Canadian Cement Industry 2008 Sustainability Report

Cement Association of Canada

Association Canadienne du Ciment

About CAC

The Cement Association of Canada (CAC) is the voice of Canada's cement industry. Its membership comprises eight companies with clinker and cement manufacturing facilities, granulating and grinding facilities, and distribution terminals from Atlantic Canada to the Pacific coast.

Through collective action by its members, CAC promotes the sustainable growth of the cement industry. The Association achieves this objective by representing members' interests and by working with stakeholders to:

- Advocate for regulations that will enhance the competitiveness of the domestic cement industry;
- Create market opportunities for Canadian cement and concrete products; and
- Raise awareness and understanding of the economic, social, and environmental contributions of the industry and its products.

Highlights

This second in a biennial series of sustainability statements from the Canadian cement industry reports that:

- The Canadian cement industry is a key contributor to Canada's economic and social development. Statistics Canada reports that the industry produced over 14.3 million tonnes of cement worth more than $1.7 billion in 2006, and provided over 2000 direct, stable, high-quality jobs. When supplementary cementing materials such as fly ash and slag are included, the industry's total production rises to more than 16.7 million tonnes of cement.
- The Canadian cement industry is committed to the continued reduction of its environmental footprint. Between 2003 and 2006, despite increasing total production by 10%, the grey cement industry was able to reduce:
  - total SO_2 emissions by 14%
  - total NO_X emissions by 23%

  As well, between 1990 and 2006, Canada's cement manufacturers improved the energy efficiency of their production operations by 11% per tonne of cement, and reduced the greenhouse gas emissions intensity of their production by 6.4% per tonne of cement.
- The industry is focusing efforts on further reductions through the introduction of supplementary cementing materials to offset the amount of clinker needed in the manufacturing of cement, and the increased use of alternative and renewable energy sources as a means to further reduce fossil fuel consumption.
- Canadian cement manufacturers remain committed to the World Business Council on Sustainable Development (WBCSD) Cement Sustainability Initiative (CSI). Improvements in implementation have been achieved in all aspects of the CSI Action Plan.
- Our industry continues to maintain an impressive health and safety record. Four of Canada's cement manufacturing plants were formally recognized as among the best of 121 in North America for their safety performance in 2006.
- We continue to develop and deploy new applications for cement and concrete products capable of meeting society's evolving needs.
  - Life cycle analysis has demonstrated that concrete highways can offer economical, environmental, user, and safety benefits;
  - In 2007, the Sydney Tar Ponds Agency identified cement solidification/stabilization as the most appropriate technology for reducing the environmental risks posed by the Sydney Tar Ponds;
  - Pervious pavement and permeable interlocking concrete pavement are being promoted to reduce the impacts of runoff in urban communities; and
  - Concrete is increasingly being recognized and used in the emerging "Green Building" movement in Canada.

Front Cover Photos

Upper Left: Vancouver Library Central (Diana Thompson)
Bottom Left: Cement Kiln (St. Marys Cement Group)
Top Right: Richmond Plant (Lafarge Canada)
Bottom Centre/Right: Delta Plant (Lehigh Hanson Canada)

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About this Report

The Cement Association of Canada (CAC) is pleased to present its second report documenting the Canadian grey cement manufacturing industry's progress in improving its environmental, social, and economic performance. The report follows from the industry's commitment to publicly report progress in implementing the World Business Council for Sustainable Development (WBCSD) Cement Sustainability Initiative (CSI).

This report presents the most up-to-date information available on the grey cement manufacturing industry's performance.[1] Environmental and economic performance data are available up to the end of 2006. Details on the Cement Sustainability Initiative represent the status of implementation as of December 31, 2007. The report also contains information on the applications of cement and concrete products, and their contribution to sustainable development.

We invite and welcome your feedback on this report and on our industry's performance. Please contact CAC with your questions and comments.

[1] The data exclude the operations of Federal White Cement, representing approximately 7% of Canadian cement production capacity. The fuels, raw materials, and processes involved in the manufacture of white cement differ from those for grey cement, and the resultant product is used in different applications.

Table of Contents

President's Message

Canada's cement manufacturing industry is committed to reducing the impacts of its operations while maintaining and improving its contributions to a competitive economy and a sustainable society.

In 2002, Canada's cement manufacturers helped to establish the World Business Council on Sustainable Development Cement Sustainability Initiative (CSI). In 2006, the Canadian cement industry compiled its first comprehensive report on its implementation of the CSI. This 2008 report provides an update on our implementation of the initiative, and indicates some of the directions the industry is pursuing to realize reduced environmental impacts.

While working to reduce its environmental footprint, the industry is also facing significant challenges. In the past year, the industry's competitiveness came under increased pressure from an unprecedented array of forces, including a high Canadian dollar, rising electrical and thermal energy prices, increased offshore competition in our domestic and export markets, and the threat of a serious slowdown in the U.S. economy – our main export market. These pressures are beginning to have an impact on the industry.

Successfully navigating this challenging business environment while simultaneously moving forward on the path to more sustainable operations will require the support and engagement of all the industry's stakeholders. We must work together to avoid the overlap and duplication of competing regulatory initiatives, to realize the benefits offered by increased use of alternative and renewable energies and supplementary cementing materials, and to promote the life cycle benefits of concrete as the construction material of choice.

The demand for cement and concrete will continue to grow as we build and reconstruct Canada's infrastructure while at the same time addressing the challenges of air quality and climate change. The contributions of a competitive domestic cement manufacturing sector will be crucial to ensuring a reliable and secure supply of cement to achieve these deeply interconnected objectives.

We invite you to review our performance in this report, and welcome your comments.

Pierre Boucher
President and CEO

WBCSD Cement Sustainability Initiative (CSI)

The World Business Council for Sustainable Development (WBCSD) is a CEO-led, global association of approximately 200 companies dealing exclusively with business and sustainable development. The WBCSD created the CSI to help the cement industry address the challenges of sustainable development. For more information, please see **www.wbcsdcement.org**.

Cement and the Canadian Cement Industry

Cement is the key ingredient in making concrete – a construction material that touches virtually every aspect of our daily lives. Canada's cement industry provides a reliable supply of the cement required to build Canada's critical infrastructure network of roads and bridges, buildings and homes, waterworks and dams, and even to remediate contaminated sites.

The eight member companies of the Cement Association of Canada operate one white and 15 grey cement manufacturing facilities in five provinces and produce over 98% of the cement consumed in Canada. In 2006, cement manufacturing directly employed over 2,000 Canadians. A further 25,000 were employed in the production of ready mix concrete and concrete construction products.

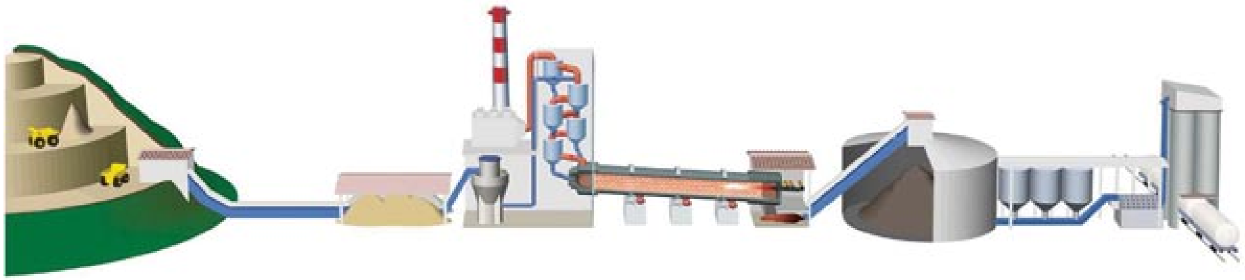
During 2006, member companies produced more than 14.3 million tonnes of cement, worth in excess of $1.7 billion. With supplementary cementing materials included, the industry's total cement production is over 16.7 million tonnes. When both cement and concrete product sales are factored together, the industry was responsible for more than $8.0 billion in sales, contributing over $3.3 billion to Canada's Gross Domestic Product.

Canadian cement producers are important members of a global industry and participate in a highly-integrated North American marketplace for cement and cement products. In 2006, Canadian manufacturers exported more than 5.0 million tonnes of cement and clinker to the U.S., approximately one third of Canadian production. This reflects a continuing downward trend in Canada's share of the U.S. cement import market – from nearly 35% in 1995 to just 14% in 2006 – while the Asian share has grown from negligible amounts to more than 54% of all U.S. imports over the same period. These emerging trade patterns may affect the continued presence of Canadian cement manufacturers in both the domestic and export markets.

