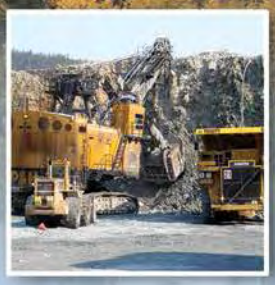
MINING SECTOR PERFORMANCE REPORT

1998-2012



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Rapport sur la performance du secteur minier – 1998-2012

Recycled paper

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For the purpose of this report and consistent with industry standards for the collection of data, the mining sector is defined using the North American Industry Classification System (NAICS) codes:

- NAICS 212 - mining and quarrying (excluding oil and gas);
- NAICS 327 - nonmetallic mineral product manufacturing;
- NAICS 331 - primary metal manufacturing; and
- NAICS 332 - fabricated metal product manufacturing.

The collection and presentation of data for this report, unless otherwise specified, **exclude oil and gas industry statistics**. The data presented in this report are current as of July 2013.

INTRODUCTION

The settlement and development of Canada are inextricably linked to the discovery and exploitation of natural resources. Beginning with fish and fur, and continuing with minerals, petroleum, forests, and other resources, Canada's socio-economic achievements are closely tied to natural resources. In particular, minerals and metals have significantly contributed to economic growth and prosperity throughout Canada's history. Today, Canada is one of the leading mining nations in the world, producing more than 60 minerals and metals and ranking at the top of the global production of many key commodities such as potash, uranium, nickel, aluminum, tungsten, and cobalt, to mention a few.

Given its importance, the mining sector has a significant impact on the Canadian economy, society, and environment. Maintaining awareness of the mining sector's economic, environmental, and social performance is essential to highlight improvements, share best practices, and identify gaps and areas that need more work to strengthen Canada's minerals and metals resource advantage. As such, federal, provincial, and territorial governments have collaborated with stakeholders from academia, industry, and Aboriginal and non-governmental organizations to produce this second triennial report.

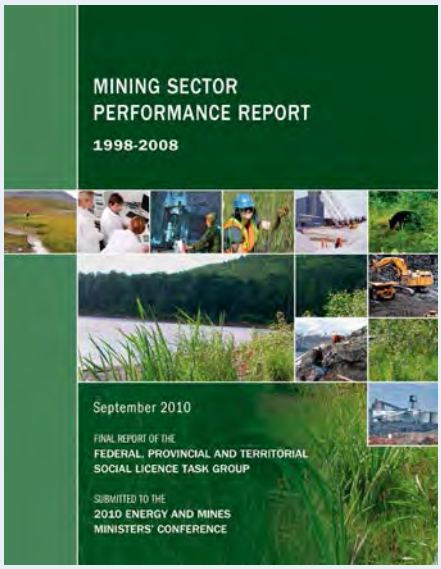
The *2013 Mining Sector Performance Report* (MSPR) builds upon the 2010 report presented to federal, provincial, and territorial Mines Ministers at their annual conference in September 2010.[1] It seeks to achieve three main objectives:

1. Provide Canadians with a common understanding of the sector's performance based on credible data;

2. Identify areas where improvements have taken place and where progress is still needed; and

3. Inform the development of priorities for the collaborative work being carried out by the federal-provincial/territorial Energy and Mines Ministers' Conference (EMMC) and Intergovernmental Working Group on the Mineral Industry (IGWG).

Box 1: 2010 Mining Sector Performance Report



Presented to Mines Ministers at their annual conference in September 2010, the report examined the economic, social, and environmental performance of the mining sector from 1998 to 2008.

www.nrcan.gc.ca/minerals-metals/publications-reports/3398

The current report measures the performance of 23 different indicators over the period 1998-2012. However, depending on the availability of data, some flexibility was applied.[2] The indicators are, for the most part, similar to the previous report and were selected on the basis of: (i) international mining performance reporting practices; (ii) the input of provinces and territories; (iii) consultation with an external advisory committee composed of individuals from academia, industry, and Aboriginal and non-governmental organizations; and (iv) the availability of data.
The report focuses on:

- The domestic activities of the sector;
- National-level indicators and, when possible, data disaggregated by province and territory; and
- Reporting on performance rather than establishing causality.

[1] The 2010 *Mining Sector Performance Report* can be found at www.nrcan.gc.ca/minerals-metals/publications-reports/3398.

[2] In some cases, the latest available data are for 2010 or 2011.

For the purpose of this report, the mining sector is defined by the North American Industry Classification System (NAICS) codes, including:

- 212 - mining and quarrying (excluding oil and gas);
- 327 - nonmetallic mineral product manufacturing;
- 331 - primary metal manufacturing; and
- 332 - fabricated metal product manufacturing.

The report does not include oil sands development. In addition, data and analysis limitations are explained throughout the document for the reader to gain a better understanding of specific constraints.[3]

Drawing from the Whitehorse Mining Initiative[4] and the Mining, Minerals and Sustainable Development[5] (North America) initiative, several "desired performance outcomes" were identified to complement the conceptual framework for this report with goals that can be measured. It is important to note that both governments and industry have a role to play in improving the performance of the sector, which is why government actions are included in the report (e.g., National Orphaned/Abandoned Mines Initiative, Metal Mine Effluent Regulations, land-use planning, and others). These outcomes, along with the indicators being used to measure performance, are introduced at the beginning of each section of the report.

The report is organized into four sections:

- **Section I** provides an overview of the key **global trends** and developments that are shaping the operating context of the mining sector; and
- **Sections II, III, and IV** respectively present the mining sector's **economic, social, and environmental** performance based on the indicators that have been selected.

Box 2: Desired Performance Outcomes

Economic

Maintain and enhance the vitality of the sector, ensuring its long-term viability and competitiveness, so that it can make an economic contribution to the local, regional, national, and global economies.

Social

The development of Canada's mineral resources will result in tangible benefits for current and future generations, including local communities in the proximity of exploration and mining activities.

Engagement processes ensure that local communities have the opportunity to participate in the development of resources that could influence their future.

Environmental

Responsible mining exploration, development, operations, and public policies will be predicated on maintaining a healthy environment and, on closure, returning mine sites and affected areas to viable self-sustaining ecosystems.

Institutional governance frameworks are in place that can provide certainty and confidence that the mechanisms exist for government, companies, communities, and residents to address adverse environmental effects.

Finally, it is important to note that this report was developed through collaboration between the federal, provincial, and territorial governments and consultation with an external multi-stakeholder advisory committee.[6] As such, all data, findings, and broad conclusions contained in this report have been reviewed by a broad range of stakeholders.

[3] For example, nominal values are used in the report for some indicators because data in real terms are not available. A mining-specific deflator does not exist and the use of an incorrect deflator could introduce potential errors. In addition, the mining sector operates in nominal terms (e.g., nominal prices or cash costs). As such, trends highlighted in the report for some indicators such as production, exports, etc., may reflect price and exchange rate fluctuations.

[4] Recognizing the need for the mineral industry "to earn the trust of Canadians and to prove that it can operate in an environmentally sensitive and sustainable fashion," The Mining Association of Canada proposed the launch of a multi-stakeholder process to develop a common vision and strategic plan that would take the mining sector into the next century. The proposal was endorsed by Mines Ministers, and on March 30, 1993, the Whitehorse Mining Initiative (WMI) was launched at the annual Prospectors and Developers Association of Canada convention (Source: Natural Resources Canada).

[5] The Mining, Minerals and Sustainable Development (North America) initiative was initiated by the World Business Council for Sustainable Development as one of a number of projects being supported by the Global Mining Initiative. It was formed as an independent process of multi-stakeholder engagement and analysis with the objective of "identifying how mining and minerals can best contribute to the global transition to sustainable development."

[6] The External Advisory Committee members for the report were: Ramsey Hart (Mining Watch Canada), Ben Chalmers (The Mining Association of Canada), Alan Young (Canadian Boreal Initiative), Wes Cragg (Canadian Business Ethics Research Network, York University), James Cooney (Canadian Business for Social Responsibility), Hans Matthews (Canadian Aboriginal Minerals Association), Lesley Williams (Prospectors and Developers Association of Canada), Ryan Montpelier (Mining Industry Human Resources Council), and Shirley Neault (Hudbay Minerals).

SECTION I: MINERAL RESOURCES PROSPECTS WITHIN A DYNAMIC AND EVOLVING GLOBAL CONTEXT

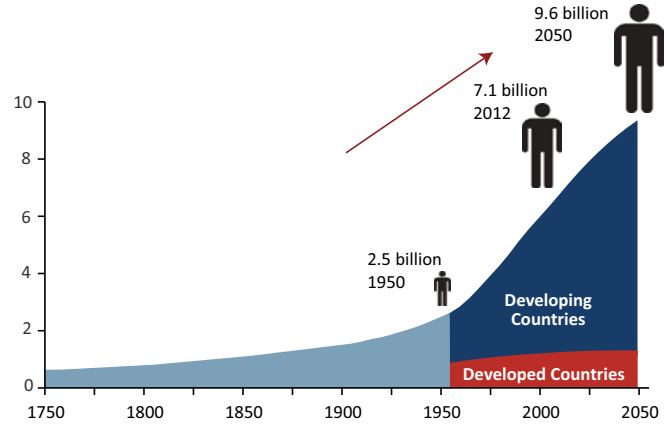
Key global trends are expected to enhance the demand for commodities in the long term

In spite of a bumpy and uneven global economic recovery[7] and short-term economic fluctuations, there are various elements that, over the long term, are expected to continue to put upward pressure on the demand for commodities and their respective prices.

From a demand side, population growth and a rising middle class in emerging economies will elevate the demand for natural resources. The current world population of more than 7.1 billion is projected to reach 9.6 billion by 2050 with most of the increase originating from emerging economies (Figure 1).

This is being accompanied by the rapid economic expansion of emerging markets, especially China and India, which could add up to 3.1 billion more middle-class consumers in the global economy by 2030.[8] A rising middle class will see its purchasing power increase and will demand more goods and services in the form of cars, appliances, electronics, housing, and improved nutrition. A rising middle class will also drive a push to expand urban infrastructure in the form of roads, buildings, bridges, ports, telecommunications, and a wide variety of other goods and services. Some estimates indicate that $57 trillion in infrastructure investment will be required between 2013 and 2030 simply to keep up with projected global Gross Domestic Product (GDP) growth.[9] In addition, according to projections by the United Nations, more than 80% of the world's middle class will reside in developing countries and account for 70% of the total consumption expenditure.[10] The striking transformation of a large number of developing countries into major economies with growing geopolitical influence will intensify global changes and the importance of natural resources.

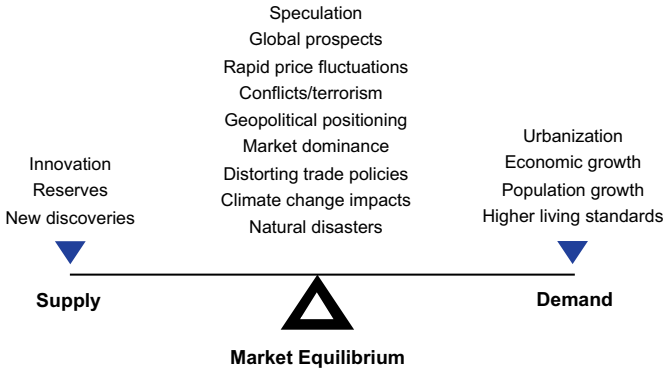
Figure 1: World Population Growth, Billions



Sources: U.S. Census Bureau; United Nations (medium fertility scenario).

Figure 2: Market Balance

In the short term, disequilibrium leads to shortage or surplus of supply



From a supply side, easily accessible high-grade global deposits are being depleted and orebodies are increasingly more costly to extract (i.e., deep mining, labour and input costs) or are located in more challenging geopolitical locations, restricting industry capacity to bring commodities to markets. In addition, other factors are expected to have an impact on supply and demand conditions, including intensified geopolitical risks, wars, or unrest in resource-rich regions; policy measures that omit property rights and limit foreign direct investment; and unpredictable events such as extreme weather patterns linked to climate change (Figure 2).

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7 According to the *International Monetary Fund's World Economic Outlook*, April 2013, what was a two-speed recovery, strong in emerging markets, and weaker in advanced economies is becoming a three-speed recovery with a growing bifurcation between the United States on one hand experiencing mild growth and the euro area on the other experiencing recessionary afflictions.

8 Organisation for Economic Co-operation and Development Working Paper No. 285, *The Emerging Middle Class in Developing Countries*, January 2010. The middle class is defined as "households with daily expenditures between US$10 and US$100 per person in purchasing power parity terms."

9 McKinsey Global Institute, *Infrastructure Productivity: How To Save $1 Trillion a Year*, January 2013.

10 Human Development Report 2013: *The Rise of the South: Human Progress in a Diverse World*.

Mineral resources becoming more strategic

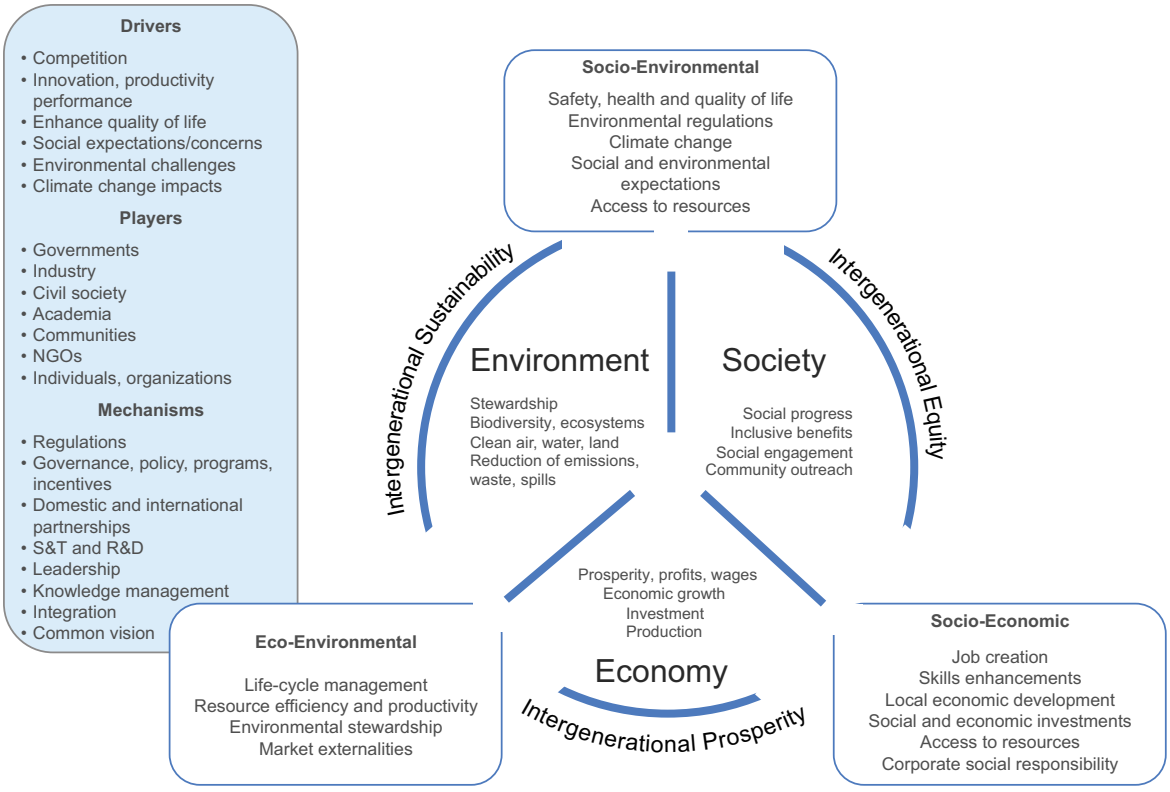
In addition, natural resources in general, and specifically mineral and metal resources, are becoming more strategic and gaining more relevance on the international stage. The four largest economies (the United States, China, Japan, and Germany) have developed minerals and metals strategies or approaches to avoid supply disruptions, mitigate challenges to their industrial sectors, and maximize economic opportunities associated with the green economy. Once again, nations understand that no modern economy can attain sustainable growth without adequate, affordable, and secure access to resources. The knowledge economy needs the resources and materials base to transform ideas into innovative products and services. There has also been an impetus on the importance of transparent markets and on the need to diversify the supply of key commodities to avoid a situation where a few countries corner the market, as is the case with rare earth elements and other critical commodities (i.e., tungsten). This is an important component of the new global context as nations around the world seek to position themselves in the international arena.

A global emphasis on social and environmental performance

Equally relevant in today's globalized digital era is the importance of environmental performance and the need to attain a social licence to operate in order to successfully develop natural resources in a responsible and sustainable manner. In this regard, local communities, governments, and international organizations are becoming more demanding for exemplary environmental practices, early social engagement, and economic benefits that extend to local communities.

A responsible and sustainable development approach has become essential to the competitive advantage of companies and countries to avoid project disruptions, promote investment, enhance technological advancements, and strengthen domestic and international partnerships. In addition, climate change will increasingly have profound impacts on societies, economic growth, and the way natural resources are developed in new, more environmentally sensitive areas. Water availability, greenhouse gas (GHG)

Figure 3: Elements of a Responsible and Sustainable Approach



emissions, unpredictable weather patterns exacerbated by climate change, and the increasing demand for resources are making the efficient and sustainable use and production of resources a necessity (Figure 3).

Canada's resource advantage

The settlement and development of Canada are inextricably linked to the discovery and development of natural resources. Beginning with fish and fur, and continuing with minerals, petroleum, forests, and other resources, Canada's socio-economic achievements are closely tied to natural resources. In particular, minerals and metals have contributed significantly to economic growth and prosperity throughout Canada's history. Today, Canada is one of the leading mining nations in the world, producing more than 60 minerals and metals and ranking among the leading producers of many key commodities such as potash, uranium, nickel, aluminum, and cobalt (Table 1).

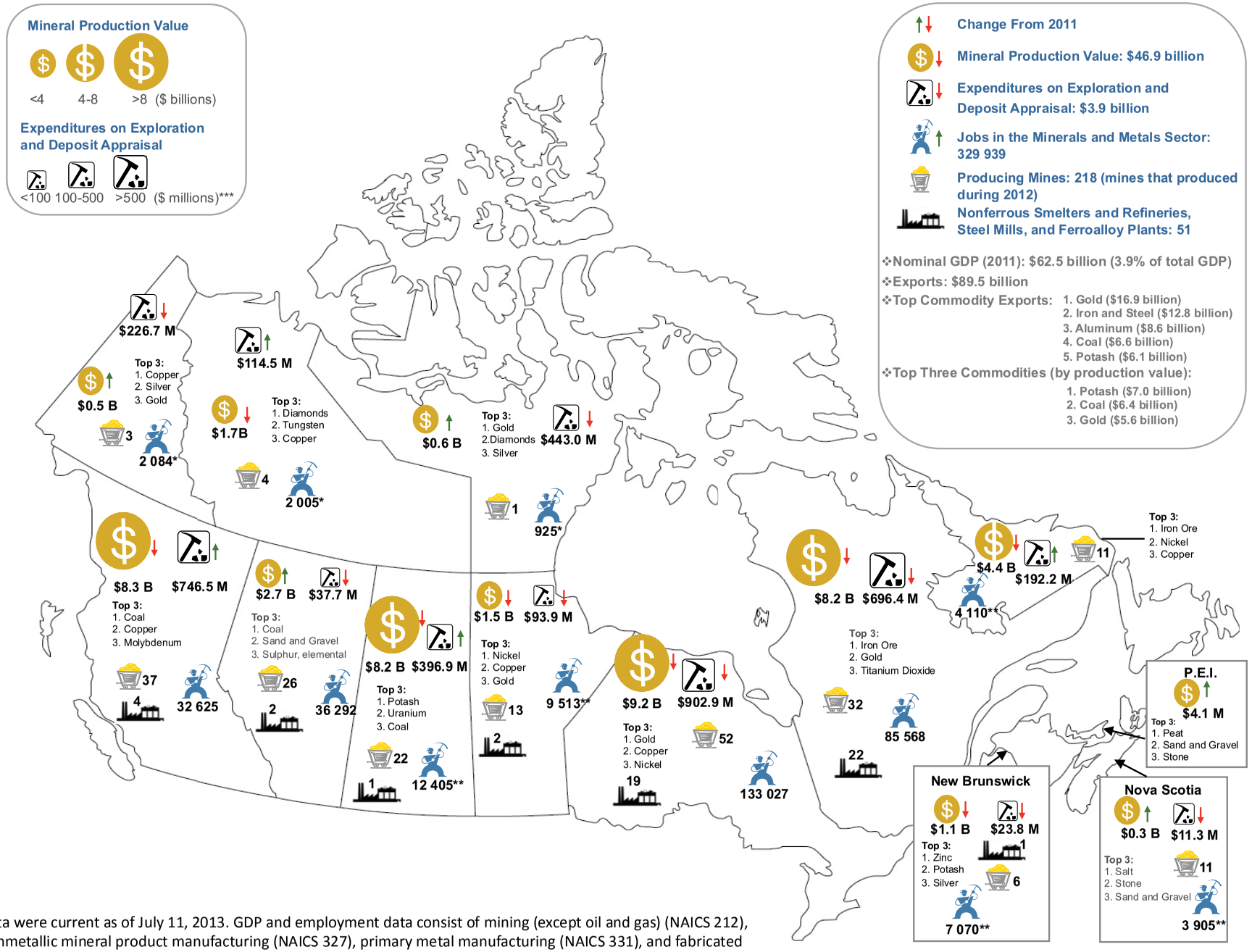
Table 1: Canada's Global Production Ranking by Volume, 2012

Commodity	Global Rank
Potash	1st
Uranium	2nd
Cobalt	3rd
Aluminum (primary)	3rd
Tungsten	3rd
Diamonds (2011)	4th
Platinum Group Metals	4th
Nickel	5th
Zinc	6th
Gold	7th
Copper	9th
Iron Ore	9th
Silver	10th

Sources: Natural Resources Canada; U.S. Geological Survey.

In addition, the sector has developed significant value-added jobs, expertise, and science and technology (S&T) related to the manufacturing of new and improved materials and to green mining technologies to improve productivity and environmental performance.

Mining is also one of the most developed industry clusters in Canada with extensive S&T networks, financial centres, more than 3200 suppliers of services (consulting, financial, legal, environmental, etc.), broad expertise in geosciences, more than 1400 exploration and mining companies, and world-class government laboratories. In 2012, over 70% ($10.3 billion) of the world's equity financing for mineral exploration and mining was raised by companies listed on Canadian stock exchanges.



Data were current as of July 11, 2013. GDP and employment data consist of mining (except oil and gas) (NAICS 212), nonmetallic mineral product manufacturing (NAICS 327), primary metal manufacturing (NAICS 331), and fabricated metal product manufacturing (NAICS 332), unless restricted by data confidentiality.

Figure 4: Overview of the Mining Sector Across Canada, 2012[11]

The socio-economic contribution of the sector to Canada is significant (Figure 4). Canada's mining sector:

- Directly employs around 330 000 workers (2012);
- Accounts for $62.5 billion in nominal GDP (3.9% of total Canadian GDP), with $28.5 billion in mineral extraction and $34.0 billion in mineral processing and manufacturing (2011);
- Contributes $16.7 billion to Canada's trade balance, including $89.5 billion in merchandise exports[12] (20.9% of the total value of exports) (2012);
- Accounts for $58.5 billion in foreign direct investment (FDI) (9.2% of all FDI in Canada) (2012); and
- Invests an estimated $22.4 billion in capital expenditures throughout Canada (2012).

In addition, Canada's mining sector:

- Contributes directly to the economic viability of several communities, mostly in rural and remote areas, and is a leading employer of Aboriginal peoples, employing around 10 300 in 2012;
- Is a capital-intensive, high-technology-driven industrial sector that plays an important role in Canada's "knowledge economy" as a purchaser, developer, and facilitator of advanced technologies;
- Is one of the few industrial sectors that consistently contributes to Canada's balance of trade, totalling over $132.7 billion since 2006, and has a robust international presence with Canadian mining assets abroad reaching $146.6 billion in over 100 countries (2011); and
- Hosts more than 200 principal producing mining establishments and 50 nonferrous smelters, refineries, and steel mills.

A large, diverse endowment of resources; effective governance, policies, and institutions; outward-looking Canadian companies exposed to intense competition; skilled workers; world-class mine operators and suppliers of equipment, professional services, and financing; and openness to technology, trade, and investment are among the key sources of Canada's minerals and metals resource advantage. However, a rapidly evolving global context is putting pressure on Canada's mining sector to become more economically productive, environmentally responsible, and socially inclusive. Continued improvements in the socio-economic and environmental performance of the sector will determine the effectiveness of Canada's ability to leverage its minerals and metals resource advantage for the benefit of Canadians across the country and in the furthest of communities. Issues around the earning of a social licence to operate, environmental sustainability, and economic competitiveness will continue to gain attention, making continual progress essential for the attainment of responsible goals.

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[11] Sources (map on previous page): Developed by the Minerals and Metals Sector of Natural Resources Canada (NRCan); Statistics Canada.
Note 1: GDP and employment data include Mining, Mineral Processing and Associated Manufacturing Industries (NAICS 212+327+331+332), unless restricted by data confidentiality or otherwise specified. Export values are for **domestic exports**, which consist of the exports of all goods grown, produced, extracted, or manufactured in Canada leaving the country for a foreign destination. For a map of producing mines and smelters across Canada, see http://geoscan.ess.nrcan.gc.ca/cgi-bin/starfinder/0?path=geoscan.downloade.fl&id=fastlink&pass=&format=FLDOWNLOADE&search=R=292216.
Note 2: Cement is excluded from the top three commodities as it is a manufactured product.

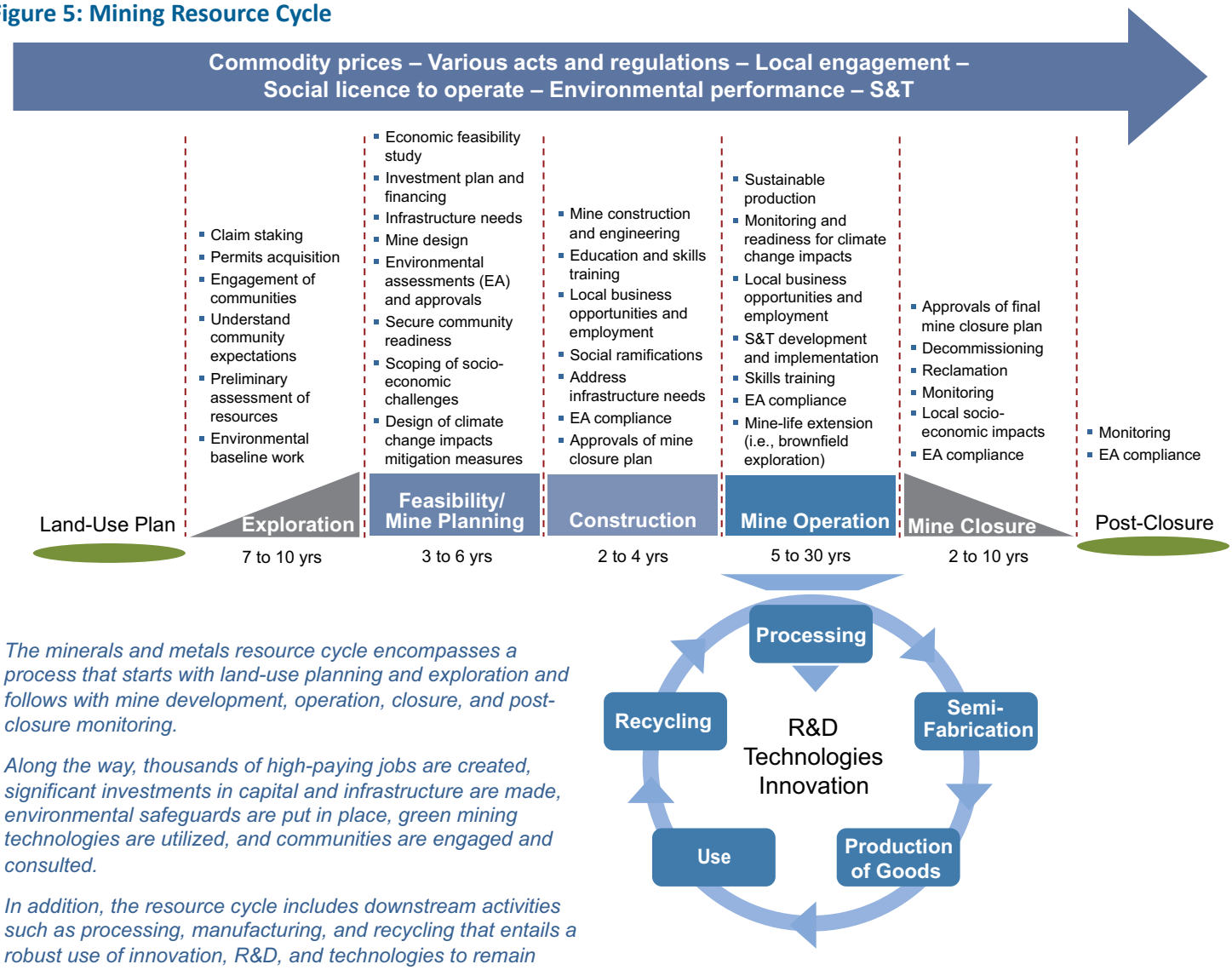
* Employment data for the territories only include Mining and Quarrying (Except Oil and Gas) [NAICS 212] and Support Activities for Mining [NAICS 21311B].

