerous goods, the Canadian mining industry was highly engaged in the reviews and consultations leading to the above reforms, and was pleased the measures adopted are largely consistent with the industry's position on the issues. Furthermore, the closing of the Tariff 8 regulatory loophole, which permitted railways to unilaterally impose liability on the shipper

without oversight by the Government of Canada, was a particularly welcome reform.

The Canadian mining industry prides itself on its safety culture. Beyond engaging responsibly in important public policy matters that impact industry practices, MAC members, notably through commitments made in the Towards Sustainable Mining initiative, invest considerably in emergency response, crisis management and material stewardship, and will continue to do so.

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 2014, shipments of coal, iron ore and other minerals and metals represented 50% of total Canadian rail freight revenue (see Figure 12). In terms of volume, the mining industry accounted for 46% of total tonnage moved in 2013, which is the largest single volume share of all industries that ship by rail.

TOP COMMODITIES CARRIED BY CANADIAN RAIL IN 2013 (BY VOLUME)

1. **Minerals and metals: 46%**
2. **Grain: 11%**
3. **Forest products: 10%**
4. **Chemicals: 6%**

Source: *Transport Canada*, Transportation in Canada: An Overview (2013)

Canada's rail freight system operates primarily as a dual monopoly, shared by CN and CP – Canada's only Class I railways. Communities and businesses are often served by only one of these companies, which gives rail customers little or no competitive choice. Mining operations are frequently captive to only one railway given the remoteness of their locations.

In 2008, the *Canada Transportation Act* 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) with 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 persisted in the relationship between railways and rail customers.

As a follow-up to these legislative changes, the federal government reviewed rail service by CN and CP in 2010, aiming to identify service problems, examine best practices, and recommend remedies to improve service. Despite the Rail Freight Service Review panel's 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 Bill C-52, the *Fair Rail Freight Service Act*.

The inadequacy of Bill C-52 – which passed into law in June 2013 – resulted in continued rail service failures later in 2013 and into 2014. These service failures, experienced across all rail-shipping sectors, resulted in Bill C-30, the *Fair Rail for Grain Farmers Act*, which enacted narrow grain sector-specific legislative measures without any consultation. This fragmented approach to addressing a systemic issue could further exacerbate long-standing service issues. As the largest single-customer group of Canada's Class I railways, and accounting for over 20% of Canada's export value, miners require a reliable logistics supply chain to compete internationally.

RAIL DATA TRANSPARENCY

A large obstacle for rail customers and public policy makers is the inability to adequately assess the nature of rail service and capacity challenges due to a lack of transparency and availability of railway performance data. Collecting and publishing railway data, as permitted under sections 50 and 51 of the *Canada Transportation Act*, is already done to some degree for the agriculture sector. Making this information available to all parties would not only enhance transparency in the transportation system, but would also improve relations between shippers and transportation service providers, avoid unnecessary and costly disputes, and provide government with the tools necessary to identify, assess, and resolve existing challenges.

In response to the rail service failures that occurred over 2013 and 2014, the government launched the 2015 statutory review of the *Canada Transportation Act*. The review panel began its work in June 2015, earlier than required, and the final report is due to be presented before the end of 2015. MAC will continue following this issue, stay actively engaged with government, and monitor developments that stem from any pertinent policy and regulatory recommendations contained in the report.

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 report, *Transportation in Canada* (2014), trucks carried \$184 billion in Canadian exports in 2014, 11% of which (\$20.2 billion) were mining-related products. Trucks carried \$275 billion in imports to Canada, 9% of which (\$24.7 billion) were mining-related products. *Note there is no detailed information about domestic truck shipments by commodity.*



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 materials.

According to the Conference Board of Canada, the age of the average truck driver has increased more rapidly than the age of the average worker because fewer young workers are entering the industry. Simultaneously, the demand for truck drivers is expected to increase as industries, such as mining, that rely on trucking services continue to grow. By 2020, it is projected that the gap between the supply and demand of drivers will be 25,000, or 14% of the anticipated driver population. This is cause for concern, not just for the trucking industry, but for its customers and the Canadian economy as a whole.

MARINE

Mining is also a leading customer of Canadian ports. In 2014, the Port of Montreal handled large volumes of iron ore and salt, as well as other mineral products such as fertilizer,

ores, gypsum and scrap metal. Total mined products accounted for 3.74 million tonnes, or 44% 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. According to the 2014 *Traffic Report*, prepared jointly by the Seaway's management and development corporations, shipments of iron ore, coke and coal represented 32% of total seaway traffic in 2014, with total mining products accounting for 44% of total volume.

Coal accounted for 39% of the total volume handled at the Port of Vancouver in 2014, 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 12%. All told, mining products account for 59.7 million metric tonnes, or nearly 61% of the port's volume.

Mining also accounts for a sizeable amount of the value of Canadian exports moved by ship to international markets. According to *Transportation in Canada* (2015), Canada transported \$167.8 billion in industrial exports by ship to non-US countries in 2014. Of that, base metals (\$16.2 billion), metallic ores (\$9.3 billion), and non-metallic minerals, coal and stone (\$6.8 billion) were the most valuable mining products.

Internationally, the International Maritime Organization (IMO) regulates pollution and safety practices at sea. Recent changes to the IMO's MARPOL Convention and the International Maritime Solid Bulk Cargoes Code will have 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 United States, 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 United States into a self-sufficient energy producer. This has drastically reduced the country's needs for imported oil. Meanwhile, growth in global oil demand has shifted to Asia, with China surpassing the United States as the world's largest oil importer.

This shift in demand is challenging Canadian oil companies because existing oil 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.

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.



Photo: ArcelorMittal Mines Canada, Port-Cartier Industrial Complex, Quebec

FIGURE 7

VALUE OF CANADIAN MINERAL PRODUCTION, 1999-2014^P

(\$ billions)	1999	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014 ^P
Metals	9.7	12.4	14.6	21.1	26.2	22.6	15.5	21.4	25.6	23.6	23.5	24.6
Non-metals	7.3	10.3	10.5	10.3	11.6	19.4	11.6	14.7	17.8	16.5	15.5	16.2
Coal	1.5	1.6	2.9	2.9	2.7	5.0	4.4	5.5	7.5	5.9	4.9	3.9
Total Mineral Production	18.5	24.4	28.0	34.2	40.6	47.0	31.4	41.6	50.9	45.9	43.9	44.7

Sources: Natural Resources Canada; Statistics Canada.

^P Preliminary.

Notes: 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 8

CANADA'S TOP TEN METALLIC AND NON-METALLIC MINERAL PRODUCTS BY VALUE OF MINERAL PRODUCTION, 2004 AND 2014^P

	Unit of Measure	2004		2014 ^P	
		Quantity (millions)	\$ Value (millions)	Quantity (millions)	\$ Value (millions)
Gold	000 kg	129	2,217	151	6,825
Potash K ₂ O ¹	kt	10,332	2,163	11,345	5,875
Copper	000 t	545	2,031	684	5,223
Iron Ore	kt	28,596	1,318	44,196	4,398
Nickel	000 t	177	3,226	221	4,067
Coal	kt	66,308	1,675	69,116	3,915
Diamonds	000 ct	12,680	2,097	12,082	2,227
Sand and gravel	kt	250,067	1,168	227,611	1,980
Cement ²	kt	14,842	1,629	12,276	1,717
Stone	kt	135,988	1,156	146,566	1,506

Sources: Natural Resources Canada; Statistics Canada.

^P Preliminary.

Notes: ¹ Shipments of potash to Canadian potassium sulphate plants are not included in this table. ² Includes exported clinker minus imported clinker. Data include shipments by producers regardless of their industrial classification.

FIGURE 9

PRODUCTION OF SYNTHETIC CRUDE OIL BY OIL SANDS MINING PLANTS, ALBERTA AND CANADA, BY QUANTITY AND VALUE, 1998-2014

	Synthetic Crude Oil (000's of m ³)	Total Crude Oil and Equivalents (000's of m ³)	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
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	23,473,269.0	54,005,153.0	43.5
2011	49,375.1	129,183.4	38.2	30,518,182.0	69,033,911.0	44.2
2012	52,455.2	143,873.9	36.5	28,588,084.0	69,346,737.0	41.2
2013	54,328.1	154,324.2	35.2	34,382,128.8	79,535,264.0	43.2
2014	55,345.9	168,971.7	32.8	35,467,401.0	94,140,139.0	37.7
CANADA						
1998	17,870.8	128,400.3	13.9	2,313,518	12,940,149	17.9
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	23,473,269.0	75,174,373.0	31.2
2011	49,375.1	175,312.1	28.5	30,518,182.0	95,496,704.0	32.3
2012	52,455.2	189,133.7	27.7	28,588,084.0	94,076,834.0	30.4
2013	54,328.1	202,292.6	26.9	34,382,128.8	106,507,173.0	32.3
2014	55,345.9	217,965.9	25.4	35,467,401.0	120,530,888.0	29.4

Source: Statistics Canada.

FIGURE 10

NON-FERROUS SMELTERS AND REFINERIES IN CANADA, 2014

Owner	Operation	Type of facility	Location	Outputs
Newfoundland and Labrador				
Vale	Long Harbour	(Ref.)	Long Harbour	Ni, Cu, Co
New Brunswick				
Glencore plc	Brunswick	(Sm.)	Belledune	Pb, Ag, Bi
Quebec				
Rio Tinto Alcan Inc./Aluminium Austria Metall Québec/Hydro Aluminum a.s./Société générale de financement du Québec/Marubeni Québec Inc. (Alouette)	Alouette	(Sm.)	Sept-Îles	Al
Alcoa Inc.	Baie-Comeau	(Sm.)	Baie-Comeau	Al
Rio Tinto Alcan Inc.	Grande-Baie	(Sm.)	Grande-Baie	Al
Rio Tinto Alcan Inc.	Laterrière	(Sm.)	Laterrière	Al
Rio Tinto Alcan Inc.	Vaudreuil Works	(Ref.)	Jonquière	Alumina
Rio Tinto Alcan Inc.	Arvida	(Sm.)	Arvida	Al
Rio Tinto Alcan Inc.	Alma	(Sm.)	Alma	Al
Alcoa Inc.	Deschambault	(Sm.)	Deschambault	Al
Alcoa Inc./Rio Tinto Alcan Inc.	Bécancour	(Sm.)	Bécancour	Al
Glencore plc	CCR	(Ref.)	Montréal-Est	Cu, Au, Ag, Se, Te, Ni, PGM
Newalta Income Fund	Sainte-Catherine	(Ref.), (Sec. Sm.)	Sainte-Catherine	Recycled Pb
Glencore plc	General Smelting Company of Canada	(Sec. Sm.)	Lachine	Recycled Pb
Glencore plc/Noranda Income Fund	Canadian Electrolytic Zinc Limited (CEZinc)	(Ref.)	Valleyfield	Zn, Cd, S*
Glencore plc	Horne	(Sm.)	Noranda	Cu, Au, Ag
Ontario				
Royal Canadian Mint	Ottawa	(Ref.)	Ottawa	Au, Ag, Cu, PGM
Cameco Corporation	Port Hope	(Con. Fac.)	Port Hope	U
Vale	Port Colborne	(Ref.)	Port Colborne	Electrolytic Co, PGM, Co oxide
Tonolli Canada Ltd.	Mississauga	(Sec. Sm.)	Mississauga	Recycled Pb
Aleris International, Inc.	Mississauga	(Sec. Sm.)	Mississauga	Recycled Zn
Johnson Matthey Limited	Brampton	(Sm.), (Ref.)	Brampton	Au, Ag, Recycled Pb
Glencore plc	Sudbury	(Sm.), (Pl.)	Sudbury	Ni, Cu, Co, Au, Ag, PGM
Vale	Copper Cliff complex	(Sm.), (Ref.), (Pl.)	Sudbury	Ni, Au, Ag, Se, Te, PGM, S*
Cameco Corporation	Blind River	(Ref.)	Blind River	U

FIGURE 10
NON-FERROUS SMELTERS AND REFINERIES IN CANADA, 2014

Owner	Operation	Type of facility	Location	Outputs
Manitoba				
Vale	Manitoba	(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
Thompson Creek Mining Limited/Sojitz Moly Resources Inc. (Endako)	Endako	(Pl.)	Fraser Lake	Mo trioxide
Rio Tinto Alcan Inc.	Kitimat	(Sm.)	Kitimat	Al

Source: Natural Resources Canada.

Notes: 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 11

CANADIAN PRODUCTION OF SELECTED REFINED METALS, 2004-2014^P

Metals	2004	2008	2009	2010	2011	2012	2013	2014 ^P
Aluminum	2,592,160	3,120,148	3,030,269	2,963,210	2,987,964	2,780,556	2,967,364	2,858,238
Cadmium	1,880	1,409	1,299	1,357	1,240	1,286	1,313	1,187
Cobalt	4,673	4,899	4,358	4,145	5,317	5,322	4,012	2,929
Copper	526,955	442,050	335,896	319,618	273,761	275,990	321,511	323,927
Lead	241,169	259,094	258,854	273,017	282,589	279,150	281,781	278,586
Nickel	151,518	167,732	116,909	105,413	142,445	139,800	137,410	116,419
Zinc	805,438	764,310	685,504	693,014	662,151	648,619 r	651,638	641,832

Sources: Natural Resources Canada; Statistics Canada.

^P Preliminary.

FIGURE 12

CRUDE MINERALS AND PROCESSED MINERAL PRODUCTS TRANSPORTED BY CANADIAN RAILWAYS, 2004-2014

(million tonnes)	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013 ^r	2014
Total Freight Volume ¹	251.2	260.7	258.7	255.7	244.4	212.9	235.4	250.8	253.5	266.8	274.1
Total Crude Minerals	106.9	112.8	108.0	112.0	111.9	85.0	107.6	109.8	103.4	112.0	108.4
Total Processed Mineral Products	27.2	27.3	27.9	27.7	27.6	21.7	24.6	26.5	27.3	28.3	28.1
Total Crude and Processed Minerals	134.0	140.0	135.9	139.8	139.4	106.7	132.3	136.4	130.7	140.3	136.5
(%)	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013 ^r	2014
Crude Minerals and Processed Mineral Products as a Percentage of Revenue Freight	53.4	53.7	52.5	54.7	57.1	50.1	56.2	54.4	51.5	52.6	49.8

Source: Statistics Canada.

^r - revised

Notes: ¹ Total 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.

THE MONEY

RESERVES, PRICES, FINANCING, EXPLORATION AND INVESTMENT

THE FIVE MAIN MONETARY ASPECTS OF THE CANADIAN MINING INDUSTRY – RESERVES, PRICES, FINANCING, EXPLORATION AND CAPITAL INVESTMENT – ARE BY NATURE INTERRELATED. GLOBAL PRICES INFLUENCE COMPANY CONFIDENCE AND, THEREFORE, EXPLORATION AND CAPITAL INVESTMENT. COMPANIES NEED SUITABLE FINANCING TO BACK THEIR EXPLORATION AND INVESTMENT PROGRAMS. GOVERNMENT INVESTMENTS IN GEOLOGICAL MAPPING ARE CLOSELY LINKED TO MINERAL EXPLORATION AND, THEREFORE, TO RESERVE LEVELS.

CANADIAN RESERVES

The past 30 years have seen a marked decline in proven and probable Canadian mineral reserves in all major base metals (see Figure 13 and Annex 6). Since 1980, the most dramatic decline has been in lead (99%), zinc (84%) and silver (83%) reserves, while copper (37%) and nickel (68%) reserves have fallen significantly as well.

While the long-term trend in reserve levels marks a significant decline for many commodities, recent years have shown fluctuating growth for certain commodities. Since 2009, gold, silver and copper reserves have fluctuated, with gold near record levels and copper at heights not seen since the early 1990s. Zinc, on the other hand, has ebbed downward, with current levels suggesting continuing decline.

The recent bumps in proven and probable gold, silver, zinc and copper reserves correlates to increases in buoyant metal prices for certain commodities in past years, and to corresponding increases in targeted exploration for these metals. While improvement in reserve levels of certain metals is a welcome change, it is unlikely to signal the start of a longer-term trend that would broaden to include a greater variety of metals and minerals. Recent commodity price declines, and the corresponding difficulties junior exploration companies are facing in raising capital to finance their operations, indicate that concern will continue

over the depletion of reserves for the majority of Canada's deposits.

Consistent investment over time, and access to large tracks of land to explore, is 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 geosciences and strengthen policies that provide incentives for exploration spending within Canada's borders.

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 45% 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 and oil when prices are low, making it difficult for analysts to forecast prices for minerals.

Figure 14 illustrates the strong growth 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 metals

since. Uranium is the only metal charted to post a gain since early 2015, while dramatic declines can be seen for iron ore, nickel, copper and aluminum.

The general consensus is that demand for mineral and metal products should be favourable over the medium to long term. Rising incomes and increased prosperity in developing countries due to industrialization and urbanization will continue to drive global demand. 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) was home to 57% of the world's public mining companies in 2013, and accounted for 62% of the equity capital raised globally

for mining in 2014, totalling \$8.9 billion. Year-to-date, as of August 31, 2015, 262 of the firms listed on the TSX are mining companies. These firms, together valued at \$189.7 billion, raised \$5.8 billion in equity capital. TSX-listed mining companies mainly deal in gold, uranium, copper, silver, nickel, iron ore, zinc and molybdenum.

The TSX is also home to the Venture Exchange (TSX-V), which gives emerging companies efficient access to capital while offering investors a regulated market for venture investments. The 1,112 mining companies listed on the TSX-V, as of August 31, 2015, are valued at a combined \$7.7 billion and raised \$707 million in equity capital year-to-date. This represents a continued and significant decline in recent years compared with 2012 when the value of junior mining companies was \$19.8 billion and the capital raised was \$2.8 billion. Junior mining companies are currently facing challenges in raising capital, which is further discussed below.

COMMODITY-SPECIFIC PRICE TRENDS

Gold. After 11 consecutive years of strong performance, and a one-day high of US\$1,923 per ounce in September 2011, the price of gold has steadily declined in recent years. From a monthly average of US\$1,744 per ounce in September 2012, to US\$1,117 per ounce in August 2015, gold has decreased 35%. Contributing to this downward pressure is persistent anticipation among investors that the US Federal Reserve will taper its quantitative easing stimulus program. This event will result in increased interest rates, enhancing the competitiveness of other investment options relative to gold. Despite the drop, the price of gold per ounce has fluctuated in the \$1,100 to \$1,200 range, suggesting a stabilization.

Nickel. The price of nickel has been volatile in recent years, but has consistently tracked downward. From a monthly average of \$12.88 per pound in February 2011, the price of the base metal dropped by roughly two-thirds to \$4.71 per pound in August 2015. Indonesia, accounting for 25% of the global nickel supply, implemented a ban on exports of mineral ore in January 2014 that pushed prices upward. To counteract rising prices, China likely shifted consumption to pre-existing domestic stockpiles of the base metal, reducing global demand and causing downward pressure on prices. Looking forward, however, as global stockpiles of nickel shrink and export bans persist, upward price pressure on nickel should resume.

Potash. Since Russia's Uralkali quit the Belarusian Potash partnership in July 2013, an over-supplied market has pushed prices down. Uncertainty in the global trade of potash has increased, causing speculation about what market impacts may result. Spot prices of potash bound for overseas markets fell from US\$417.50 per tonne (before Uralkali's exit from its marketing partnership) to \$287 per tonne for the month of August 2014, where they have hovered since. Recent reports suggest that Uralkali, the world's biggest potash producer, will continue prioritizing volumes over price, meaning prices are unlikely to rebound to former levels in the short term.

Zinc. Year-over-year average monthly prices have decreased by 22%, from \$1.06 per pound to \$0.82 per pound in August 2015. This fall – on the back of elevated prices over the year prior – is largely attributed to concerns over the outlook for China's economy. Accounting for an estimated near half of global base metal demand, China's consumption exceeds that of the United States by five times, and that Chinese economic growth is perceived to be settling. Recent financial market turbulence in China, including the steep equity market correction and the depreciation of the yuan by the People's Bank of China, fuelled fears of a "hard landing," and raised questions over the medium-term outlook for China as a growth market for raw materials. With the recent closures of Glencore's Brunswick Mine and two other world-class zinc mines this year, and with no new supply coming online, a shortage of zinc should bolster the metal price going forward.

LISTED MINING COMPANIES (AUGUST 2015)

On the TSX—Toronto: 1,374

- Senior TSX companies: 262
- TSX-V companies: 1,112

GLOBAL FINANCING

The global mining industry raised \$14.4 billion in equity in 2014, less than half of the \$31.7 billion raised worldwide in 2011, and less than a quarter of the sum raised at the height of the economic boom. However, as Figure 15 shows, this level of equity represents a near fivefold increase over the \$3.1 billion raised in 2000. Although the recession's effects on the global mining industry were relatively short-lived in many respects, recent volatility has presented challenges for some miners.

From 2008 through 2012, the TSX and the TSX-V accounted for 39% of the value of global mining equity financings, raising nearly \$72 billion. In 2013, 48% of all global mining equity financings were done on the two exchanges, and, together, these comprised 46% of the equity capital raised globally for the same year (see Figure 16).

The large proportion of public financings conducted on the TSX reflects the exchange's appeal to both junior and senior business players. 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 2015, TSX and TSX-V companies were involved in 5,618 mineral projects worldwide (see Figure 17), with more than half of them in Canada and the rest elsewhere. 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.

As the world's largest exchange for financing mineral exploration, the year-over-year drop in TSX and TSX-V issuer projects is an indicator of the challenges facing both the global and Canadian exploration industries. From December 2014 to January 2015, the TSX and TSX-V dropped 31% in the number of funded mineral projects for listed companies (see Figure 17). Notably, Canada suffered the single largest drop in absolute terms (1,159 projects) relative to other jurisdictions competing for exploration investment. While Canada remains the single largest destination of funds

raised on the TSX, the sharpness of the decline suggests that competition for a shrinking global pool of exploration investment is fierce.

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 for 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 – including smelting, refining and manufacturing – will diminish over time, and national and regional economies that benefit from strength in these sectors, such as manufacturing, will weaken.

BREAKDOWN OF TSX AND TSX-V MINING PROJECTS BY LOCATION

Canada: 55%–3,152 projects
 Latin America: 18%–1,046 projects
 United States: 12%–659 projects
 Africa: 7%–418 projects
 Asia: 3%–190 projects
 UK and Europe: 3%–153 projects
 Australia: 2%–135 projects

Sources: InfoMine, TSX/TSX-V Market Intelligence Group

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, 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.”

In 2014, exploration investment fell for the third consecutive year, by 18% to \$1.9 billion, breaking the low experienced during the financial crisis in 2009 (see Figure 18). From the all-time high of \$4.2 billion in 2011, this marks a 55% drop. Spending intentions for 2015 anticipate investment levels to drop further to \$1.86 billion for the year, below the levels seen during the global recession. In 2015, further downward pressure was experienced for a number of mineral products, and investor confidence was adversely influenced by the prevailing market volatility and the sharp focus of major miners on improving their balance sheets.



Photo: Agnico Eagle Mines Limited, Meliadine Gold Project, Nunavut

Another major issue is the persistent challenges faced by junior mining companies in raising capital. According to SNL Metals Economic Group (SNL), global mineral exploration budgets dropped by 26% in 2014. Research by the Prospectors and Developers Association of Canada indicates that as of June 2015, 30% (or almost \$4 billion) of TSX-V market capitalization in mining had been erased from the market, compared to the same period in 2014. Global financing activity (including debt and equity) across all exchanges in the mining sector has dropped significantly, falling on average by 13.6% annually since 2007 (for a total decline of over 60% in that period). The majority of the decline was due to a significant drop in equity financing, which fell 80% between 2007 and 2014 (see Figure 19).

The downturn in financing has been particularly challenging for exploration companies. Financing designated specifically for exploration (raised on Canadian exchanges) fell by 98% from Q4 2007 to Q4 2014. Not surprisingly, working capital has fallen dramatically for companies listed on the TSX-V. According to SNL data (for companies that reported working capital), 231 companies

had less than \$200,000 in working capital in 2014 and 195 companies had negative figures for the same period.

As a consequence of these financing challenges, exploration's share of the pie has shrunk relative to deposit appraisal, indicating a shift towards defining known deposits and away from the riskier discovery of new ones. Until recently, exploration has historically occupied a larger share of total spending. Spending intentions for 2014 indicate the continued reversal of this trend. As Figure 20 shows, exploration accounted for 40.7% of total exploration budgets and deposit appraisal 59%. For context, the inverse allocation of funding was in place as recently as 2009, with exploration accounting for 57% of funding and deposit appraisal 43%.

ALLOCATION OF INVESTMENT BY MINERALS AND METALS

Precious metals attracted the lion's share of Canadian exploration spending again in 2014, accounting for 42% overall (see Figure 21). Over the last two years, however, the amount allocated to precious metals exploration dropped more than 57%. This is largely due to significant price fluctuations for gold, but is also a reflection of market volatility and concerns over global economic growth, as discussed in Section 1 of this report.

Between 2004 and 2012, iron ore saw the most dramatic jump in exploration spending, rising fivefold over the decade, with many projects located in Newfoundland and Labrador and northern Canada. With the recent downward pressure on iron ore, however, the amount invested in exploration for the key steel-making ingredient has started to drop in recent years. A surplus in supply of iron ore on the market could result in a delay of a few years for prices to bounce back as this surplus tapers off.

Base metal exploration's share of total investment remained virtually unchanged year-over-year, holding at 20% in 2014. When compared to other metals, however, the rate at which investment in base metal exploration has increased over the last decade has not kept pace. For example, investments in uranium, coal and other metals have all experienced a fourfold to sixfold increase, whereas base metal investment has experienced a less than twofold increase. This trend reflects the depletion of Canadian base metal reserves, and the replenishment of reserves 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. This will have profound implications for the communities and people who benefit from the economic opportunities the industry directly and indirectly generates.

INTERNATIONAL EXPLORATION

Globally, Canada has been a top destination for mineral exploration investment for the past 36 years. Canada dropped to second place in 1992 for non-ferrous exploration budgets, surpassed by Australia. In 2004, however, Canada regained the top position where it has remained since, accounting for 14% of global non-ferrous exploration budgets in 2014 (see figure 22).

