Cement Industry

BRAZILIAN CEMENT INDUSTRY

A FOUNDATION FOR CONSTRUCTING DEVELOPMENT

INDUSTRY MEETING FOR SUSTAINABILITY

SNIC

Associação Brasileira de Cimento Portland

CNI SESI SENAI IEL

CNI

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National Confederation of Industry
Brazil

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CNI
National Federation
of Industries

Headquarters
Setor Bancário Norte
Quadra 1 – Bloco C
Edifício Roberto Simonsen
70040-903 – Brasília – DF
Phone: (61) 3317-9000
Fax: (61) 3317-9994
www.cni.org.br

ABCP
Brazilian Associaton
of Portland Cement

Headquarters
Jaguaré
Av. Torres de Oliveira, 76
05347-902 – São Paulo – SP
Phone/Fax: (11) 3760-5300
www.abcp.org.br

SNIC
Sindicato Nacional da
Indústria do Cimento

Headquarters
Rua da Assembléia, 10
20011-901 – Rio de Janeiro – RJ
Phone: (21) 2531-1314
Fax: (21) 2531-1526
www.snic.org.br

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SUMMARY

CNI PRESENTATION

The diversity of the national industry and the significant availability of natural resources reveal excellent opportunities for the sustainable development of Brazil, combining economic growth, social inclusion and environmental conservation. The materialization of concerns related to sustainability in the strategic agenda of enterprises and governments is a reality. Apart from isolated cases of success, the consequences of this attitude are felt in entire sectors of the economy. Further advances are still needed, but the path has already been identified and going back is impossible.

After coordinating an unprecedented critical thinking process on sustainability with 16 industry associations, the National Industry Confederation (CNI) delivers to the Brazilian society a wide range of information on progress, challenges and opportunities yet to come. The results presented here may not portray the significance of the discussion process experienced by the industry in preparing these documents. Developments on the process will be beyond the Rio +20 Conference, and are definitely incorporated on the daily lives of companies.

The subject of sustainability is inserted differently in each of the industrial sectors. However, some elements are common to all. The continuous pursuit for efficiency in use of resources and the need to increase industrial competitiveness are on the agenda of all the sectors. Encouraging innovation and scientific and technological development is strategic on the transition to more sustainable patterns of production.

Strategies to intensify actions coordinated internally in the industrial sectors and with governments and civil society organizations are no less important. The dissemination of sustainable practices by means of the supply chain and incentives for companies to undertake the role of integrated management of the territories are powerful tools.

The sectorial volumes developed by industry associations are valuable contributions to addressing subjects such as sustainability and competitiveness of domestic industry. One of the most representative results of this process will certainly be the strengthening of structured programs of action with a focus on promoting sustainability in the production. These initiatives will act as raw materials so that the industries involved and CNI are able to systematically publish documents presenting the national industry´s developments towards the goals of sustainable production.

The documents presented here are intended to be a valuable contribution to enhance the debate on sustainability. Each of the sectorial associations is to be congratulated for their efforts.

Robson Braga de Andrade
President of the National Confederation of Industry – Brazil

SECTORIAL PRESENTATION

The Brazilian Cement Industry is proud of being an integral part of the country's development in view of its contribution to civil construction.

Since 1936, our plants have made an effort to meet all demands of the development and expansion of infrastructure, adding to the national effort towards growth and inclusion of all Brazilians.

The Brazilian Portland Cement Association (ABCP), which researches and develops new products and technologies, works in partnership with the National Cement Industry Association (SNIC) with the goal of maximizing production without harming the environment. Given Brazil's continental dimensions and its ranking as the world's seventh largest in volume of cement production, these two pillars constitute their greatest challenges.

It is noteworthy that, among the technological advances in environmental protection, the cement industry has played a key role in the disposal of industrial waste. Until recently this waste was disposed of in urban landfills, but now is co processed by cement plants.

Nowadays we include in our production process several types of waste as raw materials or alternative fuel substitutes, eliminating environmental risks caused by an industry on a welcome growth path. This effort makes us proud of being partners in our vibrant economy for generations to come.

Renato José Giusti
President of the Brazilian
Portland Cement Association

José Otávio Carneiro de Carvalho
President of the National
Cement Industry Association

1 INTRODUCTION

The Brazilian Portland Cement Association (ABCP) was created in 1936 with the purpose of undertaking research on cement and its uses. It is a non-profit organization, supported voluntarily by the Brazilian cement industry.