How Cement is Made

Cement is the active component in the manufacture of concrete, comprising from 10% to 15% of finished concrete products. By volume, concrete is estimated to be the second most-used material in the world, after water. Natural materials with cementing properties have been used for construction since Roman times. Modern cements were developed in the 19th century and came into widespread use at the beginning of the 20th century.

The production of cement is a four-step process involving the extraction of raw materials and their processing, heating, finish grinding, and distribution.



Source: St. Lawrence Cement

Quarrying

Limestone and small amounts of sand and clay are extracted, usually from a quarry located near the cement manufacturing plant.

Raw Materials Preparation

The extracted materials are analyzed, blended with additional mineral components depending on the type of limestone available, and finely ground for further processing.

Clinker Production

The materials are heated in a kiln reaching a temperature of 1,470°C. The heat transforms the materials into a molten product called clinker, which is then rapidly cooled.

Cement Grinding and Distribution

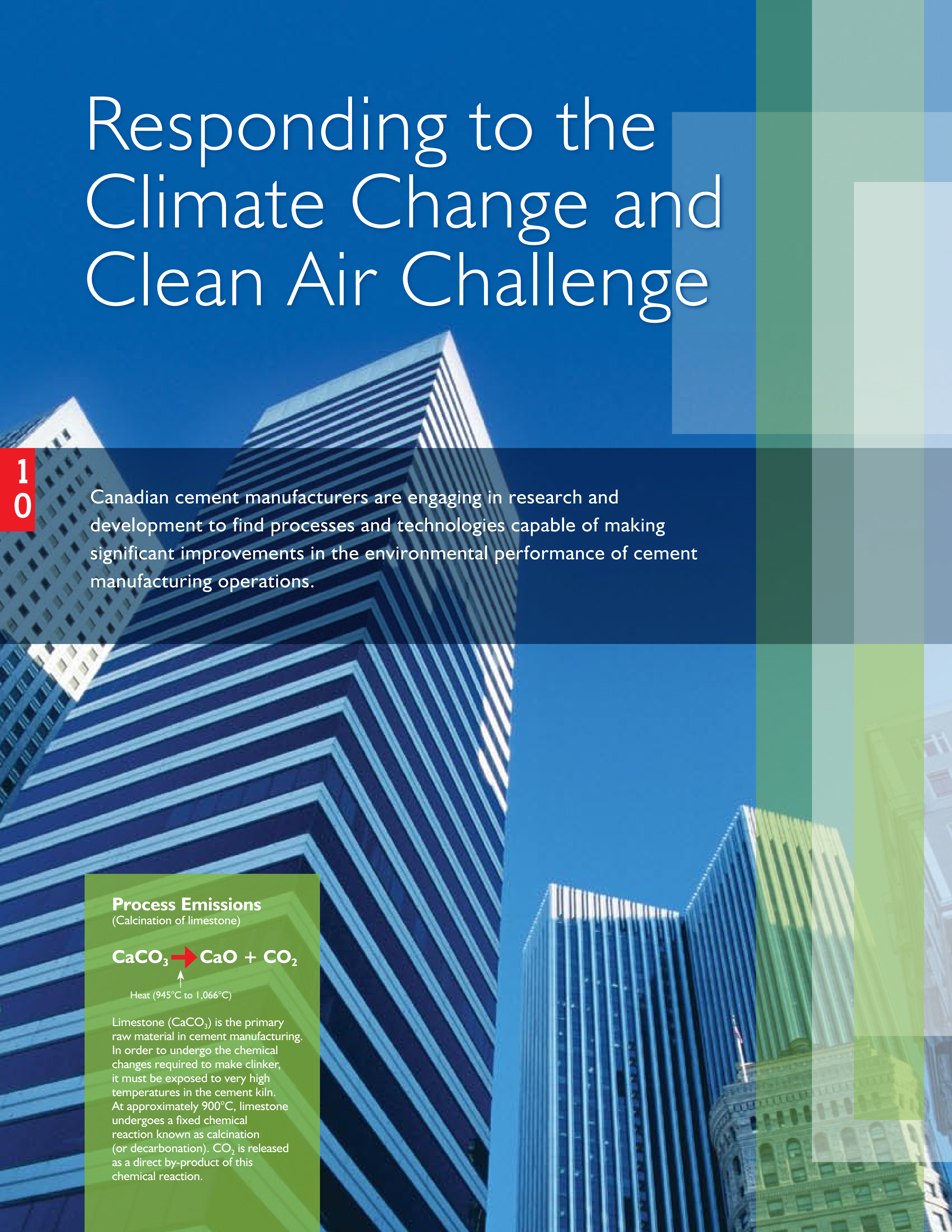
The clinker is stored and then finely ground. Gypsum is added to control setting time, along with supplementary cementing materials, such as fly ash or slag, to obtain a fine powder called cement, with the desired properties of strength and chemical resistance.

Reporting on the Cement Sustainability Initiative

Through the Cement Sustainability Initiative (CSI), global cement manufacturers have committed to an *Action Plan* addressing performance related to climate protection and CO_2 management, responsible use of fuels and materials, employee health and safety, emissions monitoring and reporting, local impacts on land and communities, and reporting and communications. Through their corporate sustainability reports, global signatories to the CSI are required to report on their actions and commitments in these areas. The table summarizes the performance of the 15 Canadian grey cement manufacturers against each CSI indicator and compares implementation status in 2007 to what was achieved in 2005. Data collection was undertaken by Stratos Inc., a leading Canadian sustainability consultant.

Issue	Individual Company Actions	Indicator	2005 # out of 15 plants	2007 # out of 15 plants
CLIMATE PROTECTION AND CO_2 MANAGEMENT	Use the tools set out in the WBCSD CSI reporting protocol to define and make public baseline emissions Report annually on CO_2 emissions in line with the protocol Develop a climate change mitigation strategy, and publish targets and progress by 2006	Number of plants that report their CO_2 emissions annually, in line with the protocol	15	15
		Number of plants that have used the tools set out in the protocol to define their baseline emissions	10	13
		Number of plants that have made their baseline CO_2 emissions publicly available	8	8
		Number of plants that have also developed a climate change mitigation strategy	10	13
RESPONSIBLE USE OF FUELS AND MATERIALS	Apply the WBCSD CSI's guidelines for fuel and raw material use	Number of plants that are using alternative energies	9	9
		Number of plants that are using alternative raw materials	13	15
EMPLOYEE HEALTH AND SAFETY	Respond to the recommendations of the WBCSD CSI Health and Safety Task Force on systems, measurement, and public reporting	Number of plants that have documented health and safety management systems in place	15	15
		Number of plants that collect data on the health and safety performance of contractors working on their sites	15	15
		Number of plants that collect performance data on contractor fatalities	14	15
		Number of plants that collect performance data on contractor lost time injuries	13	15

Issue	Individual Company Actions	Indicator	2005 # out of 15 plants	2007 # out of 15 plants
EMISSIONS MONITORING AND REPORTING	Use the tools set out in the WBCSD CSI reporting protocol for measurement, monitoring, and reporting of emissions Make emissions data publicly available and accessible to stakeholders by 2006 Set emissions targets on relevant materials and report publicly on progress	Number of plants that make their emissions data publicly available via National Pollutant Release Inventory (NPRI)	15	15
		Number of plants that have set emissions targets for: • Dust/Total particulate matter • Oxides of nitrogen and other nitrogen compounds • Sulphur dioxide and other sulphur compounds	 10 7 10	 13 11 13
		Number of plants that use monitoring systems to measure air emissions, including NO_X, SO_2, CO, O_2, HCl, particulate matter, heavy metals, and opacity as well as flow and temperature	15	15
		Number of plants that produce 100% of their clinker in kilns covered by some type of emission monitoring system	15	15
LOCAL IMPACTS ON LAND AND COMMUNITIES	Apply the WBCSD CSI Environmental and Social Impact Assessment guidelines, and develop tools to integrate them into decision-making processes Draw up rehabilitation plans for operating quarries and plant sites, and communicate them to local stakeholders by 2006	Number of plants that have rehabilitation plans in place for: • Quarries • Plants	 11 6	 14 8
		Number of plants that have community engagement plans in place for: • Quarries • Plants	 7 11	 12 12
		Number of plants that have biodiversity plans in place for: • Quarries • Plants	 9 5	 11 8
REPORTING AND COMMUNICATIONS	Integrate sustainable development programs into existing management, monitoring, and reporting systems Publish a statement of business ethics by 2006 Establish a systematic dialogue process with stakeholders to understand and address their expectations Report progress on developing stakeholder engagement programs Develop documented and auditable environmental management systems at all plants	Number of plants that have a statement of business ethics in place	15	15
		Number of plants that have established a systematic dialogue process with stakeholders	13	12
		Number of plants that have developed and implemented a formal Environmental Management System (EMS) • Of these plants, the number that have EMS that are consistent with ISO 14001 • Of these plants, the number that are certified to ISO 14001	12 6 4	12 6 6



Responding to the Climate Change and Clean Air Challenge

Canadian cement manufacturers are engaging in research and development to find processes and technologies capable of making significant improvements in the environmental performance of cement manufacturing operations.