SNL has tracked world mineral exploration since 1989. Based on data from nearly 3,500 companies, SNL determined that worldwide exploration investment in 2014 fell to US\$10.74 billion for non-ferrous metals. This is a 26% decrease from 2013, and a near 50% drop from the all-time record high of US\$20.53 billion in 2012. Exploration figures for iron ore are excluded from the above figures, and would have increased the 2014 total by an estimated US\$1.44 billion. In 2014, Canada experienced a 22% decrease in allocations over 2013, marking the third year in a row that Canada's allocations have decreased.

In past years, and as recently as 2013, Australia has taken over the top spot when iron ore exploration budgets have been added to non-ferrous budgets. 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. This, combined with the Fraser Institute's lower rankings for many Canadian jurisdictions, should sound a warning for Canadian policy makers – all may not be well for Canadian exploration.

CANADA'S ROLE IN GLOBAL EXPLORATION SPENDING IN 2014

- More than 800 Canadian companies are actively exploring outside Canada in over 100 countries.
- Canadian-headquartered mining and exploration companies accounted for the largest portion of worldwide non-ferrous exploration budgets at 30% in 2014.

Sources: SNL Metals Economic Group, Natural Resources Canada

Only a handful of major discoveries and projects will come into production within the next five years; 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 super-cycle began. The dramatic rise in this 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. As well, regulatory and infrastructure challenges are lengthening the time it takes for new discoveries to develop into producing mines. The decrease in global exploration spending in recent years will further decrease the rate at which major discoveries are made.

This gap is slowly closing, however, as a strong cohort of Canadian projects, from the start of a pre-feasibility study to a production commitment, are in the pipeline. More than 100 advanced-stage exploration projects have been identified over the period of 2011 to 2014. These and other projects contribute to the \$140 billion in potential mining investment Canada could see over the next five to ten years.

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 opens up new regions for development. The ongoing extension of the Highway 37 transmission line in northeast British Columbia is a good example of 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 project already built – the \$450 million, 300-person Red Chris mine owned by Imperial Metals. Similarly, the extension of the Monts Otish Highway in northern Quebec would improve future prospects for the development of gold, diamond and copper projects in the surrounding region. More recently, the federal government's increase of the borrowing rate for the Northwest Territories and Nunavut boosts these jurisdictions' ability to make strategic investments to enhance their attractiveness for mineral investment.

In 2014, capital spending in the Canadian mining industry totalled \$15 billion, down 23% from the previous year,

and the third consecutive year that capital spending has fallen (see Figure 23). Slightly more than \$15 billion in capital investment is projected for 2015, partially reflecting weakening prices for several commodities, as well as apprehension over the state of global economic growth and demand for mineral products.

Although capital spending covers all four stages of the industry, some 90% is typically invested in the first two stages, extraction and smelting/refining. Within Stage 1, around 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. This data lags behind capital expenditure data by one year. However, adding 2012 repair costs (about \$5.7 billion) to 2014 capital (\$15 billion) and exploration (\$1.9 billion) spending produces roughly \$22.6 billion in Canadian mineral development investment in 2014.

Figure 23 also shows capital investment in the oil sands, where spending was \$30 billion in 2014 and is projected to fall to \$25 billion in 2015. The substantial year-over-year projected drop reflects the sharp decline in oil price from \$115 per barrel in June 2014 to around \$50 per barrel at the time of writing.

Combining hard rock and oil sands mining capital investments, the Canadian mining industry invested \$52.6 billion in capital and repair expenditures in 2014.

CURRENT AND FUTURE INVESTMENTS

Saskatchewan produces one-third of the world's potash, drawing on mines that are over 40 years old. Several new projects, however, are either in development or have been identified for future development. Vale Potash Canada's \$3 billion Kronau Project, the company's first potash project in Canada, advanced to the final feasibility stage in August 2014, and completion of the feasibility study is expected by the end of 2015. In August 2013, BHP Billiton announced that it would invest US\$2.6 billion in its Jansen project over the next three years, signalling a stronger project development commitment.

In New Brunswick, Atlantic Potash Corp. continues to explore the Millstream potash deposit, with findings justifying further exploration and deposit appraisal. The company estimates upwards of \$3.8 billion will be needed to bring the mine into commercial production. Canada

holds 50% of the world's known potash reserves, and only New Brunswick and Saskatchewan currently produce it.

In northern Saskatchewan, Cameco's Cigar Lake project is the world's second-largest high-grade uranium deposit, with grades 100 times the world average. With proven and probable reserves of more than 216 million pounds of U_3O_8 , at an average grade of 18.3%, the mine began production in summer 2014. Production is expected to reach up to one million pounds of uranium concentrate in 2015 and increase to its full production rate of 18 million pounds by 2018.

There is still potential in the Canadian diamonds sector, despite the decline in exploration spending in recent years. Stornoway's Renard Diamond Project, located near Monts Otish in north-central Quebec, began construction in July 2014 and is well on its way to becoming Quebec's first diamond mine. The Chidliak project on Baffin Island offers promise, while the Gahcho Kué project in the Northwest Territories recently received environmental assessment approval and is now under construction. Also encouraging is the Kennady North Diamond Project in the Northwest Territories, which recently announced a positive valuation, suggesting a population of high-value gem-quality white diamonds. While further valuations and feasibility are needed to assess the project, this is good news.

Recent mine openings in Canada include Goldcorp's Éléonore gold mine in the James Bay region of Quebec (April 2015), Vale's Totten Mine in Ontario, and Baffinland's Mary River Project in Nunavut. The Totten Mine began operating in February 2014, and should produce 2,200 tonnes per day of copper, nickel and precious metals for 20 years once full production is reached, which is expected in 2016. The Mary River Project, one of the world's richest and largest iron ore deposits, contains roughly 365 million metric tonnes of high-grade ore. The ore can be shipped directly without the processing that produces tailings.

Altogether, over \$140 billion worth of mining-related projects have been proposed for Canada in the coming years (see Annex 7), and will proceed subject to market conditions and demand. These include billions of dollars in proposed projects for British Columbia, Alberta, Saskatchewan, Ontario, Quebec, Newfoundland and Labrador, Nunavut and the Northwest Territories. Of particular note is the high interest in northern Canada. Several gold and iron ore projects are proposed for Nunavut, and gold, diamond and rare earth projects are in the works for the Northwest Territories.

FIGURE 13

CANADIAN RESERVES OF SELECTED MAJOR METALS, 1980-2012

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 ^r	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

Source: Natural Resources Canada, based on company reports and the federal-provincial/territorial survey of mines and concentrators.

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

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

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

^r revised

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

FIGURE 14

METAL PRICES, 2000 TO AUGUST 2015

Metal Prices	2000	2007	2009	2010	2011	2014	Aug. 2015	00-Aug 15 (%)
Aluminium (\$/lb)	0.70	1.20	0.76	0.98	1.09	0.85	0.70	0
Copper (\$/lb)	0.82	3.23	2.34	3.40	4.00	3.11	2.32	182
Gold (\$/oz)	279	697	973	1,225	1,568	1,266	1,117	300
Uranium (\$/lb)	8.29	98.81	47.00	48.00	56.26	33.47	36.13	335
Nickel (\$/lb)	3.92	16.88	6.50	9.85	10.39	7.66	4.71	20
Zinc (\$/lb)	0.51	1.47	0.75	0.98	1.00	0.98	0.82	60
Iron Ore (\$/tn)	12.45	36.60	105.30	125.90	153.00	96.84	55.38	344

Source: Index Mundi

Notes: Table denotes yearly prices as well as actual price as of August 2015. The final column indicates percent growth in prices between 2000-2015.

FIGURE 15

MINING EQUITY RAISED—TORONTO STOCK EXCHANGE, 2000–2014

(value in US\$ billions)

Equity Raised	2000	2007	2008	2009	2010	2011	2012	2013	2014
Worldwide	3.1	50.3	46.6	65.9	29.6	31.7	14.8	15	14.40
TSX exchanges	1.1	17.6	8.3	22.2	17.8	12.5	10.3	6.9	8.9
% of worldwide total on TSX	36	35	18	34	60	39	70	46	62

Source: Gamah International, compiled by Toronto Stock Exchange.
Note: All values as at December 31, 2014.

FIGURE 16

GLOBAL MINING FINANCING, 2013

Exchange	TSX Venture Toronto	LSE–AIM London	ASX Australia	JSE Japan	HKEx Hong Kong	NYSE New York
Mining equity financings	1,409	180	1,351	0	1	3
Capital raised (C\$ billions)	6.9	0.733	3.4	0.0	0.381	0.710
Market value (C\$ billions)	240.4	515.6	392.0	356.2	375.9	926.4
New listings	73	12	18	1	1	10
Mining issuers listed	1,618	190	782	50	55	132

Source: Gamah International, compiled by the Toronto Stock Exchange.
Note: All values as at December 31, 2013.

FIGURE 17

GEOGRAPHIC REACH OF TSX-LISTED COMPANIES, JANUARY 2015

Location of Mineral Projects	Number	YOY Absolute Change	Percent	YOY Percent Change
Canada	3,152	-1,159	55	-26%
Latin America	1,046	-425	18	-28%
United States	659	-399	12	-37%
Africa	418	-157	7	-27%
Asia	190	-91	3	-32%
United Kingdom and Europe	153	-146	3	-52%
Australia	135	-158	2	-54%
Total	5,618	-2,535	100	-31%

Sources: Infomine, TSX/TSXV Market Intelligence Group, compiled by the Toronto Stock Exchange.

FIGURE 18

MINERAL EXPLORATION AND DEPOSIT APPRAISAL EXPENDITURES BY PROVINCE AND TERRITORY, 2006-2015ⁱ

Province / Territory / (\$ millions)	2006	2007	2008	2009	2010	2011	2012	2013	2014 ^p	2015 ⁱ	% Change from 2014
Newfoundland and Labrador	100.8	148.0	146.7	54.9	105.2	156.8	199.9	117.2	76.7	62.4	- 18.7
Nova Scotia	11.0	23.5	21.4	9.0	16.7	13.7	14.6	12.3	7.3	11.7	60.9
New Brunswick	13.4	35.8	32.7	8.1	17.1	27.1	28.0	27.6	26.0	14.6	- 44.0
Quebec	295.1	476.4	526.1	379.3	511.6	833.9	620.7	381.8	272.3	379.0	39.2
Ontario	346.5	571.7	799.3	536.2	853.4	1,067.7	961.5	562.0	507.3	357.3	- 29.6
Manitoba	52.9	102.6	152.1	97.8	83.5	140.0	105.6	61.4	27.1	30.5	12.3
Saskatchewan	235.6	314.0	430.7	311.0	299.4	334.6	411.1	221.7	232.8	303.5	30.4
Alberta	18.7	11.8	20.8	8.3	15.2	47.3	35.2	38.9	22.5	30.1	33.7
British Columbia	344.2	470.6	435.4	217.1	374.4	645.1	734.1	493.0	414.2	334.0	- 19.4
Yukon	106.4	144.7	134.0	90.9	156.9	331.7	233.2	100.6	107.1	126.4	18.1
Northwest Territories	176.2	193.7	147.7	44.1	81.7	93.8	108.7	77.9	95.8	43.6	- 54.5
Nunavut	210.6	338.0	432.6	187.6	256.7	535.7	422.5	257.6	144.6	174.3	20.5
Total	1,911.5	2,830.8	3,279.5	1,944.4	2,771.9	4,227.4	3,875.1	2,352.0	1,933.7	1,867.3	- 3.4

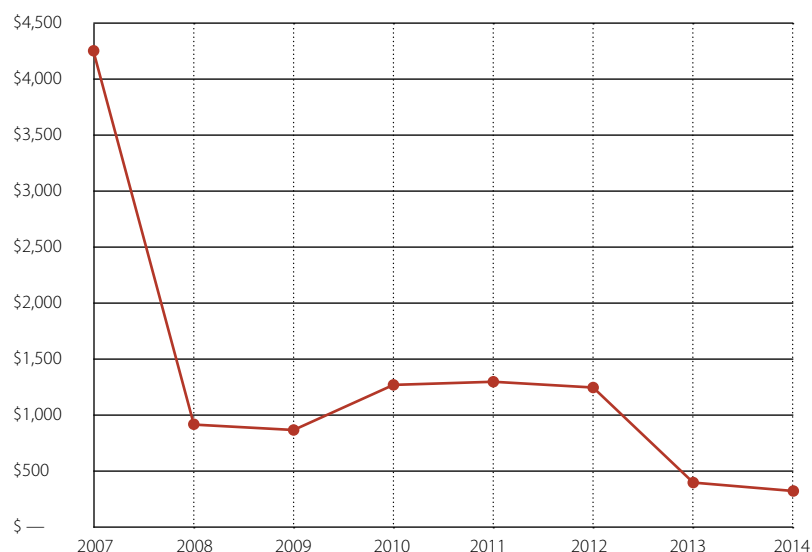
Source: Natural Resources Canada, based on the Federal-Provincial-Territorial Surveys of Mineral Exploration, Deposit Appraisal and Mine Complex Development Expenditures.

^p Preliminary; ⁱ Intentions.

Notes: 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 19

FINANCING FOR EXPLORATION BY ISSUERS LISTED ON CANADIAN EXCHANGES (TSX, TSXV AND CSE), 2007-2014



Year	Amount
2007	\$ 4,225,353,386
2008	\$909,640,007
2009	\$766,141,477
2010	\$1,244,593,926
2011	\$1,284,488,991
2012	\$1,187,792,700
2013	\$443,304,071
2014	\$378,892,840

Source: Prospectors and Developers Association of Canada.

FIGURE 20

CANADIAN EXPLORATION AND DEPOSIT APPRAISAL SPENDING BY TARGET, 2006 AND 2015ⁱ

Type of Co.	2006	%	2007	%	2008	%	2009	%	2010	%
Junior	1,238.0	64.8	1,904.4	67.3	2,117.8	64.6	1,110.7	57.1	1,547.0	55.8
Senior	673.5	35.2	926.5	32.7	1,161.7	35.4	833.7	42.9	1,224.9	44.2
Total	1,911.5		2,830.8		3,279.5		1,944.4		2,771.9	

Type of Co.	2011	%	2012	%	2013	%	2014 ^p	%	2015 ⁱ	%
Junior	2,049.1	48.5	1,847.0	47.7	963.6	41.0	742.5	38.4	760.5	40.7
Senior	2,178.3	51.5	2,028.1	52.3	1,388.4	59.0	1,191.2	61.6	1,106.8	59.3
Total	4,227.4		3,875.1		2,352.0		1,933.7		1,867.3	

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

^p Preliminary; ⁱ Intentions

Notes: 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 21

MINERAL EXPLORATION AND DEPOSIT APPRAISAL EXPENDITURES, BY TARGET, 2004 AND 2014^P

	2004		2014 ^P	
	\$ millions	% of Total	\$ millions	% of Total
Precious metals	542.9	46.1	826.0	42.7
Base metals	241.3	20.5	416.8	21.6
Uranium	43.8	3.7	178.9	9.3
Coal	18.7	1.6	120.9	6.2
Non-metals (excluding diamonds)	17.8	1.5	118.2	6.1
Other metals	25.9	2.2	108.6	5.6
Diamonds	275.0	23.3	97.1	5.0
Iron ore	12.4	1.1	67.2	3.5
Total	1,177.8	100.0	1,933.7	100.0

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 and pre- or production feasibility studies, environment, and land access costs. Totals may not add due to rounding.

FIGURE 22

TOP COUNTRIES/REGIONS BY NON-FERROUS EXPLORATION BUDGETS, 2014

Country/Region	%
Canada	14
Australia	12
Sub-Saharan Africa	9
United States	7
Chile	7
Mexico	7
China	6
West Africa	5
Pacific Islands	5
Peru	5
Other Latin America	5
Russia	5
Europe	4
Brazil	3
Former Soviet Union	2
Rest of the world	4
Total	100

Source: Metals Economic Group.

FIGURE 23

CAPITAL EXPENDITURES IN THE CANADIAN MINING INDUSTRY, 2008-2015ⁱ

(\$ millions)	2008	2009	2010	2011	2012	2013	2014 ^p	2015 ⁱ
Stage 1 - Total Mineral Extraction	7,349	6,194	9,054	12,163	16,916	15,086	11,052	10,865
Metal ore mineral extraction	4,373	3,537	5,504	8,108	11,020	9,174	5,540	5,738
Non-metallic mineral extraction	2,248	2,297	2,853	3,083	4,812	5,243	5,144	4,916
Coal mining	728	361	697	972	1,085	668	368	211
Stage 2 - Primary Metal Manufacturing	1,629	948	1,823	2,936	3,864	3,458	2,196	2,439
Stage 3 - Non-Metallic Mineral Product Manufacturing	691	581	765	672	572	459	979	1,152
Stage 4 - Fabricated Metal Product Manufacturing	734	750	608	729	536	574	790	864
Total Mining and Mineral Processing	10,403	8,473	12,250	16,500	21,888	19,577	15,017	15,320
Non-conventional oil extraction (oil sands)	20,619	10,249	17,113	22,163	26,246	29,029	30,094	25,108

Source: Statistics Canada, CANSIM Table 029-0046.

^p - preliminary; ⁱ - intentions

Notes: 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 IS A GLOBAL LEADER IN CAPITAL INVESTMENT, FINANCING AND INNOVATION. THOUGH CAPITAL IS EASIER TO ALLOCATE IN BOOM TIMES, THE INDUSTRY HAS ALSO INVESTED DURING LESS PROSPEROUS PERIODS. IN THE 1990S, FOR EXAMPLE, MINING INVESTED IN NEW AUTOMATED TECHNOLOGIES THAT ENHANCED THE ECONOMIC VIABILITY OF PROJECTS BY LOWERING PRODUCTION COSTS. THE KEY TO MAXIMIZING INVESTMENTS LIKE THESE IS A READY SUPPLY OF SKILLED INDUSTRY WORKERS.

MINING INDUSTRY EMPLOYMENT

According to Natural Resources Canada definitions and Statistics Canada data, the mining industry employed 376,455 people in 2014, accounting for 1 in every 47 Canadian jobs (see Figure 24). Since 2012, Statistics Canada has published a more comprehensive measure of employment that includes self-employment and employment in the territories. This change results in a truer reflection of the number of Canadians employed in the mining industry.

OVERALL EMPLOYMENT NUMBERS

In 2013, 63,140 (16%) of those directly employed in mining worked in Stage 1, mineral extraction (see Figure 24). Including approximately 35,900 in metal mining, 19,400 in non-metal mining and 8,000 in coal mining (see Figure 25), the overall number of people employed in Stage 1 has increased by more than 22% since 2007, indicating growth in this stage of the industry over time.

Since 2007, the number of Stage 2 jobs in primary metal manufacturing, also known as smelting and refining, has decreased by 15% (see Figure 24). This decrease, however, has not been uniform. Stage 2 employment experienced a significant drop during the economic downturn, rebounded in 2011 and 2012, and tapered off over the last two years.

STUDY FINDS ONTARIO'S MINING SUPPLY SECTOR IS TWICE THE SIZE THAN PREVIOUSLY THOUGHT

A new economic impact survey uncovered new employment information for the mining supply and services industry, which the Conference Board of Canada has called a "hidden" sector. The study, conducted by PwC for the Canadian Association of Mining Equipment and Services for Export, is based on the activities of 913 companies that considered themselves mining suppliers in 2011.

This industrial sector provides equipment, supplies and services to the global mining industry. Its economic impacts are significant, representing 68,000 jobs across Ontario, and contributing 1% to Ontario's GDP and \$1.5 billion in government tax revenues. These jobs are estimated to have generated nearly \$4.6 billion in salaries and wages.

Factors influencing this fluctuation include demand cycles, whether facilities are running at full capacity, technological advancements, the aging and closure of Canadian facilities, and more foreign competition for feedstock to process.

In the oil sands extraction sector (not shown in Figures 24 or 25), data for 2013 show that Suncor and Syncrude directly employed more than 14,000 and 5,000 people, respectively, in mining and oil and gas activities. Additionally, available figures for 2013 indicate that Shell's oil sands operations' mining and upgrading business employs more than 3,000 people. These figures do not include indirect employees, which number in the thousands. Other operating oil sands mining companies, such as Canadian Natural Resources Limited and Imperial, increase these numbers further.

Employment statistics for mining and oil sands change rapidly because of industry growth, 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. Other companies report global figures without disaggregating for the Canadian component of their operations.

As noted in Section 1 of this report, more than 3,700 companies in Canada supply goods and services to the mining industry, adding many more indirect jobs. According to Statistics Canada definitions, support activities for mining employed 27,700 people across Canada in 2014. This figure does not paint a true picture of mining supply employment as it does not reflect all of the many mining support services that are crucial to the mining sector.

WOMEN IN MINING

A 2014 report by the Mining Industry Human Resources (MiHR) Council found that while female participation in mining grew by 70% from 1996 to 2011, women accounted for only 17% of the mining workforce (see Figure 26). These numbers are well below women's current labour force participation rate, which is 47%.

Still, mining outperforms other resource sectors in the employment of women. In 2011, women represented just 12% of the construction sector workforce and 14% of the fishing industry workforce. However, mining continues to lag behind other resource sectors in this respect, with women representing 30% of the total workforce in the oil and gas sector and 24% in the utilities sector.

Part of the reason may be how a perception of gender-based challenges acts as a deterrent from interest in moving into certain trades at the educational level. For

example, in 2011, women accounted for only 14% of registered apprentices and were concentrated in certain trades. Women accounted for only 2% of carpentry apprentices, 1.9% of plumbing apprentices, and 1.5% of heavy equipment apprentices. Overall, according to Status of Women Canada, women represent roughly 5% of all skilled trades workers in Canada – a percentage well below women's participation rate in the mining industry, and significantly below women's labour force participation rate overall.

This year, Status of Women Canada announced \$495,000 in support of a new project – Addressing Systemic Barriers for Gender Equity in Mining – which will identify and work to mitigate the systemic barriers to women's participation and advancement in the mining industry in Canada. Projects such as these may hold the key to better engagement, attraction and improvement of gender balance across the industry's labour force.

EMPLOYMENT OF ABORIGINAL PEOPLE

Proportionally, the mining industry is the largest private sector employer of Aboriginal Canadians. According to MiHR research, the proportion of Aboriginal workers in the mining industry roughly doubles that of Aboriginal workers in the Canadian workforce, and exceeds the proportion of Aboriginal peoples in the Canadian population (see Figure 26). According to Statistics Canada, the number of Aboriginal people employed in the mining sector increased by 14% to 10,300 people from 2007 to 2012.

Potential for increased Aboriginal employment remains strong. Most Aboriginal communities are located within 200 kilometres of a producing mine or an exploration property. Aboriginal people across the country are, therefore, ideally situated to access employment opportunities in the mining industry. Furthermore, approximately half of all Aboriginal people are under the age of 25. By 2017, the number of Aboriginal men and women aged 20 to 29 is expected to increase by more than 40% – four times higher than the growth rate for the same age group in the general population.

A critical challenge to ensuring that this new cohort of Aboriginal Canadians has the opportunity to participate meaningfully in the Canadian workforce is ensuring that suitable and adequate training and educational opportunities are provided. Approximately one in four Aboriginal people of working age are not participating in the labour force. Since attaining an appropriate level of education is an important factor in labour force participation, training to develop the requisite skills for

meaningful participation in the labour force is critical for accessing well-paying mining jobs.

Significant opportunities exist for Aboriginal workers in the oil sands. Over the decade through 2013, Aboriginal companies have earned over \$8 billion in revenue through working relationships with the oil sands industry. In 2012 alone, Aboriginal companies in Wood Buffalo and Lac La Biche performed over \$1.8 billion in contract work with member companies of the Oil Sands Community Alliance. The Fort McKay Group of Companies (FMGC), which works extensively with oil sands firms through its six limited companies, brings in more than \$100 million in revenue annually and is completely owned and controlled by the Fort McKay First Nation.

Individual companies have also bolstered Aboriginal employment in the mining sector. For example, Shell, operator of the Athabasca Oil Sands Project, has paid over \$1.25 billion to Aboriginal contractors since 2006. As well, for many years Syncrude has been accredited at the Gold Level in the Progressive Aboriginal Relations (PAR) Program of the Canadian Council for Aboriginal Business. PAR measures corporate performance in Aboriginal employment, business development, capacity development and community relations.

IMMIGRANT WORKERS

New and recent immigrants to Canada are another demographic with increasing importance to the Canadian mining industry. Like the participation of women and Aboriginal Canadians in the mining workforce, the participation of immigrants does not match their overall participation in the general labour force, and their proportion of the Canadian population. The proportion of immigrants in the mining workforce lags behind that of their participation in the Canadian labour force by nearly 10%. 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.

MiHR is currently conducting research to further understand how women, Aboriginal people and immigrants contribute to the mining industry and what prevents them from entering the field. This research, funded in part by Employment and Social Development Canada, will identify human resources challenges to fostering a more diverse workforce and help stakeholders develop strategies to increase employment rates among underrepresented groups.

NEED FOR WORKERS AND SKILLS

The mining industry, both in Canada and abroad, faces a number of human resources challenges in the next decade. MiHR's 2015 report, *Canadian Mining Industry Employment, Hiring Requirements and Available Talent*, estimates that the Canadian mining industry will need to hire 106,000 new workers over the next decade to 2025. These new hires are required to replenish almost half of the current workforce, according to MiHR's definitions, and are needed to replace retirees and fill new positions to meet baseline production targets (see Figure 27).

This shortage is compounded by the wave of the industry's skilled core of workers who are retiring. By 2024, MiHR forecasts more than 51,030 employees will retire from the sector, which represents over 25% of the industry's current workforce. This will result in a significant loss of industry knowledge and experience.

Updated data from Statistics Canada's 2011 National Household Survey indicate that the mining industry's workforce is attracting an increased share of young professionals. For example, the 25 to 34 age group makes up approximately 25% of the mining workforce compared to only 20% in the Canadian workforce. This shift in demographics will lead to an entirely new set of challenges, with relatively inexperienced workers replacing seasoned workers, particularly in the high turn-over trades and production occupations. This places additional onus on industry to work collaboratively with government and educational institutions to ensure that new entrants to the industry have the skills required in the high-demand jobs within mining. In addition, companies need to ensure that new employees have the opportunity to learn from more experienced employees during training programs and on the job to gain valuable workplace experience.