Mission of ABCP

- Consolidate and expand the market of products and systems based on cement;
- Technical and institutional representation of the cement industry in: industrial competition, standards setting, quality and environment;
- Provide technical services
- Compile technical information, disseminate, transfer technology and provide training;

Recognized nationally and internationally as a reference in cement technology ABCP has drawn on its expertise to contribute to important Brazilian engineering works and to many types of technology transfer such as:

- Promote specialization training and education, seminars and technical meetings;
- Partnerships with many universities, schools and national research institutions;
- Support to manufacturers of cement-based products;
- Publication of books, magazines and technical documents;
- Support to drafting of Brazilian technical standards within the scope of CB-18 of the Brazilian Technical Standards Association (ABNT).

The National Cement Industry Association – SNIC was created in 1953 with headquarters in Rio de Janeiro. Also as a non-profit, it was created as a legal representative of the "Cement Industry". It is legally mandated to represent the general and individual interests of the industry and its members before administrative and legal authorities at the federal and state government levels. It assists government as a consultative technical body when it is called to explore solutions to technical problems related to the cement industry. SNIC is mandated to:

- Provide technical and legal assistance on such matters as: economic, fiscal, environmental, mining, accident prevention and work-place safety, among others;
- Collect, codify and disseminate information on production, shipping and consumption of cement in the country;
- Represent the industry in state level federations of the industry;
- Carry out prospective macroeconomic and demand studies;
- Liaise with the media, as a spokesman for the industry and in the design and implementation of campaigns to foster a good image of the cement industry.

The Brazilian cement industry consists of 79 plants among which 51 are productive units and 28 are grinding units. Together they play an important role in the national and international cement sector with a production of 63 million tons in 2011, ranking 7th largest in the world.

The national cement industry is known for its technological advance, which raises its profile among the best in the world. These advances are based on automation of productive processes, and its tireless search for electric and thermal energy savings. Cement is obviously directly linked to the development of the construction sector.

It represents the main component of concrete, an essential ingredient for the development of infrastructure in the country as it is used in the construction of roads, bridges, water supply and sewerage systems, schools, hospitals and housing.

In addition to its economic importance, cement and its production have contributed to the solution of many environmental problems, by including in its productive process, many industrial waste as raw material or fuel substitutes and by the use of mineral additions as in the case of blast furnace slags and power station fly ash.

The use of cement kilns to burn waste has given the cement industry a new and relevant role as a means to promote environmental sustainability and balance. Co processing in many cases is the most efficient and economic solution for the management of waste without risking the quality of Portland cement or the environment.

The technological advances of cement production and the replacement of fossil fuels and natural raw materials with alternative materials have always been propelled by the search for thermal and electric energy savings and by a rational use of natural non-renewable resources. With respect to emissions of green-house gases, several measures have been adopted by the industry for improvements of its productive processes, including monitoring and inventory of emissions, programs to improve energy efficiency, and the use of mineral additions and alternative fuels. The industry also participates actively in the international forum, "Cement Sustainability Initiative" (CSI) an international consortium of major global cement industries which promotes the sector's sustainability. CSI in turn is a member of the "World Business Council for Sustainable Development" (WBCSD) and Brazil is represented by six cement companies which combined represent 75 per cent of national production.

The industry undertakes several socio-environmental initiatives with the purpose of creating incentives for environmentally sustainable practices in communities, increase the public's awareness of sustainability, and by introducing the topic into school curricula. This document presents the contributions of the sector to the preservation of natural resources, by utilizing residues as substitutes for fuel and raw materials, efforts to reduce green-house gases and socio-environmental initiatives and compensatory measures adopted in the different regions of the country.