Process Emissions

(Calcination of limestone)

$$CaCO_3 \rightarrow CaO + CO_2$$

Heat (945°C to 1,066°C)

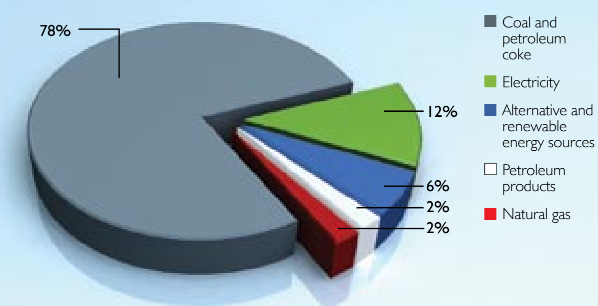
Limestone ($CaCO_3$) is the primary raw material in cement manufacturing. In order to undergo the chemical changes required to make clinker, it must be exposed to very high temperatures in the cement kiln. At approximately 900°C, limestone undergoes a fixed chemical reaction known as calcination (or decarbonation). CO_2 is released as a direct by-product of this chemical reaction.

Climate change and clean air are important concerns for Canadians and for our industry. The manufacture of cement requires large amounts of thermal energy to heat the raw materials, and this heating process currently relies on high-emission intensity fuels, such as coal and petroleum coke.

Approximately 60% of greenhouse gas emissions for our industry results from the chemical process that occurs as raw materials are heated and transformed in the cement kiln.

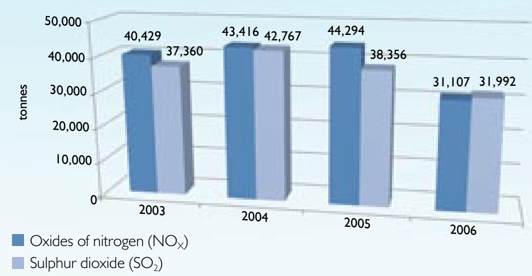
Canadian cement manufacturers are moving forward with their strategy to reduce air pollutants and greenhouse gas emissions through improvements in **energy efficiency**, and the increased use of **alternative and renewable energies** and **supplementary cementing materials**.

Canadian Cement Industry 2006 Energy Consumption Mix

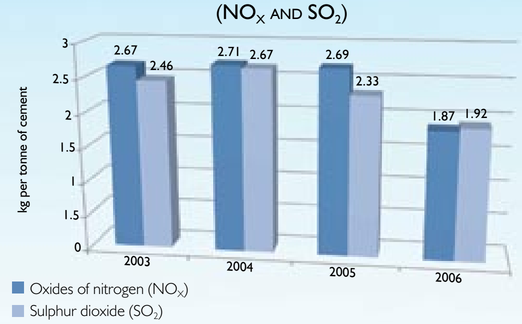


Source: PCA U.S. & Canadian Labour – Energy Input Survey (2002 through 2006)

Total Releases of Air Pollutants (NO_X and SO_2)



Emissions Intensity of Air Pollutants (NO_X and SO_2)



Air Emissions and Greenhouse Gas Emissions Performance

The manufacture of cement in Canada contributes an estimated 1.0% of total Canadian air pollutant emissions, and 1.4% of total Canadian greenhouse gas (GHG) emissions.[2]

As a result of technological advances, investments in pollution control equipment, and the introduction of process changes, the cement industry has achieved significant improvements in its environmental performance over the past three decades. Between 2003 and 2006, the Canadian grey cement industry's total SO_2 emissions decreased by 14%, and total NO_X emissions decreased by 23%, although total cement production increased from 15.2 million tonnes in 2003 to 16.7 million tonnes in 2006, a 10% increase.

[2] Environment Canada "Improving the Health of Canadians and Their Environment through an Integrated, Nationally Consistent Approach to Reducing Industrial Air Emissions". www.ec.gc.ca/ceparegistry/documents/gene_info/NOI_DisPap/NOI_DisPap.cfm

Each manufacturing facility operates pollution control equipment ("baghouses" or electrostatic precipitators) to manage particulate matter. While total particulate matter emissions have remained within allowable levels, the emissions data show an increase of 17% between 2003 and 2006. There is considerable variance, however, across the industry in terms of total particulate matter estimation techniques and the scope of activities included in these estimates. CAC member companies are taking steps to improve the accuracy and consistency of particulate matter release estimations for future reporting.

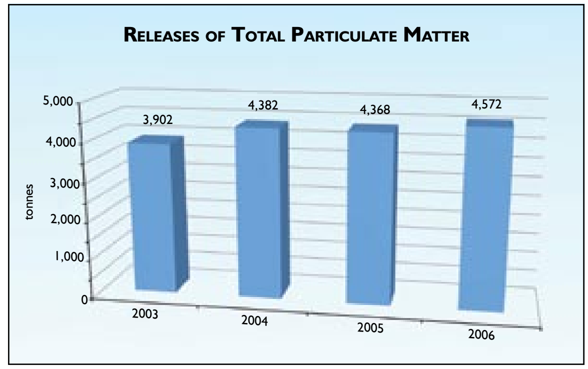
Between 2003 and 2006, direct releases of greenhouse gases (CO_2) increased by 8.5%. This upward trend is the result of a more than 10% increase in cement production, as well as the conversion of two facilities from natural gas to solid fuels as their primary energy sources.

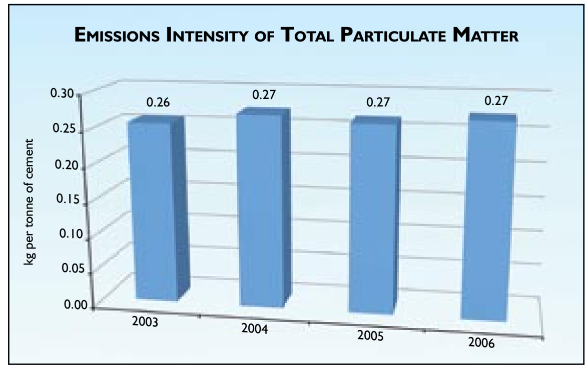
Since 1990, however, cement manufacturers have been able to reduce the greenhouse gas emissions intensity of cement production by 6.4%. These improvements arose largely from the modernization of two cement manufacturing facilities in the 1990s and the closure of some of the least efficient facilities. More recent improvements are the result of efforts to increase the use of supplementary cementing materials as substitutes for clinker in cement production. Over the period 2003 to 2006, the greenhouse gas emissions intensity of cement production improved by 1.3%.

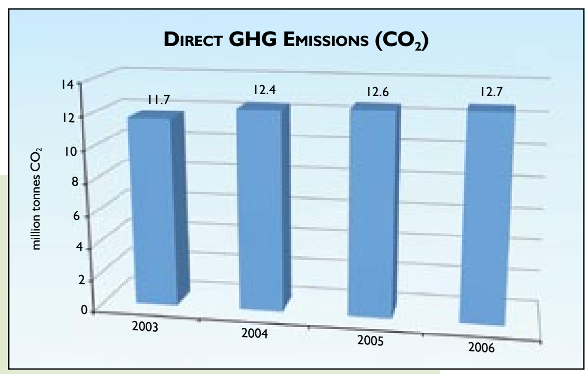
All CAC members measure and report their greenhouse gas releases through the application of the WBCSD CSI Protocol.