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, heavy equipment operation and other areas. Because today's mining industry relies on advanced technologies, much of the demand is for highly educated and skilled workers.

It is also important to note that competition for skilled workers is fierce both within Canada and beyond. 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 youth, Aboriginal 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. Recent measures include the introduction of the Canada Job Grant program to help meet training needs in high-demand fields. On the immigration

front, the government has introduced an expression of interest system for the Federal Skilled Worker category and has moved to a “just-in-time” approach for recruiting and fast-tracking the applications of skilled workers. In addition to the funding from Status of Women Canada mentioned above, in 2014, Employment and Social Development Canada (ESDC) provided \$3.5 million in funding to MiHR to enhance its Labour Market Information program, which tracks the industry’s hiring needs. The funding will also support MiHR in its research into underrepresented groups in the industry, and in its efforts to make mining career information more widely available to job seekers. ESDC has also provided funding for MiHR to help connect new Canadians and immigrants with careers in the mining sector.

MAC MEMBERS WIN 2015 JOHN T. RYAN NATIONAL TROPHIES

CANADA TROPHY FOR METAL MINES:

Cameco Corporation, McArthur River Mine, Saskatchewan

The McArthur River mine site is located in northern Saskatchewan on the southeastern portion of the Athabasca Basin, approximately 620 kilometres north of Saskatoon. It is an underground uranium mine that contains the world’s largest known high-grade uranium deposit. The mine site is compact, occupying a surface area of approximately one square kilometre. The McArthur River operation is extremely proud to have been recognized for its safety performance, which is made possible by people at all levels of the operation working together to create a workplace culture that values the safe execution of the mine’s work plans.

CANADA TROPHY FOR COAL MINES:

Teck Resources Limited, Greenhills Operation, Elkford, British Columbia

A team of approximately 650 employees work together to make the Greenhills operation successful. Greenhills safety culture depends on the spirit of openness, cooperation and personal commitment to safety performance of all its employees. Safety is a value that is deeply embedded in the operation. As a result, Greenhills has consistently been among one of the safest mines in British Columbia. This is the fourth John T. Ryan Trophy for the Greenhills operation.

CANADA TROPHY FOR SELECT MINES:

Vale, Voisey’s Bay Mine, Voisey’s Bay, Newfoundland and Labrador

Vale’s Voisey’s Bay Mine is located in a remote area on the northeast coast of Labrador, on a peninsula bordered by Anaktalak Bay and Voisey’s Bay to the south. Foremost is “Life Matters Most,” a commitment by all site employees to genuinely care for each other at work, while helping to identify risks and prevent injury. With such a committed organizational culture at the forefront, Voisey’s Bay has continued to set a high standard for safety, receiving the John T. Ryan Regional Safety Trophy in 2013 and the John T. Ryan National Safety Trophy in 2014. In 2014, the mine achieved the milestone of one million site hours without a lost-time injury.

Source: Canadian Institute of Mining, Metallurgy and Petroleum

MiHR has also been expanding its suite of National Occupational Standards for mining and further enhancing the Canadian Mining Certification Program.



Photo: Cameco, Cigar Lake Mine, Saskatchewan

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 and safety inspectors 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 both safety and health management and crisis management. (See Section 5 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 not only that existing figures and analyses are made easily accessible, but that the people and organizations compiling the statistics understand the information needs of safety professionals.

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 8 and 9 for details). The average annual pay for a mining worker in 2013 exceeded \$100,000, which surpassed the average annual earnings of workers in forestry, manufacturing, finance and construction by a range of \$21,000 to \$33,000.

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, especially if they are highly skilled workers.

WORK STOPPAGES

A total of four strikes and lockouts affected the mining industry in 2014 (see Annex 10). Although there were double the number of work stoppages year-over-year, the number of these interruptions was down significantly from a peak of 17 stoppages in 2010. Miners are pleased to see this reduction in labour interruptions, which signals better workplace relations with their employees and unions, and promises the continued productivity of their operations.

OVERALL PRODUCTION COSTS

Mining operations incur significant production costs. To put them into perspective, Leighton Holdings notes that a single mining truck tire on the spot market costs more than a Porsche or a Miami condo.

The industry's three main production costs – wages, energy (fuel and electricity), and materials and supplies – totalled \$4.6 billion, \$3.1 billion and \$8.0 billion, respectively, in 2013, the most recent year for which data are available (see Figure 28). Together, these figures constitute a 20% increase (approximately \$2.8 billion) in the cost of mining in Canada year-over-year. Wages accounted for 12% of the industry's total 2013 production value, while energy accounted for 8%, and materials and supplies represented 20% of the total value.

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: power generation such as hydroelectric dams 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. With better access to a mode of transportation for mining re-supply and bringing product to market, a community where a workforce can live, and access to the power grid, the mining cost differential between jurisdictions with these attributes and those without can be significant. 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 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. MAC determined that for base and precious metals, the premium associated with developing and operating a remote and northern mine ranges from 2 to 2.5 times the cost of a comparable mine in a southern region. Furthermore, MAC determined that 70% of this cost increase is related directly to infrastructure investment.

Acknowledging that the future of mining lies increasingly in remote and northern Canada, and that the natural synergy resource development has with governments' stated social and economic policy objectives, there is significant potential to work together for the benefit of Canadians. To support this goal, MAC has recommended that the federal

government support northern mining investment by providing investment and infrastructure-related tax relief.

INNOVATION AND 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).

While the industry invests millions 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.

INDUSTRY ENGAGEMENT

In 2013, Canadian mining and metals companies invested \$677 million in R&D (see Figure 29). Mining's investment surpassed that of the machinery sector, the pharmaceutical sector, and the wood products and paper sector. In 2013, the most recent year in which data are available, the industry employed 4,560 people in R&D (see Figure 30). This is more than the pharmaceutical and forestry sectors, which both receive extensive financial and policy support from the government.

The various stages of mining present different types of challenges, and therefore require distinct programs to work towards solutions:

- **Exploration.** The main challenge is to locate large high-grade reserves while limiting disturbance to the ground and the environment. Technologies such as GPS surveying, three-dimensional data maps, airborne technologies and down-hole seismic imaging are enabling companies to find deposits they could not have discovered using traditional methods. Together with the Canada Mining Innovation Council, a number of companies and researchers have adopted an innovation strategy dedicated to improving exploration technologies.
- **Extraction.** Much of Canada's remaining base metals are likely located two kilometres or more beneath the surface. This situation presents cost and operational challenges. In response, the industry has invested in remote-operated equipment, automated loading and transportation systems, robotics and seismic mapping. With these technologies, companies can mine at a greater depth and keep mines open that would

otherwise close. Tailings management is another vital technological area for oil sands companies, and for base metal miners and processors (discussed in Section 5).

- **Smelting and refining.** There have been no transformative technological advances in this area over the past 20 years. Traditional pyrometallurgical operations, which draw on thermal treatment, and newer hydrometallurgical operations, which draw on electricity and chemistry, continue to be adjusted and improved. The aim is to extract the most metal using the least energy and producing the fewest emissions possible. Similar gradual improvements have occurred in iron ore pelletizing. As for particulate matter emissions, established technologies such as baghouses and electrostatic precipitators are still being used.

CANADA'S APPROACH TO INNOVATION

The industry believes that government research funding mechanisms are not aligned and do not provide support commensurate with the industry's innovation needs, priorities and contributions. With approximately 7,000 government programs involved in the assessment of projects and distribution of funds, it is easy to see how strategic innovation investments could be lost in the delivery process.

Recent reporting on Canada's overall performance affirms this view. The Conference Board of Canada maintains that, despite a decade or so of innovation agendas and prosperity reports, Canada remains near the bottom of its peer group on innovation, ranking 13th among the 16 peer countries. Further findings conclude that more innovative countries are surpassing Canada on measures such as income per capita, productivity and the quality of social programs.

The industry believes that the federal government invests significantly in innovation and research and development, but needs to invest differently to achieve the desired results. In contrast to the highly regimented structures of the 7,000 different programs the government currently funds, industry has organized organically with strategic partners, based on need and expertise, to drive solutions based on strategic collaboration. The Canada Mining Innovation Council (CMIC) is a non-profit organization that was created by the industry, government and academia to fundamentally transform the minerals industry in Canada through innovation.

CMIC has created an innovation strategy for the industry called Towards Zero Waste Mining (ZWM). ZWM focuses on the environment, energy and productivity and aims to stimulate mining technology innovation in Canada

to achieve zero waste in mining and mineral processing within 10 to 20 years. A first in the industry, this highly collaborative, open innovation strategy is structured to enable rapid technology development, while reducing barriers to the adoption of technology and significantly lessening the financial risk of all collaborators.

The Canadian mining industry, through CMIC, is deeply committed to ZWM, but ensuring its success will take significant investment from both industry and government.



Photo: Syncrude Canada, Oil Sands Facility, Alberta

CMIC has proposed that the Government of Canada invest \$18 million over five years, with matching funding by industry. Such critical funding will enable ZWM to employ an approach that will foster the development and adoption of innovative technologies to achieve more efficient and sustainable operations.

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.

FIGURE 24

EMPLOYMENT IN THE CANADIAN MINING AND MINERAL MANUFACTURING INDUSTRIES, 2007-2014

(Number of Employees)

Year	Mining and Quarrying NAICS 212	Support Activities for Mining NAICS 21311B	Non-metallic Mineral Product Manufacturing NAICS 327	Primary Metal Manufacturing NAICS 331	Fabricated Metal Product Manufacturing NAICS 332	Total Mining, Support Activities, and Mineral Processing
2007 ^r	51,780	18,785	57,725	81,715	192,005	402,010
2008 ^r	56,060	21,980	54,780	82,315	181,910	397,045
2009 ^r	48,335	17,880	52,215	64,325	163,830	346,585
2010 ^r	52,025	22,005	54,475	69,260	162,355	360,120
2011 ^r	55,245	29,565	53,615	77,460	165,940	381,825
2012 ^r	56,630	30,070	53,745	75,110	169,955	385,510
2013 ^r	63,140	29,860	52,385	73,435	165,315	384,135
2014	63,590	27,700	53,110	69,625	162,430	376,455

Source: Statistics Canada, CANSIM Table 383-0031.

NAICS: North American Industry Classification System.

^r - revised

FIGURE 25

EMPLOYMENT IN THE MINERAL EXTRACTION STAGE, 2007-2013

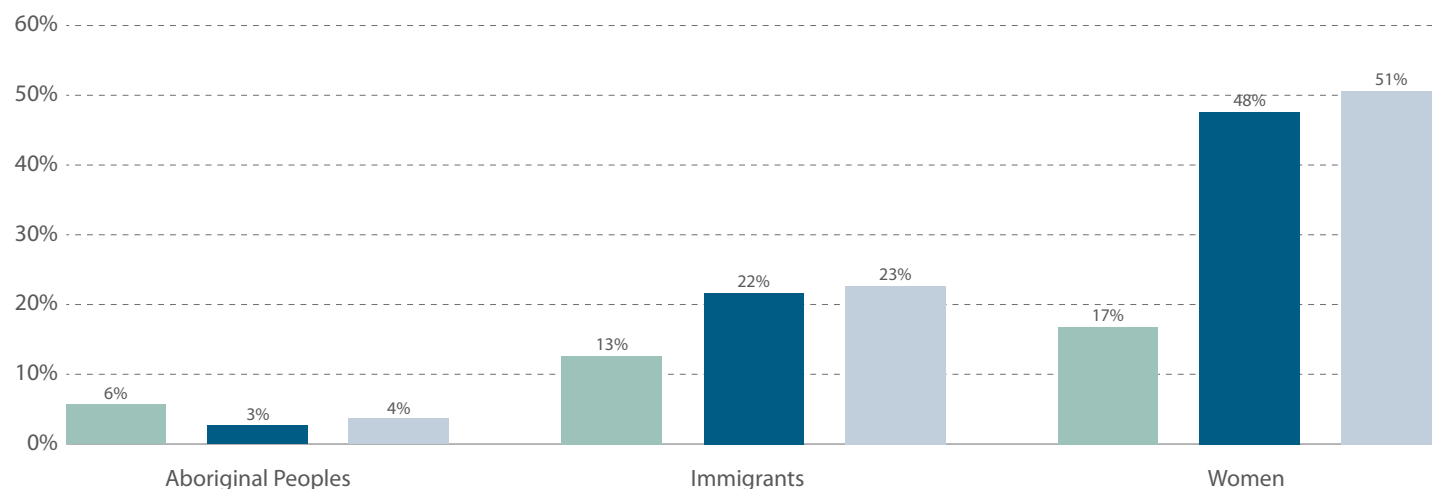
Year	Metal Mines	Non-metal Mines	Coal	Total
2007 ^r	28,520	18,840	4,420	51,780
2008 ^r	30,275	20,425	5,360	56,060
2009 ^r	23,710	19,115	5,510	48,335
2010 ^r	25,345	20,390	6,290	52,025
2011 ^r	27,445	21,305	6,495	55,245
2012 ^r	28,115	20,730	7,785	56,630
2013 ^r	35,955	19,390	7,795	63,140

Source: Statistics Canada, CANSIM Table 383-0031.

^r - revised

FIGURE 26

DIVERSITY IN CANADA'S MINING LABOUR FORCE, 2011



Sources: Mining Industry Human Resources Council, Statistics Canada.

FIGURE 27

CANADIAN MINING INDUSTRY EMPLOYMENT AND HIRING FORECAST SCENARIOS, 2016-2025

	Net Change in Employment	Retirement	Non-Retirement Separation	Cumulative Hiring Requirements
Contractionary	-6,330	48,600	41,830	85,723
Baseline	11,640	51,030	43,800	106,490
Expansionary	20,951	53,260	45,600	126,590

Sources: Mining Industry Human Resources Council; Canadian Mining Industry Employment, Hiring Requirements and Available Talent 10-year Outlook, 2015.

FIGURE 28

SELECTED COSTS OF PRODUCTION IN THE MINERAL INDUSTRY¹, 2013

By Industry	Establishments Surveyed (number)	Wages for Production and Related Workers (\$000)	Fuel and Electricity (\$000)	Materials and Supplies (\$000)	Value of Production (\$000)
Metal Ore Mining	77	2,861,977	1,729,151	5,489,097	23,231,233
Non-metallic Mining and Quarrying	1 209	1,161,030	854,157	1,744,771	11,788,241
Coal	21	559,548	500,796	770,289	4,547,358
Total Mineral Industry	1 307	4,582,555	3,084,104	8,004,157	39,566,832

Sources: Natural Resources Canada; Statistics Canada.

¹Excludes the oil and gas extraction industry

Notes:

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.

FIGURE 29

R&D EXPENDITURES BY MINING AND SELECTED INDUSTRIES, 2013

(\$ millions)	2013 ^P
Industry	
Mining and related support activities	191
Primary metals ferrous	30
Primary metals non-ferrous	208
Fabricated metal products	188
Non-metallic mineral products	60
Total	677
Other sectors:	
Oil and gas extraction	1,393
Motor vehicles and parts	F
Wood products and paper	212
Machinery	556
Aerospace products and parts	1,573
Pharmaceutical and medicine	403
Total manufacturing	6,753
Total all industries	16,032

Source: Statistics Canada, Catalogue no. 88-202-X.

Note: The projected figures in the Catalogue are revised annually by Statistics Canada and can therefore differ year over year.

F denotes "too unreliable to be published."

^P Preliminary

FIGURE 30

NUMBER OF PERSONS ENGAGED IN R&D IN MINING AND SELECTED INDUSTRIES, 2013^p

(\$ millions)	Professionals	Technicians	Other	Total
Industry				
Mining extraction	312	166	73	550
Primary metals ferrous	117	x	x	243
Primary metals non-ferrous	319	x	x	524
Fabricated metal products	1,331	1,180	230	2,740
Non-metallic mineral products	275	195	32	503
Total	2,354	1,541	335	4,560
Other sectors				
Oil and gas extraction	775	280	235	1,290
Motor vehicles and parts	1,057	581	237	1,875
Wood products and paper	495	505	118	1,116
Machinery	3,552	2,331	478	6,362
Aerospace products and parts	3,535	x	x	7,015
Pharmaceutical and medicine	1,582	1,348	192	3,122
Total manufacturing	33,703	14,709	5,167	53,570
Total all industries	89,165	33,551	9,615	132,331

Source: Statistics Canada, Catalogue no. 88-202-X.

^p Preliminary

x denotes "suppressed to meet the confidentiality requirements of the Statistics Act"

THE ENVIRONMENT

SUSTAINABLE DEVELOPMENT AND SOCIAL RESPONSIBILITY

REMOVING ORE FROM ROCK AND PROCESSING AND REFINING IT INTO PURE METAL POSES SIGNIFICANT TECHNICAL AND ENVIRONMENTAL CHALLENGES. THE CANADIAN MINING INDUSTRY IS COMMITTED TO RESPONSIBLE ENVIRONMENTAL STEWARDSHIP, AND CONTINUALLY SEEKS METHODS TO IMPROVE PROCESSES, REDUCE FOOTPRINTS AND ENHANCE 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 resource management. For example, a mine built today is obligated by Canadian law to provide financial assurance that it can be reclaimed when operations cease, and mine closure plans must be prepared and accepted by government authorities before construction. While mining has a relatively small, localized footprint, the impacts on the local area can be significant and should be managed responsibly over the life of the mine, and beyond. MAC's Towards Sustainable Mining (TSM) initiative is an example of how resource development can co-exist with environmental conservation, and how partnerships can be fostered between mining companies and communities.

In recent decades, the industry has made great strides in reducing mining's environmental impacts through the actions of individual companies, government regulations and stewardship initiatives like TSM. Together, corporate social responsibility, progressive regulations and the adherence to a host of voluntary standards have earned Canadian mining a global reputation for leading social and environmental practices.

ENVIRONMENTAL STEWARDSHIP

The Canadian mining industry has made significant progress in its environmental performance by participating in a host of domestic and international initiatives. MAC member companies, which account for the majority of Canada's mining production, have dramatically reduced their releases to the environment over the past 15 to 20 years (see Figure 31). Releases of major substances such as mercury, nickel and copper have dropped more than 99%, a result of companies investing in cleaner processes in response to voluntary initiatives and regulations.

Internationally, an array of sustainability and social licence initiatives affect the Canadian mining industry. Companies seeking project financing are now 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. Firms 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 32.

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 Mining Association of British Columbia and the Québec Mining Association have adopted the initiative for their members. In November 2015, FinnMin, the Finnish Mining Association, announced it will adopt TSM for implementation by its members within Finland. This milestone is the first time TSM has been adopted by a mining association outside of Canada, and is a significant step forward in TSM becoming a global standard. FinnMin selected TSM after a rigorous three-year process of evaluating a range of sustainability programs. FinnMin's adoption of TSM is part of a larger commitment by MAC to freely share TSM with other countries seeking tools to improve the environmental and social performance of their mining industry, such as engagement with civil society and enhanced transparency and accountability.

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 main objective is to enable mining companies to meet society's needs for minerals, metals and energy products in the most socially, economically and environmentally responsible way possible. The program's core strengths are:

- **Accountability** – TSM reporting at the facility level of their Canadian operations is mandatory for members.
- **Transparency** – Annual reporting is conducted against 23 indicators with independent verification.

- **Credibility** – TSM includes ongoing consultation with a national Community of Interest Advisory Panel to improve industry performance and shape TSM for continual advancement.

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

- Tailings management
- Energy use and greenhouse gas emissions management
- Aboriginal and community outreach
- Crisis management planning
- Biodiversity conservation management
- Safety and health

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 2015, 63 facilities reported their 2014 results.



Photo: Vale, Voisey's Bay Mine, Newfoundland and Labrador

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 2015 *TSM Progress Report*, which is available on the MAC website.

TAILINGS MANAGEMENT

Tailings impoundments 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 key environmental areas, including tailings management, has improved significantly over the years (see Figure 33). This is largely due to senior executives recognizing the importance of managing a facility's most significant environmental and safety risk. Nevertheless, with the tailings dam failure at the Mount Polley Mine in 2014, the industry faced a significant challenge and is committed to building on the efforts it has made in recent decades in developing a strong record in tailings management.

Immediately following the breach at the Mount Polley Mine, and before the cause was known, MAC proactively initiated an internal review to assess the association's tailings management program, including the mandatory requirements of the TSM initiative and MAC's three tailings management guides. This initiative is being led by MAC's Tailings Working Group, a committee of tailings management practitioners and consulting experts, and is examining what can be learned from the Mount Polley breach to ensure these incidents do not occur again.

In January 2015, an independent review of the tailings dam failure, commissioned by the Government of British Columbia, concluded that the "dominant contribution to the failure resides in the design," which "did not take into account the complexity of the sub-glacial and pre-glacial geological environment associated with the perimeter

embankment foundation." The independent panel's report stated that the failure occurred despite effective regulatory oversight, and found no evidence that the failure was due to human intervention or overtopping of the perimeter embankments. The report also stated that piping and cracking, which is often the cause of the failure of earth dams, was not the cause of the breach.

The report made seven recommendations to improve tailings management practices and reduce the potential for future failures. One of these recommendations referred to TSM's tailings management requirements and guidance, stating that corporations seeking to operate a tailings storage facility should be "required to be a member of MAC—ensuring adherence to the TSM—or be obliged to commit to an equivalent program for tailings management, including the audit function." The report also stated that compliance with the TSM initiative is an element of global best practice for the mining industry today. Notwithstanding this statement, the MAC Board believed that in light of the Mount Polley failure, it was necessary to undertake an independent external review of the TSM system and to identify opportunities for further improvements. An independent Task Force was struck in March 2015 to conduct this external review, and the Task Force's final report, which contained 29 recommendations, was tabled with the MAC Board of Directors in November 2015. Throughout 2016, MAC and its expert committees will be working to implement the recommendations in the TSM system and guides.

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 concern for the mining industry. Oil sands operators are committed to developing technologies to reduce reclamation times. One example is TRO™, developed by Suncor Energy. This technology involves adding a polymer flocculent to fluid fine tailings, which allows water to be released and tailings to dry more quickly. Other innovative examples include Syncrude's centrifuge technology and Shell'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 land and tailings reclamation and, in the years ahead, help to ensure the industry is reclaiming the landscape in a progressive manner. Suncor, Syncrude and Shell 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, and helps establish and maintain a company's privilege to operate. The TSM biodiversity conservation management protocol consists of three indicators that set out expectations for mining companies. The protocol seeks to confirm 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.

MAC members started reporting on this protocol in 2012 on an aggregate basis and, in 2013, facility-level reporting on this protocol began. There was notable improvement in results year-over-year. In 2014, 67% of facilities achieved a Level A or higher for biodiversity conservation reporting, compared to 55% in 2013 (see Figure 34). While aggregate results indicate improvement across all three indicators year-over-year, it is clear there is still work to be done to improve performance going forward.

THERE WAS NOTABLE IMPROVEMENT IN RESULTS FOR TSM'S NEWEST PROTOCOL, BIODIVERSITY CONSERVATION MANAGEMENT. IN 2014, 67% OF FACILITIES ACHIEVED A LEVEL A OR HIGHER FOR BIODIVERSITY CONSERVATION REPORTING, COMPARED TO 55% IN 2013.

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 and to help reduce operational costs at mine sites.

The energy use and GHG emissions management protocol has three indicators that seek to confirm 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.

While similar in aim, it is notable that the requirements on TSM practitioners to obtain Level A achievement on the energy use and GHG emissions management protocol extend beyond those required to obtain ISO50001 certification. While ISO is a more broadly recognizable program globally, this comparison may help readers contextualize the extent of the commitment that MAC

members undertake in pursuit of energy and GHG management excellence.

In 2013, a revised energy use and GHG emissions management protocol was introduced condensing the number of indicators for this protocol 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, as such, GHG emissions are controlled by managing energy consumption. Historical data from 2006 to 2012 are available in the *TSM Progress Report 2014*. Figure 35 shows the 2013 and 2014 performance for the three indicators.

In 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.

IN 2014, 75% OF FACILITIES REPORTED A LEVEL A OR HIGHER FOR HAVING A COMPREHENSIVE ENERGY USE AND GHG EMISSIONS MANAGEMENT SYSTEM – AN INCREASE OF 17% YEAR-OVER-YEAR.

ENERGY EFFICIENCY AND GHG EMISSIONS

Energy and GHG emissions policy issues are visible and important to Canadians. Dramatic climate events and the extensive media coverage that follows them have made this issue top of mind for many people around the world. The following offers a whole-of-industry perspective on energy use and GHG emissions that extends beyond TSM reporting.

MINERAL EXTRACTION

According to the Canadian Industrial Energy End-Use Data and Analysis Centre, direct emissions from Canada's operating metal and non-metal mines accounted for just 0.82% of the country's total GHG emissions in 2013 (see Figure 36).

Despite lacking federally regulated targets, many extraction operations are improving their capabilities in compressed air, ventilation, metering and energy management, and have been doing so for years. Canadian mining companies

are also involved in innovation initiatives to find fuel efficiencies for large mobile equipment. 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. Mines in northern Canada face a special energy challenge because of the lack of electrical grid capacity, making them more reliant on more expensive fossil fuel than their centrally located counterparts. As a result, some mines are less able to lower their carbon emissions due to the remoteness of their locations and the infrastructure challenges they face.

OIL SANDS

About 20% of the oil sands reserves are close enough to the surface to be mined, while about 80% are accessible through in-situ treatment. While mining causes a larger land disturbance, in-situ methods are generally more energy intensive. According to a 2012 IHS CERA report, well-to-wheels GHG emissions from oil sands crude oil average 11% higher than the average crude oil refined in the United States, with oil sands mining in the lower emissions range and in-situ processes in the higher range. Well-to-wheels emissions include those produced during crude oil extraction, processing, distribution and engine combustion.

Despite the higher GHG emissions per barrel, direct emissions from the oil sands themselves contribute a relatively small amount to global anthropogenic GHG emissions. According to the Canadian Energy Research Institute, the most recent estimate of global GHG emissions is for 2010, in which approximately 49 gigatonnes of CO₂ were emitted. Canada's 2014 National Inventory Report stated that 699 megatonnes were emitted in 2010. Of this, 52 megatonnes came from oil sands activity and accounted for 8.7% of Canada's GHG emissions.

While this is a sizeable contribution to Canada's GHG emissions, Canada is a small contributor to total global emissions, accounting for approximately 1.4%. At approximately 0.1% of total global emissions in 2010, even a drastic decrease in the emissions from the oil sands sector will do relatively little to reduce world GHG emissions in the absence of significant reduction efforts from other countries and industries.