** Due to data confidentiality, employment data for Manitoba, Saskatchewan, and the Atlantic Provinces (except P.E.I., for which data are not available) may be underestimated.

*** Exploration and deposit appraisal expenditures are preliminary.

[12] This value is for domestic exports. The figure for **total exports** is $92.5 billion, and consists of all goods leaving the country through customs for a foreign destination and is the sum of **domestic exports** and re-exports. **Re-exports** refer to the exports of goods that have previously entered Canada and leave in the same condition as when imported.

Figure 5: Mining Resource Cycle



The minerals and metals resource cycle encompasses a process that starts with land-use planning and exploration and follows with mine development, operation, closure, and post-closure monitoring.

Along the way, thousands of high-paying jobs are created, significant investments in capital and infrastructure are made, environmental safeguards are put in place, green mining technologies are utilized, and communities are engaged and consulted.

In addition, the resource cycle includes downstream activities such as processing, manufacturing, and recycling that entails a robust use of innovation, R&D, and technologies to remain competitive, sustainable, and responsible.

SECTION II: ECONOMIC PERFORMANCE

The mining sector[13] makes a significant contribution to Canada's economic growth and prosperity. It contributes directly to the economic viability of several communities across Canada, mostly in rural and remote areas. Beyond the mining operations, the sector contributes significant spin-off benefits to the Canadian economy. There are an estimated 3200 service suppliers (consulting, legal, environmental, and financial services, etc.) that have developed alongside the mining sector. Several of these suppliers have become global leaders in their fields.

Drawing from the Whitehorse Mining Initiative and the Mining, Minerals and Sustainable Development multi-stakeholder frameworks, the Intergovernmental Working Group committee chose the following desired outcome to frame the economic performance of the sector:

Maintain and enhance the vitality of the sector, ensuring its long-term viability and competitiveness, so that it can make an economic contribution to the local, regional, national, and global economies.

The indicators chosen to measure the sector's performance relative to these outcomes are:

- **Value of mineral production** – Value of mineral production measures the volume of commodities mined at the current value of the commodity. It helps in determining the vitality of the sector as it is linked to the revenues being generated.

- **Real Gross Domestic Product (GDP)** – GDP measures the market value of all final goods and services made within the sector. It is one of the primary indicators used to measure economic performance and the contribution of the sector to the economy. Real GDP is adjusted for inflation.

- **International trade** – International trade is the exchange of capital, goods, and services across international borders or territories. Trade is critical to the mining sector and Canada's prosperity, fuelling economic growth, supporting jobs, raising living standards, transferring technologies, and providing affordable goods and services.

- **Exploration and deposit appraisal expenditures** – Exploration activity is necessary to find mineral deposits to support future mining developments and downstream production in Canada. Measuring expenditures in exploration and deposit appraisals provides an indication of the future potential for mining production and downstream activities.

- **Capital expenditures** – Capital expenditures are made by companies to purchase or upgrade physical assets such as property, equipment, or buildings. They help improve an industry's productivity performance. Measuring trends in capital expenditures helps provide an indication of the future competitiveness of a sector.

- **Research and development (R&D)** – Innovation is needed to improve the productivity and competitiveness of the mining sector. R&D expenditures could indicate the extent to which firms are committed to improving production processes and are pivotal to the innovation performance of any industry.

- **Government revenues** – Government revenues from the mining sector are collected through taxes and royalties. Measuring them helps determine the direct contribution of the sector to government finances and some of the compensation received from the extracted resources.

Synopsis

The sector's economic performance from 1998 to 2012 was positive with most indicators trending upwards. Although several indicators fell following the global recession of 2008, they have been quick to recover. The mineral production value numbers are encouraging as high metal prices helped bring mineral production values to an all-time high in 2011. However, the mining sector's real GDP declined overall by 11.1% between 2007 and 2012, but has increased by 15.5% between 2009 and 2012. Prospects for the mining sector in Canada look promising as exploration activity and capital expenditures have both recovered well from the global recession and reached record highs in recent years. However, a bumpy global recovery could put more pressure on mining and exploration investments.

[13] The mining sector includes upstream and downstream industries. Under the North American Industry Classification System (NAICS), it includes the following codes: 212 (mining and quarrying, excluding oil and gas), 327 (nonmetallic mineral product manufacturing), 331 (primary metal manufacturing), and 332 (fabricated metal product manufacturing).

Highlights

- Driven by demand in emerging markets and high commodity prices, the mining sector's **value of mineral production** grew from $18.7 billion in 1998 to $46.9 billion in 2012. However, the value of mineral production declined by 7.9% from the 2011 level of $50.9 billion due to the global economic downturn, which affected the demand for commodities.

- In 2012, the mining sector's **real GDP** reached $53.0 billion, a decrease of 11.1% compared to 2007 ($59.6 billion), which is the earliest year available due to Statistics Canada revisions. Its real GDP was significantly affected by the economic downturn, declining by $12.2 billion (21.0%) between 2008 and 2009. In Canada, the contribution of the sector to GDP has not yet reached the pre-global recession level.

- The value of Canada's **minerals and metals exports**[14] increased by 121% between 1998 ($46.0 billion) and 2011 ($101.9 billion), before falling in 2012 ($92.5 billion). The sector's positive contribution to the **balance of trade** has fluctuated since 2008. It fell from $25.9 billion in 2008 to $11.4 billion in 2009, mainly due to global economic uncertainty and deceleration. It then grew to $24.7 billion in 2011 before declining to $16.7 billion in 2012. For the 1998-2012 period, the sector contributed a cumulative $154.0 billion to Canada's balance of trade.

- **Exploration and deposit appraisal expenditures** increased from $912 million in 1998 to $3.9 billion in 2012. The global recession of 2008 and 2009 led to a significant decline in exploration and deposit appraisal expenditures in Canada. Since 2009, however, these expenditures have seen substantial increases with 2012 expenditures surpassing the 2008 level of $3.4 billion.

Indicator, 1998-2012 (unless otherwise specified)	**Trend**
Value of Mineral Production	
GDP (2007-2012)	
International Trade	
Exploration and Deposit Appraisal Expenditures	
Capital Expenditures	
Research and Development (1998-2011)	
Government Revenues (2000-2011)	

Improved Performance | Limited Improvement | Decline in Performance

- Between 1998 and 2012, **capital expenditures** in the mining sector increased by 137.4% from $9.4 billion to $22.4 billion. Expenditures reached lows in 2002 and 2003 before rising with the boom in commodity prices from 2003 to 2008. They briefly declined from $12.8 billion in 2008 to $10.6 billion in 2009 before continuously increasing to their current level.

- Canada's mining sector **business expenditures on research and development** (BERD) totalled $590 million in 2011, up from $311 million in 1999. However, they have declined in recent years, falling by 21.8% from 2007 ($754 million) to 2011 ($590 million).

- **Government revenues: Corporate income tax** paid to governments by the mining sector in Canada fluctuated from $1.3 billion in 2000 to a high of $2.9 billion in 2006, before falling to $1.7 billion in 2011. **Resource royalties and taxes** paid to the provinces and territories increased from $508 million in 2002/2003 to $2.3 billion in 2011/2012.

[14] For the purpose of this report, total exports were used to maintain consistency with provincial- and territorial-level data.

Value of Mineral Production

Highlights

- Mineral production values have recovered from the global recession and reached an all-time high of $50.9 billion in 2011 before declining to $46.9 billion in 2012.
- While values have risen, production volumes for many minerals and metals did not increase from 1998 to 2012.
- Ontario led all provinces in mineral production value, accounting for 19.5% of total Canadian production in 2012, down from 26.6% in 1998.

Definition

Value of mineral production is a calculation of the volume of commodities mined at the current price of the commodity. It includes metallic and nonmetallic minerals and coal.

Rationale

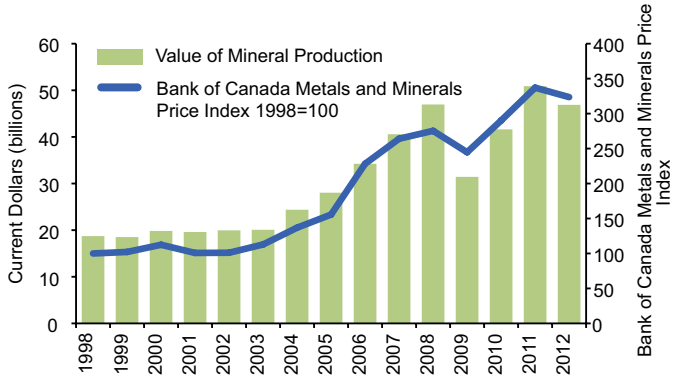
Measuring mineral production value over time helps determine the vitality of the sector as it is linked to the revenues being generated.

Analysis

In 2012, the value of Canada's mineral production was $46.9 billion, a 7.9% decrease from the record level of $50.9 billion reached in 2011 (see Figure 6). Overall, the average annual compound growth rate in the value of mineral production from 1998 to 2012 was 6.8%. Much of this growth can be attributed to the increase in commodity prices, which was driven largely by rapid growth in demand from emerging economies such as China.

Overall, extractive commodity prices have seen a dramatic rise over the past decade. Between 2003 and 2012, the Bank of Canada's Metals and Minerals Price Index[15] grew by 186.7%. Prices jumped in the period between 2003 and 2007, coinciding with double-digit economic growth in many emerging economies, then declined in late 2008 and bottomed out in early 2009 as the global financial crisis and economic slowdown led to destocking and reduced demand. They then resumed their advance before registering a small decline in 2012. The recovery in prices following the global economic downturn was driven by multiple factors, including rapid recovery in economic growth from emerging and developing economies, especially China, which consumed 43% of the world's metal output in 2011[16]; low interest rates; and the quantitative easing of policies in developed economies.

Figure 6: Mining Sector Value of Mineral Production and Price Index, 1998-2012



Sources: Natural Resources Canada; Bank of Canada.

In general, Canadian miners and mineral producers benefited from this general rise in industrial commodity prices. During this period, revenues from Canadian production of copper, iron ore, coal, lead, zinc, and potash rose substantially with little change in production volumes (see Figure 7 and Annex II for value and volume trends for key minerals and metals).

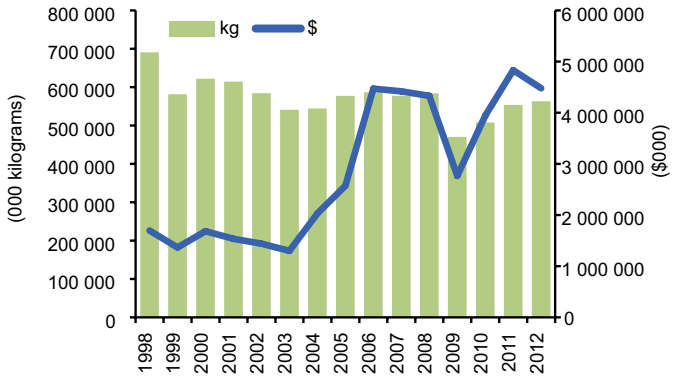
In particular, gold producers have seen substantial revenue increases since 2005, even with declines in production volumes. Gold has important industrial uses, particularly in electronics, but jewellery accounts for a significant proportion of demand. Gold is also held by investors as a hedge against rapid price inflation or currency devaluation in times of economic uncertainty. Silver has not followed this pattern, although it serves some of the same functions as gold. Production declined annually from 2004 to 2010, with revenues declining in tandem since 2006.

[15] The Bank of Canada Metals and Minerals Price Index comprises: Gold (US$/oz), Handy and Harman base price, New York; Silver (US$/oz), Handy and Harman base price, New York; Nickel (US$/lb), London Metal Exchange (LME) cash settlement; Copper(US$/lb), LME cash settlement; Aluminum (US$/lb), LME cash settlement; Zinc (US$/lb), LME cash settlement; Potash (US$/tonne), standard potassium chloride, spot price, f.o.b. Vancouver; Lead, U.S. Bureau of Labor Statistics - Producer Price Statistics; and Iron, U.S. Bureau of Labor Statistics - Producer Price Statistics.

[16] World Bank, *Prospects for Commodity Markets*, June 2012.

Ontario led the provinces and territories with its share of Canadian mineral production ranging from 26.6% in 1998 to 19.5% in 2012. British Columbia, Saskatchewan, and Quebec were the other top provinces in terms of mineral production value, with the four provinces representing over 70% of Canadian mineral production value in 2012 (Table 2).

Figure 7: Canadian Copper Production Volume and Value, 1998-2012



Source: Natural Resources Canada.

Table 2: Value of Mineral Production of Canadian Provinces and Territories, 1998, 2008, and 2012

Province or Territory		1998	2008	2012
Alberta	Value of Production (000)	1 154 132	3 952 089	2 706 136
	% of Total	6.2%	8.4%	5.8%
British Columbia	Value of Production (000)	2 893 284	7 402 675	8 312 335
	% of Total	15.5%	15.8%	17.7%
Manitoba	Value of Production (000)	893 158	1 686 975	1 512 435
	% of Total	4.8%	3.6%	3.2%
New Brunswick	Value of Production (000)	862 992	1 536 973	1 146 424
	% of Total	4.6%	3.3%	2.4%
Newfoundland and Labrador	Value of Production (000)	1 094 534	5 315 760	4 449 397
	% of Total	5.8%	11.3%	9.5%
Northwest Territories	Value of Production (000)	400 768	2 123 469	1 721 815
	% of Total	2.1%	4.5%	3.7%
Nova Scotia	Value of Production (000)	334 952	357 314	313 152
	% of Total	1.8%	0.8%	0.7%
Nunavut	Value of Production (000)	n.a.	12 654	604 665
	% of Total	n.a.	0.0%	1.3%
Ontario	Value of Production (000)	4 977 632	9 561 159	9 162 830
	% of Total	26.6%	20.4%	19.5%
Prince Edward Island	Value of Production (000)	6 499	3 230	4 133
	% of Total	0.0%	0.0%	0.0%
Quebec	Value of Production (000)	3 559 965	6 191 978	8 187 059
	% of Total	19.0%	13.2%	17.5%
Saskatchewan	Value of Production (000)	2 426 484	8 603 948	8 247 464
	% of Total	13.0%	18.3%	17.6%
Yukon	Value of Production (000)	116 614	207 644	509 608
	% of Total	0.6%	0.4%	1.1%
Total		**18 721 015**	**46 955 870**	**46 877 451**

Sources: Natural Resources Canada; Statistics Canada. n.a. Not applicable.

Data Issues

It is important to state that the value of mineral production data is only available in current dollars (not adjusted for inflation) due to the lack of an appropriate deflator. Given this limitation, the Bank of Canada Metals and Minerals Price Index has been included on the graphs and the volume produced and the value have been displayed to highlight the impact of commodity price increases on the value of mineral production.

In addition, data and analysis on the cost of mineral production to represent the other side of the production equation in the sector are limited. Some information shows that the global factors that drove mineral and metal price increases have elevated the cost of purchased materials, energy, and transportation services. Generally, higher metal prices tend to increase treatment and refining charges payable by concentrate producers, and the closure of some Canadian smelters and refineries has increased transportation costs for mines that must now ship to more distant processing facilities. There are also other indications of higher production costs in recent years, including: higher wage costs, skilled labour shortages in the sector, higher equipment services costs driven by increased demand outstripping supply, mining operations moving into more remote locations and/or mining deeper (underdeveloped infrastructure and higher energy costs), and lower-grade ore driving up overall production costs. Currency appreciation has also partially offset the effect of higher metal prices for mines, and especially for smelters and refineries. In both cases, revenues are received in U.S. dollars while operating costs are incurred in Canadian dollars; for smelters and refineries, metal price increases affect the cost of purchased concentrates, as well as the revenues, so currency appreciation has a much stronger impact. As operating profits rise, firms are able to reinvest to grow or sustain the business and to replenish declining reserves by increasing expenditures for mineral exploration and deposit appraisal, capital investment at existing operations, and mine complex development to bring new mines into production.

Gross Domestic Product

Highlights

- The mining sector's real GDP declined by 11.1% between 2007 and 2012.
- The mining sector's contribution to Canada's GDP has been increasing steadily since 2009, accounting for 3.9% in 2011.

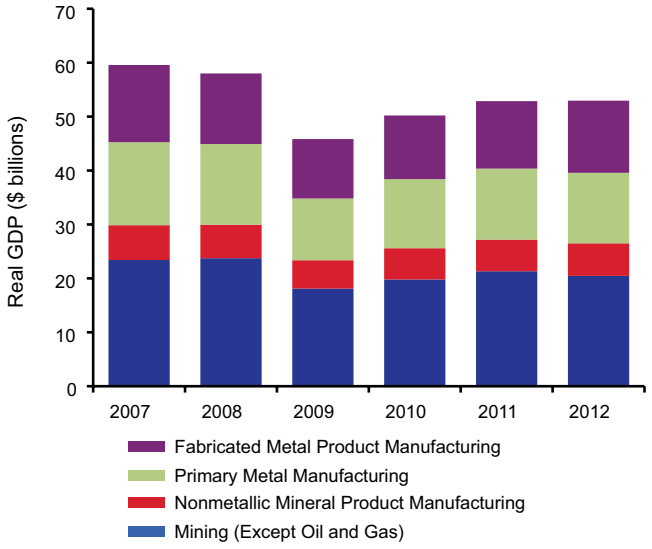
Definition

Gross Domestic Product (GDP) represents the total dollar value of all goods and services produced by an industry. GDP includes only final goods and services; it does not include intermediate goods and services used to make another product. Real GDP is adjusted for inflation using a deflator whereas nominal GDP is expressed in current dollars. Due to revisions by Statistics Canada, the period of analysis is from 2007 to 2012.

Rationale

GDP is one of the most widely used economic indicators. Real GDP data are used in this report to remove the effect of price variations. They are used to aggregate the economic contribution of the mining sector to the overall economy over time.

Figure 8: Mining Sector Real Gross Domestic Product, 2007-2012



Source: Statistics Canada.

Analysis

In 2012, the mining sector's real GDP reached $53.0 billion,[17] a decrease of 11.1% ($6.6 billion) compared to 2007 (see Figure 8). The sector was significantly affected by the economic downturn, as highlighted by a $12.2 billion (21.0%) decline in its real GDP between 2008 and 2009. Furthermore, the sector's share of Canada's GDP decreased from 4.1% to 3.2% between 2008 and 2009.[18] However, the mining sector's contribution to Canada's GDP has been increasing steadily since 2009, accounting for 3.9% in 2011.

At the subsector level, it is worth noting that between 2007 and 2012, the mineral processing industries (primary metal, fabricated metal product, and nonmetallic mineral product manufacturing) were responsible for around 60% of the sector's GDP, compared with 40% for mining (except oil and gas).

Data Issues

It is important to note that Statistics Canada's real GDP data are undergoing historical revisions.[19] Statistics Canada has so far incorporated the revisions back to 2007. As a result, the revised data presented in this section are currently not comparable to data prior to 2007.

International Trade

Highlights

- The value of the mining sector's exports increased by $46.5 billion in nominal terms from 1998 to 2012.
- The mining sector is one of the few industrial sectors that consistently make a positive contribution to Canada's balance of trade, totalling over $152.3 billion since 2001.

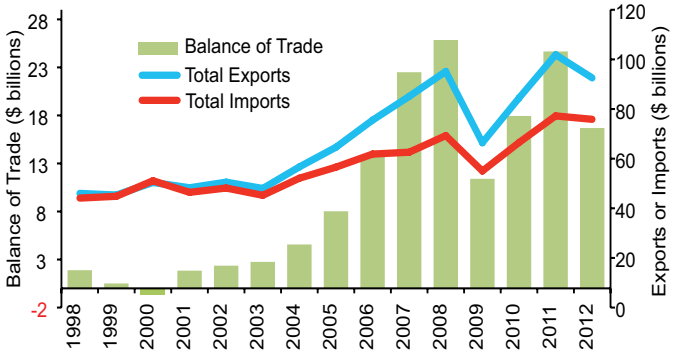
Definition

Trade is measured by the level of industry exports and imports over a given period. Balance of trade is measured by subtracting imports from exports.

Rationale

Canada is an open economy that depends heavily on foreign markets and therefore on international trade. Trade is critical to the mining sector and to Canada's prosperity, fuelling economic growth, supporting jobs, raising living standards, transferring technologies, and providing affordable goods and services.

Figure 9: Mining Sector Trade, 1998-2012



Source: Natural Resources Canada.

Analysis

The value of Canada's minerals and metals exports increased by 121.5% between 1998 and 2011,[20] before falling in 2012 (Figure 9). The mining sector is one of the few industrial sectors that consistently make a positive contribution to Canada's balance of trade (BoT), totalling over $152.3 billion since 2001.[21] The sector's trade surplus grew rapidly between 2003 and 2008 from $2.8 billion to $25.9 billion, coinciding with the dramatic run-up in demand from emerging markets and rising commodity prices. Following the global recession of 2008, the trade surplus fell by 55.9% to $11.4 billion, but it has since increased again to reach $16.7 billion in 2012.

[17] In 2011, the mining sector's nominal GDP reached $62.5 billion. Data for 2012 were not available at the time the report was being prepared.

[18] The mining sector's share of Canada's GDP is calculated using nominal GDP, which captures both changes in production volumes and prices.

[19] Conversion of the industrial structure from the North American Industry Classification System 2002 (NAICS 2002) to NAICS 2007 and a new reference year (2007) for the chained dollars series replaces the 2002 reference year data. Statistics Canada is expected to complete the revision to 1981 later in 2013.

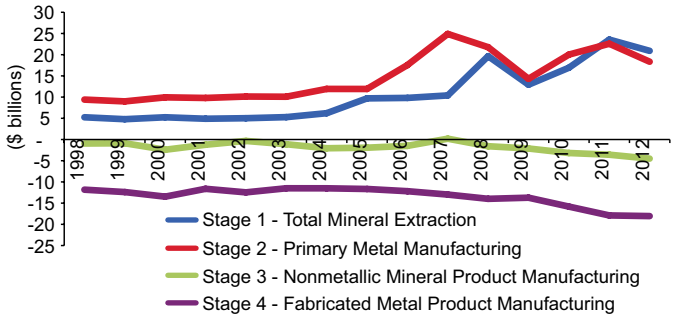
[20] For this section, total exports are used. Total exports include all goods leaving the country for a foreign destination. It consists of the sum of domestic exports and re-exports. Domestic exports consist of the exports of all goods grown, produced, extracted, or manufactured in Canada. Exports of imported merchandise that has been substantially enhanced in value are also included. Re-exports refer to goods that have previously entered Canada and are materially the same product upon leaving the country.

[21] Natural Resources Canada.

On the other hand, at the stage of nonmetallic minerals and fabricated metal manufacturing (turning smelted/refined metal into rods, plates, pipes, wire, and rails for further manufacturing),[22] Canada's BoT was close to zero from 2000 to 2007. Since 2007, that balance has been slightly negative. At the stage of fabricated metal parts, Canada traditionally runs a large negative BoT as the country imports far more than it exports. Since 2000, this negative BoT in fabricated metals has grown larger. The Bank of Canada's April 2013 *Monetary Policy Report* states that overall exports for Canada "are likely to remain below their pre-recession peak until the second half of 2014, owing to restrained foreign demand and ongoing competitiveness challenges, including the persistent strength of the Canadian dollar."[23]

Table 3 shows the top five mineral commodities exported by Canada's mining sector in 1998 and 2012 by value. Between 1998 and 2012, the value of gold exports has increased more than fivefold. As a result, gold is now Canada's most valuable exported mineral commodity.

Figure 10: Mining Sector Balance of Trade, 1998-2012



Source: Natural Resources Canada.

Table 3: Top Five Mineral Commodities Exported by Canada in 1998 and 2012, by Value

1998		2012		Main Destination (2012)
Commodity	$ billions	Commodity	$ billions	
Iron and Steel	10.0	Gold	17.0	U.K. (68.7%)*
Aluminum	7.1	Iron and Steel	13.6	U.S. (84.4%)
Gold	3.4	Aluminum	8.7	U.S. (80.7%)
Coal	2.5	Coal	6.6	Japan (27.9%)
Copper	2.5	Potash and Potassium	6.1	U.S. (54.1%)
Total Exports	**46.0**		**92.5**	**U.S. (50.1%)**

Source: Natural Resources Canada.

* The U.K. is the leading destination for Canadian gold exports as the London Metal Exchange and London Bullion Market are the leading global trading centres for gold.

[22] Trade data are collected using stages that differ slightly from the NAICS codes. Stage I - Primary - involves the discovery of ore, ore extraction, and processing to the concentrate stage. Scrap material, ash, and tailings have been placed in this category. Stage II - Smelting and Refining - refers to the metallurgical extraction process, the product of which is a relatively pure mineral, a metal, or an alloy. Some of the activities related to this stage are smelting and refining, roasting, calcining, direct reducing, and leaching. Products classified under this stage include powders, flakes, dusts, cathodes, ingots, pig, blocks, and plates. Stage III - Semi-Fabricated - involves the manufacturing or processing steps required to bring products to a semi-finished or semi-fabricated stage or form, or to a state for use as input in other industries. Products related to Stage III include rods, plates, sheets, thin strips, pipes, rails, wires, metal-based structural forms, and a number of chemicals and compounds. Ingot moulds are also included. Stage IV - Fabricated - includes products of Stage III that have undergone further processing, such as elements produced by the metal framing industry, hardware items, tools, and cutlery. This stage includes products such as pipe fittings, forged and cast parts, grinding balls, and rail parts.

[23] Bank of Canada, April 2013 *Monetary Policy Report*, Ottawa, www.bankofcanada.ca/wp-content/uploads/2013/01/mpr-2013-04-17.pdf.

Table 4: Canada's International Exports by Province and Territory, and Category,* in 1998 and 2012**

Province or Territory	Coal and Coke ($)		Metals ($)		Nonmetals ($)		Total ($)	
	1998	2012	1998	2012	1998	2012	1998	2012
Alberta	589 310 488	715 335 907	863 560 909	2 393 055 079	965 412 679	1 737 442 324	2 418 284 076	4 845 833 310
British Columbia	1 813 275 672	5 678 885 715	2 436 280 594	4 975 125 204	525 275 330	967 673 705	4 774 831 596	11 621 684 624
Manitoba	37 808	2 045	922 872 503	1 674 086 999	146 269 027	357 640 193	1 069 179 338	2 031 729 237
New Brunswick	-	-	292 518 847	425 491 457	220 790 193	468 751 597	513 309 040	894 243 054
Newfoundland and Labrador	-	-	806 210 987	2 718 525 432	2 957 512	21 349 907	809 168 499	2 739 875 339
Northwest Territories	-	-	269 008 025	98 244 047	43 646 726	1 731 859 158	312 654 751	1 830 103 205
Nova Scotia	2 764	168	120 928 280	196 640 232	115 292 435	48 548 227	236 223 479	245 188 627
Nunavut	-	-	-	1 071 384	-	3 855 039	-	4 926 423
Ontario	103 260 052	371 084 701	19 236 576 271	39 221 476 106	2 738 865 555	3 192 336 536	22 078 701 878	42 784 897 343
Prince Edward Island	-	26 699	4 836 390	5 887 174	7 283 537	4 816 092	12 119 927	10 729 965
Quebec	372 239	2 207 155	9 883 334 498	16 527 172 001	1 531 730 887	1 647 746 390	11 415 437 624	18 177 125 546
Saskatchewan	17 278 839	1 050 657	282 273 646	1 168 432 824	2 061 560 013	5 978 968 930	2 361 112 498	7 148 452 411
Yukon	-	-	187 826	211 586 891	3 345 709	25 321	3 533 535	211 612 212
Total	**2 523 537 862**	**6 768 593 047**	**35 118 588 776**	**69 616 794 830**	**8 362 429 603**	**16 161 013 419**	**46 004 556 241**	**92 546 401 296**

Sources: Natural Resources Canada; Statistics Canada. – Nil or confidential.

Exports are recorded under the jurisdiction where the commodity exits the country. As such, they may not correlate with where the commodity was mined. At this disaggregated level, the tracking of inter-provincial/territorial transactions is more difficult and there is therefore greater room for misallocation among jurisdictions.

* Natural Resources Canada's Trade Retrieval and Aggregation System (TRAGS) allows for aggregation by Harmonized System codes (HS 8 for exports and HS 10 for imports). The advantage to aggregating by HS code is that it captures specific products, providing more complete data across all NAICS codes.

** Some provincial and territorial export numbers may include value from raw materials imported from other provinces as products are only captured once they cross international boundaries. For example, a Stage I product (nickel concentrate from Newfoundland and Labrador) is transported to Ontario for smelting. In Ontario, it is transformed into a Stage II product and exported. Because the final stage of manufacturing occurred in Ontario, the product would be captured as a Stage II product originating in Ontario.

Table 4 shows the value of exports of Canada's mining sector by category: metals, nonmetals, and coal/coke. By value of production, metal ores and manufactures comprise by far the majority of Canada's exports (between 74.0% and 81.6% from 1998 to 2012). Although coal and coke comprised the smallest fraction of exports at 7.3% in 2012, this category has seen the most rapid rise since 1998 (an increase of 168.2%).

The majority of Canada's mineral trade flows to and from Ontario, Quebec, and British Columbia, whose export values may include the value of raw materials imported from other provinces. In 2012, Ontario accounted for 46.2% of exports, Quebec for 19.6%, and British Columbia for 12.6%. Mineral and metal exports also represent a sizeable proportion of total exports from many provinces and territories. For instance, minerals and metals accounted for 99% and 97.5% of the total value of exports of the Northwest Territories and Yukon, respectively.