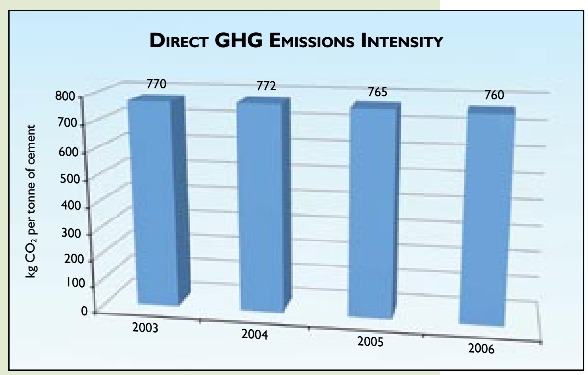
While the data are not included in this document, cement manufacturers also manage and report on other environmental aspects of their operations, including water quality, waste generation and management, site biodiversity, and noise management as well as the emissions of other air pollutants such as carbon monoxide, mercury, dioxins, and furans.

These environmental aspects of their operations are addressed through the Environmental Management Systems (EMS) in place at the manufacturing sites. As of December 31, 2007, 6 of Canada's 15 cement manufacturing facilities had their EMS certified in accordance with the ISO 14001 requirements.

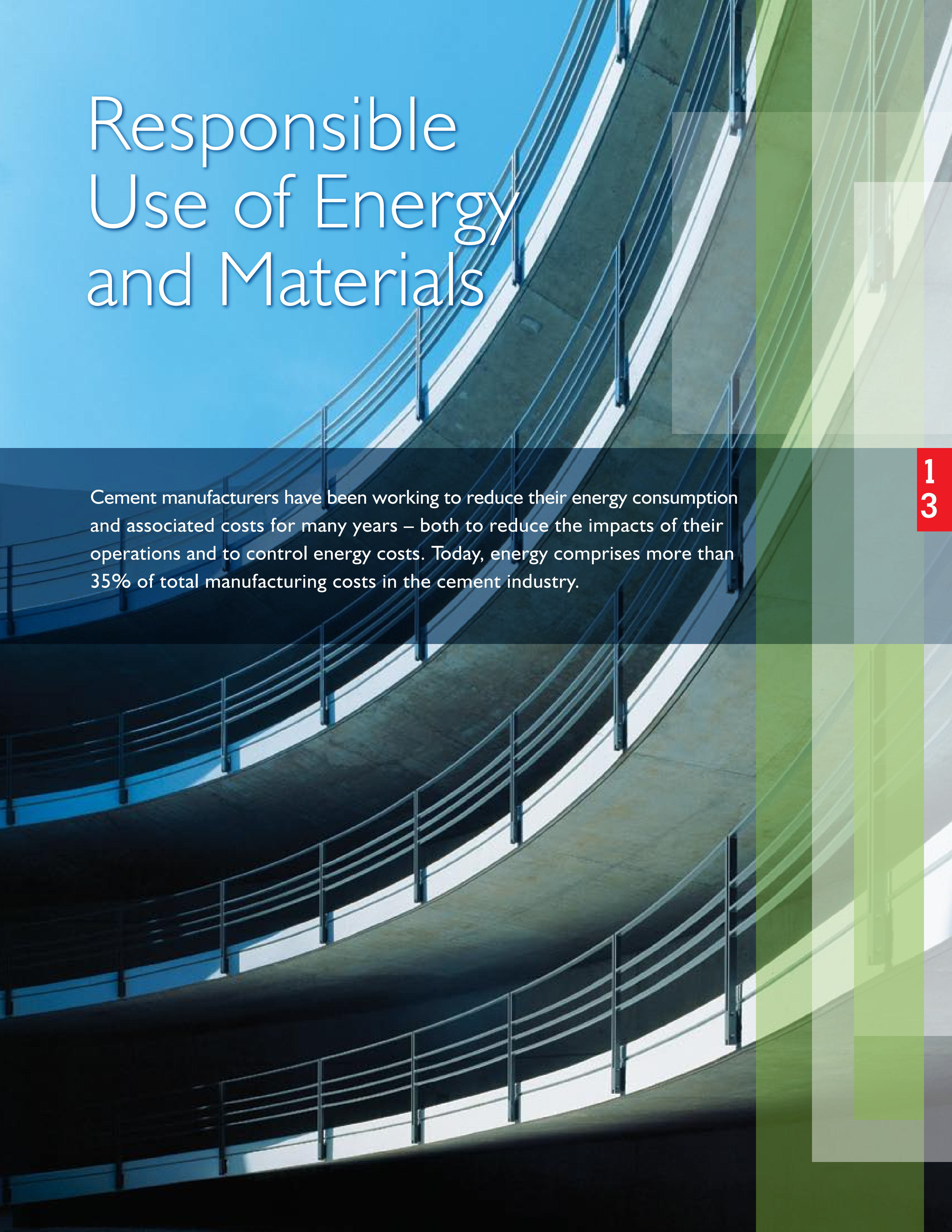








St. Marys Cement Group Plant, St. Marys, Ontario



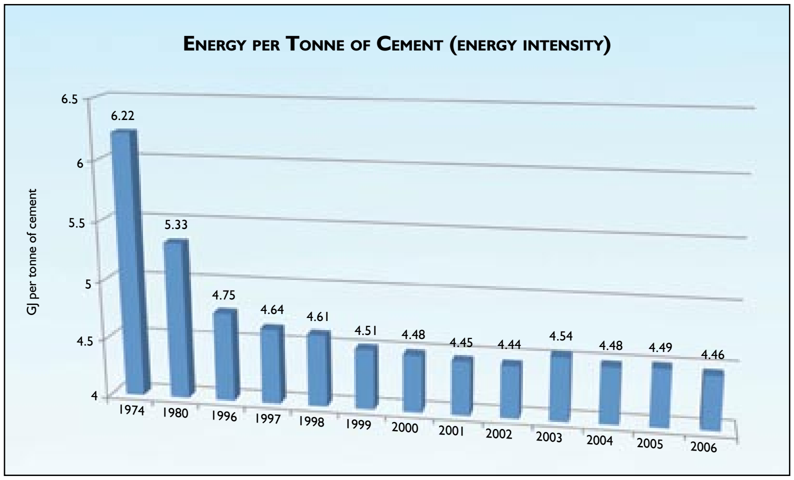
Responsible Use of Energy and Materials

Cement manufacturers have been working to reduce their energy consumption and associated costs for many years – both to reduce the impacts of their operations and to control energy costs. Today, energy comprises more than 35% of total manufacturing costs in the cement industry.

Energy Efficiency

Cement manufacturing is a highly energy-intensive process. Most of the energy goes to fuel the kilns, where a temperature of 1,470°C is required to convert the raw materials into molten clinker. The entire process, from raw material extraction through to cement grinding and distribution, requires approximately 4.46 gigajoules (GJ) of energy – 3.91 GJ of thermal energy and 0.55 GJ of electrical energy in 2006 – to produce one tonne of cement. Between 1990 and 2006, Canada's cement manufacturers reduced the energy intensity of their operations by 11%.

The Cement Association of Canada and Natural Resources Canada are jointly undertaking a comprehensive energy benchmarking study to guide further improvements in energy efficiency. The study findings will be released in 2008. This work is being co-sponsored by Natural Resources Canada's Canadian Industry Program for Energy Conservation (CIPEC).



Energy Efficiency at St. Marys Cement Group Bowmanville

A group of employees at the St. Marys Cement Bowmanville plant formed the Energy Management Conservation Committee ($E=MC^2$) in May 2006. Seventy-eight employees at the Bowmanville plant were trained as part of Natural Resources Canada's Dollars to $ense program. Similar sessions were also held at the St. Marys plant.

To date, $E=MC^2$ has developed a total of 45 initiatives and energy-efficiency projects at the plant, delivering $433,000 in annual savings. As procedures are developed, they are integrated into the plant's ISO 9001/14001 system to help drive continuous improvement.

In recognition of the efforts of the Bowmanville and St. Marys plants, the Minister of Natural Resources presented St. Marys Cement with the Canadian Industry Program for Energy Conservation Leadership award for Employee Awareness and Training.

Alternative and Renewable Energy Sources

The Canadian cement industry is working to accelerate the replacement of virgin and carbon-intensive fossil fuels with alternative and renewable energy sources. Environmental and public health authorities, from the U.S. Environmental Protection Agency[3] to the UK Health Protection Agency[4], have concluded that, when the materials are processed properly, the use of certain alternative energy sources in cement manufacturing can contribute to improved environmental performance without increasing risks to human health and the environment.

The use of alternative and renewable energy sources also plays an important role in conserving natural resources, managing by-product and residue streams from other industry sectors, and diverting these materials from municipal landfills.