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 have been reduced by 28%. For oil sands mining, GHG emissions reductions have been driven through innovations such as hydrotransport and efficiency improvements in bitumen extraction, upgrading, and natural gas-fired cogeneration for electricity and steam. With the advancement of steam-assisted gravity drainage about

CANADA'S OIL SANDS INNOVATION ALLIANCE

COSIA is a good example of industry collaboration on environmental issues. The alliance brings together 13 of the largest companies involved in Canada's oil sands, representing almost 90% of oil sands production, and focuses on performance improvements for four key environmental challenges: tailings, water, land and GHG emissions. Member companies have agreed to break down some of the barriers of funding, intellectual property and human resources that sometimes impede the discovery and implementation of breakthrough technologies in these areas. COSIA is building and expanding on the progress made in recent years by several industry research and development organizations. By setting clear environmental goals, and working together to achieve real solutions, this new and larger alliance is taking collaboration and sustainable development to the next level.

a decade ago, technical improvements have continually enhanced the steam-to-oil ratio, increasing the efficiency of this process. 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.

At the time of writing, the Government of Alberta had just released its Climate Leadership Plan, which includes an economy-wide price on carbon, rising to \$30/tonne in January 2018. Additionally, an overall oil sands emissions limit of 100 megatonnes will be set, with provisions for new upgrading and cogeneration, as well as an accelerated transition from coal to renewable generation.

While off-setting coal with renewable generation may accelerate a reduction in emissions, displacing it entirely with renewable generation may be ambitious in the proposed timeframe. The incorporation and deployment of other generation and technology options, including natural gas, the potential application of nuclear power, or the implementation of large-scale carbon capture and sequestration (CCS) would also support emissions reduction. While benefits from a combination of these options could significantly reduce GHG emissions, there are challenges with their implementation that need to be considered and addressed.

Alberta has no experience with nuclear power and no nuclear infrastructure. Natural gas cogeneration already provides the bulk of power generated in the oil sands, and CCS technology is still maturing, with only a couple of operations in the world.

Technology improvements and efforts to find alternative power will continue as individual companies and the industry focus on reducing their environmental footprint.

MINING AND NATURAL GAS

Miners who 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, which is also far more expensive (see Figure 37). This places natural gas in a good position to help miners reduce their energy costs and their carbon and other emissions when it is viable to switch.

Stornoway Diamond Corporation's Renard Diamond Project is a recent example of a mining company embracing the natural gas opportunity. In October 2013, the company announced positive results from a feasibility study on the viability of a power plant fuelled by liquefied natural gas. The study demonstrated the substantial benefits of this option, in terms of reduced annual operating costs and environmental emissions, compared to a diesel genset option. Highlights of the study included:

- Annual operating cost reductions of between \$8 million and \$10 million over the initial 11-year mine life, representing a mine-life cost savings of \$89 million, or 6.6%.
- Incremental capital cost of only \$2.6 million over the cost of diesel gensets, representing a net payback of four months.
- An estimated reduction in GHG emissions of 43%, with significant reductions in NO₂ and SO₂.

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, miners 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.

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 been made towards the development of liquid natural gas engines for heavy vehicles. As well, partnerships have formed to co-develop natural gas technology for off-road equipment, such as mining trucks, enhancing the viability of fuel switching for a mining fleet.



Photo: Wind farm at the Diavik Diamond Mine in the Northwest Territories reduces Diavik's diesel fuel consumption by 5 million litres annually.

MINING AND RENEWABLE ENERGY

Renewable energy technologies and their economics continue to improve. Renewable power is appealing to miners because it has the potential to reduce energy costs and environmental impacts while enhancing energy security and strengthening a company's privilege to operate.

From 1999 to 2013, the most recent year for which cost data are available, the annual energy bill for mining processes tripled, costing Canadian miners over \$3 billion in 2013. This cost increase can largely be explained by the remote location of many Canadian mines, the lack of regional energy infrastructure, and the resulting dependence on diesel. From 1999 to 2013, the average price of oil increased tenfold, from roughly US\$10 to more than US\$100 per barrel. Heightened transportation costs have also increased the price per unit of delivered fuel, pushing the cost of generation for some remote mines up to \$0.30 per kilowatt hour.

MINERS PUT ENERGY INTO RENEWABLE POWER

In 2014, after five years of research and preparation, Glencore installed a pilot 3-megawatt wind turbine at its Raglan Mine. The mine is located on the Ungava Peninsula in Nunavik, Quebec, roughly 1,800 kilometres north of Montreal, and historically was entirely reliant on diesel generation. The 3-megawatt turbine is expected to offset diesel dependence by 5%, or approximately 2.4 million litres, annually.

The project promises significant cost savings and emissions reduction. At Raglan Mine, energy typically accounts for approximately 20% of total operating costs. If the wind turbine pilot proves successful, Glencore will consider installing additional turbines that could generate a total of 9 to 12 megawatts of energy, reducing the mine's overall diesel consumption by up to 40%.

This project is another example of industry innovation, as it incorporates three storage technologies – a flywheel, batteries, and a hydrogen storage loop with an electrolyzer and fuel cells – in addition to the wind turbine. As a result, wind penetration will increase from 15 to 25% to an anticipated 35 to 55%. These measures enhance the turbine's generation capacity, enabling the company to better leverage the power of wind at the mine site.

Even in recent years, where the price of oil has dropped significantly, the corresponding cost of oil products, such as diesel, has been slower to fall.

Given the heightened cost of powering mining operations, miners are giving the benefits of renewable technologies greater consideration. The levelized cost of electricity (LCOE) for wind, solar photovoltaic, concentrated solar power and some biomass technologies has steadily decreased, enhancing their competitiveness, particularly for off-grid generation. A recent International Renewable Energy Agency report noted that the average 2014 LCOE for wind, solar and biomass technologies in North America was \$0.07, \$0.13 and \$0.08 per kilowatt hour, respectively.

While attractive, these average prices do not account for additional capital costs associated with remote

development. They also vary based on the quality of the renewable resource. Just as miners need to go where the viable deposits are located, renewable generation is contingent on the strength and reliability of the renewable asset. This restriction prevents renewable 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 Rio Tinto and Dominion Diamond Corporation's Diavik Diamond Mine in the Northwest Territories, IAMGOLD's Rosebel Mine in Suriname, and Glencore's Raglan Mine in Quebec.

CLIMATE CHANGE POLICIES

According to a recent report by the Intergovernmental Panel on Climate Change, global GHG emissions have continued to increase over the past four decades despite a growing number of climate change mitigation policies. The report also states that emissions have increased more rapidly in recent years than at the beginning of this time period. In fact, total GHG emissions were the highest in human history from 2000 to 2010, reaching 49 gigatonnes of carbon dioxide equivalent.

As inscribed in the Copenhagen Accord, Canada's current GHG emissions reduction targets are aligned with the United States, and commit Canada to an economy-wide target of a 17% reduction in emissions from 2005 levels. This target is poised to change, however, with the Liberal government elected on a campaign promise to put a price on carbon, and pending outcomes from the 21st Conference of Parties (COP) in Paris.

Current examples of measures the Canadian government has taken to tackle climate change include steps to reduce GHG emissions from heavy-duty vehicles, regulations to reduce carbon dioxide emissions from the coal-fired generation of electricity, and, most recently, regulations governing the use of industrial boilers. With the change in federal government, it is uncertain if further sector-specific regulations will be developed for the oil and gas sector and the mining sectors as part of a broader plan.

Regardless of the scope of the Canadian government's current climate change policies, or the shape they may take in the future, it is important that any federal policies on GHG emissions engages all Canadians in the solution, and avoids overlapping existing or developing provincial policies. Otherwise, complicated regulatory and reporting systems

could result, causing unnecessary duplication. Industry needs clear and consistent regulatory processes if it is to make the right investments in abatement technologies and emissions management systems. The federal government should also avoid a “one size fits all” approach, and focus on the facilities and regions that will deliver real environmental benefits.

THE CLEAN ENERGY ECONOMY

Around the world, demand for environmental goods and services is on the rise, reflecting concerns over climate change. Promising technology areas include low-carbon energy, energy storage, carbon capture and storage, green buildings and materials, clean vehicles and renewable energy.

This cleaner society depends on metals and minerals as 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. Hybrid cars require 30% more copper (nearly 15 pounds more per vehicle) than their conventional counterparts. 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.

Minerals and metals are essential for developing clean energy, whether the source is nuclear, wind or hydrogen. Wind turbines, for example, are made from nickel alloys. So are the gas turbines, shafts and fuel injectors used in small biogas projects (including some Clean Development Mechanism projects in India). Because nickel is strong and resists corrosion, it is well suited to air pollution reduction hardware and renewable energy infrastructure.

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. In 2013, for example, over 22 million Canadians had mobile device subscriptions, with many people replacing their devices on either an annual or biennial schedule.

COAL'S ROLE IN A SUSTAINABLE SOCIETY

Coal is required to make steel. About 770 kilograms of steelmaking 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 are 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 re-use 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.

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 183 parties, 52 of which are signatories, including Canada and the European Union.

E-WASTE RECYCLING IN CANADA

RECYCLABLES:

- **Electronic waste**—TVs, desktop and portable computers, mobile phones and devices, certain medical and monitoring devices, stereos, printers, DVD players, cameras, and audio and video game consoles.

URBAN ORE:

- **Metals**—Zinc, lead, germanium, indium, cadmium, arsenic, mercury, copper, gold and silver.

COMPANY IN THE FOREFRONT:

- **Glencore** - The Horne Smelter is located in Rouyn-Noranda, Quebec, and is the world's largest processor of electronic scrap containing copper and precious metals. The smelter is a custom copper smelter that uses both copper concentrates and precious metal-bearing recyclable materials as its feedstock to produce a 99.1% copper anode.

Ongoing capital investments have kept the facility at the cutting edge of technology, with a strong focus on emissions reduction. The Horne Smelter has the capacity to process 840,000 tonnes per annum of copper and precious metal-bearing materials.

geographical proximity makes for strong connections, but more can be done to enhance relationships between industry and Aboriginal 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 Aboriginal peoples. Such agreements have helped mining companies garner local support for their projects. 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, Natural Resources Canada estimates that 335 bilateral agreements (IBAs or other agreements at the exploration stage) have been signed for 198 mining projects in Canada, and that 265 of them remain active.

Progressive agreements, such as the EKATI mine project agreement in the Northwest Territories and the Raglan agreement in Quebec, can provide Aboriginal communities with jobs, skills training, profit sharing and environmental benefits. 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 Aboriginal 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.

While the relationship between mining companies and Aboriginal 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

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.

ABORIGINAL RELATIONS AND BENEFIT AGREEMENTS

Mining companies have developed progressive relationships with many Aboriginal communities. Given the proximity of many Aboriginal communities to mining operations, and the large number of Aboriginal youth, there is significant potential to create stronger and mutually beneficial partnerships between Aboriginal Canadians and the mining industry.

Proportionally, the mining industry is the largest private sector employer of Aboriginal people in Canada. Most Aboriginal communities are located within 200 kilometres of a producing mine or an exploration property. This

ABORIGINAL PERSPECTIVE ON BENEFIT AGREEMENTS

Aboriginal economic development corporations (EDCs) are the economic and business development arm of a First Nations, Métis or Inuit government, and are a major economic driver in Aboriginal communities. In 2011, the Canadian Council for Aboriginal Business published a survey of 50 EDCs across Canada. Of those surveyed, 32% of respondents stated they had benefited from IBAs through community-negotiated provisions for contracting and subcontracting to local Aboriginal businesses. Participants in the survey noted that IBAs ensured that members of their communities could gain access to employment and training opportunities, and that EDCs gained first access to all contracting opportunities.

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 Aboriginal title, a first in Canadian law. It also provided clear guidance on the criteria needed to demonstrate title and on the rights and obligations that flow from that, in the process also identifying 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 Aboriginal title, it has to demonstrate both a compelling public interest for the project as well as ensure that future Aboriginal generations will not be deprived from the benefit of the land where the project to go ahead – a very significant test. At its core, the decision continues a balancing act between empowering and limiting the authority of both Aboriginal peoples and governments. The Canadian mining industry believes it is a significant decision that provides much more clarity going forward.

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. 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* (NPA).

All three federal Acts were amended in 2012. A review of the Metal Mining Effluent Regulations (MMER) was announced at the same time and multi-stakeholder consultations concluded in 2015, but resulting amendments have not yet been published in Canada Gazette Part 1 for public comment. The CEAA 2012 came into force in July 2012, and its Regulations Designating Physical Activities were amended in October 2013. Amendments to the *Fisheries Act* came into force in November 2013. Amendments to the *Navigable Waters Protection Act*, changing it to the *Navigation Protection Act*, came into force in April 2014. Based on experience to date, there has been a slight increase in the number of federal approvals required for mining projects and a significant change in the processes to obtain those approvals. A recent review of the CEAA registry indicates the number of mining projects requiring review is significantly higher than other industrial sectors (see Figure 38).

The new government has promised to review the CEAA, the *Fisheries Act*, and the *Navigation Protection Act*. The uncertainty and difficult transition created by 2012 legislative changes points to the importance of consultation with affected stakeholders, transition planning, adequate capacity within departments to manage implementation, and consideration of interaction among various federal regulatory requirements and between federal and provincial processes.

FIGURE 31

MINING INDUSTRY RELEASE OF SUBSTANCES TO THE ENVIRONMENT, BASE YEAR TO 2012

	Base Year	2005	2008	2009	2011	2012	% Change Base- 2012
Cadmium	130.1	30.9	19.9	23.4	5.5	6.4	95%
Arsenic	319.5	81.0	110.0	66.4	38.5	25.2	88%
Copper	976.0	352.6	313.9	270.3	222.8	152.4	84%
Lead	1,843.9	198.8	214.5	194.1	115.3	52.8	97%
Mercury	28.2	1.8	2.5	1.1	0.4	0.4	99%
Nickel	1,372.0	392.8	212.9	119.8	138.3	150.6	89%
Zinc	3,014.6	405.3	403.9	554.1	257.6	264.3	91%

Source: MAC Member Companies, TSM Progress Report, 2014.

Notes: The air/water pollutant releases are tonnes per year and are primarily associated with the operation of metal smelters and oil sands upgraders. Data is drawn from industry submissions to the federal government's National Pollutant Release Inventory (NPRI). Base year varies by company though it is generally around 1993.

FIGURE 32

MAC MEMBER COMPANY APPLICATION OF INTERNATIONAL STANDARDS AND PROGRAMS

INTERNATIONAL INITIATIVES																	
MAC MEMBER COMPANY APPLICATION OF INTERNATIONAL STANDARDS AND PROGRAMS	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	IFC Social and Environmental Performance Standards	Dow Jones Sustainability Index	Jantzi Social Index	Responsible Jewellery International Cyanide Code Kimberley Process
*Applied at international facilities.																	
**TSM is applied at international facilities, but results are not reported publicly.																	
COMPANIES/BUSINESS UNITS HEADQUARTERED IN CANADA WITH INTERNATIONAL OPERATIONS																	
Agnico Eagle Mines Ltd.	X										X	X			X	X	NA
Barrick Gold Corporation		X	X	X		X	X	X	X	X	X	X	X		X		X NA
IAMGOLD Corporation	X			X	X				X		X	X		X	X		NA
Kinross Gold Corporation			X	X	X	X	X	X			X	X	X	X	X	X	X NA
HudBay Minerals Inc.**	X			X	X		X	X			X	X	X	X		NA	NA NA
First Quantum Minerals Inc.	X					X	X	X				X		X		NA	NA NA
Teck Resources Limited **	X	X		X		X	X		X		X	X	X	X	X	X	NA NA NA
Vale (Base Metals)				X	X	X	X	X			X	X	X	X		NA	NA NA
New Gold Inc.**	X		X	X	X	X					X	X			X	NA	X NA
Eldorado Gold			X	X	X						X	X	X				X NA
Goldcorp		X	X		X	X	X			X	X	X	X				X NA
COMPANIES HEADQUARTERED OUTSIDE OF CANADA WITH CANADIAN OPERATIONS																	
Glencore		X	NA	X	X	X	X	X			X	X	X	X	X	NA	NA NA
De Beers Canada Inc.**	X	X		X	X	X	X	X		X	X	X	X	X		X	NA X
Newmont Mining Corporation		X	X	X	X	X	X	X	X	X	X	X	X	X	X	NA	X NA
Rio Tinto		X		X	X	X	X	X	X		X	X	X	X	X	X	NA X
ArcelorMittal				X	X		X				X						

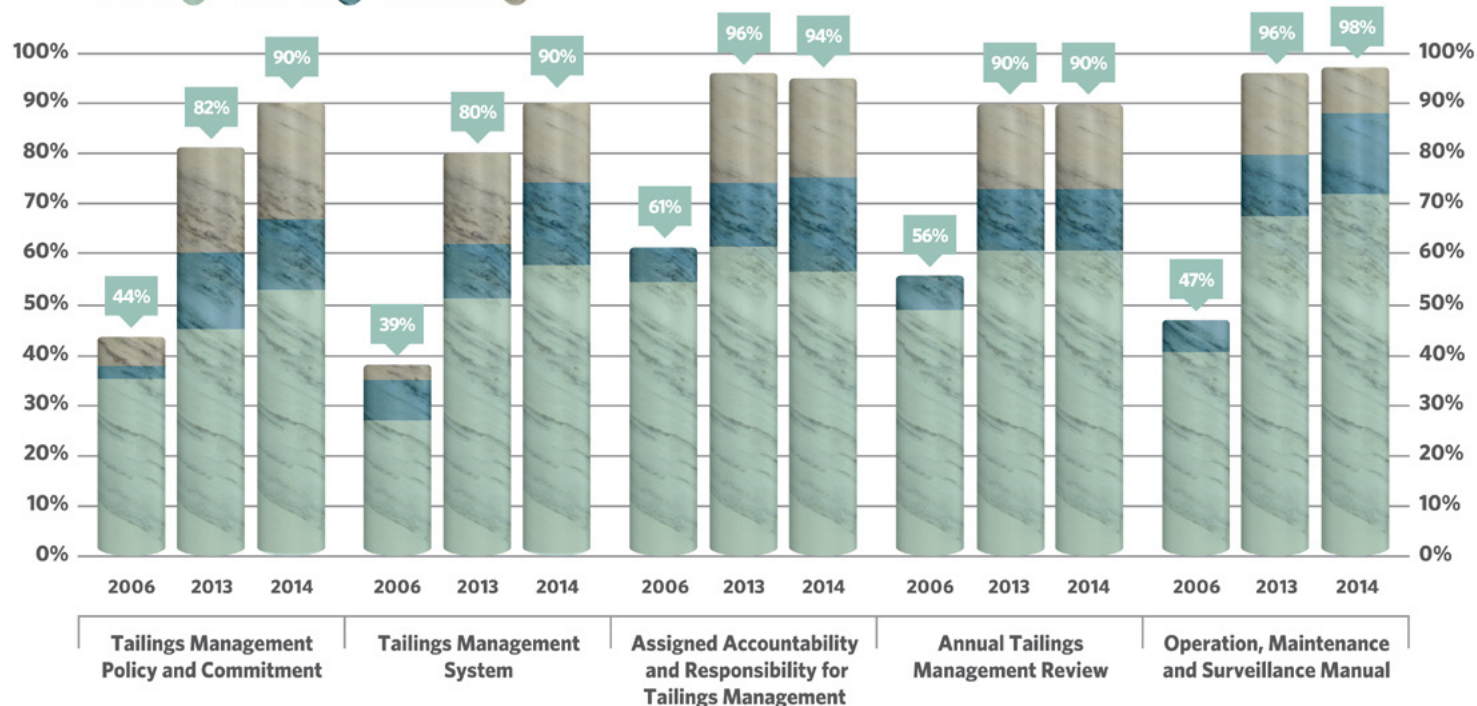
Sources: MAC Member Companies, TSM Progress Report 2015.

FIGURE 33

TSM TAILINGS MANAGEMENT

TAILINGS MANAGEMENT PERCENTAGE OF FACILITIES AT LEVEL A OR HIGHER 2006, 2013 AND 2014

Level A ● Level AA ● Level AAA ●



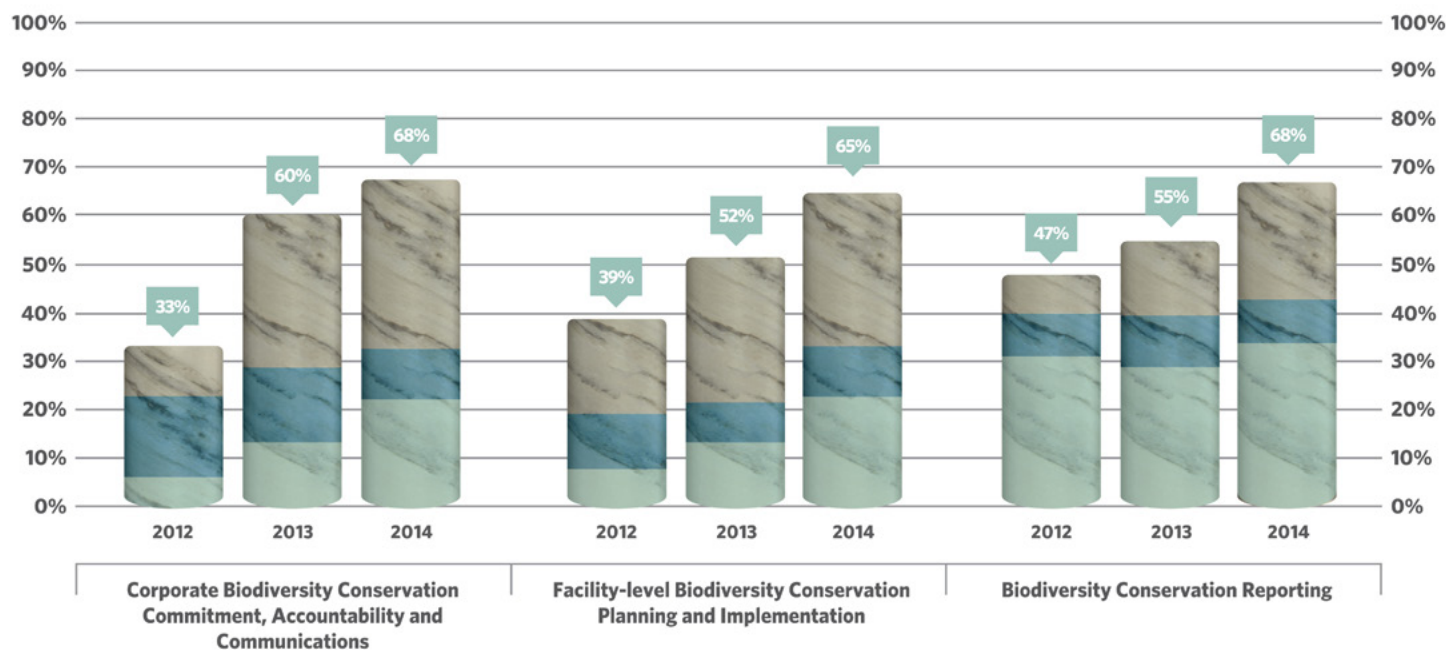
Sources: MAC Member Companies, TSM Progress Report 2015.

FIGURE 34

TSM BIODIVERSITY CONSERVATION MANAGEMENT

BIODIVERSITY CONSERVATION MANAGEMENT PERCENTAGE OF FACILITIES AT LEVEL A OR HIGHER 2012, 2013 AND 2014

Level A ● Level AA ● Level AAA ●



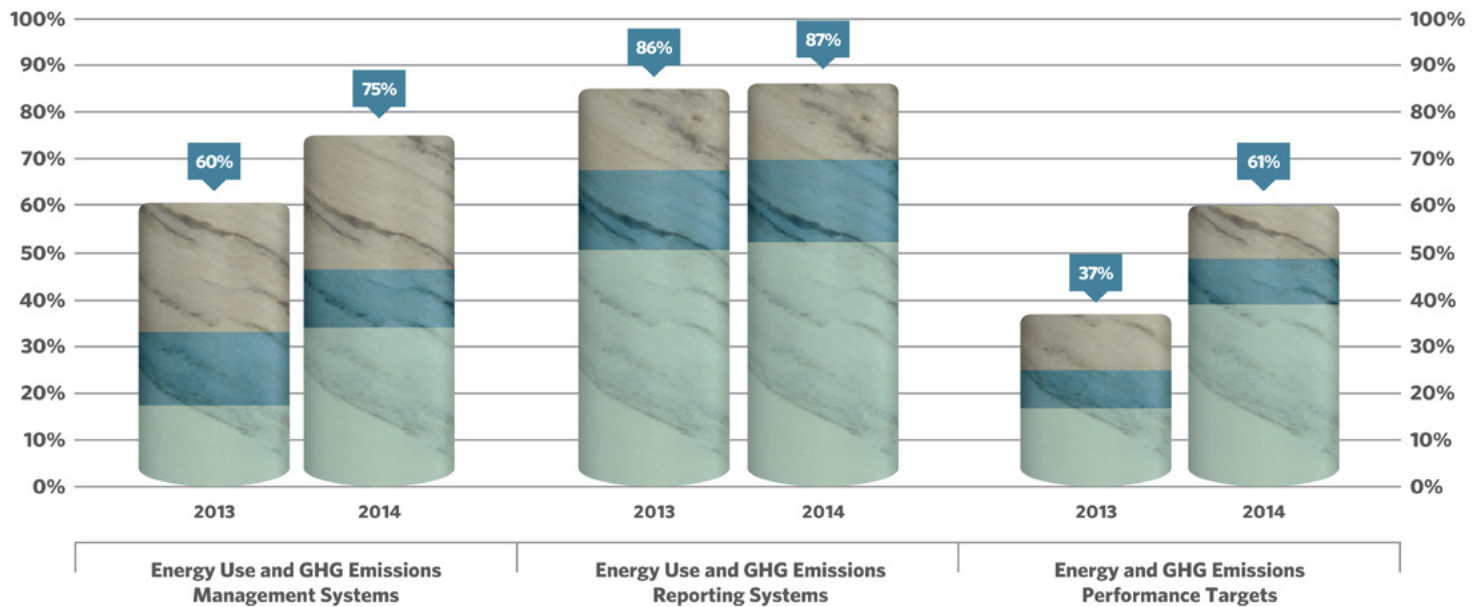
Sources: MAC Member Companies, TSM Progress Report 2015.