FIGURE 1. ECONOMIC FEATURE OF THE SECTOR

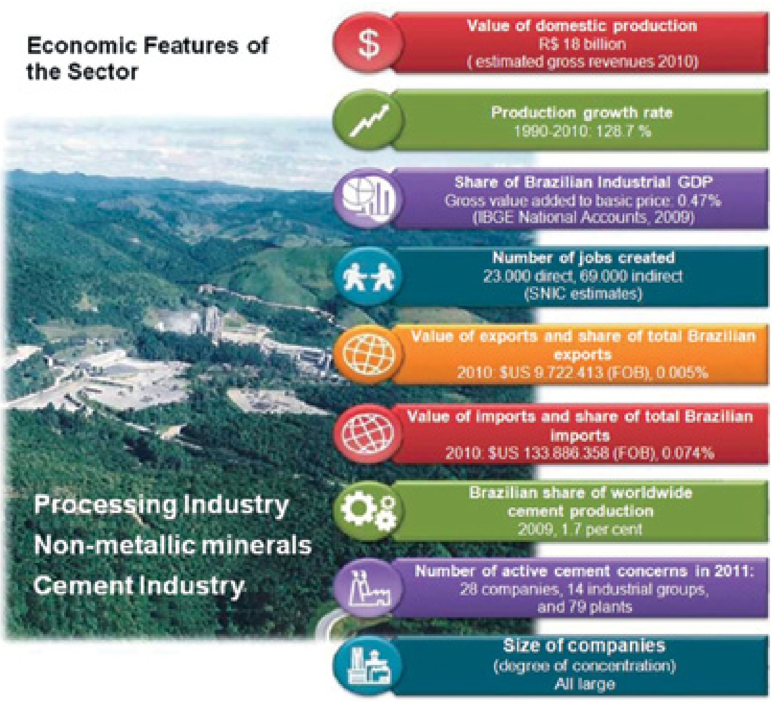
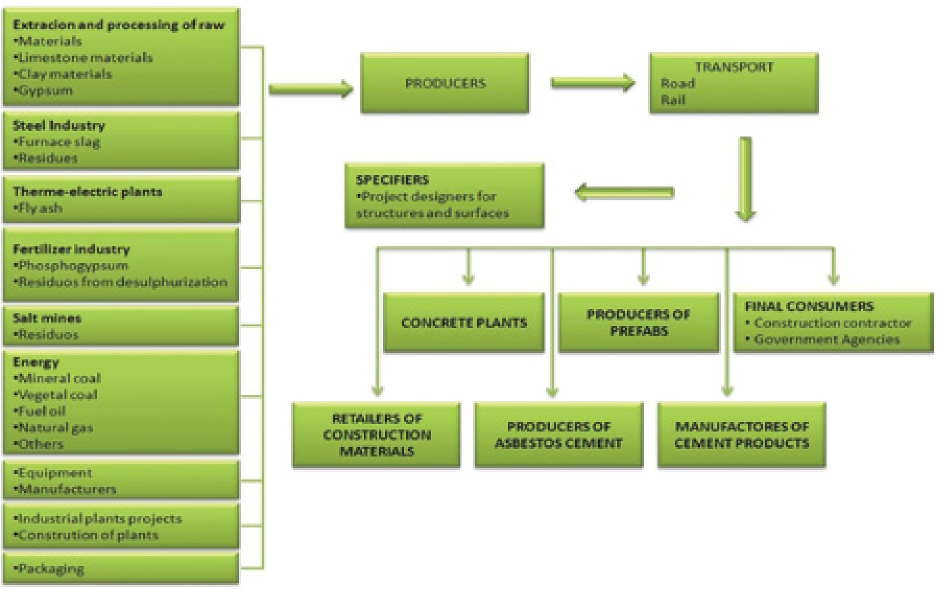


FIGURE 2. CEMENT PRODUCTION CHAIN



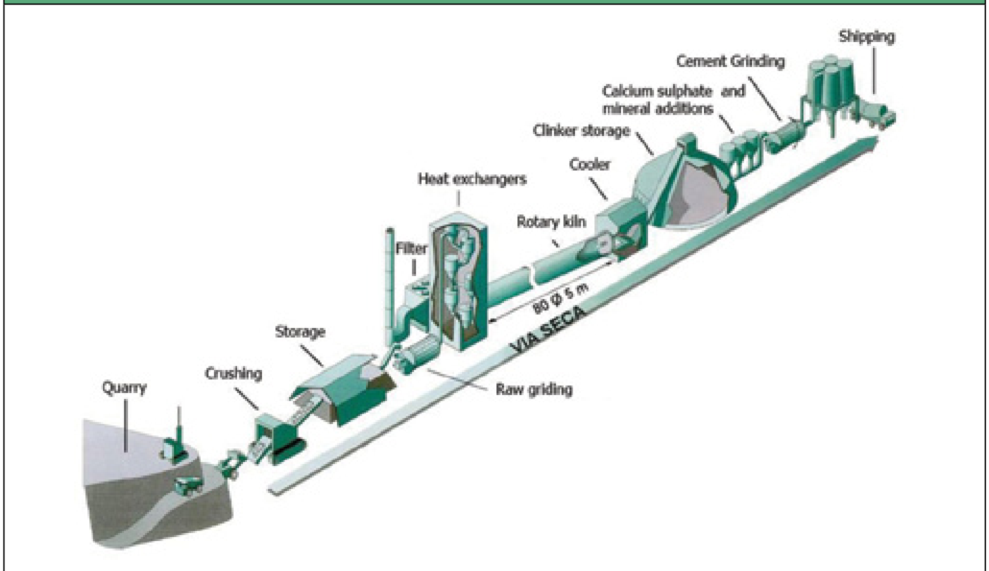
Source: Ferraz et al., 1996.