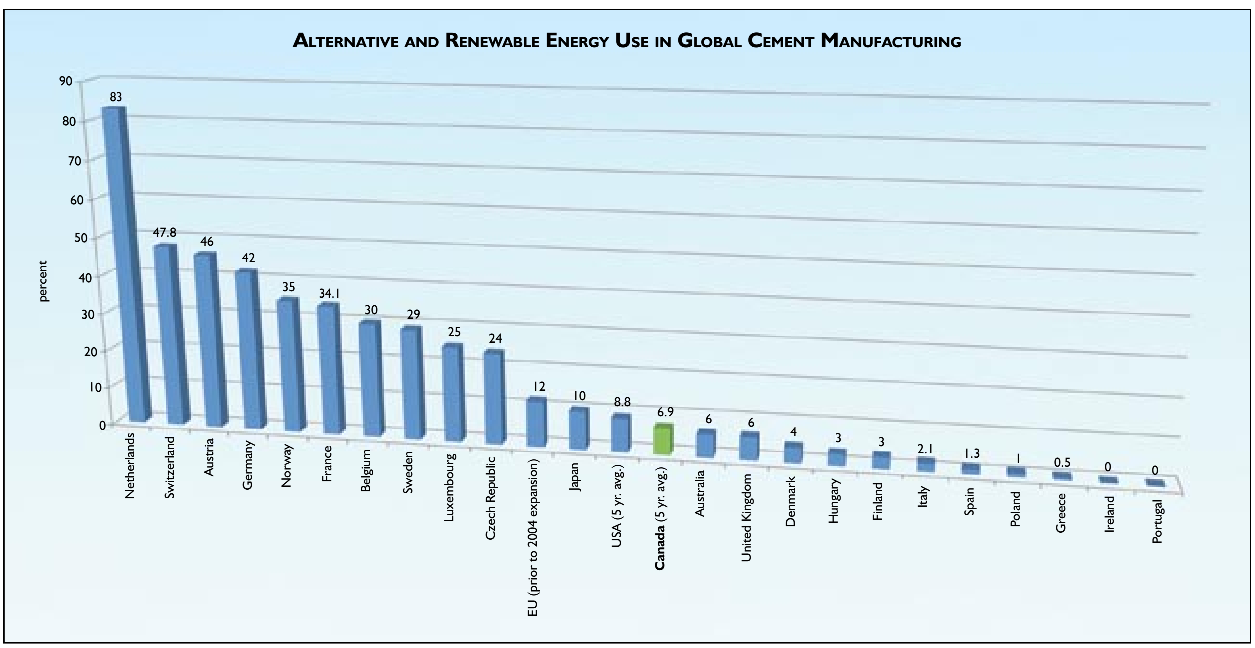
In other jurisdictions, notably within the European Union, alternative and renewable energy sources play a significant role in meeting cement manufacturers' total energy needs.

[3] Refer to the U.S. Environmental Protection Agency "Position on Tire Derived Fuel", April 2005. www.epa.gov/epaoswer/non-hw/muncpl/tires/tdf-fs.pdf

[4] Refer to the UK Health Protection Agency "Position Statement on Substitute Fuels in Cement Kilns", October 2004. www.hpa.org.uk/hpa/news/articles/press_releases/2004/041013_cement_kilns.htm

Alternative and Renewable Energy Sources in Cement Manufacturing

Alternative Sources	Renewable Sources
• Scrap tires • Used oils • Recovered solvents • Recovered asphalt shingles • Oily waters • Oil shales • Plastics • Certain hazardous wastes	• Fibre residue from forest products manufacturing • Meat and bone meal • Municipal solid waste • Agricultural waste • Post-consumer paper and packaging • Recovered wooden utility poles • Residue wood biomass from forestry operations

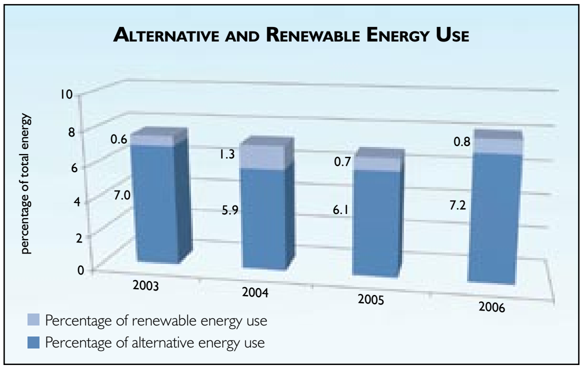


Canadian regulators have been slower to embrace the benefits of alternative and renewable energy in cement manufacturing. While 9 out of 15 grey cement plants used alternative and renewable energy sources in 2006, these sources accounted for just 8% of the industry's energy use.

The use of such fuels varies substantially across the country. Quebec regulators lead the way by allowing that province's cement plants to derive over 20% of their energy from alternative and renewable sources.

Through the Cement Sustainability Initiative, the industry has developed comprehensive ***Guidelines for the Selection and Use of Fuels and Raw Materials in the Cement Manufacturing Process***.

Member companies of the Cement Association of Canada have committed to implementing these Guidelines, informing stakeholders and responding to their concerns, and ensuring the responsible selection and use of alternative and renewable sources of energy.



The CAC and its members continue to work with provincial regulators and local stakeholders to address barriers to the use of alternative and renewable energy sources.

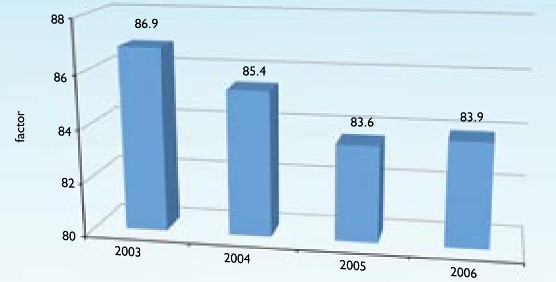
Alternative Energy at Lafarge Canada Inc. – Brookfield

Approximately 25,000 tonnes of roofing shingles are destined for Nova Scotia landfill each year. Although asphalt shingles cannot be recycled back into roofing materials, they contain valuable materials and energy that can be put to better use than landfilling.

In Nova Scotia, Lafarge Canada Inc. is working with Halifax C&D Recycling Ltd., a company that shreds recovered asphalt shingles and then screens them into grit and flake. The grit is sold to a local paving company, and the flake – a fibrous material covered in asphalt – is used as an alternative energy in Lafarge's Brookfield cement manufacturing facility, thereby offsetting an equivalent amount of coal used at the plant. Extensive testing and community consultation ensured that there would be no detrimental impacts on community, employee or environmental safety, or on the manufacturing process or product quality.

Supplementary Cementing Materials

Supplementary Cementing Materials Substitution Factor (clinker/cement factor)



Supplementary cementing materials (SCMs) can be ground with clinker to produce blended cement or can be directly added to concrete as a complementary agent. Common SCMs include waste products from other industries, such as fly ash, blast furnace slag, and silica fume.

Increasing the use of SCMs, and thus reducing the cement content, represents a technically-proven approach to reducing greenhouse gas and air pollutant emissions. This practice also has the added advantages of reducing energy consumption, using materials otherwise destined for landfill, and increasing plant capacity without installing new kilns.

SCM substitution, or the clinker/cement factor, is a measure of the extent to which SCMs are being used to replace clinker in making cement. A lower factor indicates that other materials have been used to replace clinker. Since 2003, the Canadian cement industry's clinker/cement factor has decreased from just over 86.9% to under 83.9%, indicating that other materials are increasingly being used in the manufacture of cement.

GranCem® at St. Lawrence Cement Mississauga

St. Lawrence Cement's Mississauga plant has completed its biggest expansion project in nearly 50 years: its new $80 million, state-of-the-art vertical roller mill (VRM). The new facility, built in response to growing demand for GranCem® – a specialized cement that includes slag, a by-product of the steel industry – has increased the plant's production capacity for this slag cement to 500,000 tonnes per year, more than double its former output.

The new VRM will use the hot exhaust gases from the kiln to dry the input materials entering the mill; thus eliminating the need to use any additional fuels and any increase in the Mississauga plant's CO_2 emissions despite the increase in production capacity. In addition, the new process has a scrubbing effect that helps reduce SO_x levels.

InterCem™ at Lehigh Hanson Canada

The InterCem™ product line developed by Lehigh Hanson Canada combines industrial waste material – fly ash, a by-product of coal-fired power plants – with cement to produce cement that decreases permeability and reduces shrinkage and thermal cracking in the final concrete product. Using fly ash in this manner offsets clinker cement production and reduces the amount of greenhouse gases produced per tonne of cement; it also helps to divert industrial waste from landfills.