FIGURE 35

TSM ENERGY USE AND GHG EMISSIONS MANAGEMENT

ENERGY USE AND GHG EMISSIONS MANAGEMENT PERCENTAGE OF FACILITIES AT A LEVEL A OR HIGHER 2013 AND 2014

Level A ● Level AA ● Level AAA ●



Sources: MAC Member Companies, TSM Progress Report 2015.

FIGURE 36

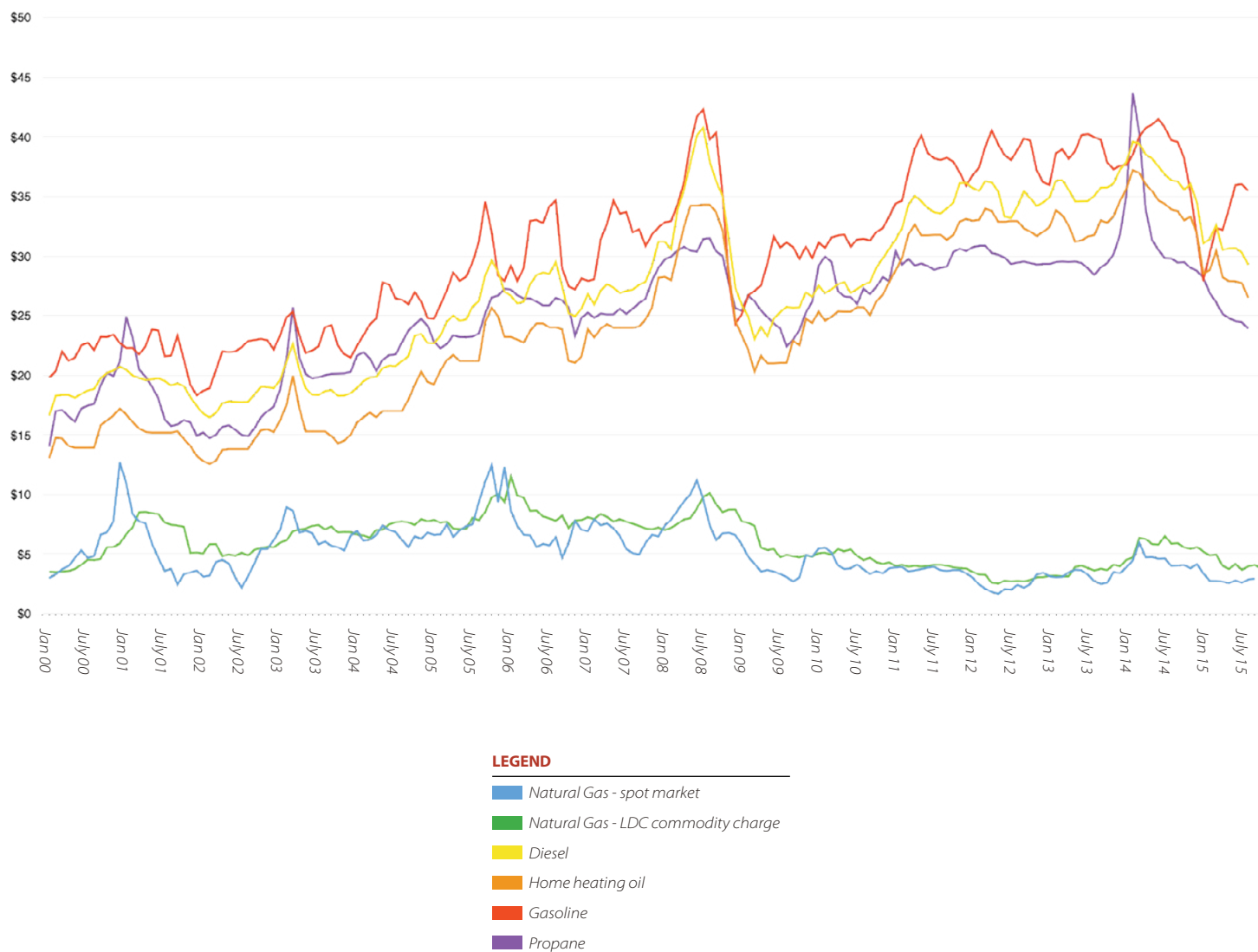
MINING INDUSTRY ENERGY AND GHG EMISSIONS DATA, 1990 AND 2013

	1990	2013
Canadian economy		
Canadian energy use (PJ)	9,608	11,520
Energy used by broader industry (PJ)	2,400	3,467
Canadian GHG emissions (mt)	592	702
Direct GHG emissions by all industries (mt)	99.1	141
Metal and non-metal mining		
Total energy use (PJ)	143	147
Share of Canadian energy use (%)	1.48	1.28
Direct GHG emissions (Mt CO ₂ e)	5.63	5.77
Direct share of Canadian GHG emissions (%)	0.95	0.82
Primary metal smelting and refining		
Total energy use (PJ)	77	46
Share of Canadian energy use (%)	0.8	0.4
Energy per unit (TJ/kt)	50.4	33.3
Direct GHG emissions (Mt CO ₂ e)	3.04	1.84
Direct share of Canadian GHG emissions (%)	0.51	0.26

Source: Canadian Industrial Energy End-Use Data Analysis Centre (CIEEDAC) Report, 2015.
Notes: Smelting and refining data are for non-ferrous metals. Also does not include aluminum.

FIGURE 37

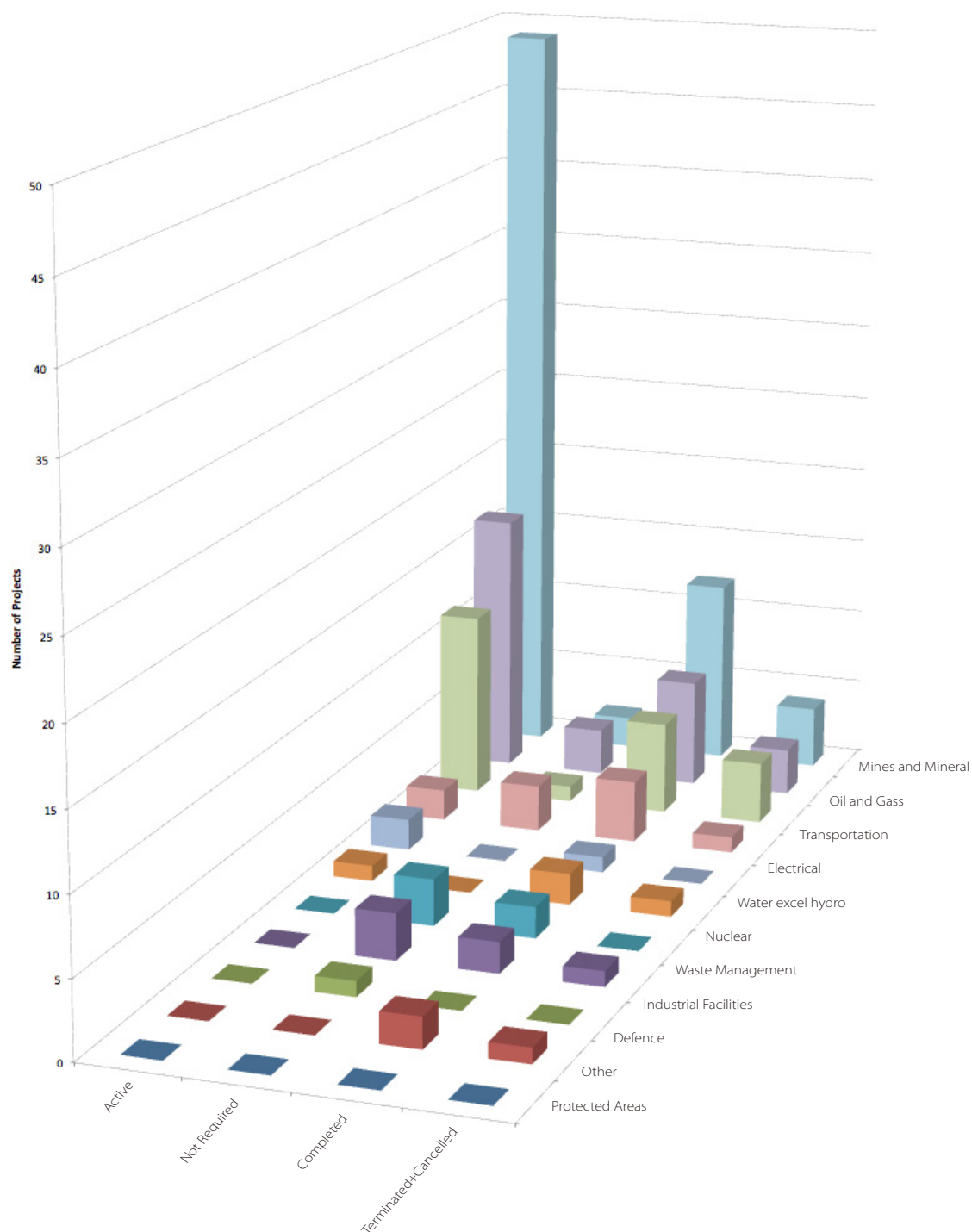
ENERGY COMMODITY PRICES (\$/MMBTU), 2000-2015



Sources: Statscan 326-0009, Kent Group, Canadian Gas Association.

FIGURE 38

ENVIRONMENTAL ASSESSMENTS UNDER CEAA 2012



Source: Canadian Environmental Assessment Agency

Note: The Canadian Environmental Assessment Act, 2012, came into force in July 2012. The above is accurate as of July 2015

THE WORLD

INTERNATIONAL MARKET ACTIVITIES AND DEVELOPMENTS

CANADIAN EXPLORATION AND MINING COMPANIES ABROAD HAVE A SIGNIFICANT PRESENCE BEYOND CANADA'S BORDERS. 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, the value of Canadian mining assets abroad reached \$153.3 billion in 2013, accounting for 66% of total Canadian mining assets (see Figure 39). By comparison, this figure is nearly double that of Canadian mining assets at home, which amounted to \$80.7 billion.

As a geographic indicator, Latin America and Africa, respectively, were the top two continental destinations for Canadian international mining assets. While some countries host more activity than others, in 2013, Canadian companies were active in 33 of Africa's 55 countries, and in every Latin American country.

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 \$969 million in equity capital for Latin American mining projects in 2013, and \$801 million for African mining projects for the same year. Despite these investments, Canadian mining companies are facing increasing competition from other mining jurisdictions operating internationally, such as Australia and China.

CANADIAN DIRECT INVESTMENT ABROAD

Canadian direct investment abroad (CDIA), and mining's share of that, is an indicator of the industry's international

CANADIAN MINING ASSETS ABROAD IN 2013

In 2013, of the 1,777 companies researched:

- 1,621 (91%) were identified as having mining assets in 2013
- 28 (2%) had mining assets with a value in excess of \$1 billion
- 166 (10%) had operating revenues
- 831 (51%) had interests outside of Canada
- 593 (37%) had mining assets in at least two countries

Source: Natural Resources Canada

presence. CDIA totalled \$779 billion in 2013, a 10% increase over 2012 (see Figure 40). Of that, the metallic minerals and metal products sector accounted for \$81.4 billion, or 10%. It is noteworthy that the annual outward flow of the metallic minerals and metal products sector is comparable to the value of domestic Canadian mining assets.

The sector's share of CDIA has held steady at about 10% over the past decade, down from 15% in the 1990s. Given the fairly consistent level of CDIA from the metallic minerals and metal products sector over the past decade, the relative decline can be attributed to large CDIA increases by other sectors.

HOST COUNTRY INVESTMENT

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 could help reshape the dialogue around resource nationalism by more clearly identifying mining's economic contributions.

It has been estimated that between 60 and 80% of all money spent in building and operating a mine remains in the host country through wages and local procurement. This estimate is supported by a 2013 World Gold Council report, *Responsible Gold Mining and Value Distribution*, which found similarly high levels of spending remaining in the country. The report surveyed almost 100 gold mines around the world, including several from Canada, and found that out of \$55.6 billion in total expenditures, at least \$44.7 billion (or 80%) was paid out in the country where the operation was situated. Further research into the nature and extent of horizontal flows would be valuable.

INTERNATIONAL TRADE STATISTICS

Despite showing a trade deficit in the third and fourth stages of mining in 2014, the sector as a whole maintained a surplus of \$13.7 billion. A near fourfold increase from a decade earlier, this surplus indicates a healthy global demand for Canadian mineral products (see Figures 41 and 42). The mining sector in Canada is one of the few sectors that consistently makes a positive contribution to Canada's balance of trade, totalling \$165.8 billion since 2004.

EXPORT

The value of Canada's mineral and metal exports increased by 11% between 2007 and 2014, but has settled over the last three years. Exports of mineral products for the first three stages of mining remained robust in 2013, at \$77 billion. Stage 4 exports totalled \$12.3 billion, nearly unchanged from 2013. All told, exports reached \$89.4 billion for all four stages, or 18.2%, of the total value of Canada's exports (see Figure 43). Given the time-lag between this data and the current downward pressure commodity prices are facing, declines are expected in 2015.

Over half of Canada's mineral and metal exports by value were destined for the United States in 2014, with iron and steel, aluminum, gold, silver, potash, copper, zinc and nickel holding the largest values (see Annex 11). The European Union is a leading destination for Canadian gold, iron ore, nickel, uranium and diamonds. Other destinations, including China, buy significant volumes of copper, iron ore, coal and potash.

IMPORTS

Imports for all four stages of mining increased in 2014, totalling \$79.4 billion, with all four stages increasing in value. Of Canada's total mineral imports by value in 2014, approximately 50% came from the United States, which equalized the balance of trade between the two countries for minerals and metals (see Annex 12).

THE CANADIAN TRADE REGIME

The Canadian mining industry boasts a significant international presence. Its reliance on international market demand for many of its products makes the industry a major stakeholder in the programs and services that Canada's Department of Global Affairs offers to companies operating abroad. But Canadian mining operations also require a consistent and predictable domestic investment regime so they can plan their business strategies and finance their projects.

Canada remains among the world's most open countries in terms of trade and investment in mining, and has no notable barriers except for some foreign ownership restrictions in uranium, which have typically been waived in cases where reciprocal openness is seen. When it comes to minerals and metals, Canada has one of the most open markets in the world, as its second consecutive first-place ranking in Behre Dolbear's assessment of countries for mining investment attests.

THE CANADIAN TRADE AGENDA

The Canadian trade regime has expanded aggressively in recent years, giving Canadian miners greater flexibility to expand into new and emerging markets, or export their products more freely to an increasing number of destinations. MAC and the mining industry supports the following policy developments and, where appropriate, provides input to Canadian policy makers and negotiators.

Trans-Pacific Partnership. On October 5, 2015, then Prime Minister Stephen Harper announced the conclusion of the Trans-Pacific Partnership (TPP) negotiations. The TPP is the largest free trade agreement in history, involving a 12-nation market of nearly 800 million customers, whose total GDP exceeds \$30 trillion.

Canada's exports of metals and minerals to TPP countries were worth on average \$158.6 billion per year from 2012 to 2014. Through the reduction of tariffs, operators in Canada stand to gain significantly with TPP partners:

- Japan: tariffs of up to 7.9%
- Vietnam: tariffs of up to 40%

- Malaysia: tariffs up to 50%
- Australia: tariffs of up to 5%
- New Zealand: tariffs of up to 10%
- Brunei: tariffs of up to 20%

Extending beyond tariff elimination and reduction, the negotiations also address numerous challenges that companies currently face in getting products, people and services across borders on a day-to-day basis. As one of Canada's largest outward investing sectors, the mining sector will benefit from the greater certainty, transparency and foreign investment protection that the TPP offers. Participating in the TPP is important because it will enable the mining industry to remain competitive on the global stage, especially when Canada's largest international competitor, Australia, is also party to the agreement.

At the time of writing, the newly elected Liberal government has signaled its intention to review the text of the agreement, as well as subject the decision to ratify the agreement to a parliamentary debate.

BEHRE DOLBEAR'S RANKING OF COUNTRIES FOR MINING INVESTMENT IN 2015

Behre Dolbear highlights countries whose policies and business conditions promote investment growth in the mining sector. Ranking is based on seven criteria:

- The country's economic system
- The country's political system
- The degree of social issues affecting mining in the country
- Delays in receiving permits due to bureaucratic and other issues
- The degree of corruption prevalent in the country
- The stability of the country's currency
- The competitiveness of the country's tax policy

The top five countries in 2015 are:

	2015 Ranking	2014 Rating	2013 Rating
1. Canada	1	1	2
2. Australia	2	2	1
3. United States	3	3	...
4. Chile	4	4	3
5. Mexico	5	5	5

Comprehensive Economic and Trade Agreement with the European Union. In August 2014, Canada and the European Union completed the text of the Comprehensive Economic and Trade Agreement (CETA), which allowed translation and the final legal review to begin. Upon implementation, the new agreement will eliminate 98% of Canadian and EU tariffs and phase out most remaining tariffs over time. Of specific interest to the Canadian mining industry is the elimination of the following tariffs:

- Aluminum and aluminum products, from rates averaging 6.3%, with peaks of 10%
- Nickel and nickel products, from rates of up to 3.3%
- Non-ferrous metals, including copper, zinc, lead and tin, from rates averaging 3.1%, with peaks of 9%
- Iron and steel and iron or steel products, from rates of up to 7%

The agreement also expands into areas of investment, labour mobility and enhanced regulatory cooperation, as well as lifts ownership restrictions on uranium. CETA is the first bilateral trade agreement in which Canada has included provisions on regulatory cooperation. By fostering cooperation earlier in the regulatory process, differences in approaches between Canada and the European Union may be reduced, resulting in fewer barriers to trade once regulations are in place.

The agreement has been stuck in "legal scrubbing" mode since Ottawa and Brussels announced that they had reached a deal. While Canada's support for the agreement has remained consistent, despite the change in government, concerns over investor-state dispute settlement (ISDS) have fuelled some public opposition on the European side, which has become a lightning rod for other social issues and politicking. Internal opposition and pressure has resulted in the European Commission proposing a new ISDS model for CETA in September 2015. The proposed change to the CETA would, among other things, create an international court system with permanent judges and an appeals process. At the time of writing, it was uncertain whether the new ISDS proposal was an ultimatum, which, if rejected, would result in failure to ratify the agreement.

China: A Strategic Trading Partner. China is Canada's third largest market for the export of minerals and metals after the United States and the European Union, with value of exports exceeding \$5.2 billion in 2014, approaching nearly 6% of the overall total. Canada remains without a Free Trade Agreement (FTA) with China, despite the significant and growing importance of that country to our trade and economic well being. Further, the absence of a FTA between

the two nations has led to several economically damaging protectionist measures being put in place, including the introduction of a 3% tariff on steelmaking coal products and challenging regulatory barriers to trade.

With 18 countries having FTAs in place with China, and 11 more countries in various stages of negotiations and pre-negotiation discussions, many nations have long acknowledged that their economic futures are inexorably tied to China. Within this context, and given the importance of China to Canada's future, we welcome signals by the federal government that it will work to focus on enhancing economic and diplomatic relations. It is essential that momentum to enhance relations is built quickly and maintained, as Canada must act more nimbly in catching up to our competitors to ensure our long term economic security and competitiveness.

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

A Foreign Investment Promotion and Protection Agreement (FIPA) is a bilateral agreement aimed at protecting and promoting foreign investment through legally binding rights and obligations. At the time of writing, Canada has 29 FIPAs in place, has concluded negotiations with seven additional countries, and remains engaged in ongoing negotiations with 11 other countries.

While the enforcement components of FIPAs are rarely used, 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. The speed with which the government has negotiated these agreements has helped facilitate industry investment in key destinations.

INVESTMENT IN LATIN AMERICA

Eight of Canada's 29 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. It is noteworthy that in 2013 Canadian companies held nearly \$66 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 11 FIPA negotiations into force with African countries. A further three of the 11 FIPA negotiations currently in negotiation are 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 are 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.



Photo: Goldcorp, Cerro Negro Mine, Argentina

FOREIGN DIRECT INVESTMENT IN CANADA

The amount of foreign direct investment in Canada (FDIC) in the metallic minerals and metals products sector leaped from \$21.1 billion in 2006 to \$60.6 billion in 2008 and has stayed in that range ever since (see Figure 39). In 2013, the sector's share of FDIC bumped upward to \$66.4 billion. This figure represents 10% of the Canadian total, which is up from the 5 to 7% seen during the 1990s, reflecting recent foreign acquisitions and Canada's openness to foreign direct investment.

RECENT DEVELOPMENTS IN CORPORATE SOCIAL RESPONSIBILITY AND CANADIAN MINING ABROAD

Over the past few decades, developing countries have opened up their economies to mineral exploration and development. In the process, Canadian mining companies

have often encountered challenging circumstances, such as weak national and local governments, corruption and poverty.

Healthy dialogue continues over the need for more effort to ensure that mining projects in the developing world respect human rights, the environment, and public health and safety. As one of the world's most successful mining countries, Canada has an important role to play in this area.

The Canadian mining industry has actively sought new skills and developed new partnerships to improve its performance in the face of these challenges. The result is a very different industry now than existed 20 years ago. By acknowledging its challenges and devoting resources to learning how to address them, the industry is changing the way it does business.



Photo: IAMGOLD, multi-functional platform for the local community near the Essakane Gold Mine, Burkina Faso

CSR STRATEGY: DOING BUSINESS THE CANADIAN WAY

With the release of the enhanced Corporate Social Responsibility (CSR) Strategy in late 2014, the federal government recommitted its efforts to ensuring that Canadian companies adopt the highest CSR standards and practices while operating abroad. The strategy includes a number of elements that help Canadian mining companies apply best practices to ensure they are managing environmental impacts and engaging with local communities. Additionally, the Government of Canada has taken steps to strengthen the Office of the Extractive Sector CSR Counsellor and the OECD National Contact Point (NCP) to help resolve disputes that may arise between communities and Canadian mining companies.

One of these steps includes the withdrawing of support from the federal government and its network of embassies and trade commissioners for companies that choose not to participate in the CSR Counsellor or NCP processes

when complaints are levied against them. Of note, in 2015, Professor John Ruggie, former Special Representative of the UN Secretary-General on Business and Human Rights, conducted a review of human rights and the OECD Guidelines for Multinational Enterprises by looking at the NCP network. In his report, he affirms that the Canadian NCP process is a leading practice that should be emulated more widely:

Furthermore, with one single exception, no government has publicly stated that non-cooperation by a company with an NCP or a negative finding against a company will have any material consequences imposed by a government. Forty years of pure voluntarism should be a long enough period of time to conclude that it cannot be counted on to do the job by itself. The one exception is Canada, which in November 2014 announced a CSR new strategy, "Doing Business the Canadian Way: A Strategy to Advance Corporate Social Responsibility in Canada's Extractive Sector Abroad." The strategy references both the Guidelines and the UN Guiding Principles. Here is the strategy's key new element: "As a penalty for companies that do not embody CSR best practices and refuse to participate in the CSR Counsellor's Office or NCP dispute resolution, Government of Canada support in foreign markets will be withdrawn."⁵⁰ Canada's NCP has already issued one final statement based on the new strategy, specifically concluding: "As the Company did not respond to the NCP's offer of its good offices, the Company's non-participation in the process will be taken into consideration in any application by the Company for enhanced advocacy support from the Trade Commissioner Service and/or Export Development Canada (EDC) financial services, should they be made."⁵¹ Surely this example deserves to be emulated more widely within the NCP community.

Ruggie, J, and Nelson, T. Human Rights and the OECD Guidelines for Multinational Enterprises: Normative Innovations and Implementation Challenges. Harvard University, 2015.

By setting high expectations of companies for their social and environmental practices and strengthening Canada's international dispute resolution mechanisms, the CSR Strategy enhances Canada's position as a global leader in the extractive sector. It helps guide Canadian mining companies in their work with communities to better realize the economic and social benefits of natural resource development, such as local procurement opportunities. The strategy also provides host governments and investors with the confidence they need to make Canadian mining companies partners of choice in developing mineral resources.

EXTRACTIVE SECTOR TRANSPARENCY MEASURES ACT

The *Extractive Sector Transparency Measures Act* was tabled by the Government of Canada in October 2014 and came into force in June 2015. Prior to its tabling, MAC, the Prospectors and Developers Association of Canada, Publish What You Pay-Canada, and the Natural Resources Governance Institute – which together formed the Resource Revenue Transparency Working Group – advocated for the federal government to adopt transparency legislation and developed a framework with recommendations for provincial governments to consider. Many of the working group's recommendations are reflected in the Act.

This legislation brings Canada in line with other jurisdictions in the European Union. It enables Canada to better contribute to the global fight against corruption in resource rich countries that are producing minerals, but may not be sharing that wealth with their citizens.

The Act requires Canadian mining companies to disclose payments made to host governments, resulting in a credible source of data that citizens can use to hold their governments accountable. The goal is to ensure local communities are benefitting from the mining activities taking place in their region. Although not a guarantee that all instances of corruption will end, the legislation is an important step towards eliminating it.

TOWARDS SUSTAINABLE MINING

Over the last 10 years, TSM has been driving social and environmental performance in the Canadian mining sector. As mentioned earlier in this report, TSM is an initiative that allows mining companies to turn high-level environmental and social commitments into action on the ground. At the same time, it provides communities with valuable information on how individual operations are faring in important areas, such as community outreach, tailings management and biodiversity. Participation in the TSM initiative is mandatory for all MAC members for their Canadian operations.

As discussed in Section 5, TSM saw its first international expansion in November 2015 when the Finnish Mining Association (FinnMin) formally adopted it. This is the first time TSM has been adopted by a mining association outside of Canada. FinnMin and many of its member companies chose TSM because it is the most advanced initiative in the mining industry. TSM will contribute to the transparency and accountability of the mining industry in Finland as it has done in Canada and will, therefore, enhance social acceptance among the different stakeholders in Finnish civil society.

The growing international adoption of the initiative is part of MAC's larger commitment to freely share TSM with other

countries seeking tools to improve the environmental and social performance of their mining industry, including engagement with civil society and enhanced transparency and accountability.