Exploration and Deposit Appraisal Expenditures

Highlights

- Exploration and deposit appraisal expenditures have recovered well from the recession of 2008 and 2009, and reached $3.9 billion in 2012.
- Canada is the world's most popular exploration target, attracting around 16% of global exploration expenditures in 2012.
- Ontario, Quebec, and British Columbia accounted for over 60% of the exploration expenditures in Canada in 2012.

Definition

Exploration expenditures are the investments or capital allocated to discover a mineral deposit, while deposit appraisal expenditures are the expenditures involved in determining the economic viability of a deposit.

Rationale

Measuring exploration and deposit appraisal expenditures provides an indication of the future potential for mining production and downstream activities.

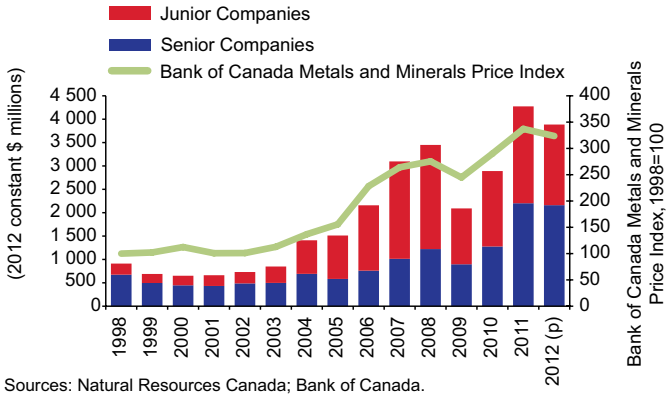
Analysis

The objective of exploration activity is to find significant, economically mineable reserves with minimal impact on the surrounding environment. Exploration and development lead to production, which expands mineral reserve levels. Without sufficient levels of investment in exploration, mine production and the downstream activities of the mine life cycle (smelting, refining, and manufacturing) would be affected.

One measure by which the performance of the exploration sector can be gauged is through exploration and deposit appraisal expenditures,[24] which can also indicate the future performance of Canada's mineral production. Advances in technology, such as GPS surveying, airborne technologies, and down-hole seismic imaging, have allowed the industry to locate deposit that could not have been found using traditional methods.

As shown in Figure 11, the global recession of 2008 and 2009 led to a significant decline in exploration and deposit appraisal expenditures in Canada. Since 2009, however, these expenditures have seen substantial increases with 2011 expenditures surpassing the previous high set in 2008 before falling slightly in 2012.

Figure 11: Exploration and Deposit Appraisal Expenditures by Company Class, With Bank of Canada Metals and Minerals Price Index, 1998-2012



Sources: Natural Resources Canada; Bank of Canada.
(p) Preliminary estimates.

Figure 11 also illustrates the importance of Canada's unique industry structure. Canada is known for its large contingent of junior mining companies,[25] who in recent years have conducted the bulk of exploration activity in Canada and were the main drivers of increased investment in exploration and deposit appraisal between 2004 and 2008. For each year during this period, junior companies accounted for more than half of exploration and deposit appraisal expenditures. Junior companies tend to focus on "greenfield" exploration (new discoveries) as opposed to "brownfield" exploration (around existing discoveries). However, in more recent years, the junior companies'

[24] Exploration expenditures are defined as spending on activities up to and including the first delineation of a previously unknown mineral deposit or the re-evaluation of a sub-marginal one. Deposit appraisal expenditures are defined as spending on activities that bring a delineated deposit to the stage of detailed knowledge required for a production feasibility study.

[25] The following criteria define a junior company: it is neither a producing company nor the recipient of significant income from production or from some other business venture; exploration funding does not come largely from accumulated cash flow from previous production or from the investment income from such funds; the exploration funds are not provided by a senior company that controls more than half of the issued shares of the subsidiary company in question; the principal way of raising exploration funds is the issue of treasury shares; the company is not primarily an oil and gas producer, nor is it the exploration arm of a large company; and it is not a government organization (Source: Natural Resources Canada, www.nrcan.gc.ca/minerals-metals/statistics/4350).

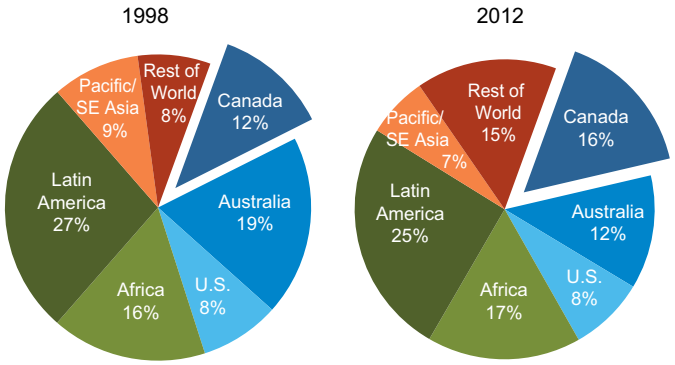
share of total spending has shrunk to below 50% as a result of their dependence on equity financing and the difficulty in accessing this type of capital during periods of economic uncertainty. This is consistent with previous cyclical downturns in the industry where exploration by major mining companies will come to constitute a higher percentage of total exploration expenditures in Canada.

On the other hand, senior companies[26] typically have greater financial resources and the technical expertise required to address the challenges associated with moving projects to the production stage. In recent years, senior companies have acquired a number of advanced exploration projects.

Figure 11 also highlights that there is a strong correlation between commodity prices and exploration activities; that is, mineral and metal prices are a key driver of exploration spending. At a time when European and North American economies are still recovering from the recent global recession, commodity demand from emerging economies, such as China, remains an important determinant of exploration activity in Canada.

The country's mineral potential has helped make Canada the world's number one exploration target for many years, including 2012 when it attracted 15.8% of global exploration expenditures, up from 12.0% in 1998 (Figure 12). Canada's policies towards mining also contribute to making the country a favourable destination for investment. As demonstrated in the Fraser Institute's Survey of Mining Companies,[27] Canadian provinces and territories consistently rank among the most attractive jurisdictions for mineral exploration and development. Over the past six years, at least 8 Canadian jurisdictions were ranked among the top 20. In the 2012/2013 survey, Alberta (3rd), New Brunswick (4th), Yukon (8th), Quebec (11th), Nova Scotia (12th), Saskatchewan (13th), Ontario (16th), and Newfoundland and Labrador (18th) ranked among the top 20. In the long term, it is expected that Canada's potential for resource development and competitive mineral investment climate will continue to generate significant levels of investment in exploration across the country and for a broad range of mineral commodities.

Figure 12: Canada's Share of Global Exploration Expenditures, 1998 and 2012



Source: SNL Metals Economics Group.

Precious metals (mainly gold) were by far the most important commodity group in terms of exploration expenditures from 1998 to 2012. However, in more recent years, other commodity groups, including coal, potash, iron ore, and other metals such as chromite and rare earth elements, have started to emerge as important exploration targets (Figure 13).

In terms of regional distribution, during the late 1990s and early 2000s, exploration and deposit appraisal expenditures were concentrated in Ontario, Quebec, and the Northwest Territories. Toward the mid-2000s, as commodity prices increased, all jurisdictions began seeing dramatic year-over-year increases in exploration spending. However, spending dropped in all jurisdictions in 2009 as a result of the global recession before rebounding in 2010 and 2011 (Figure 14). Adjusted for inflation, from 1998 to 2012, almost all jurisdictions[28] experienced positive average annual growth in exploration spending with the most dramatic rate of 18.1% occurring in Nunavut,[29] closely followed by British Columbia at 17.7%.

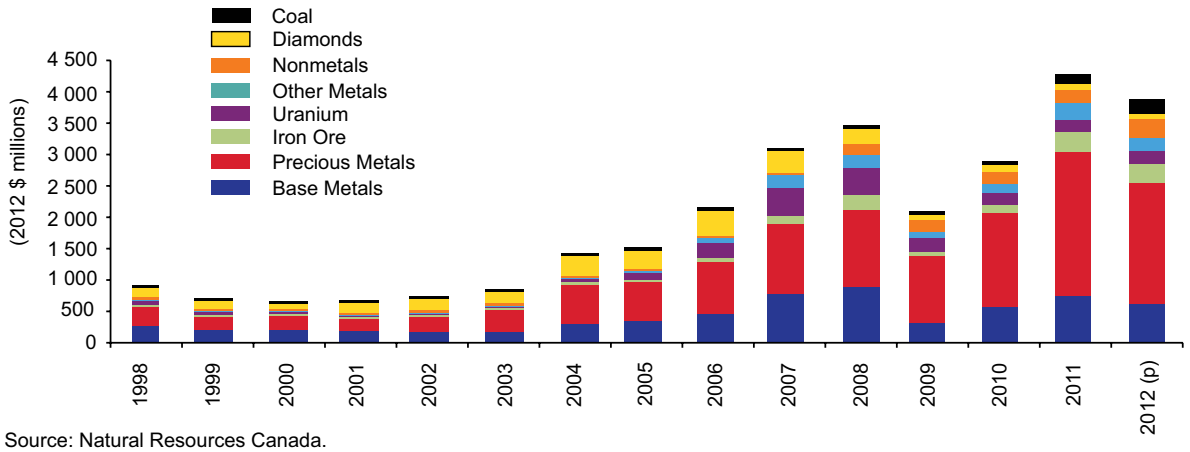
[26] Senior companies normally derive their income from mining or other business ventures (they need not be mining companies) rather than from the issue of treasury shares (Source: Natural Resources Canada, www.nrcan.gc.ca/minerals-metals/statistics/4350).

[27] www.fraserinstitute.org/research-news/display.aspx?id=19401.

[28] With the exception of Alberta and the Northwest Territories.

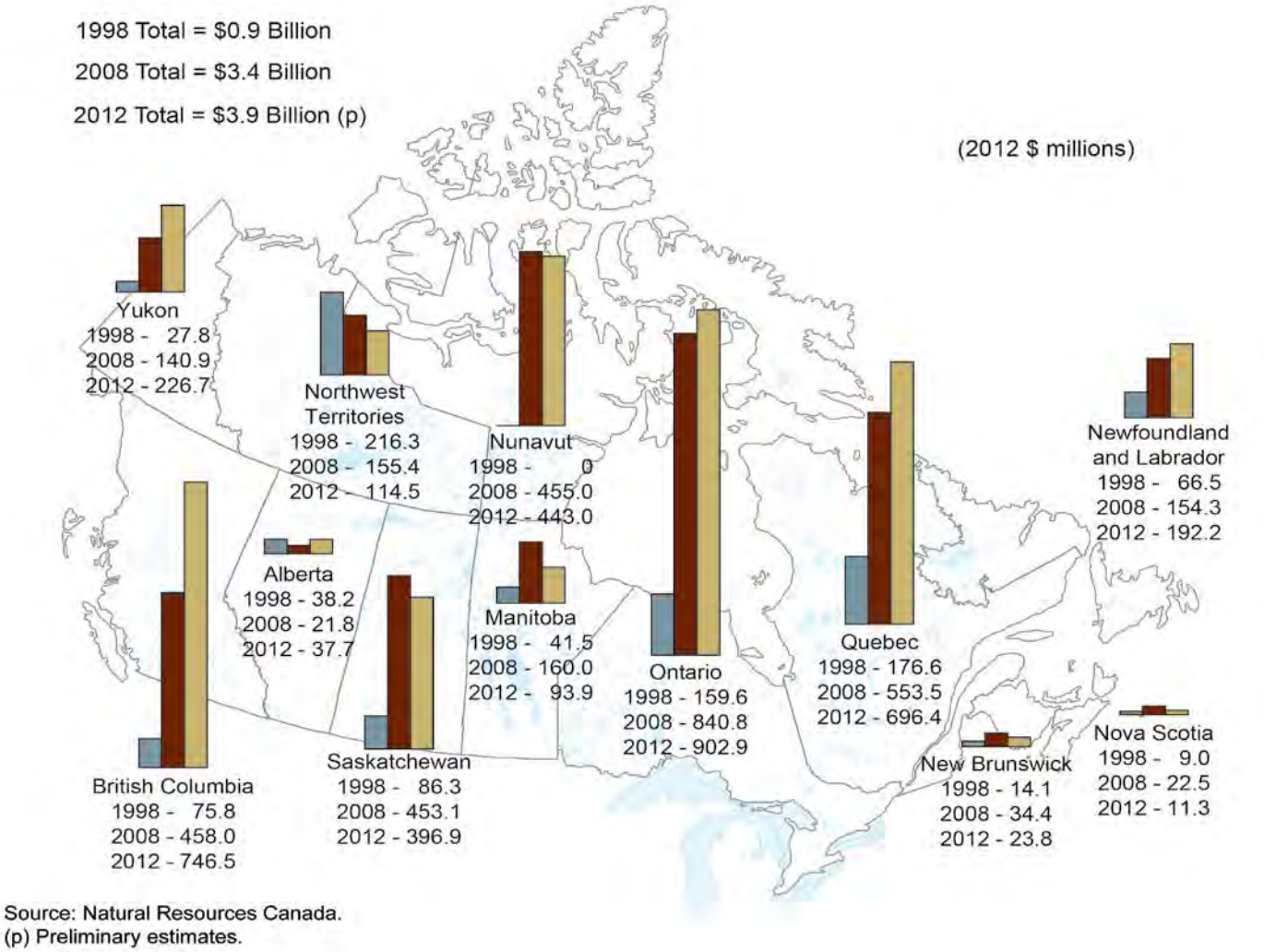
[29] Nunavut was established as a territory on April 1, 1999, by the *Nunavut Act*; therefore, the average annual growth rate for the territory is calculated for the period 1999 to 2012.

Figure 13: Mineral Exploration and Deposit Appraisal Expenditures, 1998-2012



Source: Natural Resources Canada.
(p) Preliminary estimates.

Figure 14: Exploration and Deposit Appraisal Expenditures, by Province and Territory, 1998, 2008, and 2012[30]



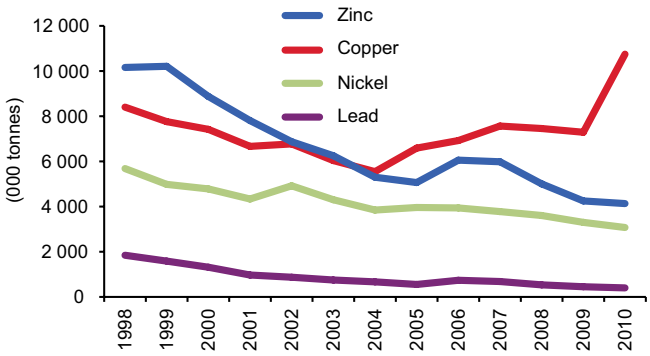
Source: Natural Resources Canada.
(p) Preliminary estimates.

[30] On April 1, 1999, the new Canadian territory of Nunavut was created by dividing the landmass previously known as the Northwest Territories into two distinct territories: Nunavut and the Northwest Territories. Therefore, there were no exploration statistics for Nunavut in 1998.

Reserves

Mineral exploration and deposit appraisals are key to improving Canada's metal reserves. Base-metal reserves have been on long-term declining trends. From 1998 to 2008, reserves dropped by 71% for lead, 51% for zinc, 37% for nickel, and 11% for copper (Figure 15).

Figure 15: Canadian Reserves of Selected Metals, 1998-2010



Source: Natural Resources Canada.

However, recent strong metal prices, robust demand from emerging economies, and record-setting exploration and deposit appraisal activity have slowed, and in some cases reversed, this long-term decline in base-metal reserves for some commodities. For instance, from 2008 to 2010 (the most recent year for which data are available), copper reserves increased by 44%, largely the result of expansions at existing mines such as Gibraltar and Highland Valley and the advancement of development projects such as Mount Milligan, Copper Mountain, and New Afton, all in British Columbia. Mineral resources at existing mines and in advancing mineral exploration projects can also potentially contribute to an improvement in base-metal ore reserves.

Box 3: Mineral Resources vs. Reserves

Resources: A concentration of material of economic interest in such a form, quality, and quantity that it has a reasonable prospect of economic extraction. It can be classified as inferred, indicated, or measured.

Reserves: The economically mineable part of a measured and/or indicated resource demonstrated by at least a prefeasibility study. It can be classified as probable or proven.

Source: Canadian Institute of Mining, Metallurgy, and Petroleum Standards on Mineral Resources and Reserves, http://web.cim.org/standards/MenuPage.cfm?sections=177&menu=178

Capital Expenditures

Highlights

- Capital expenditures in the mining sector increased by 137.4% between 1998 ($9.4 billion) and 2012 ($22.4 billion).
- Since 2008, capital expenditures have increased by 75.5%.
- In 2012, around 75% of the mining sector's capital expenditures occurred in the mining and quarrying subsector.

Definition

Capital expenditures are expenditures made by a company to purchase or upgrade physical assets such as property, equipment, or buildings.

Rationale

Changes in the level of capital expenditures can be an indicator of managers' and investors' confidence in current capacity and future demand.

Analysis

Capital expenditures in mining and quarrying are closely linked to mine capacity. Total sector capacity is in turn dependent on some factors whose influence changes over the business cycle.[31] Factors that tend to reduce capacity are permanent closures, temporary shut-downs or closures, and the erosion of some mines' ability to produce without a direct change in capacity (such as ore depletion). Elements leading to an increase in capacity are re-openings of mines that were temporarily closed, expansion of existing mines' milling capacity, and new mine start-ups. Mining company executives make decisions on these factors based on their estimates of future commodity prices and supply and demand conditions.

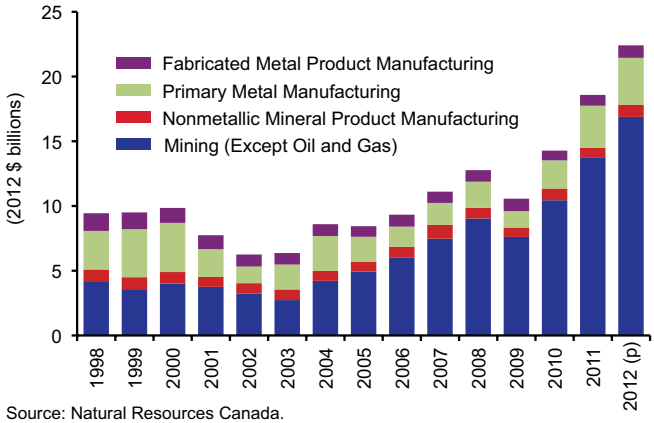
Capital expenditures in the mining sector reached a low in 2002 and 2003 (see Figure 16). They then rose with the boom in commodity prices before a brief decline during the global recession in 2008 and 2009. In 2012, capital expenditures reached $22.4 billion, an increase of $11.8 billion over 2009.[32] The rebound in commodity

[31] Crowson, Phillip, *Mining Unearthed* (Aspermont, U.K., 2008), p. 149.

[32] Using 2012 dollars.

prices following the global recession in 2008/2009 had a profound impact on mining investment in Canada. A number of advanced exploration/deposit appraisal projects progressed to the capital-intensive mine complex development stage. This includes significant investment in potash, uranium, and precious metals projects.

Figure 16: Mining Sector Capital Expenditures, 1998-2012

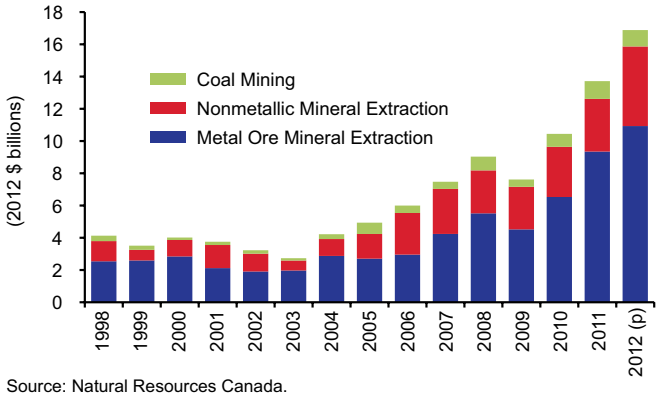


Source: Natural Resources Canada.
(p) Preliminary estimates.

Canada has a comparative advantage in the "upstream" part of the minerals value chain: extraction and smelting. As can be seen in Figure 16, the increase in capital expenditures since 2003 has been mostly at the mineral extraction stage ($14.2 billion). However, there has been a sizeable increase of $2.4 billion in primary metal manufacturing (i.e., smelting and refining) capital investment from 2009 to 2012. Over 90% of capital investment from 2010 to 2012 was focused in mining and primary metal manufacturing.

When looking at capital expenditures at the extraction stage by metal, mineral, or coal, all types have seen significant increases from 1998 to 2012 (see Figure 17). Since a cyclical low in 2009, capital investment in the metal ore sector has more than doubled. Much of this increase is attributable to gold and silver ore extraction, which witnessed a sustained period of robust prices, and to large iron ore projects that are nearing completion.

Figure 17: Mineral Extraction Capital Expenditures by Commodity Group, 1998-2012



Source: Natural Resources Canada.
(p) Preliminary estimates.

Capital investment in the nonmetallic mining sector also continued its upward trend since 2009. This trend stems largely from the strength of substantial investment increases in the potash industry and, secondarily, the diamond industry. Capital investment in the coal mining industry is more cyclical, but has also seen substantial growth over this period.

Data Issues

Investments in infrastructure to specifically support mining development are critical to the future of Canadian mining, particularly for remote and northern mining operations. These types of infrastructure expenditures are not currently tracked or collected at the national level or across mining projects with sufficient consistency to fully understand the performance of the sector in meeting infrastructure challenges.

Research and Development

Highlights

- Canada's mining sector business expenditures on R&D (BERD) totalled $590 million in 2011. While the sector's BERD have increased by 89.7% ($279 million) compared to 1999, they have diminished by 21.8% ($164 million) compared to their peak of $754 million in 2007.
- The majority of R&D expenditures (83.2%) and personnel (92.3%) are from the mineral processing subsectors.

Definition

Research and development (R&D) encompasses all activities undertaken to discover or develop new processes or products. R&D expenditures are defined as expenditures for R&D work performed within the company, including work financed by others.[33] R&D is used as a proxy to measure innovation, which is essential to the long-term competitiveness of the sector.

Rationale

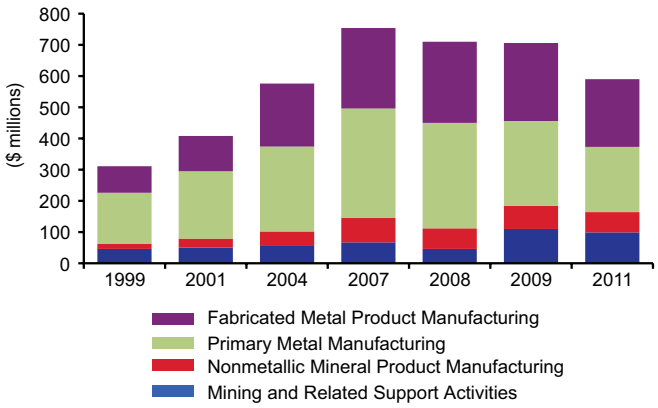
R&D is important because it plays a key role in the innovation process. R&D activity demonstrates the extent to which firms are committed to new or improved production processes and is pivotal to the innovation performance of any industry. R&D is important for a company and industry to remain competitive, minimize costs, and improve profitability in the long term.

Analysis

Innovation is increasingly perceived as essential for tackling economic, environmental, and social challenges that have an impact on the sustainable development of mineral resources. Economically, innovation is important to enhance productivity, address skilled labour shortages, develop the technologies necessary to extract mineral resources in more difficult conditions (i.e., frontier mining, deep mining), and enhance profitability and efficiency throughout the mining cycle. Environmentally, innovation is important to mitigate and adapt to the adverse impacts of climate change on the mining sector; develop new technologies and materials that are safer, lessen GHG emissions, and promote energy efficiency; minimize the environmental footprint; and improve resource management (i.e., more efficient water, energy, and infrastructure utilization) throughout the mining cycle. Socially, innovation is important to gain legitimacy in resource development; minimize community disruption or opposition; improve the image of mining through green technologies, practices, and processes; and establish the early engagement of communities through new social practices to improve external relations, mutual understanding, and inclusive benefits.

Canada's mining sector business expenditures on R&D (BERD) totalled $590 million in 2011.[34] Of note, 83.2% ($491 million) of these expenditures were from the mineral processing stages of the mining sector (primary metals manufacturing, nonmetallic mineral product manufacturing, and fabricated metal product manufacturing).[35] While the sector's 2011 BERD have increased by 89.7% ($279 million) compared to 1999, they have diminished by 21.8% ($164 million) compared

Figure 18: Mining Sector Business Expenditures on R&D, 1999-2011



Source: Statistics Canada, CANSIM Table 358-0024.

[33] Statistics Canada, CANSIM Table 358-0024.

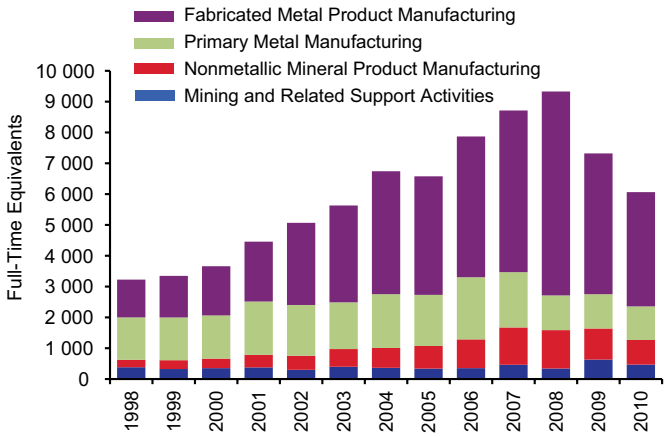
[34] Statistics Canada's dataset groups NAICS codes 212 (mining and quarrying, except oil and gas), 213117 (contract drilling, except oil and gas), and 213119 (other support activities for mining, including exploration, excluding surveying for oil and gas).

[35] Statistics Canada, CANSIM Table 358-0024.

to their peak of $754 million in 2007[36] (Figure 18). As a ratio, BERD reached 1.2% of the sector's nominal GDP in 2007 and only 0.94% in 2011.

A total of 6064 R&D personnel were working in Canada's mining sector in 2010, the latest year for which statistics are available.[37] Of note, 92% (5595) of these R&D personnel worked in the mineral processing stages of the mining sector. There was a noticeable upward trend in persons employed in R&D in the mining sector from 1998 to 2008.[38] However, the trend reversed in 2009 and 2010 (see Figure 19).

Figure 19: Mining Sector R&D Personnel, 1998-2010



Source: Statistics Canada, CANSIM Table 358-0024.

Data Issues

Statistics Canada's data for BERD contain several years with gaps based on confidentiality and/or unreliable data due to an inadequate response rate. Data on BERD contained in this section are only presented for years where the data were available for all subsectors. Exploration could also be viewed as R&D in the mining sector; however, the figures here do not include exploration expenditures as these have been discussed in the exploration section. Other indicators to measure the sector's innovation performance are needed to develop a more comprehensive analysis.

Box 4: Canada Mining Innovation Council (CMIC)

CMIC is a partnership of the mining industry, mining research community, and governments with a focus on defining and promoting the research needed by Canada's mining sector. CMIC has grown from 11 to 85 member organizations in the past year, and includes most of the major mining companies, universities with mining engineering or related departments, and provincial/territorial governments in Canada. CMIC has established effective partnerships with key national associations, including The Mining Association of Canada (MAC), the Prospectors and Developers Association of Canada (PDAC), and the Canadian Institute of Mining, Metallurgy and Petroleum (CIM).

CMIC's objective is to provide the Canadian mining industry with the technology and methodology it will need to remain competitive and economically viable while also meeting social expectations for environmental performance and safety.

CMIC has implemented major research initiatives in exploration, mining extraction, mineral processing, environmental stewardship, and energy management. It has also initiated a program on human resource needs in the sector to deal with the impending labour shortfalls.

CMIC recently received a Natural Sciences and Engineering Research Council of Canada grant to support the Exploration Footprints Program in researching the linkages between different kinds of geological, mineralogical, geochemical, and geophysical data at three of Canada's important ore deposit types.

Source: http://merc.laurentian.ca/cmic-nserc-exploration-footprints-program

[36] Statistics Canada's data on BERD are either unavailable or too unreliable to be published for various years, hence the comparison between a few selected years with reliable data.

[37] Statistics Canada, CANSIM Table 358-0024.

[38] Data for 2008 for the primary metal (ferrous) subsector are not available.

Government Revenues

Highlights

- Between 2000 and 2011, the mining sector generated $20.0 billion in corporate income tax ($12.9 billion to the federal government and $7.1 billion to provincial governments).[39]
- Mining royalties and resource taxes paid to governments have more than quadrupled from $508 million in 2002/2003 to $2.3 billion in 2011/12.[40]

Definition

Government revenues from the mining sector include corporate income tax, mining taxes, and royalty payments to provincial and federal governments. Corporate income tax data in this section are from 2000 to 2011 while provincial mining and royalty tax data are from 2002/2003 to 2011/2012.

Rationale

Taxes paid to governments are a significant part of a sector's contribution to the national economy and a way for Canadians, present and future, to receive revenue from the extraction of mineral resources.