Research and Development on Energy and the Environment

Through the U.S.-based Portland Cement Association (PCA), Canadian and U.S. cement manufacturers currently collaborate on more than 30 research and development projects valued at more than $3 million each year – solely to address issues of energy efficiency and environmental impacts. Among the current projects are assessments of various carbon capture technologies, in-situ testing of continuous emissions monitors for mercury releases, and mercury capture and removal technologies.

Canadian cement manufacturers are looking forward to 2008, when they will begin collaborating on energy and climate research and development with cement manufacturers in other jurisdictions under the auspices of the Asia-Pacific Partnership on Clean Development and Climate. Accounting for over 60% of global cement production, the Partnership's Cement Task Force currently focuses on ten priority activities, including cement kiln co-generation, high energy biomass as an alternative energy source, and kiln performance optimization and diagnosis.

Asia-Pacific Partnership on Clean Development & Climate

www.asiapacificpartnership.org/CementTF.htm

Ongoing research and development is a key investment area for the Canadian cement industry. Cement manufacturers collaborate both nationally and internationally to better understand the environmental impacts of their operations and develop new technologies to reduce these impacts.

SDTC Support for Cement R&D

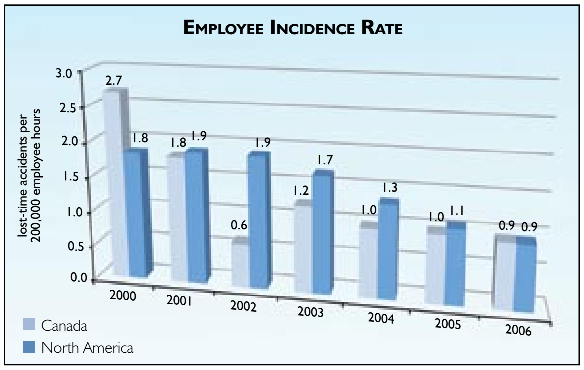
Individual member companies invest substantially in independent energy and environmental research and development activities, in Canada and abroad. For example, as part of a project with Sustainable Development Technology Canada (SDTC), St. Marys Cement Group is installing a state-of-the-art off-gas measurement system and computer optimization system called EFSOP® (Expert Furnace System Optimization Process) at its Bowmanville plant. The purpose of the project is to improve overall plant efficiency and reduce greenhouse gas emissions through reduced fuel use and improved combustion.

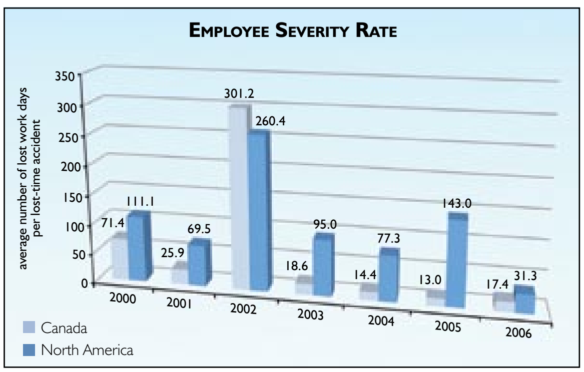
Demonstrating Responsibility to Our Communities

Canada's cement manufacturers are important members of many communities across Canada. They provide a safe workplace for employees and contractors. Cement manufacturers also engage with and receive input from local communities and stakeholders, and make financial and in-kind contributions to support local initiatives and to sustain the local environment beyond the plant gate.

Our Commitment to a Safe Working Environment

The Canadian cement industry's incidence and severity rates for employee accidents continue to improve, and both have been below or equal to the North American rates since 2001 (with the exception of the severity rate in 2002, when a fatality occurred at a Canadian cement plant).





Health and Safety at Ciment Québec Inc.

By November 2007, Ciment Québec Inc. had reached a record of 3,100 days without a lost-time accident. Ciment Québec has been recognized by the Portland Cement Association for its safety performance since 1997. While the company attributes its strong safety record to factors like its safety policy, rules and work procedures, prevention programs, and a health and safety committee, the company feels that the main factor that has helped it maintain its safety performance is that management, supervisors, and employees actively work together to resolve health, and safety issues.

PCA 2006 Safety Excellence

Five or more years without a lost-time accident
- Ciment Québec Inc. (St. Basile)
- Lafarge Canada Inc. (Brookfield)

1,000,000 or more hours without a lost-time accident
- Ciment Québec Inc. (St. Basile)
- Lafarge Canada Inc. (Brookfield)

PCA 2006 Safety Honour

Two to four years without a lost-time accident
- Lehigh Hanson Canada (Delta)

PCA 2006 Safety Commendation

One year without a lost-time accident
- Essroc Canada Inc. (Picton)

Our Commitment to Support Communities

Canadian cement plants make substantial contributions to their local economies through jobs, local purchases, and taxes, and they work to understand and respond to community needs and concerns.

Economic Contribution: Canadian cement plants are an important source of high quality jobs in their communities. Over the past five years, employment at cement plants has remained at about 2,000 employees. It is estimated that the industry directly contributed over $1.7 billion to the Canadian economy in 2006, with a large economic spin-off to local communities.

Community Engagement: CAC member companies engage local communities through both formal and informal means, ranging from citizens' committees to open houses.

Cement plants take community concerns very seriously, and 13 plants have a formal system in place to log and respond to stakeholder complaints. As well, 12 plants have established systematic or formal dialogue processes with local stakeholders.

Lehigh Hanson Canada – Delta, BC

The Delta Plant Advisory Committee was formed in March 2001. This committee facilitates communication, better understanding, and resolution of issues between the plant and the residents of Delta and the surrounding area. It is an ongoing mechanism for the public to convey its concerns to the company and for the company to communicate directly with the community.

St. Lawrence Cement – Joliette, QC

The St. Lawrence Joliette cement plant maintains ongoing dialogue with the local community through a citizens' committee called COSE Lanaudière. Established in the early 1990s, the committee meets two to three times annually. Committee members include representatives of the local public health department, agricultural producers and environmental groups, as well as politicians, individual residents and plant management. The meetings provide a forum for addressing the concerns of local residents and communicating information to them about plant performance and projects.

Source: Isabelle Beaudoin, St. Lawrence Cement

Community Development: CAC member companies are not only important contributors to the employment and economy of their respective local communities, but they also contribute financial and in-kind support for community development.

ESSROC Italcementi Group – Picton, ON

ESSROC has a long-standing relationship with the Prince Edward County (PEC) Soccer Association as a team sponsor. Through the cooperation of County Council, the PEC Soccer Association, and many organizations including Essroc, a seven-acre site was transformed into three soccer fields for some 950 young soccer players in Prince Edward County.

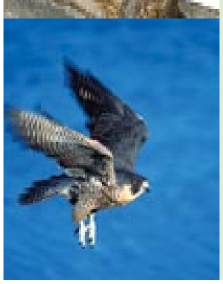
St. Marys Cement Group – Bowmanville/Westside Marsh Conservation Area

St. Marys Cement donated the provincially significant coastal wetlands of the Bowmanville Westside Creek Marsh in Ontario to help create 80 hectares of new waterfront parklands. A partnership of local organizations and the Ministry of Natural Resources funded visitor amenities, including an information kiosk, hiking trail and viewing mounds. The park has undergone extensive restoration to provide better habitat for the many wildlife species it harbours. It is now managed by the Central Lake Ontario Conservation Authority, which will continue restoration work and establish a treed wildlife corridor and upland meadow. Over the next ten years, St. Marys will continue to monitor the wetland to evaluate the ecosystem. Nearly 52,000 aquatic plants have been hand planted and now are colonizing the various created habitats. St. Marys has invested 9.4 million dollars in the reconfiguration of the Westside Marsh project.

Our Commitment to Biodiversity

Cement manufacturers understand that the value of land extends well beyond the financial benefits it provides. The recreational and aesthetic qualities of land are also vital components of community well-being and quality of life.

Steps taken by member companies to rehabilitate developed land and to protect wildlife habitat and biodiversity include such activities as partnering with environmental organizations, donating integral lands, and planting trees to revegetate developed areas.



Lafarge Canada Inc.