NEW GUIDE ON SITE-LEVEL GRIEVANCE MECHANISMS

In 2015, MAC published a guide to assist companies in overcoming common implementation challenges with site-level grievance mechanisms (GMs) – an important community relations tool that helps to ensure that community complaints are heard and addressed effectively by companies. The guide was developed by MAC's International Social Responsibility Committee, with some assistance from the Office of the CSR Counsellor.

A site-level GM is a formal way to hear, investigate and



respond to community issues and concerns. GMs give local communities a needed forum to express their concerns and seek a way to remedy them. In recent years, recognition of the value of site-level GMs as effective business and community relations tools has grown. Professor John Ruggie has explicitly identified them as an essential community relations tool and has advocated for their use to ensure that companies are respecting human rights.

Despite widespread recognition of the value of site-level GMs, uptake has been slow within the global resource development industry. When properly designed and implemented, taking into account the views and concerns of local communities, GMs help companies to build trust and social license. To encourage the use of site-level GMs, MAC's guide addresses common implementation barriers that are often associated with jurisdictions that suffer from weak governance.

CANADIAN INTERNATIONAL RESOURCE AND DEVELOPMENT INSTITUTE (CIRDI)

Canadian International Resource and Development Institute (CIRDI) is a centre of expertise that focuses on improving and strengthening resource governance. Through their involvement in CIRDI, stakeholders in resource development work collaboratively to:

- Expand their ability to develop and manage natural resources in environmentally and socially responsible ways.
- Capture a fair share of the wealth generated by natural resources.
- Use natural resources to stimulate sustainable socio-economic growth, within and beyond the extractive sector.

CIRDI now has five projects underway, each of which will run through 2018. The multi-year projects are as follows:

1. West Africa – Governance strengthening program of the extractive sector.
2. Colombia and Ecuador – Transformation of artisanal and small-scale miners.
3. Peru – Strengthening collaborative practice and enhancing the role of universities as development and innovation partners for “inclusive growth.”
4. Peru – Education and research for integrated water resource management.
5. Mongolia – Integrated management and governance in extractives.

CIRDI also hosted a week-long Summer Institute on Resource Governance that included participants from 17 countries with representatives from government, civil society, industry and academia. The institute focused on responsible and transparent governance of the extractive industry, integrated resource stewardship and the creation of sustainable livelihoods.

INTERGOVERNMENTAL FORUM ON MINING, MINERALS, METALS AND SUSTAINABLE DEVELOPMENT (IGF)

The IGF is a unique global venue that brings together government representatives from over 50 countries to address practical issues related to the sustainable management and development of the mining sector. It serves as a forum for dialogue between member-country governments, mining companies, industry associations and civil society.

Supported in recent years by Global Affairs Canada, the IGF provides a unique platform for members and observers to

actively engage with one another, sharing their expertise, knowledge and leading practices on the challenges and opportunities facing the sector. Drawing on this expertise, the IGF developed its Mining Policy Framework (MPF), and is now advancing implementation of this guidance for good governance in the mineral sector among member countries.

The focus of the IGF in 2015 was to continue carrying out pilot country assessments to implement the guidance laid out in the IGF’s MPF. During this time period, assessments were conducted in the Dominican Republic, Uganda and Madagascar, with a focus on identifying strengths, weaknesses and gaps in each country’s mining laws and policies. In addition, an analysis of the contribution of the mining sector in Suriname to local water-energy-food security was also successfully completed, and a corresponding tool was developed to replicate the analysis in other mining regions and countries.

Another focus for the IGF this year was a week-long forum on the environmental and social post-mining transition at mine closure. The annual forum addressed the necessity of starting mine closure planning in the early stages of mine development and provided an opportunity to share associated best practices.

INTERNATIONAL MINING REALITIES AND PERCEPTIONS

Mineral products are strategically important to countries with large or growing infrastructure and manufacturing sectors. Additionally, many countries and governments earn needed revenues from the industry. On the backdrop of the recent downturn in mineral and metal prices, the balance of challenges and opportunities facing companies continues to shift. In assessing this changing landscape, companies must make strategic decisions to navigate and balance the risks, rewards and opportunities before them.

Future growth, productivity and capital access are seen as the top business risks according to EY. With respect to future growth, exploiting unique and limited value propositions, consolidating market share and identifying ways to improve project economics are essential for companies to solidify a competitive advantage and prepare for the next upswing when prices rebound. Looking at the present, and in response to the “production-at-all-costs” attitude of the boom years, the shift in focus towards sustainable and enduring productivity improvements remains vital for survival and prosperity. Finally, a top challenge from last year remains, affecting both ends of the mining spectrum: access to capital continues to threaten the long-term growth prospects of major companies and the short-term survival of junior firms.

PERCEPTION OF INTERNATIONAL MINING POLICY

While a shift in focus and prioritization within mining company operations and decision-making processes can strategically manage elements of the above risks, other issues that affect competitiveness, such as domestic policy factors, are beyond company control.

Since 1997, the Fraser Institute has conducted an annual survey of mining and exploration companies to assess how mineral endowments and public policy factors such as taxation and regulation affect exploration investment. Given the predominant role of major mining companies in financing exploration and project development, the survey's focus on exploration investment, makes it an effective barometer of how these companies perceive and weigh the relative attractiveness and competitiveness of different jurisdictions.

The 2015 edition of the survey, which received input from 485 respondents. It presents data on 122 jurisdictions worldwide, from every continent except Antarctica, including sub-national jurisdictions in Canada, Australia, the United States, and Argentina. After all factors are considered, five of the top-10-ranked jurisdictions are Canadian:

1. Finland
2. Saskatchewan
3. Nevada
4. Manitoba
5. Western Australia
6. Quebec
7. Wyoming
8. Newfoundland and Labrador
9. Yukon
10. Alaska

Beyond geologic and economic considerations, a region's policy climate is also a major investment consideration. Situated as a component of the overall ranking indicators, the Policy Perception Index (PPI) serves as a report card to governments on the attractiveness of their mining policies. The index is composed of survey responses to policy factors that affect investment decisions. Policy factors examined include uncertainty concerning the administration of current regulations, environmental regulations, regulatory duplication, the legal system, the taxation regime, uncertainty concerning protected areas and disputed land claims, infrastructure, socioeconomic and community development conditions, trade barriers, political stability, labour regulations, quality of the geological database, security, and labour

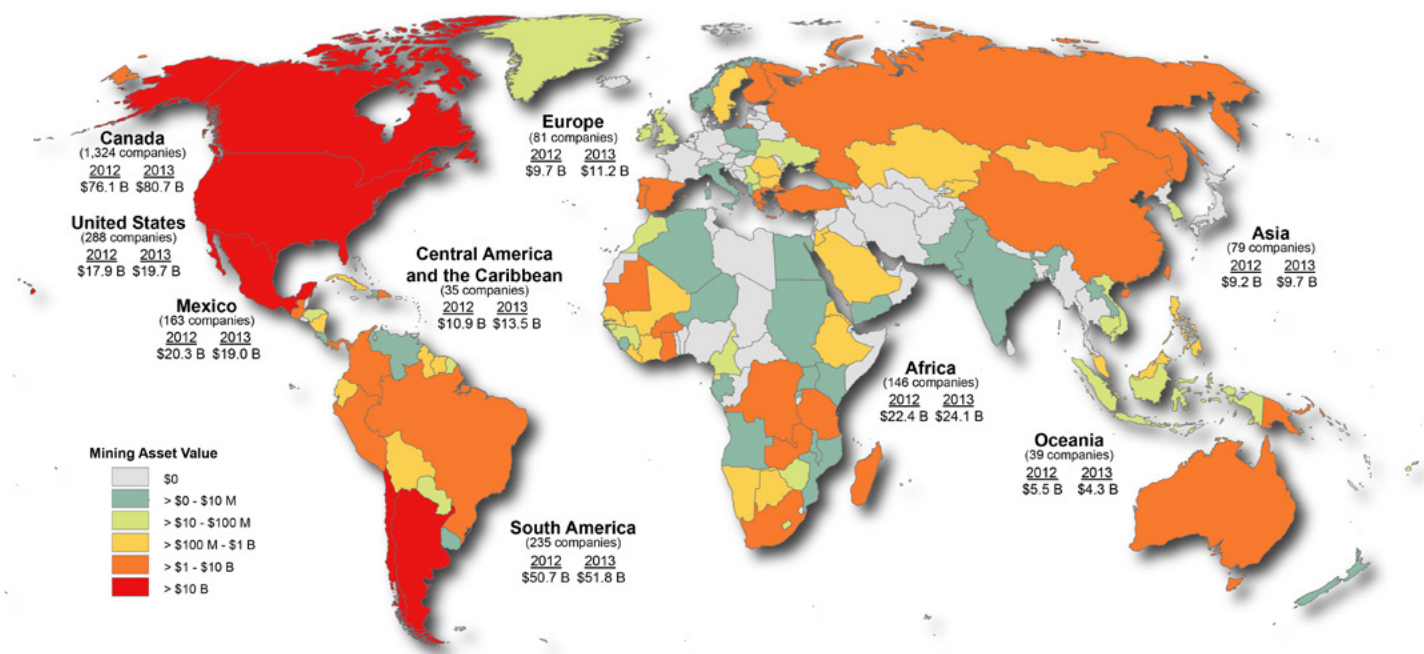
and skills availability. The PPI rankings from 2014, normalized to a maximum score of 100, include five Canadian jurisdictions:

1. Ireland
2. Finland and Alberta (tied)
4. Sweden
5. New Brunswick
6. Saskatchewan
7. Newfoundland and Labrador
8. Wyoming
9. Manitoba
10. Western Australia

The correlation between the top-ranked jurisdiction overall, and the top-ranked jurisdictions for mining policy attractiveness indicates that mineral wealth alone is not enough to attract investment for developing or sustaining a domestic mining industry. Although several Canadian jurisdictions ranked favourably overall in the Fraser Institute survey and on the PPI, the absence of the federal government's mining policies as an indicator in the survey is noteworthy. Whether the omission is intentional or not, it would be valuable to see how the federal government's mining policy attractiveness compares with competing jurisdictions in the survey.

FIGURE 39

THE GEOGRAPHICAL DISTRIBUTION OF CANADA'S MINING ASSETS, 2013



Sources: Minerals and Metals Sector, Natural Resources Canada.

Notes: M Millions; B Billions. All amounts are in Canadian dollars. Company counts are for the 2013 reference year and do not add to totals since companies can be active in multiple jurisdictions.

FIGURE 40

METALLIC MINERALS AND METAL PRODUCTS—DIRECT INVESTMENT STOCKS, 1990–2013

Direct Investment (\$ millions)	1990	1995	2000	2005	2007	2008	2009	2010	2011	2012	2013
All industries											
Canadian direct investment abroad	98,402	161,237	356,506	452,195	515,294	641,920	629,717	639,911	684,496	711,621	779,292
Foreign direct investment in Canada	130,932	168,167	319,116	397,828	512,266	550,539	572,842	585,107	607,497	633,915	686,256
Metallic minerals and metal products											
Canadian direct investment abroad	13,524	24,466	42,436	56,384	60,831	66,692	73,907	60,420	58,616	62,747	81,453
Foreign direct investment in Canada	9,829	9,553	17,425	21,174	60,672	65,114	59,400	57,681	60,930	58,546	66,422
Percentage of total											
Canadian direct investment abroad	14%	15%	12%	12%	12%	10%	12%	9%	9%	9%	10%
Foreign direct investment in Canada	8%	6%	5%	5%	12%	12%	10%	10%	10%	9%	10%

Source: Statistics Canada, CANSIM Table 376-0052.

Note: The table denotes the amount of outward and inward foreign direct investment in the metallic minerals and metal products sector and the portion this represents of the Canadian total.

FIGURE 41

BALANCE OF CANADA'S MINERAL TRADE, 2014

Stage	Domestic Exports (\$)	Total Exports (\$)	Total Imports (\$)	Balance of Trade (\$)
Stage I	27,105,159,356	27,196,819,790	7,922,267,295	19,274,552,495
Stage II	34,438,784,447	34,938,890,487	14,984,122,500	19,954,767,987
Stage III	15,567,215,675	16,705,059,234	22,165,359,847	-5,460,300,613
Stage IV	12,285,208,137	14,290,076,738	34,337,688,690	-20,047,611,952
Total	89,396,367,615	93,130,846,249	79,409,438,332	13,721,407,917

Sources: Natural Resources Canada; Statistics Canada.

Notes: 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. 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 42

VALUE OF CANADA'S MINING AND MINERAL PROCESSING INDUSTRY TRADE, 2003-2014

Year	Domestic Exports (\$ billions)	Total Exports (\$ billions)	Imports (\$ billions)	Balance of Trade (\$ billions)
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	80.1	83.1	66.1	17.0
2011	95.8	100.1	76.7	23.4
2012 ¹	88.0	90.9	75.1	15.8
2013 ¹	86.8	90.1	73.0	17.1
2014	89.4	93.1	79.4	13.7

Sources: Natural Resources Canada; Statistics Canada.

Notes: 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. 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.

¹ - revised

FIGURE 43

MINERAL AND MINERAL PRODUCT IMPORTS AND EXPORTS, 2007-2014

(\$ millions)	2007	2008	2009	2010	2011	2012	2013	2014	2014 Percentage of Canada's Total Trade
Mineral and Metal Imports									
Stage I	7,778	9,147	6,984	7,709	8,964	8,309	7,221	7,922	1.5
Stage II	7,674	9,362	7,742	12,379	15,719	14,267	13,727	14,984	2.9
Stage III	19,195	21,389	14,994	18,358	21,393	21,340	20,474	22,165	4.3
Stage IV	27,598	28,784	25,020	27,668	30,614	31,185	31,566	34,338	6.7
Stage I - IV	62,246	68,682	54,739	66,113	76,690	75,101	72,988	79,409	15.5
Metals	52,465	57,340	45,377	55,856	65,706	63,812	61,484	66,718	13.0
Non-metals	8,448	9,418	8,150	8,896	9,785	10,076	10,601	11,565	2.3
Coal & Coke	1,332	1,924	1,212	1,361	1,198	1,213	903	1,127	0.2
Total Imports of Goods	407,301	433,999	365,359	403,701	446,666	462,072	475,630	511,523	100.0
Mineral and Metal Domestic Exports									
Stage I	18,092	28,700	19,747	24,533	32,424	29,207	27,340	27,105	5.5
Stage II	32,395	30,861	21,876	31,810	36,674	32,303	32,780	34,439	7.0
Stage III	16,351	17,264	10,984	13,268	15,534	14,934	14,969	15,567	3.2
Stage IV	13,221	13,347	10,084	10,441	11,170	11,533	11,751	12,285	2.5
Stage I - IV	80,060	90,173	62,689	80,052	95,802	87,976	86,839	89,396	18.2
Metals	66,250	67,096	47,272	61,308	72,671	67,407	67,907	71,641	14.6
Non-metals	10,647	16,712	10,337	12,517	14,765	13,802	13,126	13,212	2.7
Coal & Coke	3,163	6,365	5,080	6,227	8,366	6,767	5,806	4,543	0.9
Total Domestic Exports of Goods	419,944	455,337	334,448	374,015	419,035	428,049	443,461	492,113	100.0

Sources: Natural Resources Canada; Statistics Canada.

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.

ANNEX 1

PRODUCING MINES IN CANADA, 2014

COMPANY	MINE SITE	ACTIVITY TYPE	LOCATION	COMMODITY
Newfoundland & Labrador				
Rambler Metals and Mining PLC	Nugget Pond	(C.)	Snook's Arm	Au, Cu
Rambler Metals and Mining PLC	Ming	(U.)	Baie Verte	Cu, Au, Ag, Zn
Anaconda Mining Inc.	Pine Cove	(P, C.)	Baie Verte	Au
Teck Resources Limited	Duck Pond	(P, C.)	Millertown	Cu, Zn
Vale Newfoundland and Labrador Limited	Voisey's Bay	(P, C.)	Voisey's Bay	Ni, Cu, Co
Cliffs Natural Resources Inc.	Wabush	(P, C.)	Wabush	Fe
Iron Ore Company of Canada (IOC)	Carol Lake	(P, C.)	Labrador City	Fe
Atlantic Minerals Limited	Lower Cove	(P)	Lower Cove	Limestone, dolomite
Iron Ore Company of Canada (IOC)	Plateau Dolomite	(P)	Labrador City	Dolomite
Nova Scotia				
Nova Scotia Power Inc.	Glen Morrison	(P)	Cape Breton	Limestone
CGC Inc.	Little Narrows	(P)	Little Narrows	Gypsum
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
Sifto Canada Inc.	Amherst	(Solution mining)	Nappan	Salt
Pioneer Coal Ltd.	Stellarton	(P)	Stellarton	Coal (thermal)
New Brunswick				
Le Groupe Berger Ltée	Baie-Sainte-Anne	(P)	Baie-Sainte-Anne	Vermiculite, perlite
Graymont Inc.	Havelock	(P, Plant)	Havelock	Lime, limestone
Potash Corporation of Saskatchewan Inc.	New Brunswick	(U, Plant)	Sussex	Potash, salt
Brookville Manufacturing Company	Brookville	(P, Plant)	Saint John	Dolomitic lime
Elmtree Resources Ltd.	Sormany	(P, Plant)	Sormany	Limestone
Quebec				
Cliffs Natural Resources Inc.	Bloom Lake	(P, C.)	Labrador City	Fe
ArcelorMittal Mines Canada Inc.	Mont-Wright	(P, C.)	Fermont	Fe
ArcelorMittal Mines Canada Inc.	Fire Lake	(P)	Fermont	Fe
IAMGOLD Corporation	Niobec	(U, C.)	Saint-Honoré-de-Chicoutimi	Nb
Glencore plc	Raglan	(U, C.)	Katinniq	Ni, Cu, Co, PGM
Metanor Resources Inc.	Bachelor Lake	(U, C.)	Desmaraisville	Au, Ag
Nyrstar	Langlois	(U, C.)	Lebel-sur-Quévillon	Zn, Cu, Au, Ag
Richmont Mines Inc.	Monique	(P)	Val-d'Or	Au
Richmont Mines Inc.	Beaufor	(U)	Val-d'Or	Au, Ag
QMX Gold Corporation	Lac Herbin	(U, C.)	Val-d'Or	Au, Ag
Glencore plc	Bracemac-McLeod	(U, C.)	Matagami	Zn, Cu, Au, Ag
Agnico Eagle Mines Limited	Goldex	(U, C.)	Val-d'Or	Au, Ag
Maudore Minerals Ltd.	Sleeping Giant	(C.)	north of Amos	Au, Ag

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PRODUCING MINES IN CANADA, 2014

COMPANY	MINE SITE	ACTIVITY TYPE	LOCATION	COMMODITY
Richmont Mines Inc.	Camflo	(C)	Malartic	Au, Ag
Canadian Malartic Partnership	Canadian Malartic	(P, C)	Malartic	Au, Ag
Agnico Eagle Mines Limited	Lapa	(U)	Rivière-Héva	Au
Agnico Eagle Mines Limited	LaRonde	(U, C)	Preissac	Au, Zn, Cu, Pb, Ag
IAMGOLD Corporation	Mouska	(U)	Cadillac	Au, Cu, Ag
IAMGOLD Corporation	Westwood	(U)	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
QIT-Fer et Titane inc.	Tio	(P)	Havre-Saint-Pierre	Ilmenite
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
Holcim (Canada) Inc.	Joliette	(P)	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	Saint-Aimé-du-Lac-des-Îles	(P, Plant)	Saint-Aimé-du-Lac-des-Îles	Graphite
Ontario				
Detour Gold Corporation	Detour Lake	(P, C)	Matagami	Au
St Andrew Goldfields Ltd.	Holt	(U, C)	Timmins	Au, Ag
St Andrew Goldfields Ltd.	Holloway	(U)	Timmins	Au, Ag
Kirkland Lake Gold Inc.	Macassa	(U, C)	Kirkland Lake area	Au, Ag
St Andrew Goldfields Ltd.	Hislop	(P)	Matheson	Au
Primero Mining Corp.	Black Fox	(P, U, C)	Matheson	Au
Aurico Gold Inc.	Young-Davidson	(P, U, C)	Kirkland Lake area	Au
Glencore plc	Nickel Rim South	(U)	Sudbury	Ni, Cu, Co, PGM, Au
Vale	Garson	(U)	Sudbury	Ni, Cu, Co, PGM, Au, Ag, Se, Te
Vale	Stobie	(U)	Sudbury	Ni, Cu, Co, PGM, Au, Ag, Se, Te
Vale	Clarabelle	(C)	Sudbury	Ni, Cu, Co, PGM, Au, Ag, Se, Te
Wallbridge Mining Company Limited	Broken Hammer	(P)	Sudbury	Cu, Ni, PGM
Vale	Copper Cliff North	(U)	Sudbury	Ni, Cu, Co, PGM, Au, Ag, Se, Te
Goldcorp Inc.	Hoyle Pond	(U)	south of Porcupine	Au, Ag
Northern Sun Mining Corp.	Redstone	(C)	southeast of Timmins	Ni
Lake Shore Gold Corp.	Bell Creek	(U, C)	Timmins	Au
Vale	Creighton	(U)	Sudbury	Ni, Cu, Co, PGM, Au, Ag, Se, Te
Vale	Gertrude	(P)	Sudbury	Ni, Cu, Co, PGM, Au
Goldcorp Inc.	Dome	(U, C)	Timmins	Au
Vale	Ellen	(P, U)	Sudbury	Cu, Ni
First Nickel Inc.	Lockerby	(U)	Sudbury	Ni, Cu, Co, PGM, Au, Ag, Se, Te
Vale	Coleman/McCreedy East	(U)	Sudbury	Ni, Cu, Co, PGM, Au, Ag, Se, Te
Glencore plc	Fraser	(U)	Sudbury	Ni, Cu, Co, PGM
Glencore plc	Strathcona	(C)	Sudbury	Ni, Cu, Co, PGM, Au, Ag, Se, Te
Glencore plc	Kidd Creek	(U, C)	Timmins	Cu, Zn, Ag, Se, Te, In, Cd
KGHM Polska Miedz S.A.	Levack/Morrison	(U)	Sudbury	Cu, Ni
KGHM Polska Miedz S.A.	McCreedy West	(U)	Sudbury	Cu, PGM, Au, Ag

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PRODUCING MINES IN CANADA, 2014

COMPANY	MINE SITE	ACTIVITY TYPE	LOCATION	COMMODITY
Vale	Totten	(U.)	Worthington	Ni, Cu, Co, PGM, Au
Lake Shore Gold Corp.	Timmins West	(U.)	Timmins	Au
Richmont Mines Inc.	Island Gold	(U., C.)	Dubreuilville	Au
Wesdome Gold Mines Ltd.	Eagle River	(U., C.)	Wawa	Au
Barrick Gold Corporation	David Bell	(U., C.)	Marathon	Au
Barrick Gold Corporation	Williams	(U., P., 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
Holcim (Canada) Inc.	Ogden Point	(P)	Ogden Point	Limestone
Unimin Canada Ltd.	Blue Mountain	(P, Plant)	Blue Mountain	Nepheline syenite
Unimin Canada Ltd.	Nephton	(P, Plant)	Toronto	Nepheline syenite
St. Marys CBM (Canada) Inc.	Bowmanville	(P)	Bowmanville	Limestone
CGC Inc.	Hagersville	(P)	Hagersville	Gypsum
E.C. King Contracting Ltd.	Owen Sound	(P)	Owen Sound	Dolomitic lime
Lafarge Canada Inc.	Woodstock	(P)	Woodstock	Limestone
MarFred Minerals Ltd.	Tracey Lake	(U.)	North Williams	Barite
St Marys CBM (Canada) Inc.	St Marys	(P)	St. Marys	Limestone
Sifto Canada Inc.	Goderich	(U.)	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

Manitoba				
Tantalum Mining Corporation of Canada Limited	Tanco	(U., C.)	Lac-du-Bonnet	Cs
San Gold Corporation	007	(U.)	Rice Lake	Au
San Gold Corporation	Hinge	(U.)	Rice Lake	Au
San Gold Corporation	Rice Lake	(U., C.)	Bissett	Au
Vale	Thompson	(U., P., C.)	Thompson	Ni, Cu, Co, PGM
Vale	Birchtree	(U.)	Thompson	Ni, Cu, Co, PGM
HudBay Minerals Inc.	Snow Lake	(C.)	Snow Lake	Cu, Zn
HudBay Minerals Inc.	Lalor Lake	(U.)	Snow Lake	Cu, Zn, Au, Ag
HudBay Minerals Inc.	Reed	(U.)	Snow Lake	Cu, Zn
HudBay Minerals Inc.	777	(U.)	Flin Flon	Cu, Zn, Au, Ag
HudBay Minerals Inc.	Flin Flon	(C.)	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)	Viriden	Sodium chlorate
Lehigh Cement Company	Mafeking	(P)	Mafeking	Limestone

ANNEX 1

PRODUCING MINES IN CANADA, 2014

COMPANY	MINE SITE	ACTIVITY TYPE	LOCATION	COMMODITY
Saskatchewan				
Claude Resources Inc.	Santoy	(U.)	Santoy Lake	Au
Claude Resources Inc.	Seabee	(U., C.)	Laonil Lake	Au, Ag
Cameco Corporation	Rabbit Lake	(U., C.)	Rabbit Lake	U
Golden Band Resources Inc.	Jolu	(C.)	Brabant Lake	Au
Golden Band Resources Inc.	Roy Lloyd/Bingo	(U.)	Brabant Lake	Au
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
Big Quill Resources Inc.	Wynyard	(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
Sifto Canada Inc.	Unity	(U., Plant)	Unity	Salt
Prairie Mines & Royalty ULC	Bienfait	(P)	Bienfait	Coal (thermal)
Prairie Mines & Royalty ULC	Boundary Dam	(P)	Estevan	Coal (thermal)
Prairie Mines & Royalty ULC	Poplar River	(P)	Coronach	Coal (thermal)
Alberta				
K+S Windsor Salt Ltd	Lindbergh	(solution mining)	Elk Point	Salt
Hammerstone Corporation	Steepbank	(P)	north of Fort McMurray	Limestone
Hammerstone Corporation	Aurora	(P)	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
Canexus Chemicals Canada Ltd.	Bruderheim	(solution mining)	Bruderheim	Salt
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	(P, Plant)	Exshaw	Limestone, lime
Prairie Creek Quarries Ltd.	Cougar Ridge	(P, Plant)	Rocky Mountain House	Limestone
Lafarge Canada Inc.	Exshaw	(P, Plant)	Exshaw	Limestone
Burnco Rock Products Ltd.	Clearwater	(P, Plant)	Clearwater River	Limestone
Graymont Inc.	Fish Creek	(P, Plant)	Nordegg	Limestone
Lehigh Cement Company	McLeod	(P)	Cadomin	Limestone
Prairie Mines & Royalty ULC	Sheerness	(P)	Hanna	Coal (thermal)
Prairie Mines & Royalty ULC	Paintearth	(P)	Forestburg	Coal (thermal)
Prairie Mines & Royalty ULC	Genesee	(P)	Genesee	Coal (thermal)
Keephills Aggregate Company Ltd.	Burtonsville	(P)	Burtonsville	Coal (thermal)