Analysis

The Government of Canada reduced the corporate income tax rate from 29.1% in 2003 to 15.0% in 2012. As shown in Table 5, seven provinces and territories have also reduced their corporate income tax rates since 1998 (highlighted in blue). As a result, the mining sector in Canada benefits from one of the most internationally competitive and attractive tax regimes for mining and mineral exploration companies. This includes the lowest statutory corporate income tax rate in the G7 countries, profit-based royalty systems, carry-forward and carry-back provisions, and tax incentives for exploration such as flow-through shares.[41]

Table 5: Canadian Federal and Provincial/ Territorial Corporate Income Tax Rates

	1998	2008	2011
Federal	29.12%	19.50%	16.50%
Alta.	15.50%	10.00%	10.00%
B.C.	16.50%	11.50%	10.00%
Man.	17.00%	13.50%	12.00%
N.B.	17.00%	13.00%	10.50%
N.L.	14.00%	14.00%	14.00%
N.W.T.	14.00%	11.50%	11.50%
N.S.	16.00%	16.00%	16.00%
Nun.*	n.a.	12.00%	12.00%
Ont.	15.00%	12.00%	10.00%
P.E.I.	15.00%	16.00%	16.00%
Que.	9.15%	11.40%	11.90%
Sask.	17.00%	12.50%	12.00%
Yukon	15.00%	15.00%	15.00%

*Nunavut was established as a territory on April 1, 1999, by the *Nunavut Act*. n.a. Not applicable.
Source: Natural Resources Canada.

Generally, the mining taxes in Canada are based on net income rather than revenue, although five provinces[42] have a two-tier system in which a small percentage of operating income is taxed before taxing the net income.

Also of note is Canada's unique flow-through share (FTS) mechanism that allows a principal business corporation to obtain financing for expenditures on mineral exploration and development in Canada. FTS investors can receive a 100% tax deduction for the amount of money invested in flow-through shares. In addition, this incentive has been further enhanced by the Government's extension until March 31, 2014, of the 15% Mineral Exploration Tax Credit (METC) on eligible expenditures. The METC was introduced in October 2000 to encourage greenfield mineral exploration. Furthermore, several provinces are also offering additional tax credits to flow-through share investors to encourage exploration investment in their jurisdictions.

Corporate income tax paid to governments by the mining sector in Canada has fluctuated significantly between 2000 (earliest available data) and 2011, reaching a high of $2.86 billion in 2006 and a low of

[39] The year 2000 was the first year corporate income tax data were available.

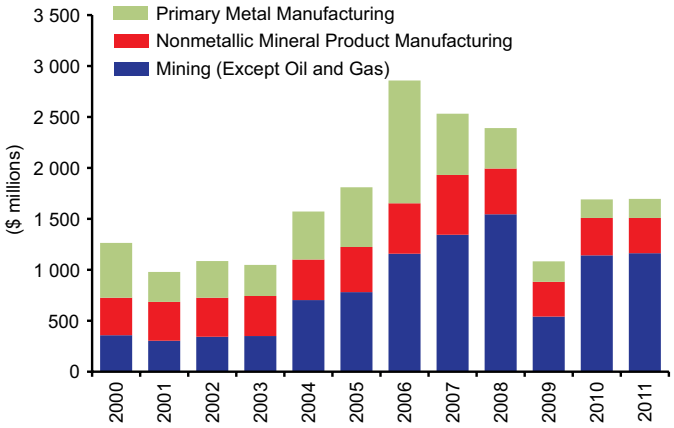
[40] Data on mining royalties and resource taxes are from the ENTRANS Policy Research Group Inc. report *Revenues to Governments From the Canadian Mineral Sector 2002-2011*, which has data from 2002/03 to 2010/11. Data for 2011/12 are from provincial budgets for fiscal year 2011/12 and from NRCan estimates.

[41] www.nrcan.gc.ca/minerals-metals/business-market/4048.

[42] Alberta, British Columbia, New Brunswick, Newfoundland and Labrador, and Nova Scotia currently have a two-tier mining royalty system. In May 2013, the Government of Quebec announced a new mining tax regime effective January 1, 2014. Companies will pay the higher of a minimum mining tax on value of production, which will vary from 1% to 4%, or a tax on profits ranging from 16% to 22.9%.

$979 million in 2001 (see Figure 20).[43] In 2011, the corporate income tax paid amounted to $1.70 billion, an increase of $613 million (56.6%) from 2009.

Figure 20: Mining Sector Corporate Income Tax, 2000-2011

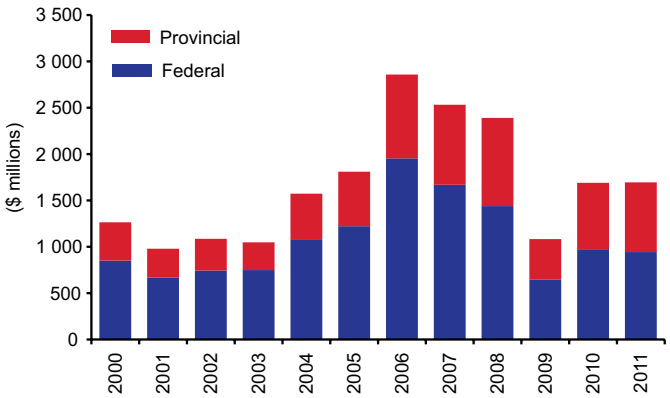


Source: Statistics Canada, CANSIM Table 180-0003.

With federal corporate income tax rates declining from 29.1% in 1998 to 16.5% in 2011, the provinces and territories have had an increasing share of corporate income tax revenues in recent years from all of the mining sector stages. For instance, in the mining and quarrying stage, the share of the provincial/territorial corporate income tax to total corporate income tax increased from 28.8% in 2000 to 46.0% in 2011.

Between 2000 and 2011, the mining sector generated $20.0 billion in corporate income tax ($12.9 billion to the federal government and $7.1 billion to provincial/territorial governments) (see Figure 21). Furthermore, mining royalties paid to governments have more than tripled from $508 million in 2002/2003 to $2.3 billion in 2011/2012 (see Table 6).

Figure 21: Mining Sector Corporate Income Tax, Federal-Provincial, 2000-2011



Source: Statistics Canada, CANSIM Table 180-0003.

Although it is not captured with statistics in this section, it is important to note that mining sector contributions to government revenues extend beyond just corporate income tax and royalties. Mining sector activity drives other economic activity that contributes to government revenue, including: sales taxes on goods and services purchases, employee income taxes, contributions to the Canada Pension Plan and the Quebec Pension Plan, and property taxes to municipalities. For example, it is calculated[44] that mining sector employees paid over $1.6 billion[45] in personal income tax in 2011, making the revenues generated from mining activities significant to the fiscal stability of governments and to the services they provide.

[43] Taxation data for the fabricated metal product manufacturing subsector (NAICS 332) are not provided in a desegregated manner.

[44] ENTRANS Policy Research Group Inc., www.mining.ca/www/media_lib/MAC_Documents/Publications/2012/ENTRANS%202012%20Report.pdf.

[45] Data do not include the fabricated metal product manufacturing subsector (NAICS 332).

Table 6: Royalties, Mining Taxes, and Similar Payments to Provinces and Territories, 2002/2003 to 2011/2012 ($ millions)

Province or Territory		02/03	03/04	04/05	05/06	06/07	07/08	08/09	09/10	10/11	11/12
Alberta	Coal Royalties	10.0	9.0	11.0	11.0	16.0	14.0	34.0	27.0	31.0	42.0
British Columbia	Mineral Tax and Mineral Land Tax	55.2	69.6	109.4	229.3	303.5	202.5	324.4	292.1	364.5	357.7
Manitoba	Mining Tax	18.2	17.7	57.9	57.9	41.1	107.1	65.0	10.0	21.0	35.0
New Brunswick	Metallic Minerals Tax	5.7	2.2	2.8	10.5	120.2	119.7	137.7	43.8	20.0	48.0
Newfoundland and Labrador	Mining and Mineral Rights Tax	17.3	16.0	14.4	21.0	53.1	276.6	302.7	138.9	171.9	287.7
Northwest Territories and Nunavut	Royalties From Mineral Resources	14.8	47.9	139.6	64.3	8.6	61.9	110.0	90.4	108.0	131.2
Nova Scotia	Gypsum Tax, Coal Royalties	1.6	1.6	2.0	2.1	2.7	3.1	3.0	2.2	1.4	1.2
Ontario	Mining Tax	41.0	51.0	29.0	51.0	147.0	231.0	73.0	16.0	72.0	180.0
Quebec	*Mining Duties Act* and *Mining Act*	28.8	13.5	26.1	55.3	55.7	102.1	31.3	114.2	323.7	353.0
Saskatchewan	Potash, Uranium and Other Minerals Royalties Plus Portion of Resource Surcharge	315.6	242.6	442.3	482.0	328.8	518.9	1 895.3	86.5	649.9	829.3
Yukon	Land and Mineral Leases and Royalties	0.1	0.3	0.3	0.2	0.2	0.3	0.1	0.3	0.3	0.2
Total		**508.3**	**471.4**	**834.8**	**984.6**	**1 076.9**	**1 637.2**	**2 976.5**	**821.4**	**1 763.7**	**2 265.3**

Sources: ENTRANS Policy Research Group Inc., *Revenues to Governments From the Canadian Mineral Sector 2002-2011*, September 2012; provincial budgets; NRCan estimates.

SECTION III: SOCIAL PERFORMANCE

The mining sector can have a variety of social impacts, both positive and negative. Mining development and production can provide significant employment opportunities and economic spinoff. This economic activity has the potential to improve the quality of life through improved infrastructure, access to energy, or education opportunities. However, mining sector operations can also bring change to a community's identity and lead to increases in crime and the cost of living in the area.[46] In addition, communities that depend on mining to sustain their economies are especially vulnerable to negative social impacts when the mine closes. In this regard, transparency and communication with local communities must be ensured throughout the mining cycle to earn and maintain a social licence to operate and maximize mutual benefits. Failure to do so can have a negative impact on a project and on a mining company's profitability and competitiveness. Corporate social responsibility implies that local benefits in the form of jobs, business development, and broader economic opportunities are available to local communities while minimizing environmental impacts in the surrounding areas. Therefore, understanding the social dimensions of mining is essential to ensure that best practices, policies, and approaches are shared among participants and stakeholders.

The outcomes and indicators in this section have been developed to help measure the sector's social performance. From the assessment of the various multi-stakeholder frameworks in developing the report, the overall desired outcomes chosen to frame social performance are:

The development of Canada's mineral resources will result in tangible benefits for current and future generations, including local communities in the proximity of exploration and mining activities.

Engagement processes ensure that local communities have the opportunity to participate in the development of resources that could influence their future.

The indicators[47] being used to measure the sector's performance relative to these outcomes are:

- **Employment (Aboriginal and non-Aboriginal)** – Employment in the mining sector provides income security, an improved standard of living, and the acquisition of transferable skills. Measuring the sector's level of employment helps assess one of the most important socio-economic contributions provided to communities.

- **Agreements between mining companies and Aboriginal peoples or governments** – Agreements have helped secure benefits for local Aboriginal communities and businesses, and provide certainty for exploration and mining companies. Monitoring the number of agreements gives an indication of the mining sector's efforts to earn a social licence to operate.

- **Government funding for public participation in environmental assessments** – Environmental assessments examine a comprehensive list of potential factors in natural resource development, including the cumulative effects of the proposed project, measures to mitigate those effects, and concerns and comments raised by the public. Efforts to include community groups in environmental assessments are a key indicator of social inclusion.

- **Gender equality** – Gender equality is the measurable representation of women and men. It is one of the indicators that can help assess the mining sector's level of inclusiveness.

- **Workplace health and safety** – Workplace health and safety is measured as the injury rate, both fatal and non-fatal. Measuring it helps determine the mining sector's level of performance in ensuring safe and healthy work environments.

- **Mine closures and openings** – Mine closures and openings can result in significant socio-economic impacts, both positive and negative, including changes in employment, government revenues, population, and economic activity in the local area. Monitoring is important given the potential for significant impacts on local communities. However, the concept of "mining communities" is changing

[46] Natural Resources Canada, *The Social Dimension of Sustainable Development and the Mining Industry*, www.nrcan.gc.ca/minerals-metals/policy/sustainable-development/social-dimension/3363.

[47] The authors acknowledge that the indicators presented in the report are not currently sufficient to measure all of the social implications of mining, either positive or negative. Efforts will be made in future reports to collect reliable and credible data to improve this section.

as new mines are developed in more isolated areas that require fly-in, fly-out operations, particularly in the North. These mining operations draw from several communities rather than from one nearby town, changing the more traditional view of "mining communities" and making the ramifications of closures on communities more widespread.

- **Labour stoppages** – Strikes and lockouts are the result of grievances between employees and the employer. Regardless of the reason for the strike or lockout, it can have a negative impact on the industry, the workers, and the local community.

Synopsis

Overall, the sector's social performance was variable between 1998 and 2012. Employment numbers have been gradually declining since the late 1990s and have not recovered with the increases in value of mineral production and other economic indicators. This decline has mainly been in the metal manufacturing subsectors, while employment in the mining and quarrying subsector has increased slightly. Aboriginal employment in recent years followed a similar trend, and only has recently recovered from the economic downturn of 2008 and 2009. On the other hand, the sector has performed well in reaching agreements with Aboriginal peoples and in providing a stable and safe workplace.

Highlights

- The number of people **employed** in the mining sector went from 378 839 in 1998 to 329 939 in 2012, a reduction of 48 900 (12.9%). Most of these losses can be attributed to losses in the primary metal and fabricated metal manufacturing subsectors. Of note, employment decreased to a low of 307 802 in 2010 and has been increasing gradually since then. However, employment in the mining and quarrying subsector has increased during this period.

- Between 2007 and 2012, the number of **Aboriginal peoples employed** in the mining sector increased from 9039 to 10 300. During the economic downturn of 2008 and 2009, Aboriginal employment decreased by 2846. However, between 2011 and 2012, it increased by 2446, or 31.1%.

- The number of **agreements signed between mining companies and Aboriginal communities** has increased significantly since the late 1990s with a total of 297 signed between 1998 and 2012, compared to 38 before 1998.

Indicator, 1998-2012 (unless otherwise specified)	**Trend**
Employment	
Aboriginal Employment (2007-2012)	
Agreements	
Participation (2011)	Incomplete Assessment
Gender Equality	
Workplace Health and Safety (1998-2010)	
Mine Closures and Openings	Incomplete Assessment
Labour Stoppages	
Improved Performance 	Limited Improvement 	Decline in Performance 

- **Female representation** in the mining and quarrying and oil and gas sector[48] improved from 1998 to 2012, with women accounting for 20.2% of the labour force in 2012 relative to 16.8% in 1998. Between 2006 and 2010, female representation declined from 20.1% to 18.0% before returning to over 20% in 2012. However it lags behind in comparison to other sectors in the Canadian economy.

- Between 1998 and 2010 (the latest year for which data are available), the rate of fatal **injuries** per 100 000 employees in the mining and quarrying subsector fell from 47.1 to 9.3.

[48] Data from Statistics Canada are only available for mining and quarrying and oil and gas extraction grouped together.

- Between 1998 and 2012, there were 76 **mine openings** and 73 **re-openings**, while 77 mines **closed** and 98 **were suspended**. Of note, there were 21 suspensions and 1 closure of base-metal mines in 2008 and 2009 during to the global recession. However, between 2009 and 2012, 19 precious-metal mines opened and 7 re-opened.

- Between 1998 and 2012, there was a decrease in the number of **strikes and lockouts**. The number of person-days not worked also decreased from 1998 to 2008 before an upsurge in 2009 and 2010 due to a small number of large strikes in the downstream subsectors.

Employment

Highlights

- The number of people employed in the mining sector went from 378 839 in 1998 to 329 939 in 2012, a reduction of 48 900 (12.9%).
- Ontario was particularly hard hit in terms of employment decline between 2000 and 2012, losing 26 920 jobs in primary metal manufacturing and 31 313 jobs in fabricated metal manufacturing.
- The average weekly wage in the sector rose from $858 in 1998 to $1158 in 2012 (compared to a national average of $633 in 1998 and $897 in 2012).
- Mining sector employment has increased by 7.0% since 2009.

Definition

Employment is the number of people employed directly by companies operating in the mining sector.

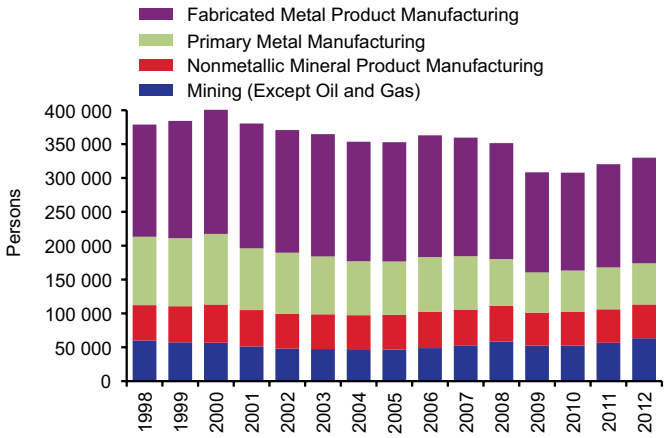
Rationale

Employment provides increased income security that can result in an improved quality of life and the acquisition of transferrable skills. In addition, employment can lead to higher consumption and spending in the local community (usually in services and retail), which drives local economic development and improved quality of life, often resulting in better health. As well, there is a positive correlation between employment and GDP growth,[49] which tends to increase living standards.

Analysis

The number of people employed in the mining sector went from 378 839 in 1998 to 329 939 in 2012, a reduction of 48 900 (12.9%). Employment in the mining sector has generally been decreasing since 2000. The number of people employed in the sector went from 400 637 in 2000 to 329 939 in 2012, a decrease of 70 698 (17.6%)[50] (see Figure 22). Of note, the majority of this decline has been in the primary metal manufacturing stage in which there was a loss of 43 519 employees (41.7%) between 2000 and 2012. Ontario was particularly hard hit in terms of employment decline between 2000 and 2012, losing around 26 920 jobs in primary metal manufacturing and 31 313 jobs in fabricated metal manufacturing.

Figure 22: Mining Sector Employment, 1998-2012



Source: Statistics Canada, CANSIM Table 281-0024.

[49] See Okun's Law.

[50] Statistics Canada, CANSIM Table 281-0024.

This decrease is due in large part to technological advancements,[51] aging Canadian facilities, and increased foreign competition for feedstock to process.[52] Employment in the mining and quarrying subsector increased from 56 698 in 2000 to 63 418 in 2012, up 11.9%.

The global economic downturn has also had an impact as mining sector employment trends are strongly influenced by the global economy and commodity prices. Nevertheless, mining sector employment grew from 308 361 in 2009 to 329 939 in 2012, an increase of 7.0%. In 2012, the mining sector accounted for 40.8% of the 808 396 workers in the natural resource sector (mining, forestry, and energy).[53] Furthermore, workers in the mining sector are among the highest paid in Canada. The average weekly wage rose from $858 in 1998 to $1158 in 2012 (compared to a national average of $633 in 1998 and $897 in 2012).[54]

Data Issues

Skills and knowledge development is one of the positive social benefits associated with employment in the mining sector. What is not measured in this section is the sector's performance in developing and retaining skilled labour through investment in education, job training and skills enhancement (both industry and government), mentoring, or other programs. According to the Mining Industry Human Resources Council (MiHR), the mining sector will need to hire between 116 000 and 199 000 workers over the next 10 years to address retirements, attrition, and growth.[55]

Moving forward, it will be important to track the efforts made to address/prevent the shortage of skilled labour.

[51] Increased productivity over the years, allowing fewer workers to produce the same or more volume, has contributed to there being fewer workers at many facilities.

[52] The Mining Association of Canada, *Facts and Figures* 2012.

[53] The data reported for each of the natural resource sectors reflect the value of primary industries and related manufacturing industries. Values for Petroleum Product Wholesalers-Distributors (NAICS 4121), Gasoline Stations (NAICS 447), and Pipeline Transportation (NAICS 486) are not included.

[54] Statistics Canada, CANSIM Table 281-0027.

[55] Mining Industry Human Resources Council, *Canadian Mining Industry Employment and Hiring Forecasts 2013*, www.mihr.ca.

Aboriginal Employment

Highlights

- Aboriginal employment in the mining sector increased 14.0% from 2007 (9039) to 2012 (10 300).
- In 2012, 38.8% of Aboriginal employment was concentrated in the mining and quarrying subsector, up from 29.4% in 2007.

Definition

The Labour Force Survey (LFS)[56] measures the Aboriginal population by using the concept of Aboriginal identity. A person has an Aboriginal identity if he or she reports as identifying with at least one Aboriginal group, for example, North American Indian (First Nations person), Métis, or Inuit. This is based on the individual's own perception of his/her Aboriginal identity.[57]

Rationale

Governments and the mining industry have recognized that there is potential for Aboriginal peoples to increase their employment rate in the mining sector. The Aboriginal population in Canada is younger and growing at a faster rate than the general population, and several Aboriginal communities are located in close proximity to producing mines and exploration properties. Training and skills development will be important factors to increase the participation rate for Aboriginal peoples in the mining sector's labour force.

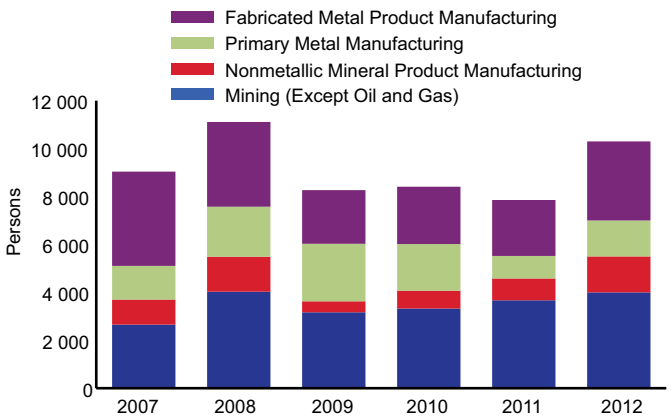
Analysis

Between 2007 and 2012, the number of Aboriginal peoples employed in the mining sector fluctuated considerably, reaching a high of 11 112 in 2008, falling to a low of 7854 in 2011, and increasing again to 10 300 in 2012 (Figure 23). Most of the decline in recent years happened during the economic downturn as 2846 jobs were lost between 2008 and 2009, representing a reduction of 25.6%.

[56] The Labour Force Survey measures the Aboriginal population by using the concept of Aboriginal identity. Aboriginal identity is self-reported by LFS participants and is understood as identifying with at least one Aboriginal group. The data in this section do not include estimates for the territories and persons living on reserves and settlements due to data limitations.

[57] www.statcan.gc.ca/pub/71-588-x/71-588-x2011003-eng.htm.

Figure 23: Mining Sector Aboriginal Employment, 2007-2012



Source: Statistics Canada. Aboriginal People and the Labour Market: Estimates From the Labour Force Survey.

In 2012, the majority of Aboriginal employment in the mining sector was concentrated in the mining and quarrying subsector, representing 38.8% of total Aboriginal employment in the mining sector, up from 29.4% in 2007.

According to the MiHR's survey of Yukon exploration and extraction employers and producers, Aboriginal peoples comprise more than one-fifth of the mining labour force in Yukon, which was estimated at 2675 persons in 2012.

Data Issues

The Aboriginal employment numbers presented in this section are from Statistics Canada's Labour Force Survey (LFS). This is different from the 2010 MSPR in which data

Box 5: Cameco's Northern Employment Program

During the late 1980s, two federal and provincial companies (Eldorado Nuclear Limited and Saskatchewan Mining Development Corporation) merged to form Cameco Corporation, one of Canada's leading Aboriginal employers with numerous partnerships with Aboriginal businesses. From its inception, Cameco has worked with all levels of government and local communities to implement policies and programs focused on training, education, employment, business development, and improving consultation with Aboriginal peoples (World Bank and International Finance Corporation, 2002).

By 2004, half of Cameco's mine-site work force was from northern Saskatchewan and primarily Aboriginal. Cameco continues to work towards meeting its long-term goal of a 67% northern work force by promoting education through scholarships, school awards, and initiatives with education and post-secondary authorities to help build its future educated labour pool. By learning how to organize, negotiate, and take advantage of opportunities, local communities are learning how to achieve sustainability via social capital (McIntyre & Holman, 2004). This work addresses the expectations of the Government of Saskatchewan, set out in long-term mine surface lease agreements, that mines on northern Saskatchewan Crown land will use (and regularly report on) their best efforts to train, employ, and negotiate contracts with northern people.

In 2001, Cameco also initiated a community-based environmental monitoring program to improve data provision, follow-up, stakeholder engagement, and local capacity for environmental management. This agreement promotes community awareness of mining impacts on the environment and knowledge of the scientific process. Data collected through community monitoring mix traditional knowledge with Western science and follow standard scientific protocol.

This community-based program, along with the extensive industry environmental effects monitoring program and the new government/industry Eastern Athabasca Regional Monitoring Program (also with community involvement), is widely recognized in northern Saskatchewan as providing excellent monitoring and protection. Monitoring results are extensively discussed in community forums such as the Athabasca Working Group (industry/community) and the 34-community-member Northern Saskatchewan Environmental Quality Committee established in 1995 by the provincial government. Such monitoring initiatives and related open discussions have built trust and respect among all parties over the years and have allowed the uranium industry to steadily move forward.

Sources: http://iportal.usask.ca/docs/Journal%20of%20Aboriginal%20Economic%20Development/JAED_v4no1/JAED_v4no1_Article%20pg6-13.pdf; www.cameco.com/sustainable_development/2012/supportive_communities/case_studies/northern_saskatchewan_impact/; Government of Saskatchewan

on Aboriginal employment were sourced from the 2006 census. The LFS excludes persons living on reserves and settlements. Although the LFS produces employment estimates for the territories, it uses a different methodology than the one used for the provinces and does not provide estimates at the industry level required for this report. As such, the data included in this section are incomplete and may underestimate the number of Aboriginal peoples employed in the mining sector. Moreover, because of differences in methodologies, data prior to 2007 were not included in this section as it could not be compared with data from 2007 to 2011.

Agreements Between Mining Companies and Aboriginal Peoples or Governments

Highlights

- A total of 297 agreements were signed between 1998 and 2012, compared to 38 before 1998.
- Since 2008, 176 agreements have been signed.
- Exploration-stage agreements, as a share of all agreements between mining companies and Aboriginal peoples or governments, have increased from 8.1% of all agreements signed before 1998 to 55.6% of all agreements signed between 1998 and 2012.

Definition

The number of agreements negotiated between exploration and mining companies, governments, and Aboriginal communities has continued to grow. Agreements have helped secure benefits for local Aboriginal communities and businesses, and certainty for exploration and mining companies when mineral development is located within the traditional territory of a First Nation, Inuit, or Métis group and/or when development may have an impact on Aboriginal or treaty rights.

Box 6: Importance of Earning a Social Licence to Operate (Two Case Studies)

Kitchenuhmay-koosib Inninuwug (K.I.) First Nation and Platinex Inc. exemplify the case for companies to build good community relations and to reach agreements from the outset of a project. While Platinex had engaged with the community about mining exploration and development on its traditional territories located in northern Ontario, no agreement or understanding was reached between the community and the company.

When the company began exploration and drilling without the community's support, K.I. residents protested on the exploration site. The tensions were exacerbated when Platinex continued to work without the community's support and the case landed in court. Platinex's exploration plans were stalled by protests and legal battles. The project was finally abandoned after nearly a decade of litigation and court cases.

Source: Canadian Business Ethics Research Network, www.cbern.ca/research/projects/workspaces/cura_project/case_studies/ki_vs_platinex

Detour Gold and the Métis Nation of Ontario have signed an Impact and Benefit Agreement (IBA) with respect to the development and operation of the company's Detour Lake gold mining project in northeastern Ontario. This first-of-its-kind IBA between a mining company and a Métis community includes provisions on how the Métis community will benefit from the development of the Detour Lake project and throughout the life of the mine, including employment and business opportunities, training and education initiatives, and financial participation in the project. The IBA also establishes a Métis scholarship and bursary program at College Boreal and Northern College.

Sources: www.detourgold.com and metisnation.org

Rationale

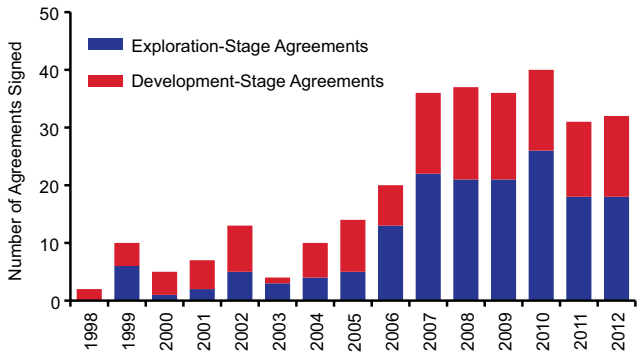
Agreements between companies and Aboriginal communities have the potential to help establish working relationships and improve understanding between a community and companies. These agreements have the potential to provide a framework for participation, employment, training, and business opportunities for Aboriginal peoples. Failure to reach an agreement can have a negative impact on a project and a mining company's profitability and on opportunities for communities (see Box 6).

Analysis

Some 335 separate agreements (Impact and Benefit Agreements or agreements at the exploration stage) have been signed since 1974 for 198 different mining projects. Since the 1990s, the increase in the number of agreements that have been signed is notable as a total of 297 were signed between 1998 and 2012, compared to 38 before 1998. Not all of these signed agreements are still active. There are approximately 260 active agreements across Canada.