Lafarge Canada has partnered with WWF Canada to protect predators such as black bears, grizzly bears, timber wolves, bobcats, and mountain lions in the Bow River Valley, where Lafarge has several sites, including the Lafarge Exshaw cement manufacturing facility. The joint projects are designed to minimize the number of threatened and endangered species deaths as a result of vehicular and train traffic.

In addition, Lafarge Canada Inc. donated land to the city of Calgary, Alberta, for Fish Creek Provincial Park, one of the largest urban parks in North America. This park offers biking and equestrian trails, archaeological sites, a visitor centre, and 40 kilometres of hiking.

St. Lawrence Cement – Mississauga, ON

For the past several years, peregrine falcons have used the tall silos and high ledges of the St. Lawrence Mississauga cement plant as a nesting place. The plant has partnered with the Canadian Peregrine Foundation and, in cooperation with the Ontario Ministry of Natural Resources, works towards gaining a better understanding of how to provide favourable nesting conditions for these birds, an endangered species.

Lafarge Canada Inc. Bath Plant employees have been working with Cub Scouts and local students in a tree planting program.

Sustainable Attributes of Cement and Concrete

Cement and concrete products make many contributions to sustainable communities in Canada, including the construction of cost-effective, high-performance, long-lasting, and energy-efficient residential and commercial buildings, buried infrastructure, roads and bridges, dams and power stations – and even remediation of contaminated sites.

In an effort to address the challenges of sustainable development, citizens, governments, and industries are increasingly basing choices on considerations that go far beyond traditional financial concerns to include factors such as:

- **Energy requirements** to manufacture, install, operate, and decommission;
- **Pollution releases** during each phase of the product life cycle;
- **Consumer and public safety**;
- **Flexibility and adaptability** – to respond to changing societal and customer needs;
- **Product durability** and lifetime operating and maintenance costs;
- **Ability to recover, recycle, or reuse** the product and its components; and
- **Intangible attributes**, such as aesthetics and contribution to community well-being.

When assessing competing construction materials against these considerations, architects, engineers, and builders are identifying concrete as a responsible choice for sustainable development.

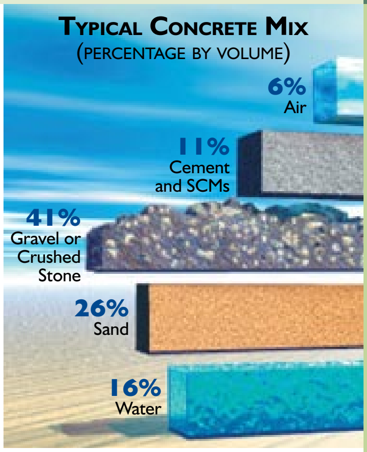
While CAC member companies support the use of cement and concrete products for all these applications, the role of the CAC is to encourage the introduction and growth of cement use in innovative and sustainable applications. Present efforts focus on the following key applications:

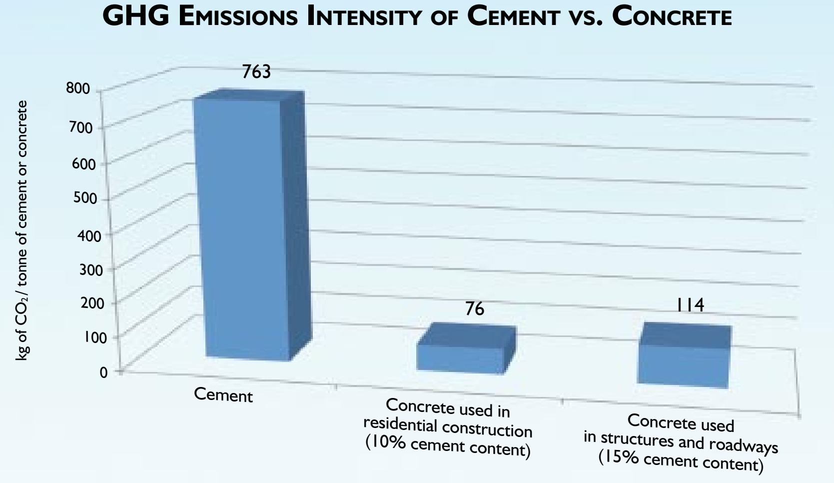
- Highways;
- Green buildings;
- Pervious and permeable pavements; and
- Remediation of contaminated sites.

Concrete – A Low Greenhouse Gas (GHG) Emissions Intensity Construction Material

Cement and supplementary cementing materials (SCMs) are the critical ingredients that lock sand and gravel together into an inert concrete matrix. They typically represent 10% to 15% of a concrete mix.

On average, concrete has a greenhouse gas emissions intensity equal to 1/9 that of cement. This is an important characteristic of concrete, making it a sustainable construction material of choice.





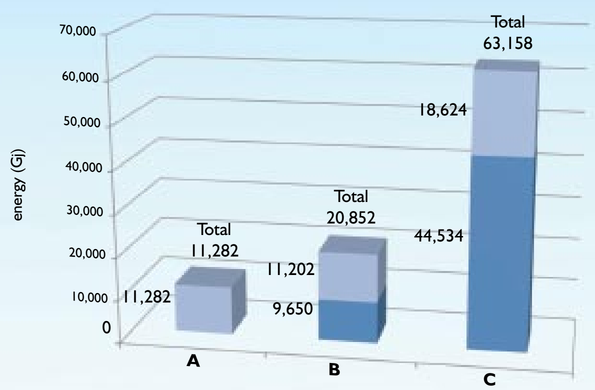
Source: Data based on WBCSD CO_2 Protocol (2006) and Cement Association of Canada *Design and Control of Concrete Mixtures*, 7th edition.

Highways

Our public infrastructure is aging and stressed, with a substantial portion built more than 40 years ago. To ensure that Canadians receive maximum value for the significant investments that will need to be made, decision-makers should consider the full life cycle costs and benefits of their choices. Life cycle analysis has demonstrated that concrete highways can offer economic, environmental, user, and safety benefits.

Over a 50-year period, the embodied primary energy* required to construct, maintain, and rehabilitate a typical high volume concrete highway is 3 times less than for its typical asphalt equivalent, as shown in pavement structure B.

COMPARATIVE *EMBODIED PRIMARY ENERGY FOR TYPICAL HIGH VOLUME HIGHWAY DESIGN
(REFERRING TO A 4-LANE ONE KILOMETRE HIGHWAY)



A Concrete pavement (concrete shoulders, no asphalt overlay)
B Concrete pavement (asphalt shoulders and asphalt overlay)
C Asphalt pavement

Primary energy
Feedstock energy

DEFINITIONS

Primary Energy: The energy resources required by processes, including the energy input used to extract the energy resources.

Feedstock Energy: The gross combustion heat for any material input, such as bitumen, which is considered an energy source, but is not being used as an energy source.

***Embodied Primary Energy:** The sum of primary energy and feedstock energy.

However, if one uses concrete shoulders and concrete restoration with no overlay as part of the maintenance and rehabilitation schedule, as shown in pavement structure A, the primary embodied energy is 5.6 times less than the asphalt option.[5]

[5] The Athena Sustainable Materials Institute, A Life Cycle Perspective on Concrete and Asphalt Roadways: Embodied Primary Energy and Global Warming Potential, Ottawa, September 2006.

Concrete pavement is smooth, comfortable, and quiet. There is less potential for hydroplaning on concrete surfaces, and concrete provides better night-time visibility through reflectance and minimizes pothole potential.

Concrete highways also enable improved transportation efficiencies and lower vehicle emissions since trucks use on average 3.9% less fuel on concrete pavements; thus reducing greenhouse gas and other air pollutant emissions.[6]

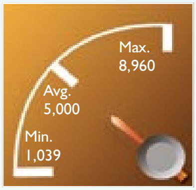
[6] Effects of Pavement Structure on Vehicle Fuel Consumption – Phase III, NRC, CSTT-HVC-TR-068, Taylor and Patten, January 2006.

Fuel Savings and Reductions in Emissions

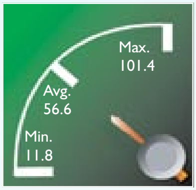
The range of potential fuel savings and reductions in emissions that will be achieved by trucks if a **100 km** section of a **major urban arterial highway in Canada** were to be paved in concrete are presented here. It is assumed 1,095,000 heavy trucks travel on this section of roadway, based on 20,000 vehicles per day at 15% heavy truck traffic.