ANNEX 1

PRODUCING MINES IN CANADA, 2014

COMPANY	MINE SITE	ACTIVITY TYPE	LOCATION	COMMODITY
Transalta Corporation	Highvale	(P)	Seba Beach	Coal (thermal)
Coal Valley Resources Inc.	Coal Valley	(P)	Edson	Coal (thermal)
Teck Resources Limited	Cardinal River	(P)	Hinton	Coal (metallurgical)
Grande Cache Coal Corporation	Grande Cache	(P, U)	Grande Cache	Coal (metallurgical)
Suncor Energy Inc.	Millennium and Steepbank	(P)	Fort McMurray	Upgraded crude oil
Shell Canada Energy	Jackpine	(P)	Fort MacKay	Upgraded crude oil
Synchrude Canada Ltd.	Aurora North and South	(P)	Fort MacKay	Upgraded crude oil
Synchrude 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
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
Avino Silver & Gold Mines Ltd.	Bralorne-Pioneer	(C)	Whistler	Au
Thompson Creek Mining Limited	Mt Milligan	(P, C)	Fort St James	Cu, Au
Thompson Creek Mining Limited	Endako	(P, C)	Fraser Lake	Mo
Nyrstar	Myra Falls	(U, C)	Buttle Lake	Zn, Cu, Au, Ag
Huckleberry Mines Ltd.	Huckleberry	(P, C)	Houston	Cu, Mo, Au
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
Imasco Minerals Inc.	Crawford Bay	(U)	Crawford Bay	Dolomite, limestone
Imasco Minerals Inc.	Lime Creek	(U)	Lost Creek	Limestone
Lafarge Canada Inc.	Falkland	(P, Plant)	Falkland	Gypsum
Lafarge Canada Inc.	Harper Ranch	(P, Plant)	Kamloops	Limestone
Absorbent Products Ltd.	Bud	(P)	Princeton	Calcium, clay
Canadian Mining Company Inc.	Bromley Creek/Zeo	(P)	Bromley Creek	Zeolite
Absorbent Products Ltd.	Red Lake	(P)	Kamloops	Diatomite, bentonite, leonardite
Graymont Inc.	Pavilion Lake	(P, Plant)	Pavilion Lake	Limestone, lime
Imperial Limestone Co. Ltd.	Van Anda	(P)	Texada Island	Limestone
Texada Quarrying Ltd. (Lafarge Canada Inc.)	Gillies Bay	(P)	Texada Island	Limestone
Ash Grove Cement Company	Blubber Bay	(P)	Texada Island	Limestone
Fireside Minerals Ltd.	Fireside	(P)	Fireside	Barite
Imasco Minerals Inc.	Benson Lake	(P)	Benson Lake	Limestone
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)
Anglo American plc	Trend	(P)	Tumbler Ridge	Coal (metallurgical)
Walter Energy, Inc.	Wolverine-Perry Creek	(P, U)	Tumbler Ridge	Coal (metallurgical)

ANNEX 1

PRODUCING MINES IN CANADA, 2014

COMPANY	MINE SITE	ACTIVITY TYPE	LOCATION	COMMODITY
Walter Energy, Inc.	Brule	(P)	Tumbler Ridge	Coal (metallurgical)
Walter Energy, Inc.	Willow Creek	(P)	Tumbler Ridge	Coal (metallurgical)
Hillsborough Resources Limited	Quinsam	(U)	Campbell River	Coal (thermal)
Yukon				
Yukon Zinc Corp.	Wolverine	(U, C)	Ross River, Watson Lake	Zn, Ag, Cu, Pb, Au
Capstone Mining Corporation	Minto	(P, C)	Pelly Crossing	Cu, Au, Ag
Northwest Territories				
North American Tungsten Corporation Ltd.	CanTung	(U, C)	Cantung	W
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.	Snap Lake	(U, Plant)	Snap Lake	Diamonds
Nunavut				
Agnico Eagle Mines Limited	Meadowbank	(P, C)	Baker Lake	Au

Source: Natural Resources Canada.

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

Notes: Excluded operations are clay products, peat, and most construction materials (most stone, sand and gravel). Included are operations that produced during 2014.

ANNEX 2

MINING ESTABLISHMENTS IN CANADA, BY MINERAL, PROVINCE OR TERRITORY, 2013

	NL	PE	NS	NB	QC	ON	MB	SK	AB	BC	YT	NT	NV	TOTAL
Metals														
Iron Ore	3	-	-	-	3	-	-	-	-	-	-	-	-	6
Gold & Silver Ore	1	-	-	-	15	13	1	2	-	-	-	-	1	33
Lead-zinc Ore	-	-	-	1	-	-	-	-	-	1	2	-	-	4
Nickel-copper Ore	1	-	-	-	2	4	1	-	-	-	-	-	-	8
Copper, copper-zinc Ore	2	-	-	-	3	1	1	1	-	7	1	-	-	16
Uranium	-	-	-	-	-	-	-	3	-	-	-	-	-	3
Other Metals	-	-	-	-	3	1	1	-	-	1	-	1	-	7
TOTAL METALS	7	-	-	1	26	19	4	6	-	9	3	1	1	77
NON-METALS														
Diamonds	-	-	-	-	-	1	-	-	-	-	-	3	-	4
Gypsum	1	-	3	1	-	-	-	-	-	1	-	-	-	6
Peat	1	1	1	24	21	1	6	1	7	1	-	-	-	64
Potash	-	-	-	1	-	-	-	9	-	-	-	-	-	10
Salt	-	-	2	-	1	4	-	3	1	-	-	-	-	11
Sand and gravel	2	-	7	10	87	304	20	70	234	98	2	-	-	834
Stone	2	-	16	8	89	97	9	-	21	25	-	-	-	267
Shale, Clay and other refractory minerals	-	-	1	-	2	1	-	1	1	-	-	-	-	6
Other non-metals	-	-	-	-	3	2	-	-	-	2	-	-	-	7
TOTAL NON-METALS	6	1	30	44	203	410	35	84	264	127	2	3	-	1,209

Sources: Natural Resources Canada; Statistics Canada.

- Nil

ANNEX 3

CANADIAN PRODUCTION OF LEADING MINERALS BY PROVINCE AND TERRITORY, 2014^P

	GOLD		POTASH (K ₂ O) ¹		COPPER		IRON ORE		NICKEL	
	KILOGRAMS	\$000	TONNES	\$000	TONNES	\$000	KILOTONNES	\$000	TONNES	\$000
Newfoundland	723	32,699	-	-	52,736	402,691	15,586	x	48,262	888,795
Prince Edward Island	-	-	-	-	-	-	-	-	-	-
Nova Scotia	-	-	-	-	-	-	-	-	-	-
New Brunswick	-	-	x	x	-	-	-	-	-	-
Quebec	41,131	1,860,938	-	-	42,344	323,339	28,610	x	41,341	761,332
Ontario	75,447	3,413,522	-	-	204,712	1,563,184	-	-	105,065	1,934,886
Manitoba	3,673	166,189	-	-	37,587	287,018	-	-	26,182	482,161
Saskatchewan	1,996	90,304	x	x	716	5,469	-	-	-	-
Alberta	30	1,357	-	-	-	-	-	-	-	-
British Columbia	10,838	490,336	-	-	324,258	2,476,031	-	-	-	-
Yukon	2,881	130,342	-	-	21,405	163,451	-	-	-	-
Northwest Territories	-	-	-	-	243	1,859	-	-	-	-
Nunavut	14,134	639,480	-	-	-	-	-	-	-	-
Canada	150,852	6,825,167	11,345	5,874,318	684,003	5,223,043	44,196	4,397,618	220,850	4,067,174

	COAL		DIAMONDS		SAND AND GRAVEL ²		CEMENT ³		STONE ⁴	
	KILOTONNES	\$000	000'S OF CARATS	\$000	KILOTONNES	\$000	KILOTONNES	\$000	KILOTONNES	\$000
Newfoundland	-	-	-	-	4,029	15,351	-	-	6,754	48,181
Prince Edward Island	-	-	-	-	x	x	-	-	x	x
Nova Scotia	-	-	-	-	2,454	16,893	x	x	10,818	87,214
New Brunswick	-	-	-	-	2,003	10,768	-	-	6,596	55,486
Quebec	-	-	-	-	15,335	85,156	2,597	377,630	39,019	451,951
Ontario	-	-	650	432,245	71,145	468,749	5,037	600,401	56,724	601,406
Manitoba	-	-	-	-	11,089	76,310	-	-	7,863	70,737
Saskatchewan	x	x	-	-	12,994	92,975	-	-	-	-
Alberta	x	x	-	-	79,609	936,346	x	x	7,231	88,425
British Columbia	x	x	-	-	27,267	265,644	x	x	11,229	100,042
Yukon	-	-	-	-	x	x	-	-	x	x
Northwest Territories	-	-	11,432	1,794,280	x	x	-	-	x	x
Nunavut	-	-	-	-	-	-	-	-	-	-
Canada	69,116	3,914,766	12,082	2,226,525	227,611	1,979,877	12,276	1,717,397	146,566	1,506,391

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.

(3) Includes exported clinker minus imported clinker. (4) Shipments of stone to Canadian cement, lime and clay plants are not included.

ANNEX 4

CANADA'S ROLE AS A PRODUCER OF CERTAIN IMPORTANT MINERALS, 2014^P

			Rank of Five Leading Countries				
		World	1	2	3	4	5
			Canada	Russia	China	Belarus	Germany
Potash (K ₂ O equivalent)	000 t	35,000	9,800	6,200	4,400	4,300	3,000
(mine production)	% of world total		28.0	17.7	12.6	12.3	8.6
			Kazakhstan	Canada	Australia	Niger	Namibia
Uranium (metal content)	t	59,673	22,567	9,332	6,350	4,528	4,315
(mine production) (2013)	% of world total		37.8	15.6	10.6	7.6	7.2
			Brazil	Canada			
Niobium (mine production)	t	59,000	53,000	5,000			
	% of world total		89.8	8.5			
			Congo	China	Canada	Australia	Russia
Cobalt (mine production)	t	112,000	56,000	7,200	7,000	6,500	6,300
	% of world total		50.0	6.4	6.3	5.8	5.6
			China	Russia	Canada	UAE	India
Aluminum (primary metal)	000 t	49,300	23,300	3,500	2,940	2,400	2,100
	% of world total		47.3	7.1	6.0	4.9	4.3
			China	Russia	Canada	Vietnam	Bolivia
Tungsten (mine production)	t	82,400	68,000	3,600	2,200	2,000	1,300
	% of world total		82.5	4.4	2.7	2.4	1.6
			South Africa	Russia	Canada	Zimbabwe	United States
Platinum group metals	kg	351,000	170,000	106,000	24,200	21,000	15,850
(metal content)	% of world total		48.4	30.2	6.9	6.0	4.5
			Philippines	Russia	Indonesia	Canada	Australia
Nickel (mine production)	000 t	2,400	440	260	240	233	220
	% of world total		18.3	10.8	10.0	9.7	9.2

			Rank of Five Leading Countries				
		World	1	2	3	4	5
			China	United States	India	Canada	Germany
Salt (mine production)	000 t	269,000	71,000	44,100	17,000	13,330	12,000
	% of world total		26.4	16.4	6.3	5.0	4.5
			China	United States	Russia	Canada	Saudi Arabia
Sulphur, elemental	000 t	72,400	12,000	9,770	7,300	6,000	4,000
(mine production)	% of world total		16.6	13.5	10.1	8.3	5.5
			South Africa	Australia	China	Canada	Vietnam
Titanium concentrate	000 t	6,680	1,100	1,100	1,000	900	500
(Ilmenite)	% of world total		16.5	16.5	15.0	13.5	7.5
			Russia	Botswana	D.R.C.	Australia	Canada
Diamonds (precious) (2013)	000 carats	130,482	37,884	23,188	15,682	11,729	10,562
	% of world total		29.0	17.8	12.0	9.0	8.1
			China	South Korea	Japan	Mexico	Canada
Cadmium (metal)	t	22,200	7,300	4,090	1,790	1,440	1,270
	% of world total		32.9	18.4	8.1	6.5	5.7
			China	Australia	Russia	United States	Canada
Gold (mine production)	t	2,860	450	270	245	211	160
	% of world total		15.7	9.4	8.6	7.4	5.6
			China	United States	Chile	Peru	Mexico
Molybdenum (Mo content)	t	266,600	100,000	65,500	39,000	18,100	11,000
(mine production)	% of world total		37.5	24.6	14.6	6.8	4.1
			China	Australia	Peru	United States	India
Zinc (mine production)	000 t	13,300	5,000	1,500	1,300	820	700
	% of world total		37.6	11.3	9.8	6.2	5.3

ANNEX 4

CANADA'S ROLE AS A PRODUCER OF CERTAIN IMPORTANT MINERALS, 2014^P

			Rank of Five Leading Countries				
		World	1	2	3	4	5
			Chile	China	Peru	United States	Congo
Copper (mine production)	000 t	18,700	5,800	1,620	1,400	1,370	1,100
	% of world total		31.0	8.7	7.5	7.3	5.9
			China	Australia	Brazil	India	Russia
Iron ore (mine production)	000 t	3,220	1,500	660	320	150	105
	% of world total		46.6	20.5	9.9	4.7	3.3
			Mexico	China	Peru	Australia	Russia
Silver	t	26,100	4,700	4,200	3,700	1,900	1,700
	% of world total		18.0	16.1	14.2	7.3	6.5
			China	United States	India	Indonesia	Australia
Coal (primary) (2013)	000 t	7,822,816	3,560,720	903,994	612,774	488,617	459,304
	% of world total		45.5	11.6	7.8	6.2	5.9
			China	Australia	United States	Peru	Mexico
Lead (mine production)	000 t	5,460	2,950	720	355	270	220
	% of world total		54.0	13.2	6.5	4.9	4.0
			China	United States	Iran	Thailand	Spain
Gypsum (mine production)	000 t	246,000	132,000	17,100	13,000	8,300	6,400
	% of world total		53.7	7.0	5.3	3.4	2.6

Sources: U.S. Geological Survey (USGS); International Energy Association; World Nuclear Association; Kimberley Process.

^P - preliminary; n.a. Not applicable.

ANNEX 5

MINERAL PRODUCTION OF CANADA, 2008-2014^P

METALLIC MINERALS

	Unit	2008		2009		2011		2013		2014 ^P	
		(quantity)	(\$000)	(quantity)	(\$000)	(quantity)	(\$000)	(quantity)	(\$000)	(quantity)	(\$000)
Antimony	t	111	731	54	318	x	x	148	1,562	4	41
Bismuth	t	71	1,918	87	1,615	136	3,346	103	2,006	3	86
Cadmium	t	313	1,976	322	1,055	1,516	4,135	160	316	123	263
Calcium	t	-	-	-	-	-	-	-	-	-	-
Cesium	t	x	x	x	x	x	x	x	x	x	x
Cobalt	t	4,809	440,913	2,275	102,241	3,741	146,768	4,005	118,114	3,865	135,949
Copper	t	584,003	4,329,801	470,347	2,766,112	553,725	4,831,801	620,989	4,695,298	684,003	5,223,043
Gold	kg	94,909	2,835,318	96,573	3,448,639	101,975	5,087,438	131,404	6,141,048	150,852	6,825,167
Ilmenite	000 t	x	x	x	x	x	x	x	x	x	x
Indium	kg	x	x	x	x	x	x	x	x	x	x
Iron ore	000 t	32,102	4,063,452	31,728	2,673,757	35,705	5,505,772	42,063	5,348,433	44,196	4,397,618
Iron, remelt	000 t	x	x	x	x	x	x	x	x	x	x
Lead	t	87,127	236,115	71,377	140,041	62,548	166,003	22,895	50,506	3,714	8,639
Lithium	t	x	x	x	x	x	x	x	x	x	x
Magnesium	t	-	-	-	-	-	-	-	-	-	-
Molybdenum	t	8,229	x	9,116	x	8,543	x	7,956	186,788	9,698	273,860
Nickel	t	246,197	5,713,003	132,471	2,213,597	211,417	4,787,323	218,026	3,372,864	220,850	4,067,174
Niobium (Columbium)	t	4,400	x	4,169	x	4,551	x	4,916	x	5,480	x
Platinum group	kg	22,764	618,547	10,925	258,242	22,337	749,572	25,465	767,363	29,403	980,229
Selenium	t	191	13,933	131	7,633	128	17,500	138	10,411	154	9,629
Silver	t	709	364,295	609	328,201	582	658,514	620	489,872	472	327,393
Tantalum	t	53	x	29	x	-	-	40	12,698	-	-
Tellurium	t	20	4,526	16	2,817	9	3,167	8	895	9	1,135
Tungsten	t	2,795	61,862	2,506	48,378	2,466	73,707	3,017	86,293	2,689	84,707
Uranium	t	8,703	953,858	10,133	1,358,144	9,017	1,307,174	7,889	806,418	10,037	927,009
Zinc	t	704,780	1,408,149	669,879	1,265,402	591,004	1,281,887	412,277	811,361	329,396	778,033
TOTAL, METALLIC MINERALS		..	22,594,378	..	15,474,941	..	25,569,557	..	23,497,305	..	24,601,597

NON-METALLIC MINERALS

	Unit	2008		2009		2011		2013		2014 ^P	
		(quantity)	(\$000)	(quantity)	(\$000)	(quantity)	(\$000)	(quantity)	(\$000)	(quantity)	(\$000)
Barite	000 t	9	3,344	16	4,443	x	x	x	x	x	x
Carbonatite	000 t	x	x	x	x	x	x	x	x	x	x
Cement ¹	000 t	13,604	1,733,146	10,831	1,413,826	11,914	1,587,136	12,022	1,618,827	12,276	1,717,397
Chrysotile	000 t	x	x	x	x	x	x	x	x	x	x
Clay products ²	000 t	-	187,774	-	132,902	-	135,422	-	122,577	-	119,564
Diamonds	000 ct	14,523	2,369,266	10,946	1,684,304	10,752	2,509,232	10,600	1,964,125	12,082	2,226,525
Gemstones	t	51	5,851	22	2,759	42	2,941	554	4,607	6,220	6,382

ANNEX 5

MINERAL PRODUCTION OF CANADA, 2008-2014^P

NON-METALLIC MINERALS		2008		2009		2011		2013		2014 ^P	
	Unit	(quantity)	(\$000)	(quantity)	(\$000)	(quantity)	(\$000)	(quantity)	(\$000)	(quantity)	(\$000)
Graphite	000 t	x	x	x	x	x	x	x	x	x	x
Gypsum ³	000 t	5,819	83,023	3,568	55,749	2,449	34,632	1,837	25,872	1,811	25,299
Lime	000 t	2,046	273,316	1,613	238,508	1,937	294,909	1,856	308,127	1,945	334,717
Magnesite	000 t	x	x	x	x	x	x	x	x	x	x
Marl	000 t	x	x	x	x	-	-	-	-	-	-
Mica	000 t	x	x	x	x	x	x	x	x	x	x
Nepheline syenite	000 t	646	54,864	527	53,354	602	58,377	646	72,911	670	73,700
Peat	000 t	1,231	238,510	1,214	266,634	1,139	213,359	1,173	213,798	1,153	245,634
Phosphate	000 t	x	x	x	x	x	x	x	x	-	-
Potash (K ₂ O) ⁴	000 t	10,379	7,662,373	4,297	3,431,147	10,686	7,569,282	10,196	5,768,609	11,345	5,874,618
Potassium sulphate	000 t	x	x	x	x	x	x	x	x	x	x
Pumice	000 t	x	x	x	x	x	x	x	x	x	x
Quartz (silica) ³	000 t	1,938	74,872	1,192	47,661	1,620	84,280	2,331	80,064	1,623	103,157
Salt	000 t	14,224	537,273	14,676	578,618	12,757	697,404	12,244	655,848	13,876	755,062
Sand and gravel	000 t	241,591	1,690,944	201,678	1,361,664	222,288	1,560,213	241,113	1,941,867	227,611	1,979,877
Serpentine	000 t	-	-	-	-	-	-	-	-	-	-
Soapstone, talc, pyrophyllite	000 t	64	22,314	56	19,701	116	25,244	175	34,223	81	32,994
Sodium sulphate	000 t	x	x	x	x	x	x	x	x	x	x
Stone ³	000 t	153,556	1,488,290	153,038	1,503,455	161,729	1,591,511	147,746	1,509,427	146,566	1,506,391
Sulphur, elemental	000 t	6,880	2,116,017	6,435	16,499	5,970	637,250	5,624	342,937	5,265	319,576
Sulphur, in smelter gas	000 t	746	148,456	543	77,817	638	116,022	677	129,197	649	108,768
Titanium dioxide	000 t	x	x	x	x	x	x	x	x	x	x
Tremolite	000 t	-	-	-	-	-	-	-	-	-	-
Zeolite	000 t	x	x	x	x	x	x	x	x	x	x
TOTAL, NON-METALLIC MINERALS		..	19,372,019	..	11,552,034	..	17,839,820	..	15,477,138	..	16,229,192

MINERALS FUELS		2009		2010		2011		2012		2013 ^P	
	Unit	(quantity)	(\$000)	(quantity)	(\$000)	(quantity)	(\$000)	(quantity)	(\$000)	(quantity)	(\$000)
Coal	000 t	67,750	4,985,956	62,935	4,406,365	67,113	7,471,408	68,751	4,886,804	69,116	3,914,766
TOTAL MINERAL FUELS		67 750	4,985,956	62,935	4,406,365	67,113	7,471,408				

TOTAL MINERAL PRODUCTION	..	46,952,353	..	31,433,340	..	50,880,785	..	43,861,247	..	44,745,555
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Sources: Natural Resources Canada; Statistics Canada.

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

Notes:

¹ Includes exported clinker.

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

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

⁴ Shipments 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, 1978-2012

Metal Contained in Proven and Probable Mineable Ore ¹ in Operating Mines ² 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	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 ¹	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

Source: Natural Resources Canada, based on company reports and the federal-provincial/territorial survey of mines and concentrators.

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

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

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

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

¹ - revised

ANNEX 7

PROPOSED CAPITAL INVESTMENTS BY THE CANADIAN MINING INDUSTRY

Company	Project	Province	(\$ millions)
			Capital Investment
Coalspur Mines Ltd.	Vista Thermal Coal Mine	AB	500
Canadian Natural Resources Ltd. (CNRL)	Project Horizon	AB	2,100
Fort Hills Energy Corp. (SuncorEnergy Inc. / Total SA / Teck)	'Fort Hills' Oil Sands Mine	AB	13,500
Shell Canada	Athabasca Oil Sands Project Debottleneck Phase 1 (withouth Pierre River Mine Cap Cost)	AB	2,000
SilverBirch Energy/Teck Resources	'Equinox' Oil Sands Mine (Lease 14)	AB	5,750
SilverBirch Energy/Teck Resources	'Frontier' Oil Sands Mine Phase 1	AB	20,000
Suncor Energy Inc. / Total SA	Voyageur	AB	4,400
Synchrude Canada Ltd.	Mildred Lake	AB	3,600
Synchrude Canada Ltd.	Aurora	AB	2,335
KGHM Ajax Mining Inc.	Ajax Copper-Gold Mine	BC	795
Snip Gold Corporation	Bronson Slope Metal Mine	BC	257
Nova Gold/Teck	Galore Creek	BC	5,200
Pretivim	Bruce Jack Gold-Silver Mine	BC	746.9
Canadian Dehua	Gething Coal	BC	1,360
Cardero	Carbon Creek	BC	878
New Gold	Blackwater Gold	BC	1,865
AuRico Gold	Kemess Underground Project	BC	452
Avanti Mining Inc.	Kitsault Molybdenum Mine	BC	1,000
Seabridge Gold Inc.	KSM (Kerr-Sulphurets-Mitchell) Copper-Gold Mine	BC	6,000
Capstone Mining Corp.	Kutcho Copper-Zinc-Silver-Gold	BC	213.5
Teck Coal Ltd.	Line Creek Coal Mine Expansion	BC	140
Pacific Booker Minerals Inc.	Morrison Copper-Gold Mine	BC	516.68
Fortune Minerals	Arctos Anthracite Project	BC	788
HD Mining	Murray River Underground Coal Mine	BC	668
Taseko Mines Ltd.	New Prosperity Gold-Copper Mine	BC	1,500
Teck Coal Ltd.	Quintette Coal Mine	BC	500
Compliance Coal Corp.	Raven Underground Coal Mine	BC	150
Anglo American	Peace River Coal	BC	320
Copper Fox Metals	Schaft Creek	BC	3,256
Spanish Mountain Gold Ltd.	Spanish Mountain	BC	755.9
Columbia Yukon Explorations	Storie molybdenum Mine	BC	390
Hard Creek Nickel	Turnagain Nickel Project	BC	2,308
Cline Mining Corporation	Crown Mountain Coal Project	BC	370
Victory Nickel	Minago Nickel Mine	MB	596
Winston Resources Inc.	Elmtree Property Gold Mine	NB	8
Northcliff Resources Ltd.	Sisson Tungsten-Molybdenum Mine	NB	579
IOC (Rio Tinto operator)	Wabush 3	NL	250
Canada Fluorspar	St. Lawrence fluorspar mine reactivation	NL	100
Alderon Resources Corp.	Kami Iron Ore Project	NL	1,270
Morien	Donkin Coal Project	NS	500

ANNEX 7

PROPOSED CAPITAL INVESTMENTS BY THE CANADIAN MINING INDUSTRY

Company	Project	Province	(\$ millions)
			Capital Investment
TMAC	Hope Bay	NU	642
Baffinland Iron Mines	Mary River	NU	750
Mountain Province Diamonds Inc. and De Beers	Gahcho Kue	NWT	1,000
Canadian Zinc	Prairie Creek	NWT	193
Avalon Rare Metals	Thor Lake - Nechalacho	NWT	1,575
Fortune Minerals	Nico	NWT	347
Tyhee Resources	Yellowknife Gold	NWT	150
Canadian Malartic	Hammond Reef Gold Mine	ON	1,500
Noront Resources Inc.	Eagle's Nest Multi-metals Mine	ON	609
Vale	Sudbury	ON	2,000
Bending Lake Iron Ore	Josephine Cone Mine	ON	900
IAMGOLD	Cote Lake Gold Mine	ON	1,200
New Gold	Rainy River Gold Mine	ON	885
Goldcorp	Red Lake	ON	885
Goldcorp	Porcupine	ON	335
Goldcorp	Musselwhite	ON	390
Treasury Metals	Goliath Gold Project	ON	200
Northern Iron	Griffith Iron	ON	1,600
KGHM International	Victoria Mine	ON	750
Adriana Resources Inc.	Lac Otelnuk Iron Mine	QC	13,000
Matamec	Kipawa	QC	316
Arriane Resources	Lac à Paul	QC	1,214
Critical Elements Corp	Rose Tantalum Mine	QC	269
Royal Nickel Corp.	Dumont Nickel Project	QC	1,200
Stornoway Diamond Corporation	Renard Diamond Mine	QC	946
Champion Iron Mines	Fire Lake North	QC	1,400
Ungava	Hopes Advance Iron Mine	QC	2,850
Mine Arnaud Inc.	Arnaud Apatite Mine	QC	750
Western Troy Capital Resources Inc.	MacLeod Lake Molybdenum-Copper	QC	210
Strateco Resources Inc.	Matoush Project	QC	310
Métaux BlackRock Inc.	BlackRock Vanadium Iron Titanium Mine	QC	600
BHP	Jansen Potash Mine	SK	13,000
AREVA Resources Canada Inc.	Midwest Uranium Mining and Milling	SK	435
Encanto	Muskowekwan Potash Mine	SK	2,800
Shore Gold Inc.	Star-Orion South Diamond Mine	SK	1,900
Total			145,029

Note: The information in this table refers to investments proposed over the coming decade and is drawn from government web sites, company websites, and various media. The progress that will be made on advancing these projects will be affected by market forces. Some will likely be delayed or cancelled. In this sense, the list should be referenced as an indicator and not an ascertainment of project development.