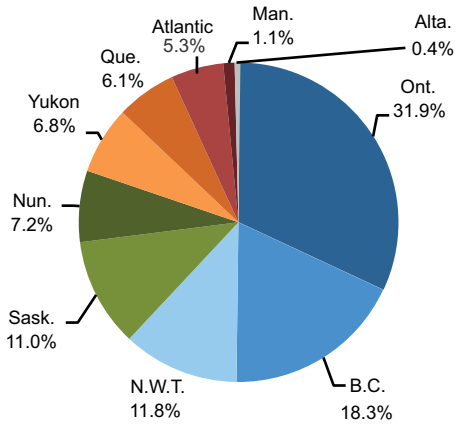
Of note, the share of exploration-stage agreements has increased from 8.1% of all agreements signed before 1998 to 55.6% of all agreements signed between 1998 and 2012 (see Figure 24). Exploration-stage agreements serve to establish a positive working relationship and to build a mutual understanding between a community and an exploration company. Even at this early stage, these agreements provide a framework for negotiation on local benefits such as participation, employment, training, and business opportunities. Today, these early agreements often lead to more formal and detailed agreements (e.g., Impact and Benefit Agreements [IBAs]) if the project advances to the development stage. In fact, the number of IBAs (including participation agreements and socio-economic agreements) signed has also increased significantly since the late 1990s as 67 agreements were signed between 1998 and 2012, compared to 17 before 1998.

Figure 24: Number of Agreements Signed Between Mining Companies and Aboriginal Communities or Governments, 1998-2012



Source: Natural Resources Canada.

Figure 25: Distribution of Active Agreements Across the Provinces and Territories of Canada, 2012

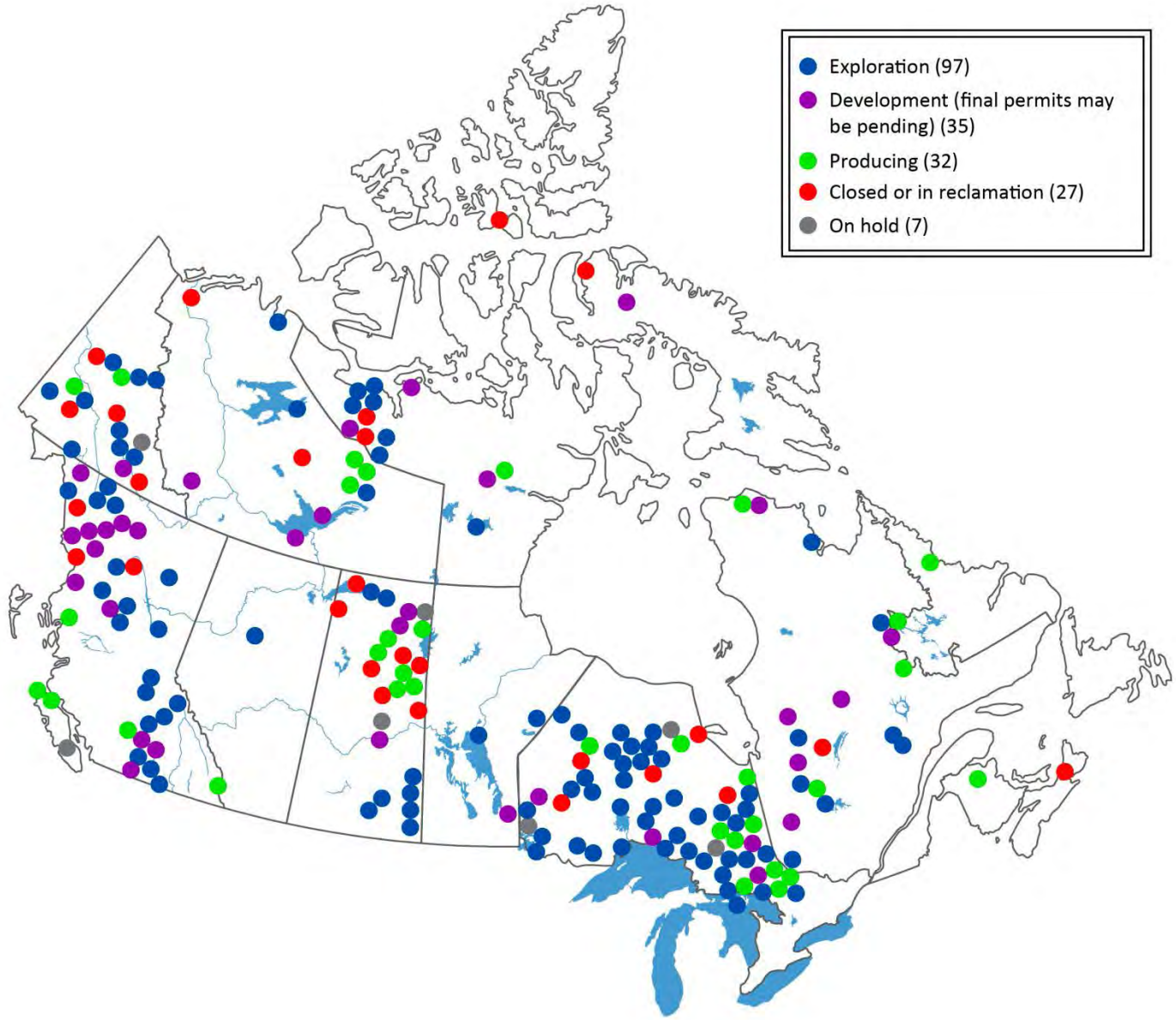


Source: Natural Resources Canada.

The number of agreements varies by province and territory with the majority of active agreements being found in Ontario (31.9%), British Columbia (18.3%), the Northwest Territories (11.8%), and Saskatchewan (11.0%). Quebec, Yukon, Nunavut, and Newfoundland and Labrador each share between 5% and 7% of the total agreements while the other provinces' share (Manitoba, Alberta, Nova Scotia, New Brunswick, and Prince Edward Island) is minimal (see Figure 25).

Part of this discrepancy between the provinces and territories can be attributed to the low level of mining activity in a province (as is the case with Prince Edward Island) or to the fact that the primary mining activities of the province are not covered by this analysis

Figure 26: Agreements by Stage of Development, 2011[58]



(specifically oil and gas in the case of Alberta[59]). In Ontario, the majority of active agreements consist of exploration agreements and memoranda of understanding signed between the Aboriginal community and the mining company, whereas in Saskatchewan nearly all of the agreements that are signed are between the Government of Saskatchewan and the mining company in the form of a surface lease agreement. These surface lease agreements contain a component that commits the company and government to work together to increase employment and business opportunities for Northerners, including Northerners of Aboriginal descent.

Natural Resources Canada has produced and disseminated guides, toolkits, and information products to facilitate partnerships and dialogue between Aboriginal communities, the mining industry, and governments to ensure mutual understanding and benefits. These can be found at www.nrcan.gc.ca/minerals-metals/aboriginal/3697.

[58] Natural Resources Canada Interactive Map of Aboriginal Mining Agreements, www2.nrcan.gc.ca/mms/map-carte/MiningProjects_cartovista-eng.html.

[59] Alberta has one exploration agreement.

Box 7: British Columbia's Economic and Community Development Agreements

British Columbia initiated revenue sharing on major new mine projects and expansions through Economic and Community Development Agreements (ECDAs) in 2009, achieving the first revenue-sharing agreement for the New Afton mine project in 2010. British Columbia was the first province in Canada to commit to directly sharing provincial mineral tax revenues from mines with First Nations.

Under these agreements, British Columbia commits to sharing a percentage of the incremental mineral tax received by the Province. The amount to be shared is determined on a project-by-project basis, and no revenue share has exceeded 37.5% of the mineral tax revenue that will be received by British Columbia.

There are a number of benefits for the Province and the First Nations resulting from these agreements:

- ECDAs are designed to secure greater support for mining projects by moving all parties towards a partnership position on a project supported by direct economic benefit.
- ECDAs result in increased process certainty, with the Province and First Nations setting out and agreeing to how consultation will be undertaken.
- First Nations are not required to agree to mine development in advance, and British Columbia continues to engage in appropriate consultation on mine decisions.
- ECDAs deliver on British Columbia's New Relationship with First Nations by enabling First Nations to utilize ECDA payments to fulfill the goals of the Transformative Change Accord.

ECDAs also provide for prescribed processes and timelines for discussion and action on issues. ECDAs therefore contribute significantly to an enduring, productive, and positive relationship between the Province and First Nations.

British Columbia has concluded ECDAs related to various new mine and expansion projects, including some of the largest mine projects in the province: New Afton, Mount Milligan, Elk Valley Coal, Mount Polley, Highland Valley Copper, and Copper Mountain.

Source: www.newrelationship.gov.bc.ca/agreements_and_leg/economic.html

Data Issues

Given the private nature of agreements, it is difficult to determine the exact benefit of these agreements for Aboriginal groups or how sustainable the benefits are over the long term. Also, some provinces have quite broad agreements with Aboriginal groups, limiting the ability to make comparisons across jurisdictions.

Government Funding for Public Participation in Environmental Assessments

Highlights

- In 2011/2012, the Canadian Environmental Assessment Agency awarded $5.4 million in funding to 199 recipients to help them participate in environmental assessment processes.

Definition

Environmental assessments (EAs) examine a comprehensive list of potential factors in natural resource development, including the cumulative environmental effects of the proposed project, measures to mitigate those effects, and concerns and comments raised by the public.

The Participant Funding Program (PFP), administered by the Canadian Environmental Assessment Agency (CEAA),[60] is designed to support public consultation by providing financial support to individuals, non-profit organizations, and Aboriginal communities to participate in federal EAs. It is being used in this section as a proxy to gauge the sector's performance in terms of public participation.

Rationale

The public's participation in the EA process helps ensure that the views of Canadians are considered. It also has several other benefits, including strengthening the social fabric of affected communities, increasing inclusion of traditional knowledge in studies, and improving knowledge and understanding of concerns and potential issues. Subsection 58 (1.1) of the *Canadian Environmental Assessment Act* requires that a funding initiative be established to facilitate the public's participation in consultation activities.

Analysis

The PFP consists of two funding channels: the Regular Funding Envelope (RFE) and the Aboriginal Funding Envelope (AFE). While the RFE provides financial

Box 8: Abacus Ajax Mine Project

In 2011, KGHM Ajax Mining Inc. proposed a gold-copper mine to be located in the city of Kamloops in British Columbia. In assessing the proposal, the Canadian Environmental Assessment Agency (the Agency) determined that the project would be subject to a federal environmental assessment. The Agency determined that a comprehensive study, which is required for large projects with the potential for significant adverse environmental effects, would have to be undertaken. Under the Aboriginal Funding Envelope of the Participant Funding Program, $329 700 was made available for Aboriginal groups to support their participation in the following consultative activities related to the gold-copper mine:

- Review and comment on the Environmental Impact Statement (EIS) Guidelines;
- Review and comment on the EIS submitted by the project proponent; and
- Review and comment on the Comprehensive Study Report.

Recipient	Amount Recommended
TK'emlups (Kamloops) Indian Band	$147 050
Skeetchestn Indian Band #687	$102 000
Lower Nicola Indian Band	$30 150
Métis Nation British Columbia	$25 700
Ashcroft Indian Band	$24 800
Total	**$329 700**

Source: www.ceaa-acee.gc.ca/050/document-eng.cfm?document=52799

[60] www.ceaa.gc.ca/default.asp?lang=En&n=E33AE9FB-1.

assistance to individuals and organizations, including Aboriginal groups, to participate in public consultations, the AFE is meant specifically for Aboriginal groups and provides funding to "prepare for and participate" in public consultation activities.

Along with the PFP, the *Canadian Environmental Assessment Act, 2012* requires the Canadian Nuclear Safety Commission and the National Energy Board to establish a participant funding program (see Box 9).

Provinces and Territories

All provinces and territories allow for a degree of public participation in the EA process, ranging in scope from broad public participation initiatives to a more limited form of participation. Given that the environment is a shared jurisdiction, joint EAs with the federal government may be carried out if the proposed project is under federal jurisdiction. To that end, the federal government has signed bilateral agreements with Alberta, British Columbia, Manitoba, Newfoundland and Labrador, Ontario, Quebec, Saskatchewan, and Yukon thus far. The agreements contain commitments to facilitate the public's participation in the joint EAs, albeit to varying degrees that reflect existing provincial/territorial laws. In the case of joint EAs, the public may access funding from the PFP in support of participatory and consultative activities related to the project under review.

Data Issues

Data from the PFP and similar programs provide a very limited indication of the level of community participation and inclusiveness in the mining sector. Moving forward, it will be important to develop better indicators to measure the levels of participation, which will help in the development of government and corporate policies and programs to promote participation.

Box 9: CEAA Participant Funding Programs for Other Sectors

Canadian Nuclear Safety Commission (CNSC)

Introduced in 2011, the CNSC's participant funding program is intended to enhance the public's participation in EAs by providing financial assistance to stakeholders to participate in the CNSC's regulatory process, including EAs and its licensing process. The program has an annual budget of $1.1 million per fiscal year from 2011 to 2014/2015. Individuals, Aboriginal groups, organizations, and other stakeholders are eligible to receive funding to participate.

Source: www.cnsc-ccsn.gc.ca/eng/getinvolved/participant-funding-program/index.cfm

National Energy Board (NEB)

The NEB's participant funding program is intended to support the public's participation in the "regulatory process for oral facility hearings" that are conducted under the *National Energy Board Act*. The NEB's PFP differs from the one administered by the CEAA in that it "only applies to the NEB's oral facility hearings" and extends the scope of eligible activities "beyond the EA process to include social and economic issues relevant to the project."

Source: www.neb-one.gc.ca/clf-nsi/rthnb/pblcprtcptn/prtcpntfndngprgrm/prtcpntfndngprgrm-eng.html

Gender Equality

Highlights

- Women accounted for 20.2% of employees in mining and quarrying and oil and gas in 2012, up from 16.8% in 1998.
- Since 2008, the employment of women in mining and quarrying and oil and gas has increased from 19.0% to 20.2% (9300 jobs).
- The trends presented in this section highlight that the mining and quarrying and oil and gas sector lags behind the general labour force as a whole in employing women.

Definition

Gender equality is the measurable equal representation of women and men in the mining sector.

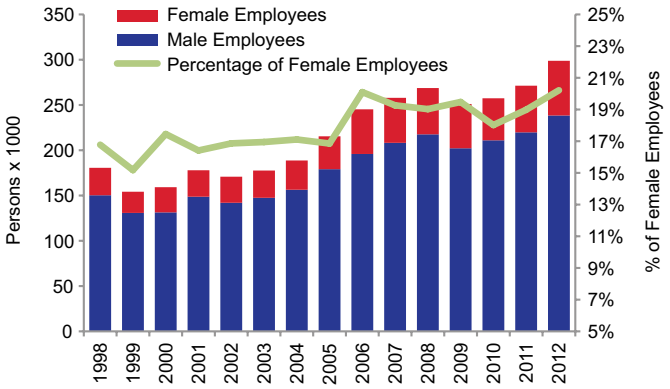
Rationale

Gender equality is an important social performance measure. It has been shown that increases in education, quality of life, or health for women not only benefit women, but also their families as the link between an improvement in the situation of women and an improvement in the family situation is strong. Also, from a company perspective, there are several studies that draw links between a critical mass of women in the work force and leadership positions and an organization's improved financial performance and governance.[61] A lack of gender diversity could have an impact on a firm's productivity and profitability.

Analysis

Figure 27 shows the employment trends by sex for mining and quarrying with oil and gas extraction[62] and the proportion of female employees from 1998 to 2012. The proportion of female employees in these sectors increased from 16.8% in 1998 to 20.2% in 2012. Relative to other key sectors of the Canadian economy, the mining and oil and gas sectors are underperforming in terms of gender equality in both labour force and senior management positions. According to a study from the Centre for Women in Politics and Public Leadership, the mining and oil and gas sectors had the lowest share of women in the labour force in 2011 at 18.6% (Table 7). Furthermore, the share of women in senior management position in those sectors was only 12.3%. Only the energy and manufacturing sectors had less representation of women in senior management positions.

Figure 27: Mining and Quarrying and Oil and Gas Employment by Sex, 1998-2012



Source: Statistics Canada, CANSIM Table 282-0008.

In June 2013, Statistics Canada released preliminary results from the 2011 National Household Survey,[63] which included data on labour and gender equality for the year 2011. The results show that women represented 15.1% of all mining sector employees. In comparison, women represent 48.0% of the Canadian work force, 23.8% of the energy sector,[64] and 17.2% of the forest sector.[65]

[61] Georges Desvaux, et. al., *Women Matter: Gender Diversity, A Corporate Performance Driver* [online]. France: McKinsey & Company, 2007, www.mckinsey.com/careers/women/social_sector_impact/~/media/Reports/Women/Mckinsey_women_matter.ashx, p. 13.

[62] Statistics Canada, CANSIM Table 282-0008 groups mining, quarrying, and oil and gas extraction together. Data for downstream activities are grouped with too many other industry sectors to present here.

[63] www12.statcan.gc.ca/nhs-enm/2011/as-sa/index-eng.cfm#tabs4.

[64] The energy sector includes NAICS codes: 211 (Oil and Gas Extraction), 213 (Support Activities for Mining and Oil and Gas Extraction), 2211 (Electric Power Generation, Transmission and Distribution), 2212 (Natural Gas Distribution), 324 (Petroleum and Coal Products Manufacturing), and 486 (Pipeline Transportation).

[65] The forest sector includes NAICS codes 113 (Forestry and Logging), 321 (Wood Product Manufacturing), and 322 (Paper Manufacturing).

Table 7: Representation of Women in Senior Management and Labour Force (%) in Selected Industries, 2011*

Industry	Senior Management	Labour Force
Service	50.1	71.9
Public Administration	41.0	47.7
Technical and Scientific	33.6	42.7
Tourism and Transport	25.0	45.2
Financial	19.3	61.5
Retail and Wholesale	18.5	49.3
Real Estate	17.2	43.8
Mining, Oil and Gas	**12.3**	**18.6**
Manufacturing	10.7	21.7
Energy	8.4	24.6
Total	**28.92**	**47.49**

* Centre for Women in Politics and Public Leadership (2012) and Catalyst (2011).

In 2010, the Mining Industry Human Resources Council and Women in Mining[66] partnered to produce a study on the status of women in Canada's mining and exploration sector. The report highlighted not only the underrepresentation of women in the mining sector work force, but also the wage gap between men and women and several of the barriers that women face in mining careers. A male-dominated work culture, limited opportunities for advancement, lack of flexible work arrangements, and insufficient support for family care were cited as some of the barriers women face in careers in mining.

The trends presented in this section highlight that the mining sector lags behind the general labour force as a whole in employing women. Significant progress is needed to reach a more balanced level of employment between both sexes. From a provincial/territorial perspective, it is worth noting that Newfoundland and Labrador now requires all new mining projects to provide a gender and diversity employment plan.

[66] Women in Mining Canada, *Ramp-UP: A Study on the Status of Women in Canada's Mining and Exploration Sector*, Ottawa, Ontario, http://0101.nccdn.net/1_5/1f2/13b/0cb/RAMP-UP-Report.pdf.

Data Issues

The 2010 MSPR reported on gender equality using Statistics Canada census data from 2006, which disaggregated mining and quarrying from oil and gas. Given the changes in the census and the inconsistencies created, the data for this report are from the Labour Force Survey (LFS), which groups mining and quarrying with oil and gas extraction. The trends in these data should be viewed with caution as the inclusion of oil and gas extraction may skew the numbers upward. For instance, the 2006 census data showed women represented 14.1% of mining and exploration workers while the LFS data showed women represented 20.1% of mining and quarrying and oil and gas workers. Also not captured in the data currently available are the gender equality statistics for the professionals that work with the mining industry such as geologists, engineers, accountants, lawyers, and finance specialists.

Workplace Health and Safety

Highlights

- The rates of fatal injuries in the mining sector declined steadily between 1998 (47.1 per 100 000 employees) and 2010 (9.3 per 100 000).
- The mining sector's non-fatal injury rates were among the lowest across industrial sectors in Canada between 1998 and 2010.

Definition

Workplace health and safety is measured as the injury rate, both fatal and non-fatal, in the mining sector.

Rationale

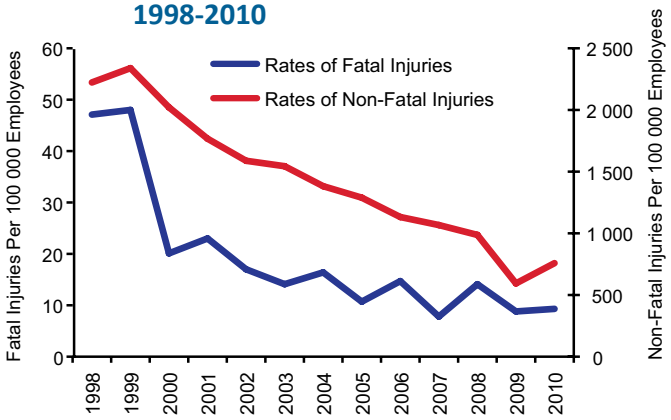
A safe and healthy work environment is one of the more important social issues for workers and local mining communities.

Analysis

The mining sector in Canada has improved its performance in providing safe work environments and has seen a significant improvement in its rates of injury,

both fatal and non-fatal. For fatal injuries, the rate per 100 000 employees fell from 47.1 in 1998 to 9.3 in 2010 (see Figure 28).[67]

Figure 28: Total Compensated Fatal and Non-Fatal Injuries in Mining and Quarrying, 1998-2010

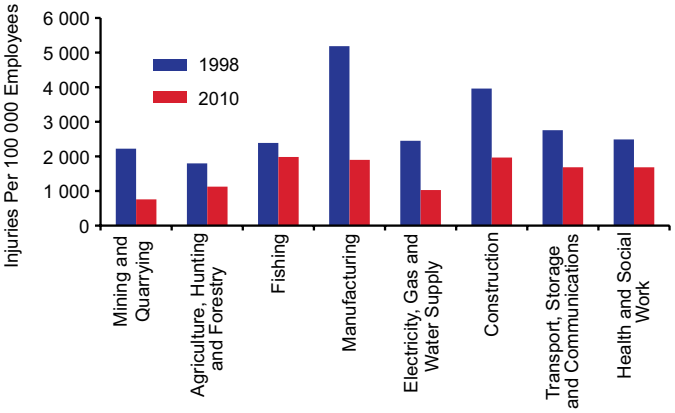


Source: International Labour Organization, LABORSTA and ILOSTAT.

Labour unions and industry associations have played an important role in improving worker health and safety by encouraging the sharing of best practices, developing industry standards, and providing third-party auditing and external verification. These improvements can be attributed to improved health and safety management systems and to increased investments in automation technologies that keep mine workers out of more dangerous situations.

Mining and quarrying also compares very favourably to other industrial sectors when it comes to safety. Construction, fishing, transport, and health and social work all had much higher rates of non-fatal injury in 2010 (see Figure 29).

Figure 29: Rate of Non-Fatal Injury by Industry, 1998 and 2010



Source: International Labour Organization, LABORSTA and ILOSTAT.

[67] Source: International Labour Organization. LABORSTA Database.

The Prospectors and Developers Association of Canada (PDAC) and the Association for Mineral Exploration British Columbia (AMEBC) produce an annual health and safety report for the mineral exploration sector that provides details on the frequency, severity, and cause of incidents in the sector. The most recent report published in 2010 shows that the frequency of lost workday incidents in most regions was relatively constant from 2005 to 2010, with noticeable spikes in frequency in 2006 and 2010.[68] Of note, The Mining Association of Canada (MAC) will begin reporting on member companies' health and safety performance in 2013.

Box 10: e3 Plus – A Framework for Responsible Exploration

The Prospectors and Developers Association of Canada (PDAC) developed *e3 Plus - A Framework for Responsible Exploration* as a voluntary guideline to help exploration companies integrate social responsibility, environmental stewardship, and health and safety into all of their exploration programs. The first phase of e3 Plus was completed in March 2009 and included principles, guidance, and three Internet-based toolkits. The second phase is under way to generate performance objectives, reporting criteria, and verification processes.

Source: www.pdac.ca/programs/e3-plus/about-e3-plus

Data Issues

The latest available data from the International Labour Organization (ILO) are from 2010, making the analysis less recent than other indicators. Also, since the ILO uses a different industry classification system,[69] we are only able to present data for mining and quarrying and not for the other downstream subsectors.

[68] Prospectors and Developers Association of Canada, *Canadian Mineral Exploration Health & Safety Annual Report 2010/2011*, www.pdac.ca/pdf-viewer?doc=/docs/default-source/e3-plus---common/2012-news-canadian-mineral-exploration-health-safety-annual-report.pdf.

[69] ILO data for Canada use International Standard Industrial Classification Revision 3. Under this classification, mining and quarrying includes mining of coal and lignite, extraction of peat, extraction of crude petroleum and natural gas, service activities incidental to oil and gas extraction excluding surveying, mining of uranium and thorium ores, mining of metal ores, and other mining and quarrying.

Mine Closures and Openings

Highlights

- Between 1998 and 2012, 77 mines closed and 98 suspended operations.
- During this same period, 76 mines opened and 73 re-opened.

Definition

The indicator is defined as the numbers of mines that close, suspend, open, or re-open operations (see the box on the next column for detailed definitions).

Rationale

Mine closures and openings can result in significant socio-economic impacts, both positive and negative, including changes in employment, government revenues, population, and economic activity in the local area. Monitoring is important, given the potential for significant impacts on local communities.

Analysis

The nature of the mining industry results in a fluctuating number of mines opening and closing. Mines may close at the end of their planned mine life based on the availability of the resource and they may re-open, suspend, or close prematurely based on price fluctuations or a variety of other factors (e.g., input costs, natural disasters, etc.).

Between 1998 and 2012, approximately 77 mines closed and 98 suspended their operations (see Table 8).[70] Of note, there were 21 suspensions and 1 closure of base-metal mines in 2008 and 2009 in response to the global recession. However, between 2009 and 2012, 19 precious-metals mine opened and 7 re-opened.

Mine Opening

A mine is considered open when the operating company announces it has achieved production or when it is reported as such by the regulating jurisdiction.

Mine Re-Opening

A mine re-opening refers to the opening of a mine that had previously been closed or suspended.

Mine Suspension

A mine is considered to have suspended its operations when its ore-extracting operations have indeterminately ceased for reasons such as production no longer being economically viable due to commodity price fluctuations or depletion of higher-grade ore with a reasonable probability that operations will resume once the situation is resolved. Strikes and lockouts are excluded because of their unpredictable nature.

Mine Closure

A mine is considered closed when its ore-extracting activities have ceased indefinitely with no clear intention of resuming operations. A mine is considered closed when the operating company announces its closure, when it is reported by the regulating jurisdiction as closed, and/or, with the exception of extraordinary circumstances (e.g., strikes, natural disasters), when it has no production for three consecutive months or more. Mine closure is usually due to the depletion of reserves.

Source: Natural Resources Canada

[70] Source: Natural Resources Canada. Note: These figures are additive and do not exclude operations that may have re-opened in later years.

Table 8: Opening and Closing of Mines in Canada, 1998-2012

	Precious Metals				Base Metals				Other Minerals			
	Opening	Re-opening	Sus-pension	Closing	Opening	Re-opening	Sus-pension	Closing	Opening	Re-opening	Sus-pension	Closing
1998	1	3	2	3	1	0	6	4	3	1	1	1
1999	1	2	9	5	1	2	2	5	4	0	0	3
2000	0	4	4	2	1	0	1	1	1	0	2	2
2001	1	0	6	3	0	0	1	1	1	0	1	3
2002	1	4	1	1	0	2	0	4	0	2	2	1
2003	0	0	4	0	0	1	1	0	2	0	3	1
2004	1	2	0	6	2	1	0	3	4	4	1	2
2005	0	3	1	2	1	4	0	3	2	1	0	0
2006	1	4	0	1	0	3	0	0	4	0	0	0
2007	2	2	1	4	2	5	0	0	2	1	0	1
2008	4	0	3	1	3	0	10	0	1	0	1	3
2009	3	1	1	1	1	3	11	1	0	0	1	2
2010	2	4	1	1	1	4	1	0	1	1	3	2
2011	7	1	2	1	2	3	2	0	1	1	5	1
2012	7	1	3	0	3	3	4	2	1	0	1	0

Source: Natural Resources Canada.

Labour Stoppages

Highlights

- Between 1998 and 2012, the total number of strikes and lockouts decreased.
- The number of person-days not worked also decreased from 1998 to 2008 before an upsurge in 2009 and 2010.

Definition

The International Labour Organization (ILO) defines a strike as a refusal to work or continue to work, or a slowdown designed to limit production to attain key demands from companies. A lockout is defined as a temporary closure of places of employment, or the hindering of the normal work activities of employees, by employers to attain key demands from employees.[71]

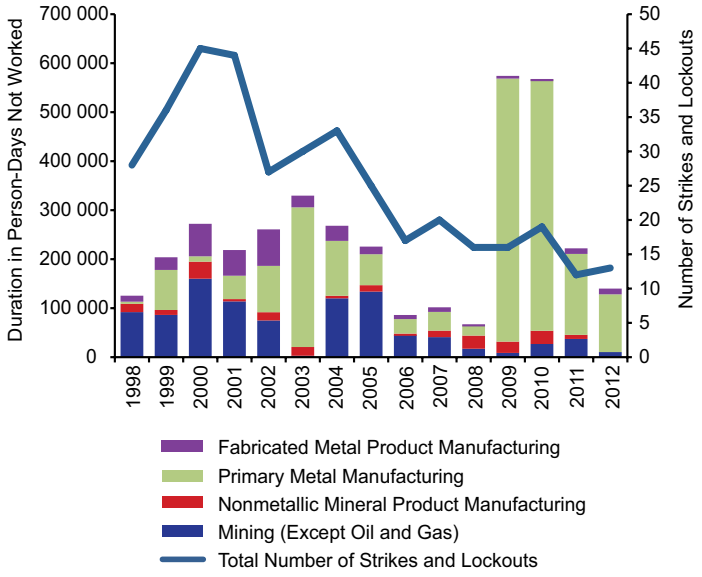
Rationale

Strikes and lockouts can occur for a variety of reasons, including disagreements over wages, benefits, social programs, or work conditions. Regardless of the reason for the strike or lockout, it has an impact on the industry, the workers, and the local community. Strikes and lockouts threaten the stability of the relationship between labour and industry and have the potential to affect both investment and employees' decisions to remain in the sector. As well, they may have an impact on the public image of the company and industry.