Fuel Savings
Litres per year

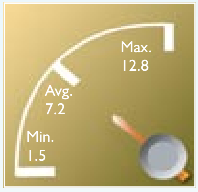
CO_2 Emissions Reductions
Tonnes per year



NO_X Emissions Reductions
Tonnes per year



SO_2 Emissions Reductions
Tonnes per year



Concrete is a cost-effective paving solution that is long-lasting, stands up to seasonal stresses, is easy to maintain, and has lower maintenance and repair costs.

Green Buildings

The cement industry supports the use of energy rating systems to encourage the construction of better public and private sector buildings in Canada.

An example is LEED™ Canada, a point system to rate the energy and the environmental performance of a building and encourage market evolution towards sustainable design and construction. A building needs at least 26 points for LEED™ certification, and concrete products can contribute over 20 points towards this goal. Some of these contributions include:

Durability: Concrete will not rust, rot, or burn, and requires less energy and resources over time to repair or replace.

Superior Energy Performance: The thermal mass of concrete can be used to increase the energy efficiency of buildings by reducing heating and cooling loads.

Improved Indoor Air Quality: There is no off-gassing from concrete, and concrete floors do not require carpeting. Exposed concrete walls do not require paints or sealants, and concrete does not sustain the growth of mould or mildew.

Adaptable and Recyclable: Open-concept concrete buildings can be adapted and reused many times over decades, as owners and occupants and their needs change. Ultimately, the concrete in a building can be crushed and reused. Recycling concrete reduces demand for virgin materials and diverts significant waste from landfills. Currently, 80% of concrete is recycled in Canada.[7]

[7] Five Winds International, Estimating Concrete Waste Flows & Recycling Rates in Canada, November 29, 2006.

Radiance@Minto Gardens
Radiance@Minto Gardens in Toronto was the first high-rise multi-residential building in Canada to receive LEED certification and the first building in Canada to earn the LEED "durability credit". As a result of the durable masonry and concrete products used in the building envelope, building owners and buyers enjoy lower operating costs and a healthier building envelope system that is leak- and mould-resistant. Radiance uses about one-third less energy than similar-sized buildings.

Pervious and Permeable Pavements

The cement and concrete industry has developed innovative products, such as pervious pavement and permeable interlocking concrete pavement, to reduce the impacts of runoff in urban communities.

Pervious concrete pavement is a durable but porous material that contains little or no sand. The final result is a solid, uniform pavement that allows water to pass through. Permeable interlocking concrete pavement is comprised of a layer of concrete pavers separated by joints filled with small stones.

By allowing rainwater to seep into the ground, both concrete products can recharge groundwater and reduce stormwater runoff. They also eliminate the need for expensive retention ponds and other stormwater management devices. When rainwater is allowed to percolate into the ground, soil chemistry and biology can treat the surface contaminants that build up on the paved surface over time.

Pervious Concrete: Putting Rainwater Back in the Ground

Applications for pervious concrete include:

- Low-traffic pavements, such as residential roads, alleys, and driveways
- Parking lots
- Sidewalks and pathways
- Patios
- Tennis courts and swimming pool decks
- Foundations/floors for greenhouses, fish hatcheries, aquatic amusement centres and zoos
- Load-bearing and other walls
- Sound barriers
- Well linings
- Tree grates in sidewalks
- Seawalls

The use of pervious concrete has been recognized by the U.S. Environmental Protection Agency among the Best Management Practices for the management of stormwater runoff on a regional and local basis.

Rehabilitation of Contaminated Sites

Soil solidification/stabilization with cement is an increasingly common technology for the safe management, treatment, and reuse of contaminated properties in Canada and around the world.

The technique involves mixing cement into contaminated soil. The cement reacts chemically with water in the material being treated, creating changes in its physical and chemical properties. The process prevents leaching of contaminants into groundwater, and their airborne dispersion.

Solidification/stabilization technology can treat a wide variety of contaminants in many different forms, including heavy metals like lead and arsenic, and organic contaminants like creosote and petroleum products.

The U.S. Environmental Protection Agency (www.epa.gov) has identified solidification/stabilization as a Best Demonstrated Available Technology for at least 50 commonly produced industrial wastes.

The treated material can be reused on site, reducing transportation costs, the need for replacement landfill, and demands on landfill space.

Source: Sydney Tar Ponds Agency

Solidification/Stabilization – The Technology of Choice to Remediate the Sydney Tar Ponds

The Sydney Tar Ponds are one of Canada's most polluted industrial sites. A century of steel and coke production left more than a million tonnes of contaminated soil and sediment in Sydney, posing long-term risks to the local environment and citizens.

In January 2007, the governments of Canada and Nova Scotia identified solidification/stabilization as the treatment technology of choice to remediate the Tar Ponds.

Cement will be mixed into the contaminated material to solidify and stabilize it. When the process is complete, the solidified areas will be covered with an engineered cap consisting of a high-density polyethylene liner or clay, followed by layers of gravel and soil. The final surface will be planted with grass and other vegetation.

Glossary

Clinker – an intermediary, partially fused, rock-like product of a cement kiln produced by pyroprocessing of a properly proportioned mixture of finely ground raw materials (lime, silica, aluminum, and iron oxide), which is then ground with additives to make cement.

CO_2 – carbon dioxide is a colourless, odourless, non-poisonous gas that results from respiration, organic decomposition, and fossil fuel combustion.

Direct and Indirect CO_2 Emissions – direct emissions refer to emissions from sources that are located at the reporting facility, such as combustion from fuel use. Indirect emissions are from the fuels used to generate external electricity consumed at the reporting facility.

Emissions Intensity – a measure of emissions per unit of production. For example, kg of NO_X per tonne of cement.

Energy Intensity – a measure of the energy use per unit of production. For example, GJ per tonne of cement.

Gigajoule (GJ) – unit of energy equal to 10^9 joules. One GJ equals approximately 950,000 BTUs or 278 kWh of electricity.

Granulating Facility – the facility that takes molten slag, a by-product of pig iron production, and rapidly quenches it with water or cold air to form granules. These granules are later dried and ground to a suitable fineness, the result of which is slag, which can then be blended as supplementary cementing material with portland cement.

Greenhouse Gases (GHG) – are components of atmosphere that contribute to the greenhouse effect. Without the greenhouse effect, the Earth would be uninhabitable. GHGs include, in order of relative abundance, water vapour, carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O) and ozone, as well as chlorofluorocarbons.

Grinding Facility – a facility to reduce the particle size of rock-like materials. In cement manufacturing, machinery, such as ball mills or vertical mills are used to co-grind clinker with additives, such as gypsum, limestone, and other mineral components in order to produce cement powder.

Life Cycle Analysis (or Life Cycle Assessment) – LCA evaluates all stages of a product's life, from cradle to grave, including: resource extraction; manufacture and transportation of materials; assembly and construction; operation, including energy consumption and maintenance; and disposal and reuse.

NO_X – compounds of nitrogen and oxygen produced by burning fossil fuels.

SO_X – compounds containing sulphur and oxygen, such as sulphur dioxide (SO_2) and sulphur trioxide (SO_3).

Supplementary Cementing Material – a material that, when used in conjunction with cement, contributes to the properties of hardened concrete through hydraulic or pozzolanic activity, or both. Supplementary cementing materials include by-products of other industries, such as fly ash, ground granulated blast furnace slag (GGBFS), silica fume, and rice husk ash.

Total Cement Production – total cement production includes clinker sales, portland and blended cement sales, and the sale of cement substitutes, slag, fly ash, and natural pozzolans.

Total Particulate Matter – are fine particles of solids or liquids suspended in a gas, produced by natural and man-made causes.

Ce document est aussi disponible en français.

Members of the Cement Association of Canada

Grey Cement Producers

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PLANT: Picton, ON

Lafarge Canada Inc.

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www.lafargenorthamerica.com

PLANTS: Richmond, BC; Kamloops, BC; Exshaw, AB; Bath, ON; Woodstock, ON; St. Constant, QC; Brookfield, NS

Lehigh Hanson Canada

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www.lehighcement.com

PLANTS: Delta, BC; Edmonton, AB

St. Lawrence Cement

HEAD OFFICE: Concord, ON
Tel: (905) 532-3000
www.stlawrencecement.com

PLANTS: Mississauga, ON; Joliette, QC

St. Marys Cement Group

HEAD OFFICE: Toronto, ON
Tel: (416) 696-4411
www.stmaryscement.com

PLANTS: St. Marys, ON; Bowmanville, ON

White Cement Producer

Federal White Cement Ltd.

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Tel: (519) 485-5410
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Cement Association of Canada
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