2 CEMENT PRODUCTION PROCESS

In short, the production process is a combination of mining and processing of non-metallic mineral materials, their chemical transformation into clinker (an intermediate cement product) in kilns at 1450 centigrade degrees and subsequent grinding and blending with other materials, according to the cement type.

The production of Portland clinker can be broken down into four types of processes: wet, semi-wet, semi-dry and dry, depending on the degree of humidity of the raw materials. The dry process ensures greater energy efficiency, fuel economy and reduced emission of pollutants and CO_2.

FIGURE 3. CEMENT PRODUCTION PROCESS SCHEME



Source: CAILLON ROUGE/ROGER RIVET.

Limestone and clay are the essential raw-materials to produce the clinker in a proportion of 75% and 25% respectively. Furthermore, corrective additions may be used, such as iron ore, sand and bauxite. Once mined, the limestone is (broken into gravel) crushed and pre-homogenized with clay and other additions for storage in appropriate silos. These minerals are carefully dosed in exact proportions, ground and homogenized up to the point when they become a fine material with homogeneous concentrations, known as ”raw meal”. The chemical-physical transformation of the raw meal into clinker goes through four stages: pre-heating, calcination, “clinkerization” and cooling.

The preheaters towers and/or precalcinators available in modern dry kilns reutilize the exiting hot gases to heat the “raw meal”. At this stage the raw material may reach a temperature of 800 centigrade degrees, when calcination – or decarbonation of the limestone starts- and the break-down of the molecular structure of the raw materials. The process then moves to the rotary kiln, where one finds the main burner, with a flame of 2000 degrees centigrade at its highest temperature.

At this stage the mix reaches temperatures of up to 1450 centigrade degrees, partially melting and turning into clinker. It is then cooled and ground along with calcium sulphate and, depending on the type of cement desired, with blast furnace slag, fly ash, pozzolan, and limestone filler, which then becomes Portland cement.

The cement industry has been investing in the modernization of its facilities and plants since the 1970s, seeking energy and fuel efficiency gains and emission reductions.

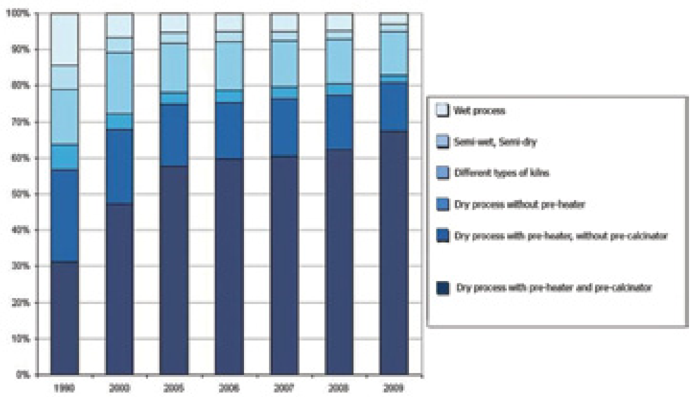
3 USE OF RESOURCES

3.1 Energy

During cement production, the use of thermal energy from the fuel used for drying, heating and calcination of raw materials represents 90 percent of used energy. The consumption of electric energy represents the remaining 10 percent of energy use. Most electrical energy is used in the grinding of the clinker (40%), the grinding of raw materials (25%), in the operation of the kiln, and the cooler (20%) Maringolo, 2011. The Brazilian cement industry has an efficient and modern industrial park, with plants and facilities that operate with low energy use.

Practically all cement in Brazil is produced by dry process, which ensures fuel savings of up to 50 percent relative to other processes. In 2009, the dry kilns in Brazil accounted for 99 percent of the cement production, whereas worldwide these kilns, according to CSI data, represent only 81 per cent.