Analysis

According to data from Human Resources and Skills Development Canada, the total number of strikes and lockouts in the mining sector decreased between 1998 and 2012. There was also a decline in person-days lost due to strikes and lockouts from 1998 to 2008 before a significant increase in 2009 and 2010 (see Figure 30). This recent upsurge can be partly explained by a few large strikes and lockouts at smelting and refining and steel facilities in 2009 and 2010.

Figure 30: Mining Sector Labour Stoppages, 1998-2012



Source: Human Resources and Skills Development Canada, Workplace Information Directorate.

[71] www.ilo.org/global/statistics-and-databases/statistics-overview-and-topics/social-dialogue/lang--en/index.htm.

SECTION IV: ENVIRONMENTAL PERFORMANCE

Mining sector operations have the potential to have significant impacts on both local and regional ecosystems. Minimizing these impacts, while continuing to be a leading global mining nation, is one of the most important challenges facing the Canadian mining sector. The sector's public image and reputation are closely linked to its environmental performance as public concerns over water, mine waste, greenhouse gas (GHG) emissions, and the legacy issues of orphaned and abandoned mines continue to rise. Sustainable mining practices have become increasingly relevant for companies that seek to operate in Canada. In this regard, initiatives, such as *Towards Sustainable Mining* developed by The Mining Association of Canada, provide a set of guiding principles and performance elements that govern key activities of companies in the sector. This industry initiative helps the mining sector sustain its position as a leading economic contributor in Canada while protecting the environment and remaining responsive to Canadian expectations.

The outcomes and indicators in this section were developed to measure the sector's performance in addressing these concerns and environmental challenges. From the assessment of the various multi-stakeholder frameworks[72] in developing the report, the desired outcomes chosen to frame environmental performance are:

Responsible mining exploration, development, operation, and public policies will be predicated on maintaining a healthy environment and, on closure, returning mine sites and affected areas to viable self-sustaining ecosystems.

Institutional governance frameworks are in place that can provide certainty and confidence that the mechanisms exist for government, companies, communities, and residents to address adverse environmental effects.

The indicators chosen to measure the sector's performance relative to these statements are:

- **Waste and tailings management** – Effective management of waste and tailings is an important environmental and safety issue. The sector's performance in waste management provides an indication of its efforts to minimize the adverse environmental effects of its operations.

- **Water quality** – Water quality is fundamental to support safe drinking water for human health and ecological processes that support fish, vegetation, wetlands, and other wildlife. Assessing the trends in water quality using the Metal Mining Effluent Regulations data provides an indication of the performance of the sector in minimizing impacts on local ecosystems.

- **Air emissions** – Emissions of nitrogen oxide (NO_x), sulphur oxide (SO_x) and particulate matter (PM_{10} and $PM_{2.5}$) from operations have an impact on local, regional, and national ecosystems. These air pollutants contribute to smog, acid rain, and poor air quality, affecting human health and the health of ecosystems. Tracking trends in air emissions provides an indication of how the sector is performing with respect to reducing air pollution.

- **Greenhouse gas emissions** – Greenhouse gases act as a shield that traps heat in the earth's atmosphere. Monitoring the mining sector's management of these emissions is necessary to minimize environmental and climate change impacts.

- **Energy consumption and efficiency** – The vast majority of air pollutants emitted by the mining sector are linked to energy use by heavy equipment, power generation, and process furnaces. Measuring the sector's energy consumption provides an indication of its level of resource efficiency.

- **Environmental expenditures** – Measuring the level of the sector's environmental expenditures provides an indication of its efforts to improve the environmental performance of its operations.

- **Land-use planning** – The preservation of ecosystems is one method for governments and communities to work together with stakeholders to minimize adverse environmental effects for current and future generations.

[72] As mentioned in the introduction, the Whitehorse Mining Initiative and the Mining, Minerals and Sustainable Development frameworks were used in the development of the performance outcomes.

- **Orphaned and abandoned mines** – The legacy of orphaned and abandoned mines' environmental liability, human health concerns, and costs of clean-up is a serious issue facing Canada. Assessing the sector's performance in restoring abandoned mine sites to healthy ecosystems is critical to understand the progress in this area.

Synopsis

Overall, the environmental performance of the sector has gradually improved between 1998 and 2012. However, GHG emissions and energy intensity numbers have increased in most subsectors in the years following the global recession. It is important to note that there are limited data available to measure the evolution of the performance for protected areas and orphaned and abandoned mines.

Highlights

- Between 2006 and 2009, reported levels of **tailings and waste rock** were relatively consistent despite fluctuations in mineral production value and activities. However, levels increased by 23% between 2009 and 2010 and by 27% between 2010 and 2011.

- In 2011, 112 mines were subject to the Metal Mining Effluent Regulations (MMER), up from 73 in 2003. Between 2003 and 2011, the mining sector achieved a compliance rate of over 99% for several prescribed elements (asbestos, copper, nickel, zinc, radium-226, cyanide, lead) and only a few sporadic exceedances of the prescribed limits were reported for cyanide (4) and lead (1). Of note, the total number of exceedances over prescribed limits has decreased in recent years from 130 in 2008 to 74 in 2011.

- Between 1998 and 2011, the mining sector made significant progress in reducing **emissions of SO_x** (52.0%), **$PM_{2.5}$** (44.2%), **NO_x** (28.4%), and **PM_{10}** (26.9%). However, NO_x and PM_{10} emissions have both increased from 2008 to 2011 in the mining and quarrying subsector.

- In 2011, the mining sector emitted 46.3 million tonnes (Mt) of **GHG**, a decline of 7.9 Mt (14.5%) compared to 1998 emissions of 54.2 Mt. Of note, emissions decreased by 10.8 Mt (21.3%) between 2008 and 2009 before increasing again in both 2010 and 2011.

- Between 1998 and 2011, there was a decline in **energy intensity** (the ratio of energy consumption over GDP) for mining and quarrying (3.0%), primary metal manufacturing (8.9%), and nonmetallic mineral product manufacturing (26.2%), and an increase for fabricated metal product manufacturing (10.6%). However, the energy intensity in all of the subsectors, with the exception of nonmetallic mineral product manufacturing, increased between 2007 and 2011.

- Between 1998 and 2010, the mining sector's **environmental expenditures** (capital and operating) increased from $1.02 billion to $1.56 billion.

- Most provinces and territories have worked collaboratively with industry and communities in the establishment of **land-use plans** designed to conserve land and protect valuable ecosystems. The work undertaken varies considerably, but the overall goal of protection and land-use certainty appears to be consistent.

- Canada's federal, provincial, and territorial governments have spent more than $1 billion in the past 10 years to manage **abandoned mine sites** and to prevent/eliminate future abandonment.

Indicator, 1998-2012 (unless otherwise specified)	**Trend**
Waste and Tailings Management (2006-2011)	
Water Quality (2003-2011)	
Air Emissions (1998-2011)	
GHG Emissions (1998-2011)	
Energy Consumption and Efficiency (1998-2011)	
Environmental Expenditures (1998-2010)	
Land-Use Planning	Incomplete Assessment
Orphaned and Abandoned Mines	Incomplete Assessment
Improved Performance / Limited Improvement	Decline in Performance

Waste and Tailings Management

Highlights

- The level of tailings and waste rock was relatively unchanged between 2006 and 2009 before increasing in 2010 and 2011.
- In 2011, the percentage of NPRI substances in tailings and waste rock as a share of total releases, disposals, and transfers was 14.1% (13.7% for tailings and 0.4% for waste rock).

Definition

There are two main types of solid waste by mines: tailings and waste rock. Tailings are the by-products that remain following the extraction and recovery of valuable minerals from mine operations. They are generated by a milling process and are a mixture of finely ground sand- to silt-sized rock particles, water, and processing reagents.[73] Waste rock is rock that is removed in the mining process to provide access to the ore and is not further processed.[74]

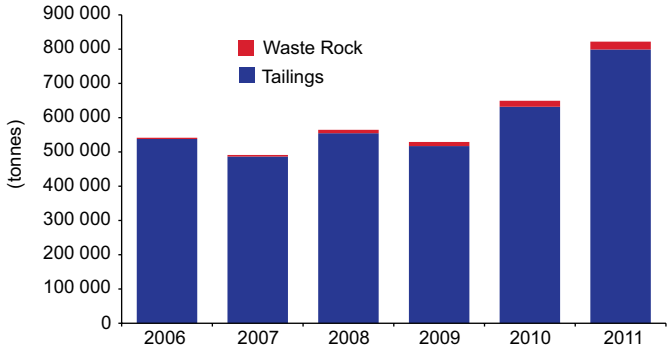
Rationale

The management of waste and tailings created by mining activity has a significant impact on the objective of maintaining a healthy environment.

Analysis

Beginning in 2009, the National Pollutant Release Inventory (NPRI)[75] collected information on the management of substances deposited in tailings management facilities and contained in waste rock piles.[76] The reporting requirements for tailings and waste rock were applied retroactively to 2006 for certain types of mining operations.

Figure 31: Taillings and Waste Rock Disposal, 2006-2011



Source: Environment Canada, National Pollutant Release Inventory.

In 2009, 85 mining and other facilities reported on tailings and waste rock. However, some metal ore and coal mines did not report.

The amount of substances disposed of in tailings and waste rock remained fairly consistent between 2006 and 2009. However, there was a marked increase of 23% in reported substances in the disposal of tailings and waste rock between 2009 and 2010, and a further increase of 27% between 2010 and 2011 (see Figure 31).[77] In 2011, the percentage of NPRI substances in tailings and waste rock as a share of total releases, disposals, and transfers was 14.1% (13.7% for tailings and 0.4% for waste rock).[78]

Environment Canada has reported a breakdown of tailings and waste rock by subsector for 2009 (see Table 9). Metal ore mines, including iron ore, accounted for close to 75% of reported substances in tailings and waste rock.

When natural water bodies that contain fish are used to store metal mine tailings, specific authorization is required to list the natural water body on Schedule 2 of the Metal Mining Effluent Regulations (MMER). In the 2010 MSPR, it was noted that between 2002 and 2009, five whole or partial natural water bodies were approved by the federal government to be used as tailings impoundment areas. The government had also added ten other water bodies to the MMER to reflect existing facilities operating prior to these regulations. Since 2009, four more water bodies have been approved to be used as tailings impoundment areas under Schedule 2 for the Mount Milligan (B.C.) and Jolu Central Mill (Sask.) projects.

[73] Natural Resources Canada Tailings Management factsheet.

[74] Environment Canada, National Pollutant Release Inventory, www.ec.gc.ca/inrp-npri/default.asp?lang=En&n=4A577BB9-1.

[75] In 2009, the Federal Court ruled that Environment Canada should collect and publish information in relation to releases and transfers to tailings and waste rock disposal areas by mining facilities.

[76] The NPRI does not report on direct releases to the environment.

[77] Total Reduced Sulphur (TRS) has been excluded from these totals.

[78] Environment Canada, *Summary Report: Reviewed 2011 NPRI Facility-Level Data*, http://ec.gc.ca/inrp-npri/default.asp?lang=En&n=0AD32A89-1.

Governments and industry are working together to develop methods to improve tailings management. One such initiative is the Green Mining Initiative's Green Mines Green Energy project, which utilizes tailings areas for energy crop production (see Box 11).[79]

Table 9: Tailings and Waste Rock Disposal (tonnes) by Subsector, 2009

Subsector	Tailings	Waste Rock	Total TWR	% of Total TWR
Metal Ore Mining	246 837	11 388	258 225	48.90%
Iron Ore Mining	126 100	-	126 100	23.80%
Oil Sands Mining	48 205	-	48 205	9.10%
Nonmetallic Mineral Mining	24 815	580	25 395	4.80%
Coal Mining	20 377	-	20 377	3.80%
Non-Mining Facilities	50 781	17	50 798	9.60%
Total	**517 115**	**11 985**	**529 100**	**100%**

Source: Environment Canada, National Pollutant Release Inventory. (TWR) Tailings and waste rock. - Nil.

Another industry tailings management initiative is The Mining Association of Canada's (MAC) Tailings Management Protocol under the Towards Sustainable Mining (TSM) initiative (see Box 12). The protocol assesses MAC members on their level of management system implementation of tailings management policies and commitments; tailings management systems; assigned accountability and responsibility for tailings management; annual tailings management reviews; and operation, maintenance, and surveillance manuals. Member performance is based on the systems and targets in place, with grades ranging from C (no systems in place) to A (comprehensive systems developed and implemented) to AAA (excellence in leadership). Since 2006, there has been an improvement in the percentage of members with "A" performance or better, but MAC notes in the 2012 TSM Progress Report that there is still work to be done to ensure all members are consistently meeting the protocol.[80]

Box 11: Green Mines Green Energy

Natural Resources Canada's Green Mines Green Energy (GMGE) initiative is advancing mine-site reclamation through the beneficial use of organic residuals for the sustainable establishment of biofuel crops and other productive land uses.

By 1994 estimates, there are more than 41 000 hectares (ha) of mine tailings in Canada, including 12 000 ha in Ontario and more than 2500 ha in the Sudbury area alone. Even if only half of the tailings area in Canada was amenable to energy crop production (because of climate, water cover, etc.), there is still potential to develop more than 20 000 ha of "marginal land" for the production of biofuel crops. Further, with increasing municipal demands to divert organic materials from landfill, there are opportunities to utilize these materials for mine reclamation. As a result, the GMGE approach offers an opportunity for the mining sector to significantly improve its sustainability by turning its waste areas into agriculturally productive land. Other benefits would be gained through the production of green energy, a reduction in greenhouse gases, and the potential to generate carbon credits through carbon sequestration. The concept builds on previous successes using paper mill biosolids to restore tailings areas.

Through GMGE efforts to date, demonstration sites for the technology have been developed at three mines in northern Ontario. Biosolids have been applied as covers for approximately 6 ha of tailings in northern Ontario to provide a growth medium for crops that include canola, sunflower, switch-grass, and hybrid willow. Covers also prevent fugitive tailings dust emissions through wind erosion, and the thick covers may act as oxygen and hydraulic barriers to slow or eliminate air and water movement to the tailings below.

The GMGE initiative has demonstrated the technical feasibility of this reclamation approach, with crops generating in the order of 10 tonnes per hectare (dry weight) of biomass and enough canola oil to generate net revenue of approximately $900 per hectare while producing in the range of 3600 litres of biodiesel per year. Limitations to this reclamation approach include the availability of biosolids in large volumes and the cost of transportation. Ongoing research with industrial, academic, and government partners is examining options for cultivating crops using thinner covers or directly within tailings. These efforts will further refine the model to improve economic feasibility and applicability to mine sites elsewhere in Canada and internationally.

Source: Natural Resources Canada

[79] www.nrcan.gc.ca/minerals-metals/technology/4473.

[80] The Mining Association of Canada, *Towards Sustainable Mining Progress Report 2012*, http://mining.ca/tsm/.

Box 12: Towards Sustainable Mining (TSM)

Towards Sustainable Mining (TSM) is an initiative developed by MAC in 2004 to help mining companies evaluate and manage their environmental and social responsibilities. Until now, MAC members have been reporting on four performance elements: tailings management, energy use and GHG emissions management, external outreach, and crisis management planning. Performance elements and management system-based indicators are developed to measure how MAC members implement the commitments. Companies report against the indicators for each facility annually in MAC's *Towards Sustainable Mining Progress Report* and have their results externally verified every three years.

Source: www.mining.ca/site/index.php/en/towards-sustainable-mining.html

Data Issues

In interpreting the data, it is important to note that the totals for tailings and waste rock do not take into account changes in the breakdown of substances in the disposals. For example, if the amount of mercury in tailings decreases while the amount of other less innocuous substances increases, this would lessen the environmental impact, but would not be captured in the overall totals. Also, as the requirements came into effect in 2009 and facilities were asked to report retroactively for 2006 through 2008, there may be some errors in the retroactive reporting. There have also been changes in reporting requirements for 2006 to 2008 and 2009 to 2010. The 2006 to 2008 requirements are applicable only to mining and oil sands facilities that generated or disposed of tailings and/or waste rock from the processing of bitumen, coal, diamonds, potash, or metals, while the 2009 to 2010 requirements apply to all facilities that generated or disposed of tailings and waste rock. It should also be noted that not all mining facilities meet the new tailings and waste rock reporting requirements (e.g., certain potash and coal mines).

Water Quality

Highlights

- Although the number of mines subject to the MMER has increased since 2003, the number of exceedances of prescribed limits has declined by 30.2% from 2003 to 2011.
- Between 2003 and 2011, base-metal mines accounted for 40.6% of the exceedances.

Definition

The water quality measure in this report is defined by the mining sector's compliance with the Metal Mining Effluent Regulations (MMER).

Rationale

Mineral extraction produces a large amount of waste. Water used in the mining process and precipitation permeating mine tailings can become contaminated with metals, process reagents, and other undesirable constituents. If not contained and managed properly, the impacts on water quality can continue for decades or centuries after the mining activity has finished. Measuring compliance with the MMER provides insight on the industry's performance in maintaining healthy ecosystems.

Analysis

Section 36 of the *Fisheries Act* prohibits the deposit of deleterious substances in waters frequented by fish unless otherwise authorized. The MMER,[81] enacted in 2002 and pursuant to section 36 of the *Fisheries Act*, grant mining companies the authority to deposit substances that would otherwise be prohibited into fish-bearing waters. Mines may be granted transitional authorizations to deposit tailings with higher suspended solid concentrations than allowed under the MMER.[82]

The data employed in this section do not distinguish between mines with transitional authorizations and those without.

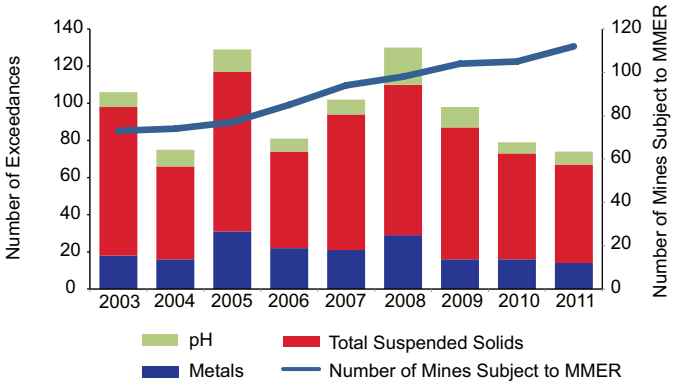
[81] The MMER set out the effluent limits on releases of arsenic, copper, cyanide, lead, nickel, zinc, radium-226, and total suspended solids. The regulations apply to all metal mines with the exception of placer, coal, and diamond mines.

[82] The MMER require effluent monitoring and reporting, and environmental effects monitoring.

From 2003 to 2011, there was an overall pattern of decrease in the number of exceedances across different substances. While the number of exceedances reported for total suspended solids made up the bulk of exceedances between 2003 and 2011, these had dropped to 53 by 2011, 33.8% lower than 2003 levels (80 exceedances). At the same time, the compliance rate for total suspended solids increased from 92.1% in 2003 to 96.1% in 2011. Most of the exceedances occurred at three problematic facilities for which appropriate remediation measures and technical solutions are being examined and/or implemented to fix the problem.

In 2011, 112 mines were subject to the MMER, up from 73 in 2003. Despite the consistent annual increase in the number of facilities subject to the MMER, the number of reported exceedances[83] over prescribed limits declined from 106 in 2003 to 74 in 2011, a decrease of 30.2%. However, there were large fluctuations in the number of exceedances throughout this period (see Figure 32).

Figure 32: Distribution of MMER Exceedances by Substance, 2003-2011



Source: Environment Canada, Summary Review of Performance of Metal Mines Subject to the Metal Mining Effluent Regulations.

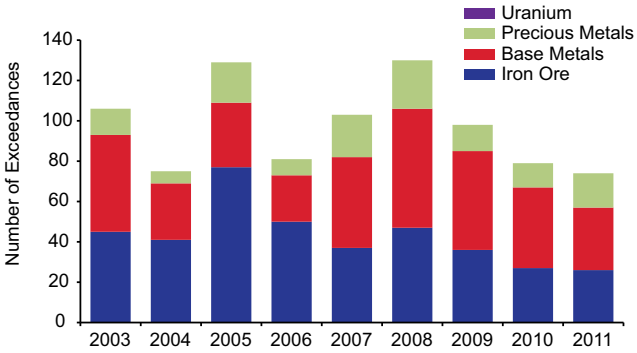
Furthermore, between 2003 and 2011, the mining sector achieved a compliance rate of over 99% for several prescribed elements (asbestos, copper, nickel, zinc, radium-226, cyanide, lead) and only a few sporadic exceedances were reported for cyanide (4) and lead (1).

The majority of exceedances between 2003 and 2011 were in the iron ore and base-metal subsectors.

[83] The MMER impose limits on releases of cyanide, stringent requirements for total suspended solids, an upper pH limit, and prohibit the discharge of effluent that is lethal to fish. An exceedance is any discharge above these requirements and/or limits.

Both reported large fluctuations in the number of exceedances, particularly from 2003 to 2007 (see Figure 33).

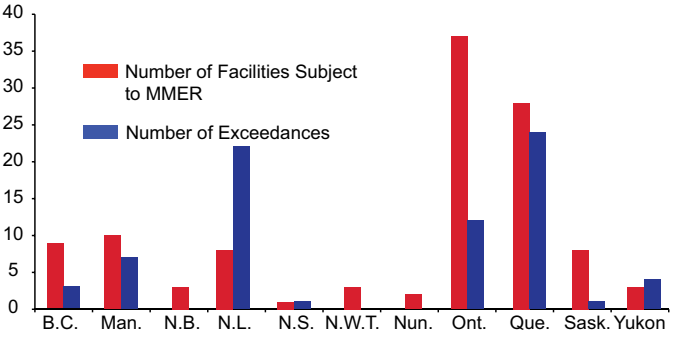
Figure 33: MMER Exceedances by Subsector, 2003-2011



Source: Environment Canada, Summary Review of Performance of Metal Mines Subject to the Metal Mining Effluent Regulations.

In terms of regional distribution, Quebec (24), Newfoundland and Labrador (22), and Ontario (12) had the highest number of reported exceedances in 2011 and collectively accounted for 78.4% of total exceedances (see Figure 34). The majority of the remaining exceedances were concentrated in Manitoba (7), Yukon (4), and British Columbia (3). Of note, both Yukon and Newfoundland and Labrador had a higher number of exceedances than facilities subject to the MMER.

Figure 34: Regional Distribution of Facilities and Exceedances, 2011

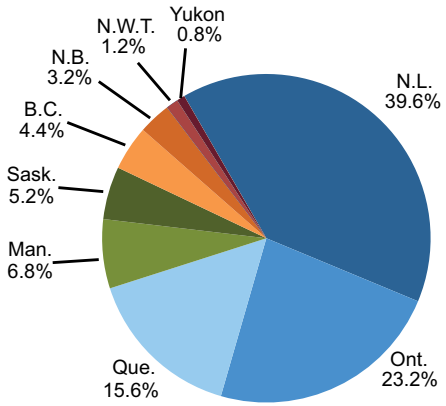


Source: Environment Canada, Summary Review of Performance of Metal Mines Subject to the Metal Mining Effluent Regulations.

Under the MMER, mine effluent is required to be non-acutely lethal to rainbow trout. Figure 35 shows the regional distribution of acutely lethal effluent tests to rainbow trout for each jurisdiction. Acute lethality means that an effluent results in a mortality rate of

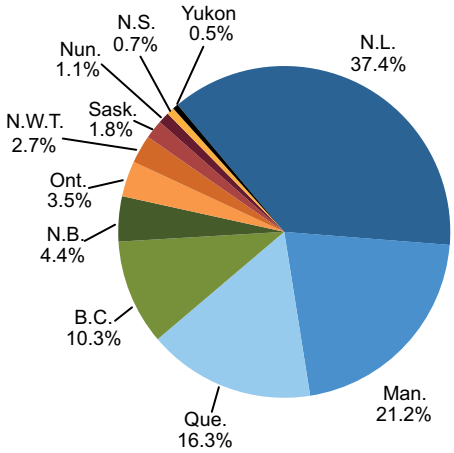
more than 50% of the species to which it is subjected within 96 hours of exposure. Between 2003 and 2011, Newfoundland and Labrador accounted for 39.6% of total acutely lethal effluents to rainbow trout while Ontario and Quebec accounted for 23.2% and 15.6%, respectively. Figure 36 shows the regional distribution of acutely lethal effluent tests to Daphnia Magna[84]; Newfoundland and Labrador also had the highest percentage of lethal tests between 2003 and 2011 at 37.4% while Manitoba and Quebec accounted for 21.2% and 16.3%, respectively.

Figure 35: Regional Distribution of Acutely Lethal Rainbow Trout Tests, 2003-2011



Source: Environment Canada, Summary Review of Performance of Metal Mines Subject to the Metal Mining Effluent Regulations.

Figure 36: Regional Distribution of Daphnia Magna Acutely Lethal Tests, 2003-2011



Source: Environment Canada, Summary Review of Performance of Metal Mines Subject to the Metal Mining Effluent Regulations.

[84] A marine invertebrate (a freshwater flea) used in laboratories to test eco-toxicity.

Air Emissions

Highlights

- The mining sector's air emissions for many of the pollutants decreased between 1998 and 2011. Of note, SO_x emissions decreased by 52.0% while NO_x emissions decreased by 28.4%.
- The only increase in emissions was a small increase (0.03%) in PM_{10} in the mining and rock quarrying subsector.

Definition

Air emissions are defined as the release of pollutants into the atmosphere. Air pollutants discussed in this section are sulphur oxide (SO_x), nitrogen oxide (NO_x), and particulate matter respirable (PM_{10}) and fine ($PM_{2.5}$).

Rationale

Emissions of these pollutants pose environmental health risks as they contribute to smog, acid rain, ground-level ozone, and poor air quality, and have adverse effects on human health.

Analysis

According to the National Pollutant Release Inventory (NPRI), between 1998 and 2011, the mining sector made significant progress in reducing emissions of SO_x (52.0%), $PM_{2.5}$ (44.2%), NO_x (28.4%), and PM_{10} (26.9%) (see Table 10). At the subsector level, emissions of each pollutant have consistently declined in nonmetallic mineral product manufacturing and primary metal manufacturing. However, emissions of two pollutants increased in the mining and rock quarrying subsector: PM_{10} levels increased by a mere 0.03% between 1998 and 2011, and by 13.9% between 2008 and 2011, while NO_x levels increased by 24.2% between 2008 and 2011.

Table 10: Mining Sector Air Emissions (tonnes), 1998, 2008, and 2011

Mining and Rock Quarrying*					Nonmetallic Mineral Product Manufacturing**			
	SO_x ▼	NO_x ▼	PM_{10} ▲	$PM_{2.5}$ ▼	SO_x ▼	NO_x ▼	PM_{10} ▼	$PM_{2.5}$ ▼
1998	55 852	42 694	49 598	19 932	39 490	44 102	19 859	9 439
2008	23 203	30 011	43 566	13 406	32 236	38 430	18 508	8 977
2011	17 729	37 265	49 614	11 757	22 940	30 053	14 652	6 950
Primary Metal Manufacturing* **					**Total Sector Emissions**** **			
	SO_x ▼	NO_x ▼	PM_{10} ▼	$PM_{2.5}$ ▼	SO_x ▼	NO_x ▼	PM_{10} ▼	$PM_{2.5}$ ▼
1998	890 910	27 328	41 768	28 813	986 252	114 124	111 225	58 184
2008	665 563	18 453	21 107	16 064	721 002	86 895	83 182	38 448
2011	432 605	14 340	17 003	13 765	473 274	81 658	81 269	32 472

Source: Environment Canada, National Pollutant Release Inventory, www.ec.gc.ca/inrp-npri/default.asp?lang=En&n=0EC58C98-1.

* Environment Canada's NPRI for criteria air contaminants uses a different industry coding system. Mining and rock quarrying in this data table includes Mining and Rock Quarrying (Rock, Sand and Gravel, Metal Mining, Coal Mining Industry, Potash, and Other Minerals) and Iron Ore Mining Industry and Pelletizing.

** Using NPRI industry coding, this dataset includes: Clay Products, Brick Products, Other Mineral Products, Cement Manufacture, Lime Manufacture, Concrete Batching & Products, and Abrasives Manufacture.

*** Using NPRI industry coding, this dataset includes: Ferrous Foundries; Nonferrous Foundries; Die Casting; Primary (Blast Furnace and DRI); Secondary (Electric Arc Furnaces); Steel Recycling; Nonferrous Smelting and Refining Industry (Primary Ni, Cu, Zn, Pb, Secondary Pb, Cu, and Other Metals); and Aluminum Industry (Alumina [Bauxite Refining], Primary Aluminum Smelting & Refining, and Secondary Aluminum [Includes Recycling]).