ANNEX 8

EMPLOYMENT COUNT AND ANNUAL COMPENSATION IN THE CANADIAN MINING, SMELTING AND REFINING INDUSTRIES, 2007-2013

	Number of Employees (000)	Compensation per Job ¹ (\$)
Metal Mines		
2007	28,520	98,205
2008	30,275	103,582
2009	23,710	123,596
2010	25,345	122,611
2011	27,445	121,955
2012	28,115	134,021
2013	35,955	110,501
Non-Metal Mines		
2007	18,840	76,588
2008	20,425	82,302
2009	19,115	80,566
2010	20,390	84,412
2011	21,305	88,412
2012	20,730	96,653
2013	19,390	105,595
Coal Mines		
2007	4,420	112,092
2008	5,360	115,101
2009	5,510	112,238
2010	6,290	109,849
2011	6,495	121,490
2012	7,785	112,205
2013	7,795	115,855
Smelting & Refining ²		
2007	61,080	90,602
2008	62,330	87,626
2009	48,000	90,069
2010	52,525	91,799
2011	57,605	90,922
2012	54,600	94,896
2013	53,415	93,774

ANNEX 8

EMPLOYMENT COUNT AND ANNUAL COMPENSATION IN THE CANADIAN MINING, SMELTING AND REFINING INDUSTRIES, 2007-2013

	Number of Employees (000)	Compensation Per Job(\$)
Total Mining, Smelting and Refining		
2007	112,860	91,025
2008	118,390	92,031
2009	96,335	97,703
2010	104,550	98,914
2011	112,850	99,755
2012	111,230	106,325
2013	116,555	102,377

Sources: Statistics Canada; Natural Resources Canada.

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

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

ANNEX 9

AVERAGE ANNUAL EARNINGS, BY CANADIAN INDUSTRIAL SECTOR, 2007-2013

(\$)	Forestry	Mining, Smelting and Refining ¹	Manufacturing	Construction	Finance & Insurance
2007	63,400	91,025	61,176	57,681	65,151
2008	65,889	92,031	62,447	59,206	64,237
2009	65,130	97,703	62,197	59,082	65,013
2010	67,152	98,914	62,757	59,673	65,162
2011	69,434	99,755	64,537	61,761	67,742
2012	75,133	106,325	67,537	65,904	70,013
2013	81,174	102,377	68,916	68,391	70,011

Sources: Statistics Canada; Natural Resources Canada.

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

ANNEX 10

STRIKES AND LOCKOUTS IN CANADIAN MINING AND MINERAL MANUFACTURING INDUSTRIES, 2009-2014

	Work Stoppages	Workers (Maximum)	Person Days Not Worked	Work Days
2009				
Year - Total	11	4,874	568,580	120.1
Mining - Total	1	125	8,690	108
Mineral Fuel	.	.	.	.
Metal	1	125	8,690	108
Non-Metal	.	.	.	.
Support Activities	.	.	.	.
Mineral Extraction - Total	10	4,749	559,890	121.3
Non-Metallic Mineral Products	3	163	23,080	109.3
Primary Metals	7	4,586	536,810	126.4
2010				
Year - Total	17	6,022	567,390	96.8
Mining - Total	3	373	26,890	101
Mineral Fuel	1	168	6,720	40
Metal	1	125	19,530	255
Non-Metal	1	80	640	8
Support Activities	.	.	.	.
Mineral Extraction - Total	14	5,649	540,500	95.9
Non-Metallic Mineral Products	7	344	27,020	65
Primary Metals	7	5,305	513,480	126.9
2011				
Year - Total	10	1,467	176,435	82
Mining - Total	1	125	2,895	23
Mineral Fuel	.	.	.	.
Metal	1	125	2,895	23
Non-Metal	.	.	.	.
Support Activities	.	.	.	.
Mineral Extraction - Total	9	1,342	173,540	88.6
Non-Metallic Mineral Products	3	137	8,380	61.3
Primary Metals	6	1,205	165,160	102.2
2012				
Year - Total	9	1,701	128,240	58.1
Mining - Total	1	361	10,440	29
Mineral Fuel	.	.	.	.
Metal	.	.	.	.
Non-Metal	1	361	10,440	29
Support Activities	.	.	.	.
Mineral Extraction - Total	8	1,340	117,800	61.8
Non-Metallic Mineral Products	.	.	.	.
Primary Metals	8	1,340	117,800	61.8
2013				
Year - Total	2	62	10	96
Mining - Total	1	1	10	11
Mineral Fuel	.	.	.	.
Metal	.	.	.	.
Non-Metal	1	1	10	11
Support Activities	.	.	.	.
Mineral Extraction - Total	1	61	0	181
Non-Metallic Mineral Products	.	.	.	.
Primary Metals	1	61	0	181
2014				
00 Year - Total	4	654	24,060	117.3
10 Mining - Total	2	537	7,560	42.5
11 Mineral Fuel	.	.	.	.
12 Metal	1	536	7,500	14
13 Non-Metal	1	1	60	71
14 Support Activities	.	.	.	.
20 Mineral Extraction - Total	2	117	16,500	192
21 Non-Metallic Mineral Products	.	.	.	.
22 Primary Metals	2	117	16,500	192

Source: Workplace Information Division, Labour Program, HRSDC, November 14, 2014.

Note: (.) Nil

ANNEX 11

TOTAL EXPORTS OF MINERALS AND MINERAL PRODUCTS, BY COMMODITY AND COUNTRY OF DESTINATION, 2014

(\$)	United States	European Union	China	Japan	Other Countries	Total
METALS						
Aluminum	8,212,747,934	568,872,671	232,421,527	124,742,450	649,621,489	9,788,406,071
Antimony	212,754	120,114	-	-	-	332,868
Barium	-	-	-	-	24,314	24,314
Beryllium	18,943	10,912	-	-	-	29,855
Bismuth	515,615	-	-	-	8,519	524,134
Cadmium	425,420	1,051,380	1,243,087	168,338	137,146	3,025,371
Calcium metals	108,782	4,938	351	-	1,046,518	1,160,589
Chromium	30,456,834	466	-	-	105,972	30,563,272
Cobalt	41,345,899	52,297,814	6,006,804	65,019,874	141,261,721	305,932,112
Copper	3,419,488,706	438,842,518	1,258,088,273	869,157,503	1,011,433,100	6,997,010,100
Gold	4,665,497,554	8,769,947,482	80,952,189	402,429,715	4,004,175,003	17,923,001,943
Iron and steel	11,941,676,294	224,023,372	122,195,050	14,919,392	1,396,217,416	13,699,031,524
Iron ore	419,160,686	1,641,385,787	1,126,415,727	470,633,685	760,066,424	4,417,662,309
Lead	734,082,374	11,466,952	34,944,207	3,375,053	12,644,787	796,513,373
Lithium	23,320	160,634	695,128	-	15,141	894,223
Magnesium and magnesium compounds	50,216,682	163,103	286,202	8,464	176,075	50,850,526
Manganese	1,356,151	39,006	70,494	-	489,265	1,954,916
Mercury	761,054	6	-	-	410	761,470
Molybdenum	197,960,484	39,589,465	1,514,625	823,716	26,007,309	265,895,599
Nickel	1,160,702,340	1,671,140,637	430,786,801	142,230,863	2,031,253,210	5,436,113,851
Niobium	68,753,393	93,103,809	31,212,414	4,377,293	41,399,158	238,846,067
Platinum group metals	374,767,931	135,848,528	15,244,517	5,484,821	46,997,703	578,343,500
Rare earth metals	322,641	46,777	-	-	284,312	653,730
Selenium	1,075,995	9,819,044	14,171,537	-	4,671,137	29,737,713
Silicon	129,496,073	11,685,035	24,096	-	14,275,410	155,480,614
Silver	1,236,531,362	28,444,918	17,245,787	22,798,344	43,807,399	1,348,827,810
Tantalum	401,885	61,293	-	-	61,126	524,304
Tellurium	2,367,091	12,829,417	-	397,025	2,997,018	18,590,551
Tin	52,746,285	5,218,616	718	5,352	616,976	58,587,947
Titanium metal	22,888,384	9,005,316	1,224,067	354,716	8,961,957	42,434,440
Tungsten	58,122,389	53,066,662	272,454	11,195	2,569,914	114,042,614
Uranium and thorium	531,468,115	389,078,360	268,129,622	58,575,158	108,890,469	1,356,141,724
Vanadium	234,058,350	267,716,116	39,762,992	42,421,265	29,041,456	613,000,179
Zinc	1,406,868,898	45,870,188	17,540,942	10,457,830	107,058,691	1,587,796,549
Zirconium	2,647,850	6,762,549	7,516,270	-	145,021	17,071,690
Other metals	3,903,966,722	1,053,654,695	104,690,005	79,203,451	620,185,563	5,761,700,436
Grand Total	38,903,241,190	15,541,328,580	3,812,655,886	2,317,595,503	11,066,647,129	71,641,468,288
NON-METALS						
Abrasives	268,316,524	15,409,708	14,059,109	9,039,985	23,113,697	329,939,023
Boron	752,539	235,884	46,845	-	1,362,640	2,397,908

ANNEX 11

TOTAL EXPORTS OF MINERALS AND MINERAL PRODUCTS, BY COMMODITY AND COUNTRY OF DESTINATION, 2014

(\$)	United States	European Union	China	Japan	Other Countries	Total
Bromine	27,773	-	-	-	2,246	30,019
Cement	606,537,541	4,616,640	1,354,467	202,498	13,816,061	626,527,207
Chlorine and chlorine compounds	161,126,103	827,437	-	20	10,752,142	172,705,702
Chrysotile (Asbestos)	3,161,335	47,687	98,515	67,768	2,450,726	5,826,031
Clay and clay products	20,807,623	11,486,250	1,064,834	48,975	6,127,344	39,535,026
Diamonds	62,772,461	1,543,848,948	832,915	840,737	920,467,780	2,528,762,841
Dolomite	22,860,084	592,920	-	-	2,300,090	25,753,094
Fluorspar	12,689,006	122,934	306,052	-	14,537,464	27,655,456
Glass and glassware products	498,207,190	23,230,868	3,684,034	1,786,751	24,903,398	551,812,241
Granite	30,005,042	656,681	1,173,606	45,303	574,186	32,454,818
Graphite	59,413,583	7,121,404	640,516	1,722,443	5,035,271	73,933,217
Gypsum	80,263,011	413,860	37,253	13,116	1,287,663	82,014,903
Iodine	3,652,237	891,200	-	-	680,558	5,223,995
Lime	60,932,269	18,277	21,108	1,112	342,014	61,314,780
Limestone flux and other limestone	18,585,726	3,992,916	260,313	-	14,673,238	37,512,193
Marble, travertine and other calcareous stones	22,320,045	1,395,461	495,485	-	577,389	24,788,380
Mica	9,133,742	563,414	461,408	1,989,947	1,046,815	13,195,326
Mineral pigments	149,977,694	944,100	1,549,180	34,437	6,437,530	158,942,941
Nepheline syenite	92,171,117	8,195,723	1,228,823	900,457	3,465,494	105,961,614
Pearls	870,884	144	4,889	26,744	390,577	1,293,238
Peat	311,708,725	490,100	444,601	12,382,274	20,434,200	345,459,900
Phosphate and phosphate compounds	72,515,332	659,013	327,078	970,834	8,823,474	83,295,731
Potash and potassium compounds	2,826,692,560	32,117,021	384,557,538	122,198	1,983,110,156	5,226,599,473
Salt and sodium compounds	611,205,512	6,003,934	3,805,200	30,824,607	64,203,893	716,043,146
Sand and gravel	52,046,065	9,479	4,296	-	6,593,598	58,653,438
Sandstone	124,682	-	-	-	-	124,682
Silica and silica compounds	66,652,916	2,174,202	525,037	270,633	2,547,845	72,170,633
Slate	4,541,204	6,565,672	-	36,903	325,347	11,469,126
Sulphur and sulphur compounds	247,989,753	1,967,469	65,793,157	-	315,645,159	631,395,538
Talc, soapstone and pyrophyllite	39,095,565	786,630	258,294	24,012	38,579	40,203,080
Titanium oxides	231,841,339	4,909,603	797,654	-	10,587,760	248,136,356
Other nonmetals	602,897,138	33,630,063	7,725,223	3,958,449	39,636,239	687,847,112
Other structurals	148,739,482	6,863,497	1,768,337	226,364	25,647,330	183,245,010
TOTAL NON-METALS	7,400,633,802	1,720,789,139	493,325,767	65,536,567	3,531,937,903	13,212,223,178
MINERAL FUELS						
Coal	434,251,941	448,132,699	900,892,116	1,085,100,588	1,666,768,197	4,535,145,541
Coke	6,359,771	437	-	-	1,170,400	7,530,608
TOTAL MINERAL FUELS	440,611,712	448,133,136	900,892,116	1,085,100,588	1,667,938,597	4,542,676,149
TOTAL MINING DOMESTIC EXPORTS	46,744,486,704	17,710,250,855	5,206,873,769	3,468,232,658	16,266,523,629	89,396,367,615

Sources: Natural Resources Canada; Statistics Canada.

- Nil

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.

ANNEX 12

TOTAL IMPORTS OF MINERALS AND MINERAL PRODUCTS, BY COMMODITY AND COUNTRY OF ORIGIN, 2014

(\$)	United States	European Union	China	Mexico	Other Countries	Total
METALS						
Aluminum	3,402,672,020	318,952,279	501,303,247	44,189,549	1,523,333,089	5,790,450,184
Antimony	1,775,425	196,487	13,821,489	112,330	1,156,463	17,062,194
Barium	3,462,917	1,127,945	1,668,820	52	72,378	6,332,112
Beryllium	556,627	944	-	7,772	6,731	572,074
Bismuth	1,180,790	221,796	2,295,600	-	232,275	3,930,461
Cadmium	4,515,911	26,239,546	8,538,777	25,469	222,576	39,542,279
Calcium metals	58,034,230	2,832,181	842,951	41,896	969,758	62,721,016
Chromium	9,110,806	6,979,233	3,803,447	463,699	45,800,153	66,157,338
Cobalt	20,985,053	12,889,652	6,834	-	15,462,606	49,344,145
Copper	2,093,815,468	163,047,980	156,747,941	81,131,327	774,125,523	3,268,868,239
Gallium	16,130	174,244	827,586	-	1,209	1,019,169
Germanium	8,514,896	598,380	420,611	-	5,210,213	14,744,100
Gold	1,286,311,593	1,195,237,182	1,247,754	332,573,107	7,125,301,162	9,940,670,798
Hafnium	678,374	-	-	-	21,171	699,545
Indium	1,076,518	109,279	-	-	161,021	1,346,818
Iron and steel	15,199,709,046	2,592,707,130	3,195,951,512	1,194,325,365	3,793,673,492	25,976,366,545
Iron ore	1,116,686,318	17,082,349	6,757	259	52,289	1,133,827,972
Lead	448,308,219	16,829,444	54,505,926	44,287,906	194,680,775	758,612,270
Lithium	34,571,908	5,271,879	8,537,266	439,888	35,471,949	84,292,890
Magnesium and magnesium compounds	38,566,579	7,077,956	192,320,748	732,465	11,626,015	250,323,763
Manganese	139,220,345	13,129,577	25,860,780	6,110,045	174,297,689	358,618,436
Mercury	1,082,187	8,627,073	1,060,349	30,175,466	7,629,848	48,574,923
Molybdenum	89,872,575	8,118,737	2,473,760	5,293,931	16,857,282	122,616,285
Nickel	273,375,091	245,827,026	10,666,106	1,040,372	378,890,502	909,799,097
Niobium	22,293,765	1,267,682	191,419	2,002	35,294,600	59,049,468
Platinum group metals	110,571,015	77,558,732	11,246	12,886	119,005,102	307,158,981
Rare earth metals	993,171	203,417	2,222,630	-	372,270	3,791,488
Rhenium	4,775	-	-	-	-	4,775
Selenium	414,576	1,741,272	238,655	71,763	4,272,690	6,738,956
Silicon	11,847,823	6,903,875	17,743,976	-	57,041,604	93,537,278
Silver	1,119,438,190	139,270,999	43,777,731	137,561,508	1,149,046,381	2,589,094,809
Strontium	17,814	348,744	5	255,751	-	622,314
Tantalum	1,238,149	192,491	42,174	-	27	1,472,841
Tellurium	747,383	309,571	1,710,557	-	4,828,610	7,596,121
Thallium	2,051	-	-	-	-	2,051
Tin	19,041,822	3,200,361	11,297,123	1,184,856	65,701,850	100,426,012
Titanium metal	99,740,408	21,759,832	9,050,261	500,793	70,095,581	201,146,875
Tungsten	14,283,825	1,724,481	2,801,702	69,802	2,085,372	20,965,182
Uranium and thorium	101,241,869	42,310,552	311,655	2,466	355,109,736	498,976,278
Vanadium	5,414,694	9,784,172	6,822,546	-	20,163,572	42,184,984
Zinc	392,497,846	22,921,441	4,158,690	60,136,898	274,385,431	754,100,306

ANNEX 12

TOTAL IMPORTS OF MINERALS AND MINERAL PRODUCTS, BY COMMODITY AND COUNTRY OF ORIGIN, 2014

(\$)	United States	European Union	China	Mexico	Other Countries	Total
Zirconium	39,859,638	1,120,949	81,457	3	3,792,453	44,854,500
Other metals	6,024,327,380	1,291,895,674	2,284,970,605	1,400,393,943	2,078,142,882	13,079,730,484
Grand Total	32,198,075,220	6,265,792,544	6,568,340,693	3,341,143,569	18,344,594,330	66,717,946,356
NON-METALS						
Abrasives	225,188,134	126,339,538	71,398,023	8,686,215	102,571,910	534,183,820
Arsenic	977	31,952	123,899	-	9,422	166,250
Barite and witherite	13,564,161	437,482	26,040,336	3,122,898	6,223,312	49,388,189
Boron	20,495,891	685,514	4,167,514	-	15,802,498	41,151,417
Calcium (Industrial minerals)	2,411,309	22,299	68,334	1,218	1,112,951	3,616,111
Cement	496,178,261	58,680,697	66,400,346	5,302,395	97,482,228	724,043,927
Chlorine and chlorine compounds	116,096,369	9,030,389	16,200,134	2,558,962	6,452,041	150,337,895
Chrysotile (Asbestos)	106,082,271	7,291,642	9,479,328	2,819,791	14,000,873	139,673,905
Clay and clay products	385,958,975	254,468,171	439,965,095	70,876,833	174,168,515	1,325,437,589
Diamonds	103,447,603	41,142,157	2,083,507	-	425,283,990	571,957,257
Dolomite	17,112,388	28,964	87,600	-	46,030	17,274,982
Feldspar	686,370	664	-	-	49	687,083
Fluorspar	19,530,685	4,887,134	11,268,069	27,535,152	3,284,032	66,505,072
Glass and glassware products	1,830,317,803	229,067,074	425,786,877	182,705,398	122,902,620	2,790,779,772
Granite	14,742,001	26,607,511	27,045,727	67,321	89,571,090	158,033,650
Graphite	242,395,467	165,759,200	75,859,396	3,231,910	45,604,609	532,850,582
Gypsum	180,165,163	1,589,717	417,660	3,131,918	359,109	185,663,567
Iodine	6,172,082	8,544	88,309	-	11,853,242	18,122,177
Lime	38,456,089	523,900	322,747	-	20,713	39,323,449
Limestone flux and other limestone	28,335,594	256,481	1,450,969	1,029	967,737	31,011,810
Marble, travertine and other calcareous stones	19,051,637	44,733,552	36,821,306	2,728,916	54,006,337	157,341,748
Mica	4,036,741	2,879,568	151,061	15	1,432,946	8,500,331
Mineral pigments	134,423,752	35,502,698	4,118,879	960,420	15,104,781	190,110,530
Nepheline syenite	97,976	-	-	-	10,523	108,499
Olivine	888,767	209,620	18,888	187	838,624	1,956,086
Pearls	10,049,261	878,397	16,349,033	24,278	6,904,054	34,205,023
Peat	10,161,520	841,352	12,138	8	3,079,124	14,094,142
Perlite	19,135,962	3,961,933	1,200	-	-	23,099,095
Phosphate and phosphate compounds	662,662,777	13,923,824	12,301,561	1,219,454	135,990,439	826,098,055
Potash and potassium compounds	84,259,018	9,055,070	6,848,126	322,081	15,185,486	115,669,781
Salt and sodium compounds	431,046,337	35,797,704	49,875,463	20,156,041	90,234,138	627,109,683
Sand and gravel	14,656,917	30,027	616,633	49,293	297,908	15,650,778
Sandstone	1,669,488	177,884	203,072	-	5,367,224	7,417,668
Silica and silica compounds	317,862,002	19,648,800	25,210,758	1,840,848	11,255,728	375,818,136
Slate	2,577,345	539,361	4,612,221	8	2,192,416	9,921,351
Sulphur and sulphur compounds	24,281,630	1,419,877	180,022	753	2,982,414	28,864,696
Talc, soapstone and pyrophyllite	11,869,972	925,808	81,739	570	324,111	13,202,200
Titanium oxides	202,614,571	34,779,227	13,785,817	7,545,952	15,777,960	274,503,527
Vermiculite	1,569,322	16,668	37,843	-	1,228,751	2,852,584

ANNEX 12

TOTAL IMPORTS OF MINERALS AND MINERAL PRODUCTS, BY COMMODITY AND COUNTRY OF ORIGIN, 2014

(\$)	United States	European Union	China	Mexico	Other Countries	Total
Other non-metals	1,033,222,948	89,191,892	40,516,238	19,110,413	92,109,015	1,274,150,506
Other structurals	85,553,956	23,038,808	44,351,759	2,810,917	28,249,621	184,005,061
TOTAL NON-METALS	6,919,029,492	1,244,411,100	1,434,347,627	366,811,194	1,600,288,571	11,564,887,984
MINERAL FUELS						
Coal	690,260,367	2,897,019	5,349,952	379,319	180,595,686	879,482,343
Coke	187,589,826	1,743,378	26,743,512	-	31,044,933	247,121,649
TOTAL MINERAL FUELS	877,850,193	4,640,397	32,093,464	379,319	211,640,619	1,126,603,992
TOTAL MINING IMPORTS	39,994,954,905	7,514,844,041	8,034,781,784	3,708,334,082	20,156,523,520	79,409,438,332

Sources: Natural Resources Canada; Statistics Canada.

- Nil

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.

THE CANADIAN MINING INDUSTRY AT A GLANCE

	2005	2007	2009	2013	2014
Mining industry GDP (\$ billion)	40.0	41.9	32.0	54	57
Percentage of total Canadian GDP (%)	3.8	3.4	2.7	3.4	3.5
Value of mineral production (\$ billion)	27.4	40.6	32.2	43.6	44.7
Synthetic crude production value (\$ billion)	9.2	18.0	n/a	34.4	35.5
Synthetic crude production (million cubic metres)	21.9	39.9	n/a	54.3	55.3
Number of mining establishments	859	766	961	1,262	1,209
Mineral extraction employment (thousand)	47	53	52	63,775	63,590
Total mining/mineral industry employment (thousand)	353	360	308	380	376,455
Mineral exploration/appraisal spending (\$ billion)	1.3	2.8	1.9	2.3	1.9
Mining industry capital expenditures (\$ billion)	7.4	10.1	9.8	18.3	15.07
Oil sands capital expenditures (\$ billion)	9.8	16.8	10.6	32.6	25.1
Stock of foreign direct investment (\$ billion)	21.2	61.6	59.8	66.4	n/a
Stock of Canadian direct investment abroad (\$ billion)	56.4	57.3	64.5	81.4	n/a

n/a—not available





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