**** The NPRI database does not provide data on fabricated metal manufacturing.

In the mining and rock quarrying subsector, the main direct sources of air emissions are diesel engines used in haulage, drilling, maintenance, personnel transportation, and heating and cooling. PM emissions are largely a result of dust created in the crushing and fragmenting processes and transportation. The majority of SO_x emissions are produced by smelting and refining activities. The decline in SO_x and NO_x emissions can be attributed in part to federal and provincial/territorial government regulatory initiatives such as the implementation of the Canada-Wide Acid Rain Strategy for Post-2000,[85] as well as agreements with the United States on SO_x emission caps.[86] The decline can also be attributed to the use of low-sulphur fuels, technological upgrades, pollution controls for base-metal smelters, and facility closures.

Data Issues

Environment Canada's NPRI uses different industry coding that does not always match with the North American Industry Classification System used for most other sections of this report to define the mining sector.

[85] Signed by federal, provincial, and territorial energy ministers in 1998, it provides a framework for the long-term management of acid rain in Canada. Among other things, it requires regular reporting on SO_2 and NO_x emissions and forecasts, www.ccme.ca/assets/pdf/1998_acid_rain_strategy_e.pdf.

[86] Transboundary pollution is a significant source of air pollution.

Greenhouse Gas Emissions

Highlights

- In 2011, the mining sector emitted 46.3 million tonnes (Mt) of GHG, a decline of 7.9 Mt (14.5%) compared to 1998 levels.
- The mining sector accounted for 6.6% of Canada's total GHG emissions in 2011 compared with 8.0% in 1998.
- Since 2009, GHG emissions have increased by 15.8% (6.3 Mt).

Definition

Greenhouse gases (GHG) include methane (CH_4), chlorofluorocarbons (CFC), and carbon dioxide (CO_2). These gases act as a shield that traps heat in the earth's atmosphere.

Rationale

Climate change, as a result of GHG accumulation in the atmosphere, has emerged as one of the most important environmental, economic, and social issues extending beyond local and national boundaries. In May 2013, the daily mean concentration of carbon dioxide in the atmosphere of Mauna Loa, Hawaii, surpassed 400 parts per million, reaching a concentration not seen on earth for at least three million years.[87] The period 2001-2010 was the warmest decade on record since modern meteorological records began around the year 1850.[88]

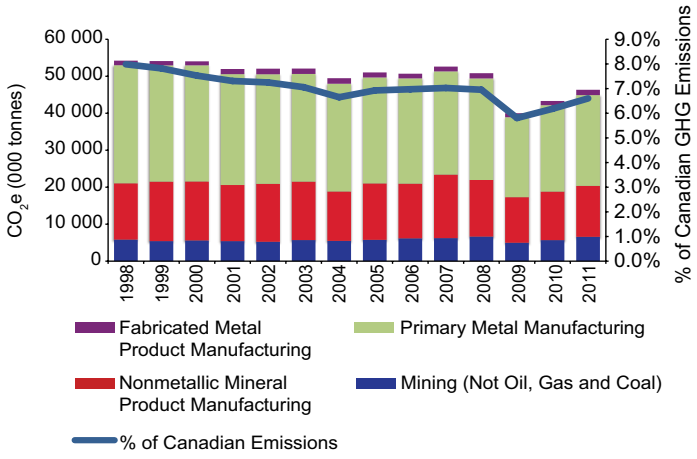
Analysis

The vast majority of GHG emitted by the Canadian mining sector is linked to energy use by heavy equipment, power generation, and process furnaces. In 2011, the mining sector emitted 46.3 Mt of GHG, a decline of 7.9 Mt (14.5%) compared to 1998 levels (see Figure 37). The mining sector accounted for 6.6% of Canada's total GHG emissions in 2011, compared with 8.0% in 1998.[89]

At the subsector level, between 1998 and 2011, there was a decline in GHG emissions intensity (a ratio of CO_2 equivalent over GDP) for mining and quarrying (0.2%), primary metal manufacturing (25.2%), and nonmetallic mineral product manufacturing (23.4%), and a slight increase for fabricated metal product manufacturing (1.7%) (see Figure 38).

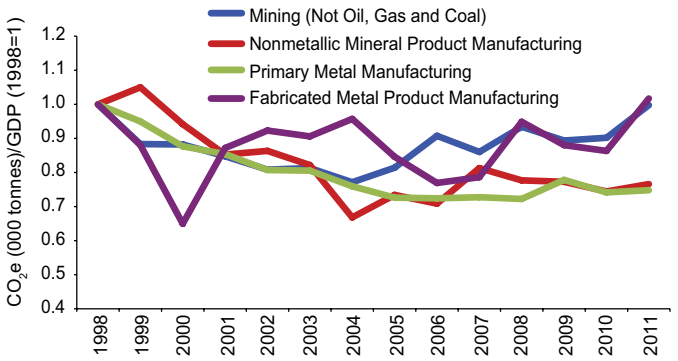
Of note, between 1998 and 2011, the GHG emissions per unit of production (Mt) increased by 1.4% in the nonmetal mining and quarrying industry and by 7.1% in the metal ore mining industry. As mines become older and move deeper and more remote, the energy required to access and extract the metals becomes much higher. This increased energy requirement could lead to higher GHG emissions per unit of production.

Figure 37: Mining Sector GHG Emissions, 1998-2011



Sources: Canadian Industrial Energy End-Use Data and Analysis Centre; Environment Canada.

Figure 38: Mining Sector GHG Emission Intensity (GDP), 1998-2011



Source: Canadian Industrial Energy End-Use Data and Analysis Centre.

[87] www.esrl.noaa.gov/gmd/news/7074.html.

[88] United Nations World Meteorological Organization, www.wmo.int/pages/index_en.html.

[89] Sources: www2.cieedac.sfu.ca/index.html and www.ec.gc.ca/ges-ghg/default.asp?lang=En&n=68EE206C-1.

The Mining Association of Canada (MAC) has worked with its members to develop a voluntary Energy and GHG Emissions Management Protocol as a component of its Towards Sustainable Mining (TSM) initiative.[90] This protocol, originally developed in 2004, was revised in 2012. Within this protocol, three performance indicators have been established: (1) energy use and greenhouse gas emissions management systems, (2) reporting systems, and (3) performance targets. The members are assessed on the systems and targets in place, with grades ranging from C (no systems in place) to A (comprehensive systems developed and implemented) to AAA (excellence in leadership). The most recent progress report released in 2012 highlights that 50% of the members had a comprehensive GHG emissions reporting system in place in 2011 (up from 30% in 2006), while 30% had established emissions intensity targets (up from 20% in 2006).[91]

Data Issues

Two different datasets were used in measuring the sector's GHG emissions as a percentage of Canada's overall emissions. As the Canadian Industrial Energy End-Use Data and Analysis Centre database only provides total industrial emissions, Environment Canada's National Inventory Report was used for the overall emissions.

Energy Consumption and Efficiency

Highlights

- The mining sector's energy consumption remained relatively constant between 1998 and 2011; it decreased following the global recession of 2008 and 2009, but has risen since then.
- Energy intensity has increased for most subsectors in recent years.

Definition

Energy consumption is defined as the energy used from all sources during a given year. Energy intensity is the ratio of energy consumption over output. In this section, both GDP and production per kilotonne are used as outputs to calculate intensity.

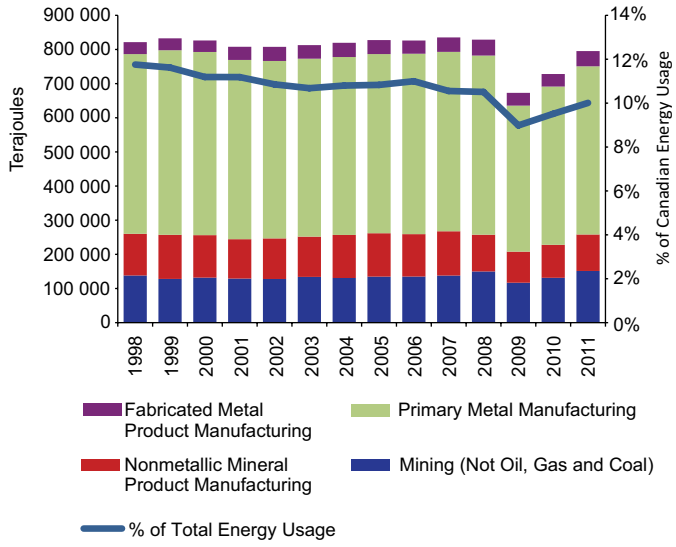
Rationale

The vast majority of air pollutants emitted by the mining sector are linked to energy use by heavy equipment, power generation, and process furnaces. Trends in energy intensity provide an indication of the resource efficiency of the sector.

Analysis

Among the energy efficiency challenges facing the mining sector is the challenge of older and deeper mines requiring more energy to access and extract the minerals. Mining operations in remote regions, especially in the North, also face a particular energy challenge given their lack of access to the electrical grid, forcing companies to rely on less efficient and more costly sources of power generation and limited infrastructure.

Figure 39: Mining Sector Energy Consumption, 1998-2011



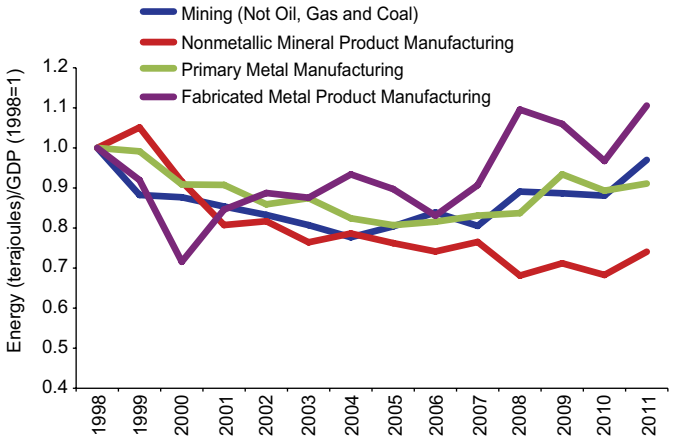
Sources: Canadian Industrial Energy End-Use Data and Analysis Centre; Statistics Canada, CANSIM Table 128-0016.

[90] www.mining.ca/site/index.php/en/towards-sustainable-mining.html.

[91] The Mining Association of Canada, *Towards Sustainable Mining Progress Report 2012*.

At the subsector level, between 1998 and 2011, there was a decline in energy intensity (a ratio of energy consumption over GDP)[92] for mining and quarrying (3.0%), primary metal manufacturing (8.9%), and nonmetallic mineral product manufacturing (26.2%), and an increase for fabricated metal product manufacturing (10.6%). Of note, there has been an increase in the energy intensity of each subsector in recent years (see Figure 40).[93]

Figure 40: Mining Sector Energy Intensity (GDP) 1998-2011



Source: Canadian Industrial Energy End-Use Data and Analysis Centre.

Between 1998 and 2011, the energy consumption over production (kilotonnes) of the nonmetal mining and quarrying industry improved by 0.2% from 1998 to 2011 while it increased by 2.6% for the metal ore mining industry.

In MAC's most recent TSM progress report, over 60% of its members had comprehensive energy use reporting systems, up from 34% in 2006, and close to 40% of the members had established energy intensity targets, up from less than 20% in 2006.

Governments and industry have identified energy as a key challenge for the industry going forward and have been working together on a variety of initiatives to improve energy-use practices. One such initiative is the Green Mining Initiative's Ventilation on Demand Project[94] (see Box 13), which looks to decrease the energy use required for ventilation in underground mining operations.

[92] Energy intensity by GDP trends should be viewed with caution as high metal and mineral prices can increase GDP, which diminishes the effects of increased energy consumption on the intensity data.

[93] Source: Canadian Industrial Energy End-Use Data and Analysis Centre.

[94] www.miningexcellence.ca/projects/vod/.

Box 13: Ventilation on Demand (VOD)

Underground metal mines have a significant impact on Canada's economy. In 2010, they added $7.4 billion to the Canadian economy and employed roughly 15 000 workers (Natural Resources Canada, 2012). Part of keeping the industry competitive means controlling operational costs, including the energy costs associated with the underground extraction process. Of these, ventilating underground workings represents 40% of the total. In medium to large operations, this can be as much as $12 million per year in expenditures. From the point of view of environmental impact, generating energy has a GHG footprint. The challenges of operating a safe, cost-effective underground mine involve having access to many potential extraction sites or orebodies. As a result, ventilation systems can be very extensive and complex. In order to be efficient, these systems need to be managed carefully in order to supply air when and where it is needed. VOD through monitoring of airborne contaminants, air volumes, the presence of diesel equipment, and the real-time status of the ventilation infrastructure (main and auxiliary fans, regulators, etc.) allows real-time fine-tuning of the system to provide optimal air volumes in support of the extraction process. It is estimated that a well-managed VOD system could reduce the costs associated with ventilation by as much as 40%.

CanmetMINING's involvement in the VOD research to date has been very successful. Its contribution to the Centre for Excellence in Mining Innovation (CEMI) VOD project has demonstrated a high rate of return and has leveraged its R&D investment with an estimated internal rate of return of close to 22%.

Source: Natural Resources Canada

Data Issues

As with GHG emissions, two different datasets were used in measuring the sector's energy usage as a percentage of Canada's overall energy usage. The Canadian Industrial Energy End-Use Data and Analysis Centre database provides only total industrial energy use; therefore, Statistics Canada data on supply and demand of primary and secondary energy were used for the overall energy use.

Environmental Expenditures

Highlights

- Between 1998 and 2010, the mining sector's environmental capital expenditures increased by 48.7% while environmental operating expenditures increased by 54.2%.
- Both types of expenditures increased significantly from 2006 to 2008 before declining in 2010.

Definition

Environmental expenditures are defined as all capital (investment) and operating (current) expenditures incurred by businesses to comply with current, and anticipate future, Canadian and international environmental regulations, conventions, or voluntary agreements. Expenditures are sub-divided by Statistics Canada into environmental monitoring, environmental assessments and audits, reclamation and decommissioning, wildlife and habitat protection, waste management and sewerage services, pollution abatement and control processes (end-of-pipe, including waste management), pollution prevention processes, fees, fines and licences, and others.

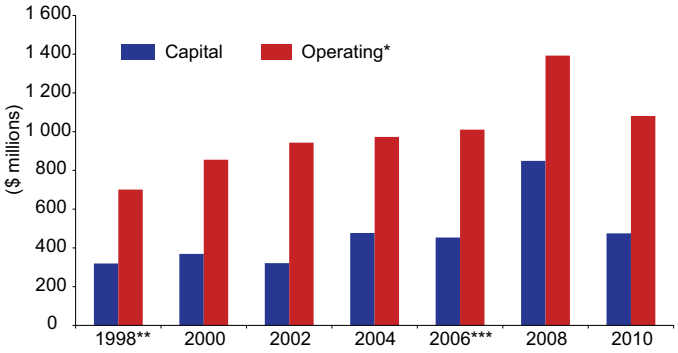
Rationale

Expenditures on environmental protection provide an indication of the level of commitment the industry is making to protect the environment and maintain healthy ecosystems.

Analysis

Between 1998 and 2010, the mining sector's capital expenditures on environmental protection increased from $320 million to $475 million, while operating expenditures increased from $701 million to $1080 million (see Figure 41). In 1998, the mining sector accounted for 18.4% of Canada's total capital expenditures on environmental protection and 24.1% of operating expenditures. The sector's share dropped to 11.4% for capital expenditures and 20.7% for operating expenditures in 2010. Of note, the mining sector's capital expenditures almost doubled between 2006 and 2008, growing from $454 million to $849 million, while operating expenditures increased by one-third from $1010 million to $1393 million.[95] As with many of the economic indicators, these expenditures fell following the global recession in 2008 and 2009. In 1998, the primary metals subsector accounted for the largest share of both capital (57.6%) and operating (59.4%) expenditures on environmental protection in the mining sector (see Figure 42). By 2010, however, the mining and quarrying subsector had surpassed the primary metals industry in capital expenditures, accounting for 60.3% of the mining sector's capital expenditures on environmental protection. Nonetheless, the primary metals subsector retained the largest share of operating expenditures (48.0%) on environmental protection in the mining sector in 2010. The bulk of the primary metals subsector's operating expenditures was spent on pollution abatement and control processes (33.5%), waste management and sewerage services (30.6%), and pollution prevention processes (22.6%).

Figure 41: Environmental Protection Expenditures in the Mining Sector, 1998-2010

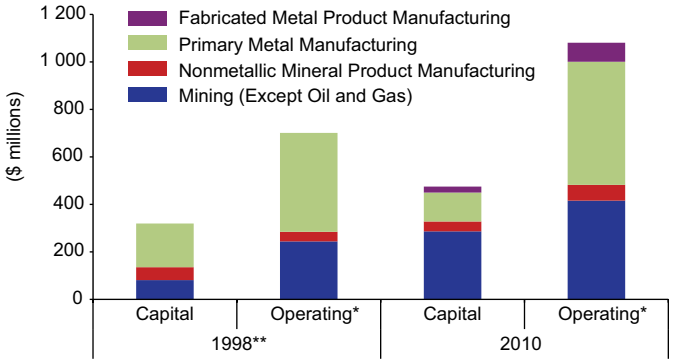


* Fees, fines and licence expenditures are excluded from operating expenditures.
** In 1998, the Fabricated Metal Products Industry was included with "other manufacturing" and thus was excluded.
*** In 2006, the Fabricated Metal Products Industry data were too unreliable to publish and thus were excluded.

Source: Statistics Canada, Environmental Protection Expenditures in the Business Sector.

[95] Statistics Canada, Environmental Protection Expenditures in the Business Sector.

Figure 42: Environmental Protection Expenditures, Disaggregated, 1998 and 2010



* Fees, fines and licence expenditures are excluded from operating expenditures.

** In 1998, the Fabricated Metal Products Industry was included with "other manufacturing" and thus was excluded.

Source: Statistics Canada, Environmental Protection Expenditures in the Business Sector.

Data Issues

It is important to note that the data on environmental expenditures for the fabricated metal manufacturing subsector are unavailable for various years. Capital expenditures data by types of activities for each subsector are also suppressed to meet confidentiality requirements or are too unreliable to be published for various years.

Land-Use Planning

Definition

Land-use planning is the process to evaluate and regulate land use in an appropriate and efficient manner. The goal of land-use planning is to reduce the possibility of conflict between competing land uses by designating preferential uses for specific areas.

Rationale

Governments have long planned the use of public land to promote human settlement, facilitate economic development, and protect natural resources. The absence of up-to-date land-use plans over large areas of Canada, however, is becoming an issue as the pressure to develop or conserve resources increases. Conservation groups, for example, have long objected that the mineral tenure and free entry system, prevalent in most Canadian jurisdictions, allows mining companies to register mineral claims and acquire mineral tenure on most lands regardless of other possible land uses. This approach, developed as an incentive to encourage mineral exploration, has in the past affected the protection of areas that are important for environmental or cultural reasons and can lead to conflict.

Analysis

Land-use planning in Canada generally falls under the responsibility of provincial/territorial governments. In recent years, some governments (Ontario, Quebec) have made changes to mining titles legislation to balance the competing pressures for surface and sub-surface resources. Most provinces revised their land-use policies and planning acts in the 1980s and 1990s. British Columbia was a leader in this area and, as of 2008, approximately 85% of the province was covered by 26 strategic land-use plans.[96] For its part, Alberta has established a Land-Use Framework to address the cumulative impacts of multiple industrial developments on its ecosystems.[97] In addition, Nova Scotia established a process for land-use planning with a legislated target of legally protecting 12% of its land by 2015.[98] At the national level, one important initiative in recent years has been the Boreal Caribou Recovery Strategy,[99] an overarching national set of guidelines for the protection of woodland boreal caribou. The strategy identified critical habitat across northern Canada and included a protection threshold of 65% of existing critical habitat. Aboriginal communities, government(s), industry stakeholders, environmental non-governmental organizations, and academia across Canada were consulted in the development of this strategy. During the consultation period, over 192 technical submissions were received from the various groups. Under the *Species at Risk Act*, the Minister of the Environment must report on the implementation of this strategy and the objectives every five years.

Yukon

Yukon also has a regional land-use planning process, governed by Chapter 11 of the First Nation Final Agreement.[100] In this process, the Yukon government,

[96] Forest Practices Board (2008), *Provincial Land-Use Planning: Which Way From Here?*, www.llbc.leg.bc.ca/public/pubdocs/bcdocs/450886/sr34_lml.pdf.

[97] Canada's Fourth National Report to the United Nations Convention on Biological Diversity, p. 55, www.cbd.int/doc/world/ca/ca-nr-04-en.pdf.

[98] Government of Nova Scotia, www.gov.ns.ca/nse/12percent/.

[99] Environment Canada, www.sararegistry.gc.ca/default.asp?lang=En&n=33F-F100B-1.

[100] Government of Yukon, www.emr.gov.yk.ca/lands/regional_land_use_planning.html.

First Nations, stakeholders, and residents work together to develop blueprints to guide the future use and development of land in their area. To date, a regional land-use plan has been completed for the North Yukon region. The goal is to have regional land-use planning completed for all regions throughout the territory.

Yukon also has a number of territorial and national park interests where land has been designated for park purposes. There are also other areas identified and managed for habitat or other wildlife/natural values through various management tools. Lands have also been withdrawn from disposition as part of continued discussions with three First Nations that have not settled final comprehensive agreements with the government.

Ontario

The Far North land-use planning initiative in Ontario is linked to the *Far North Act*. The initiative will result in withdrawals of mining rights under the *Mining Act* across a large area in the Far North of the province. There is one amendment to the *Mining Act* (Section 31 (2)) that accommodates withdrawal of areas of spiritual and cultural significance. It applies across the entire province and not just in the Far North. Under the Far North land-use planning initiative, First Nations groups will work with the Ontario Ministry of Natural Resources to prepare local community-based land-use plans. When completed, these plans will become part of Ontario's land-use policy, identifying what type of activities, including resource development, would be permitted and where. Ontario expects this process to take between 10 and 15 years to complete.

Data Issues

As land-use planning falls within provincial jurisdiction[101] and varies from province to province, it is very difficult to provide a national picture of land-use planning in Canada with respect to the mining sector.

[101] With the exceptions of Yukon (Yukon government), Northwest Territories (federal), and Nunavut (federal).

Orphaned and Abandoned Mines

Highlights

- Canada's federal, provincial, and territorial governments have spent more than $1 billion in the past 10 years to manage abandoned mines and to prevent the occurrence of new ones.

Definition

Orphaned or abandoned mines are mines for which the owner cannot be found or for which the owner is financially unable or unwilling to remediate the site. Canada's long mining history has led to around 10 000 abandoned exploration and mining sites that require varying degrees of rehabilitation.[102]

Rationale

Abandoned mines pose environmental, health, safety, and economic problems to local communities, the mining industry, and governments. Abandoned mines also represent a significant liability to the Crown. Today, mining legislation in all Canadian jurisdictions requires mine developers to submit mine closure plans that describe how the site will be rehabilitated throughout its life cycle, how it will be decommissioned when mining activities end, and to post a financial surety[103] to ensure these activities are carried out.

Analysis

Canada's federal, provincial, and territorial governments have spent more than $1 billion in the past 10 years to manage abandoned mines and to prevent the occurrence of new ones.

To address the problem of orphaned and abandoned mines, governments, industry, and civil society created the National Orphaned/Abandoned Mines Initiative (NOAMI) in 2002. Since it began, provinces and territories have taken significant steps to address orphaned and abandoned mines through either regulations or voluntary initiatives. Today, while the potential for new orphaned and abandoned mines is very low, NOAMI continues to work toward eliminating

[102] National Orphaned/Abandoned Mines Initiative (2009), 2002-2008 Performance Report, p. 5, www.abandoned-mines.org/pdfs/NOAMIPerformanceReport2002-2008-e.pdf.

[103] Standards and requirements vary. These are not a guarantee of the obligations that a company may incur (e.g., may not be financial surety for 100%) but, rather, an assurance of compliance with the defined closure plan.

any future abandonments, and Canadian jurisdictions are constantly striving to improve the management and rehabilitation of existing properties through new and innovative approaches.

At the core of NOAMI lie two major strengths. One is that the initiative is multi-stakeholder in nature and the other is that it is truly national in its reach. Funding and other valuable resources are provided by the federal government, several provinces and territories, the mining industry, and non-governmental organizations. It is a pan-Canadian effort that has made tremendous progress in addressing issues related to orphaned and abandoned mines in this country.

NOAMI is currently developing a high-level roadmap for managing long-term liabilities and issues related to the return of lands to the Crown. This includes developing a decision-making process that follows the progression of actions and identifies the key issues and questions that should be addressed for relinquishment of a site. The report is to provide guidance to jurisdictions and industry in determining whether a site should be brought under government jurisdiction or remain the responsibility of the operator.

Federal and Provincial Initiatives

Federal Government – Aboriginal Affairs and Northern Development Canada

In 2005, the Federal Contaminated Sites Action Plan was established by the federal government. This program committed $3.5 billion over a 15-year period for the assessment and remediation of contaminated sites under the federal government's responsibility, which includes abandoned mines in the three territories. The Northern Contaminated Sites Program (NCSP) within Aboriginal Affairs and Northern Development Canada is responsible for the remediation of abandoned mines in the North, including the Giant mine in the Northwest Territories (N.W.T.) and the Faro mine in Yukon. The Faro mine project is co-managed with the Yukon government.

To date, the NCSP has remediated five abandoned mines in the N.W.T. (Port Radium, Discovery, North Inca, Hidden Lake, and Colomac) and one site in Nunavut (Robert's Bay). Ongoing in 2013 and 2014 is the assessment and/or remediation of 4 abandoned mines in Yukon and 13 abandoned mine projects in the N.W.T.

British Columbia

The Crown Contaminated Sites Program was established in 2003 to address a broad range of contaminated sites, including many abandoned mine sites. Since 2003, remediation has been completed or is under way on 83 Crown land sites. The British Columbia (B.C.) government has committed $276 million to the remediation and management of contaminated sites. As of March 2013, approximately $161 million of these funds had been spent.

Manitoba

In 2000, Manitoba established the Orphaned/Abandoned Mine Site Rehabilitation Program to address the environmental, health, and public safety concerns of orphaned and abandoned mines in the province. Within this program, 149 former mine sites were identified, including five high-priority sites (Lynn Lake, Sherridon, Gods Lake, Snow Lake, and Baker Patton), and 31 high-hazard sites. As of December 31, 2012, the Province had spent over $100 million on orphaned and abandoned mine-site rehabilitation.[104]

Manitoba also established mine closure regulations which require that environmental liabilities incurred during mining operations be financially secured to cover future remediation costs. Mine closure plans and financial security must be filed and approved prior to a permit being granted for a new mine. In 2006, Manitoba established a provincial environmental liability account for orphaned and abandoned mines.

Newfoundland and Labrador

Orphaned and abandoned mines (OAMs) in Newfoundland and Labrador are mostly historic and predate the province joining Confederation in 1949; all of the sites predate the *Mining Act*. These properties, ranging from exploration sites to large-scale former producing mines, can pose safety risks to the public and some have environmental issues.

Newfoundland and Labrador has spent over $30 million on OAMs in recent years. In 2002, the Hope Brook mine site returned to the Province after the Royal Oak Mines bankruptcy. The government rehabilitated the site, addressing both environmental issues and safety at a cost of $21 million and a continued annual budget of $30 000. Hope Brook provided the final impetus

[104] www.manitoba.ca/iem/mrd/mines/oa_rehabilitation.html.

leading to implementation of the *Mining Act*, which requires an acceptable rehabilitation and closure plan with 100% financial assurance in place before a project can commence. Newfoundland and Labrador has also implemented a program of dam safety reviews and repairs of tailings dams at OAMs with the goal of bringing the dams to Canadian Dam Association standards.

Ontario

Ontario established its Abandoned Mine Rehabilitation Fund (AMRF) in 1999. Between September 1999 and March 2013, $116 million was spent on rehabilitating the highest-priority Crown-held mine sites.

Quebec

In Quebec, the liability associated with abandoned mines is close to $1.2 billion. The Government of Quebec has allocated over $850 million for the rehabilitation of abandoned mine sites and, as of March 2011, had identified 679 mine sites. The restoration work on these identified mine sites is projected to be completed in the next few years.[105]

To date, several sites have been restored, including 14 major exploration sites in the Nunavik region that were cleaned up through a partnership between the Restor-Action Nunavik Fund (a group of exploration companies), Makivik Corporation, the Government of Quebec, and the Kativik regional government.

Data Issues

One of the initial goals of NOAMI was the development of a national inventory of orphaned and abandoned mines. Work on a national web-based inventory, using a feature-based classification and portal, has continued and the release of the inventory is anticipated in the near future once approval is received from the various jurisdictions. When it becomes available, this inventory will provide a Canada-wide perspective on the number, status, and features of orphaned and abandoned mines and will allow a better understanding of the situation and the development of appropriate policies to address it.

[105] www.mrn.gouv.qc.ca/mines/restauration/restauration-sites.jsp (in French only).

Conclusion

The performance of the mining sector has improved across many of the economic, social, and environmental indicators that were measured in this report. Economically, the sector continues to make a significant contribution to Canada's economy, trade balance, and employment. Environmentally, the mining sector has made significant progress in reducing air and greenhouse gas emissions. Socially, the number of agreements signed between mining companies and Aboriginal communities has increased considerably. In essence, the sector continues to be a significant contributor to the socio-economic vitality of Canada that translates into thousands of jobs, significant economic growth, and prosperity that extends to numerous remote communities, cities, and to the furthest corners of our country, such as the North. At the same time, the sector continues to understand that its environmental and social performance is a critical component to its image, acceptance, reputation, and long-term success in Canada.

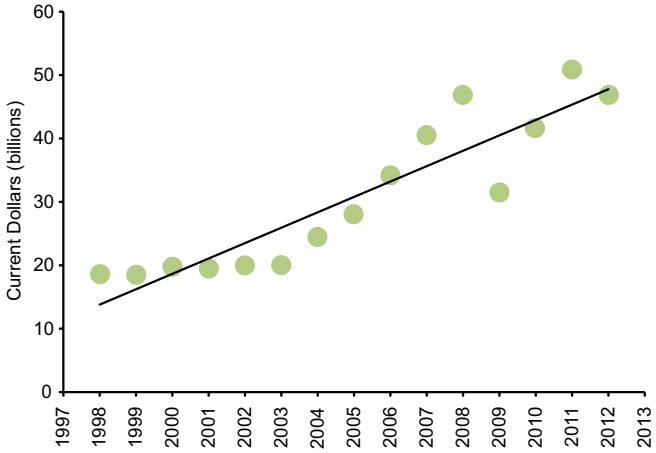
The objective of this report was to help outline the sector's performance over the years to gain a better understanding of successes, gaps, and areas that need further attention. It is hoped that the information compiled in this report will help industry, governments, civil society, and academia to better develop priorities and strategic directions to ensure that Canada continues to benefit from a sustainable and responsible resource sector.

Moving forward, it is important to note that some gaps remain in measuring the sector's progress relative to the outcomes presented in this report. Competitive pressures, environmental concerns, and social expectations will increasingly become more prevalent topics in the domestic and international arena. Advances in productivity and innovation are going to be critical to attain, maintain, and enhance the sector's competitiveness, environmental sustainability, and social acceptance. The assessment of these issues will become critical in understanding the performance of the mining sector over time. In addition, some issues will require further attention, such as enhancing economic opportunities for Aboriginal peoples throughout the mining cycle, attracting and retaining highly skilled personnel, and attaining the investment necessary to capture the full potential of Canada's minerals and metals resource advantage. Continuous collaborative work will therefore be essential to develop the indicators and gather the data needed to ensure ongoing improvements in monitoring the sector's performance going forward.

Annex I: Trendline Graphs for the Mining Sector Indicators

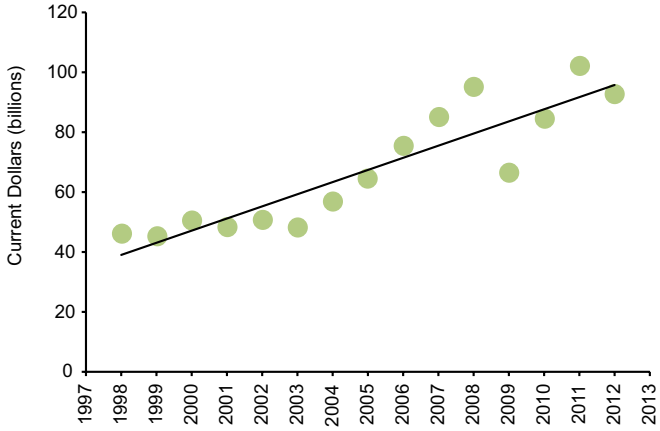
Economic

Value of Mineral Production



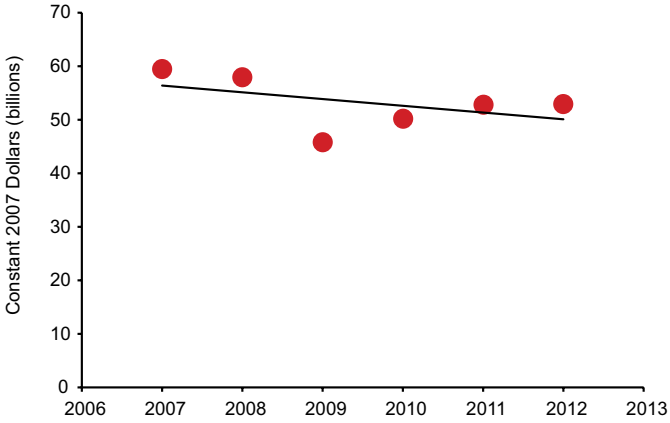
Source: Natural Resources Canada.

Exports



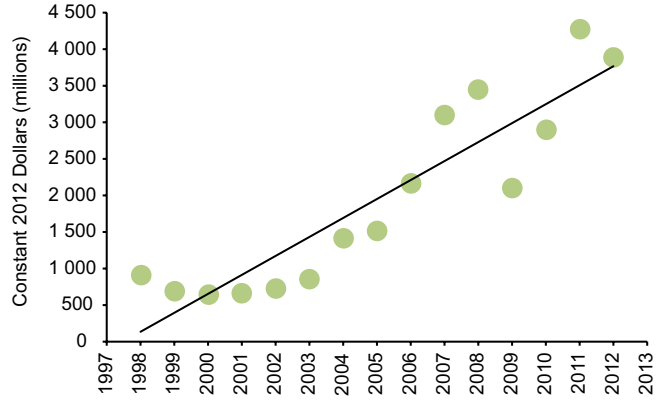
Source: Natural Resources Canada.

Real GDP



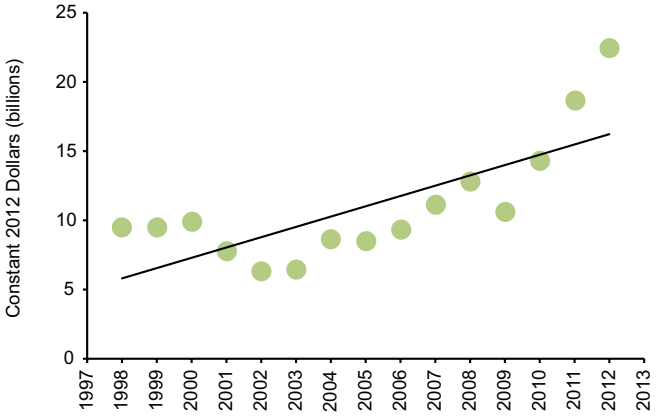
Source: Statistics Canada.

Exploration and Deposit Appraisal Expenditures



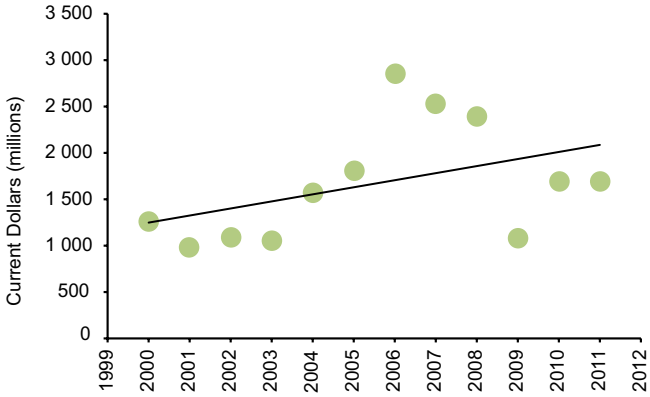
Source: Natural Resources Canada.

Capital Expenditures



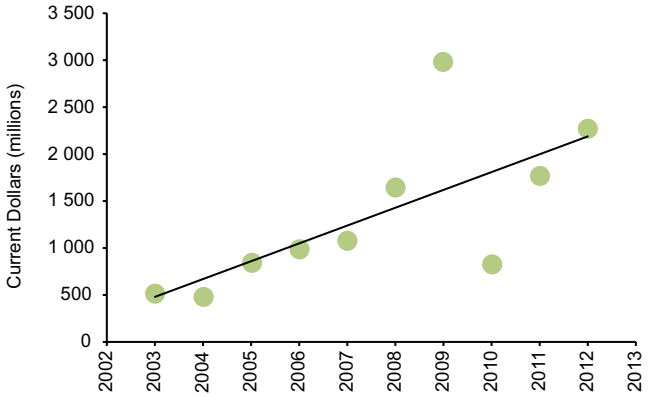
Source: Natural Resources Canada.

Corporate Income Tax



Source: Statistics Canada, CANSIM Table 180-0003.

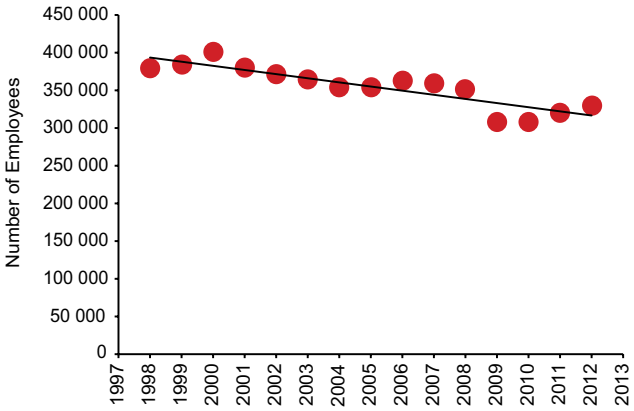
Resource Royalties and Commodity Taxes



Sources: ENTRANS Policy Research Group Inc.; provincial budgets; Natural Resources Canada.

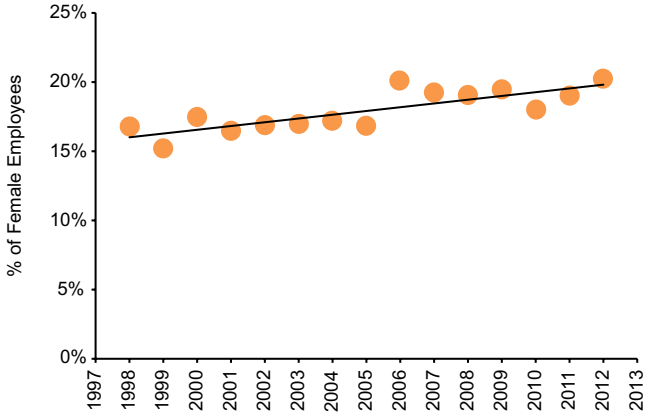
Social

Employment



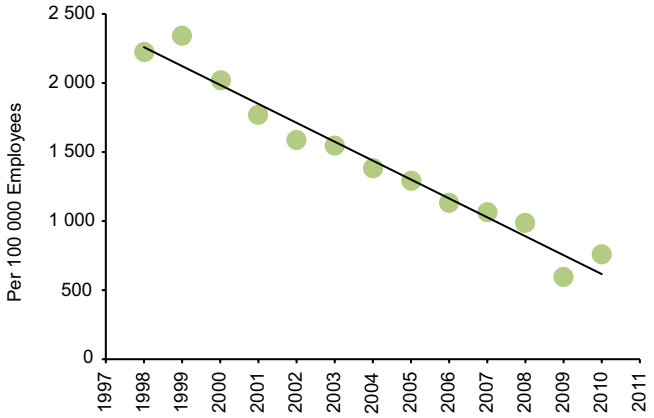
Source: Statistics Canada, CANSIM Table 281-0024.

Share of Female Employees, Mining and Quarrying and Oil and Gas Industries



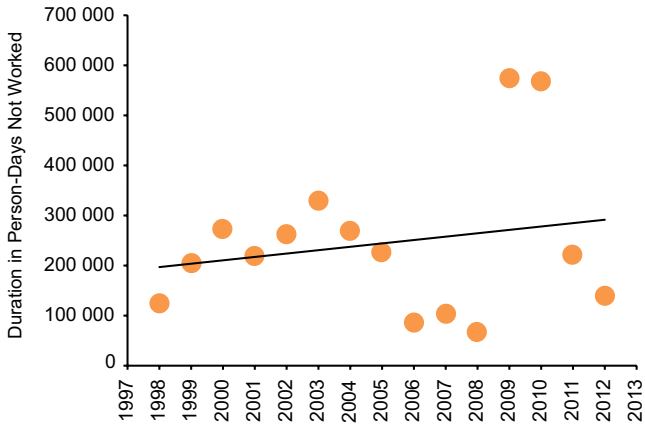
Source: Statistics Canada, CANSIM Table 282-0008.

Mining and Quarrying Non-Fatal Injuries



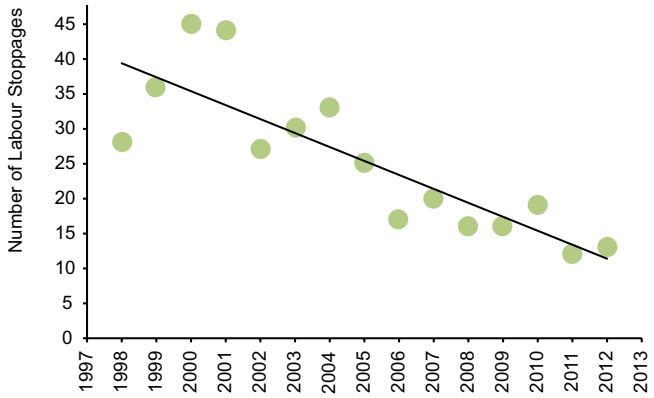
Sources: International Labour Organization, LABORSTA and ILOSTAT.

Person-Days Not Worked Due to Labour Stoppages



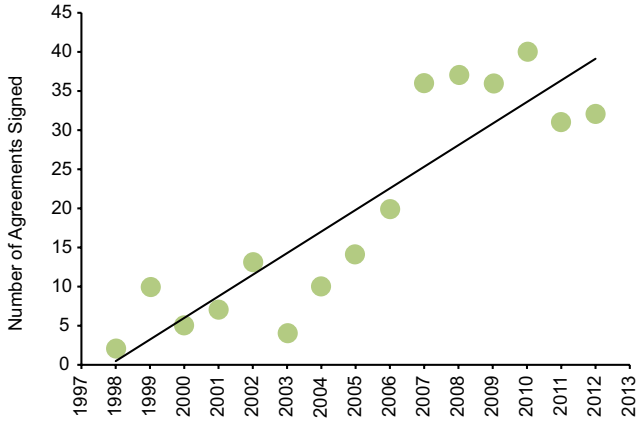
Source: Human Resources and Skills Development Canada, Workplace Information Directorate.

Labour Stoppages



Source: Human Resources and Skills Development Canada, Workplace Information Directorate.

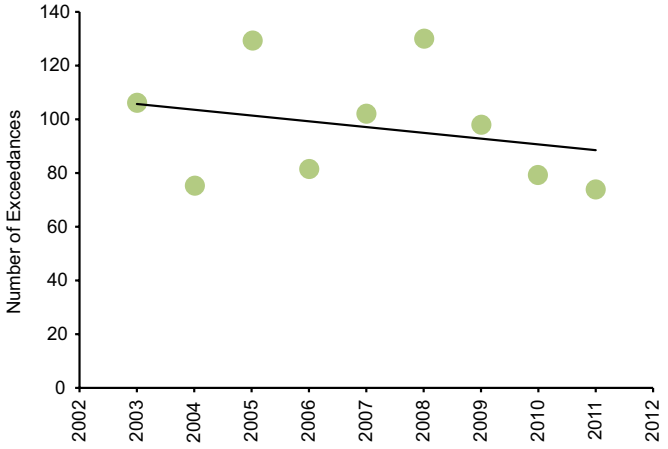
Agreements Signed Between Mining Companies and Aboriginal Communities



Source: Natural Resources Canada.

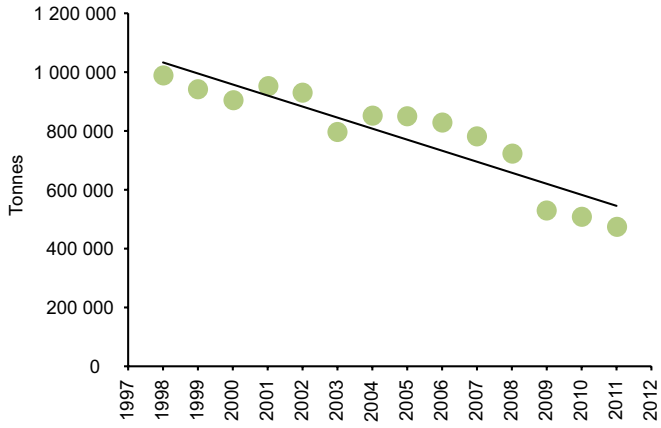
Environmental

Metal Mining Effluent Regulations Exceedances



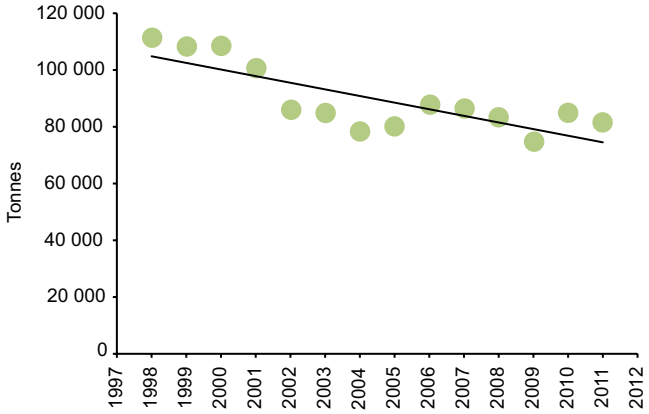
Source: Environment Canada, Summary Review of Performance of Metal Mines Subject to the Metal Mining Effluent Regulations.

Sulphur Oxide Emissions



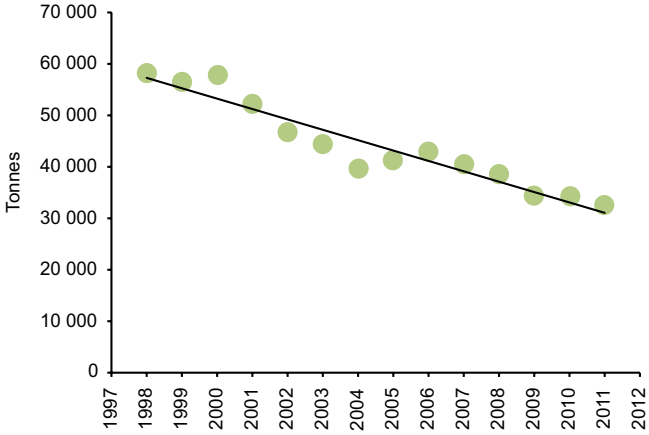
Source: Environment Canada, National Pollutant Release Inventory.

Particulate Matter 10 Emissions



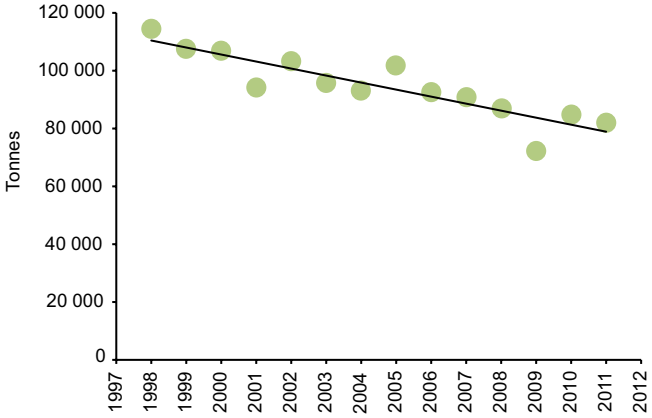
Source: Environment Canada, National Pollutant Release Inventory.

Particulate Matter 2.5 Emissions



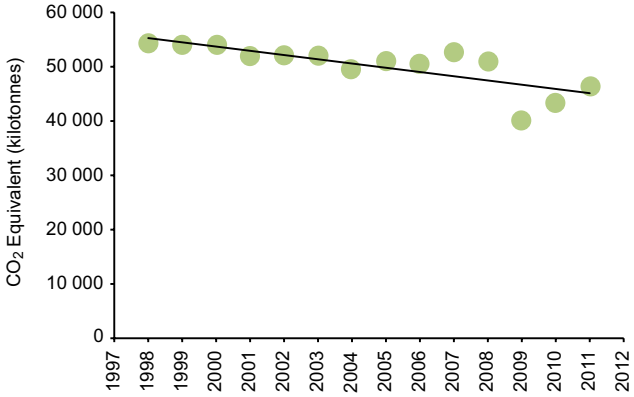
Source: Environment Canada, National Pollutant Release Inventory.

Nitrogen Oxide Emissions



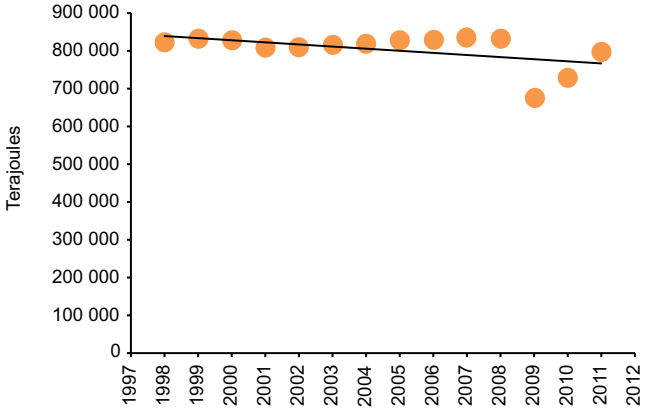
Source: Environment Canada, National Pollutant Release Inventory.

Greenhouse Gas Emissions



Source: Canadian Industrial Energy End-Use Data and Analysis Centre.

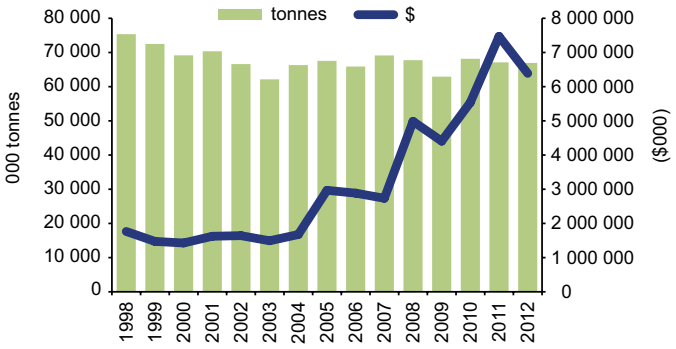
Energy Usage



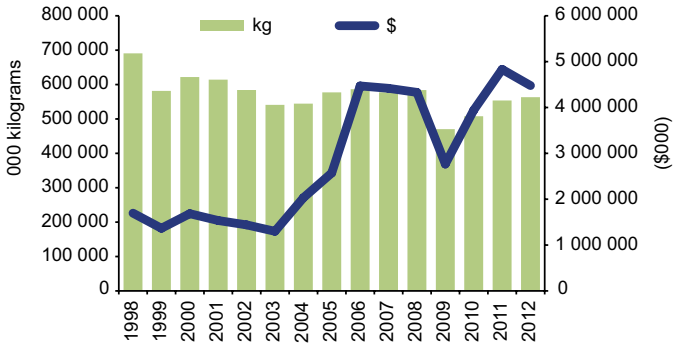
Source: Canadian Industrial Energy End-Use Data and Analysis Centre.

Annex II: Production Volume and Value for Selected Commodities[106]

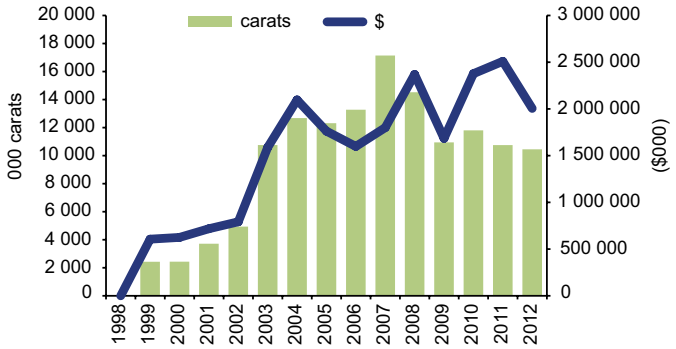
Canadian Coal Production Volume and Value, 1998-2012



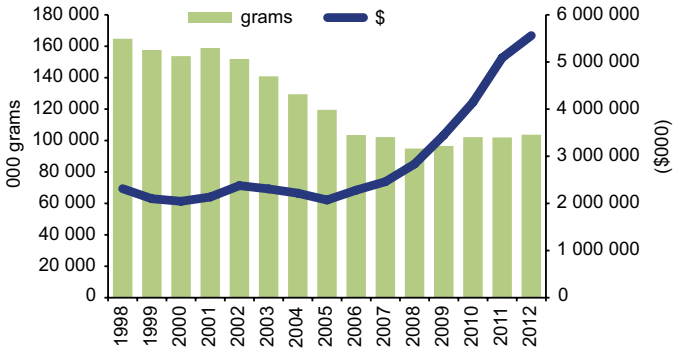
Canadian Copper Production Volume and Value, 1998-2012



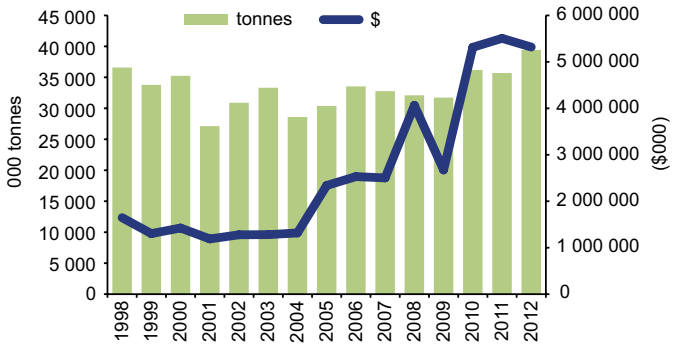
Canadian Diamond Production Volume and Value, 1998-2012



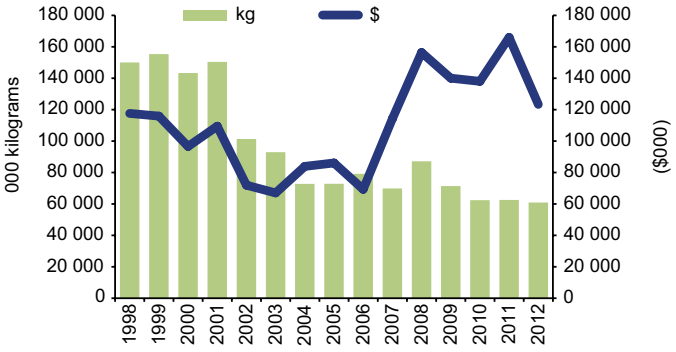
Canadian Gold Production Volume and Value, 1998-2012



Canadian Iron Ore Production Volume and Value, 1998-2012

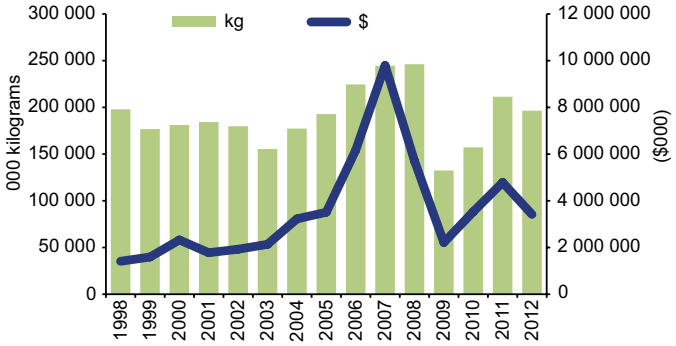


Canadian Lead Production Volume and Value, 1998-2012

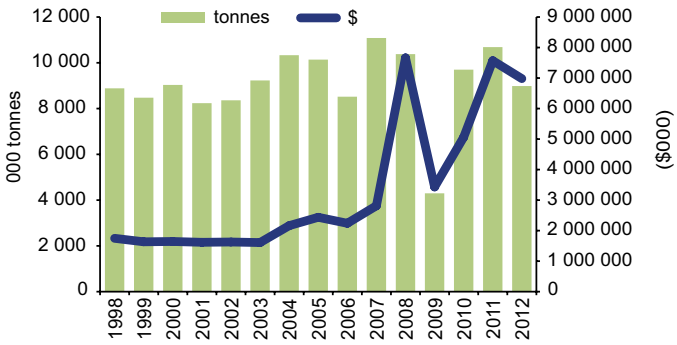


[106] Sources: Natural Resources Canada; Statistics Canada.

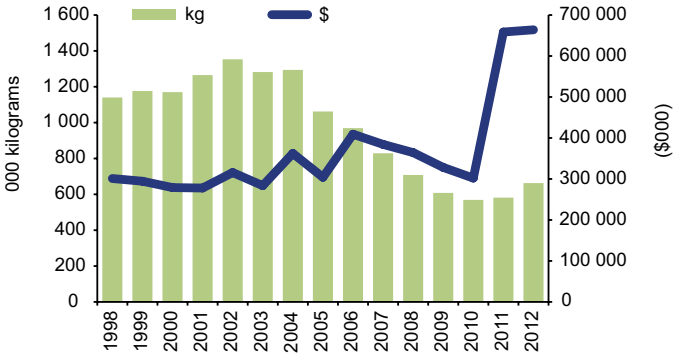
Canadian Nickel Production Volume and Value, 1998-2012



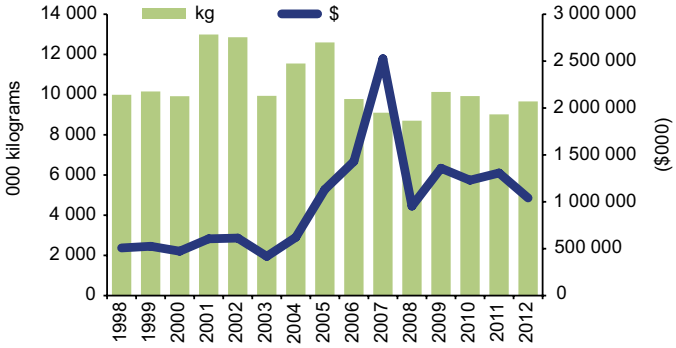
Canadian Potash Production Volume and Value, 1998-2012



Canadian Silver Production Volume and Value, 1998-2012



Canadian Uranium Production Volume and Value, 1998-2012



Canadian Zinc Production Volume and Value, 1998-2012