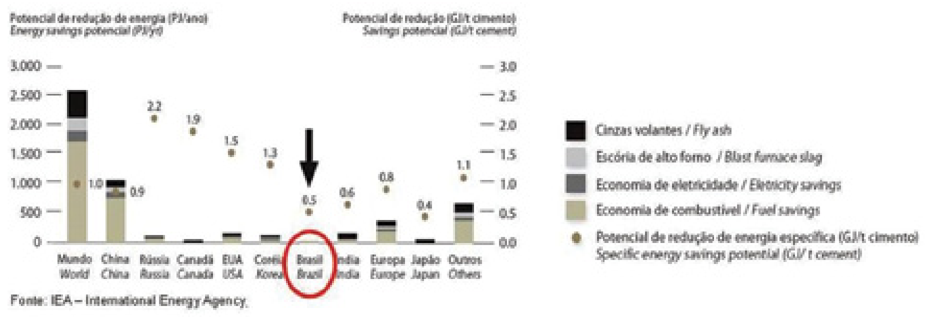
FIGURE 4. CLINKER VOLUME BY TYPE OF KILN (%)



Source: CSI – Cement Sustainability Initiative.

As a result of this technological modernization, a study undertaken by the International Energy Agency (IEA) analyzing the potential energy savings among the main cement producing countries, singled out Brazil as having one of the lowest savings potential, in view of the best available technologies.

FIGURE 5. ENERGY SAVINGS POTENTIAL BASED ON BEST AVAILABLE TECHNOLOGY IN 2006



Source: IEA – International Energy Agency.

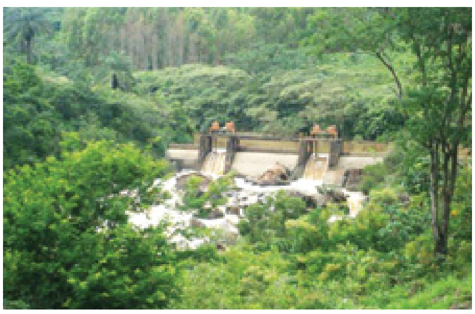
At present, the main fuel used by the cement industry is pet coke, which represents approximately 75 per cent of total consumption. Among others fuels used, the following are included: mineral coal, fuel oil, tires, industrial waste and biomass (coal residues, rice husk , sugar cane bagasse, etc.)

Energy – *Votorantim Cement Case*

Votorantim Cement (VC) runs small hydroelectric plants (PCH) in its plants of Rio Branco do Sul (PR) and Itau de Minas (MG), in addition to the hydroelectric plant of Pedra do Cavalo in Bahia, built next to a water reservoir used to supply the city of Salvador.

With an investment of R 250 million in this plant, VC started generating 42 per cent of the energy necessary for its production in Northeastern Brazil.

FIGURE 6. PCH ST. JOHN IN ITAÚ DE MINAS – MG



With an installed capacity of 160 megawatts, the plant generates 4 per cent of available energy in the state of Bahia, enough to meet the demand of 775.000 inhabitants. In addition to supplying energy to the State, it contributes to clean development, having been the first large hydroelectric project in the world to generate carbon credits. Up to 2010, it had reduced emissions by 342.000 tons of CO_2 equivalent.

The Votorantim Cement Case – Energy efficiency

Votorantim Cement adopted a CO_2 policy to make explicit its strategies and goals for emission reductions. It has invested in research and initiatives to increase the use of alternative raw materials and co processing waste in industrial process, without altering and even improving the product's performance.

The company also invests in the development of technologies to increase the energy efficiency of kilns. Up to 2012, approximately US$ 140 million will be invested in new projects to further reduce the specific emission of CO_2, which at present is quite close to the lowest international indices, according to CSI reports.

Energy – *The Lafarge Case*

The entire production chain of Lafarge is based on sustainability. Over 10 percent of energy used by this group comes from alternative fuels, which replace fossil fuels.

Over 50 percent of its research is on topics related to sustainable construction, such as CO_2 emissions, energy efficiency, protection of natural resources , safety, comfort and quality of life, and construction costs.

According to studies by the Lafarge Group, construction accounts for 40 percent of the energy used in most countries. This consumption rises substantially in countries with intensive real estate growth, such as Brazil. In order to mitigate the environmental impact of construction, the company has set as a priority incentives for environmentally friendly works and to contribute its expertise to the development of socially responsible products.

The group invests continuously on industrial ecology, above and beyond many regulatory requirements. Over the last five years, over 800 million Euros were invested to diagnose and reduce the environmental footprint of the Group's cement factories around the world.

3.2 Water

In the production of cement water is used in cooling towers and for injection into the mills for cooling of materials, at the rate of 100 liters for each ton of cement. The water used in the cooling of gases is absorbed by the process and ejected as steam, without generating any contaminant. However, water utilized to cool down equipment, is sorted out to eliminate oils, and is recycled. Water used in most plants is recycled at practically 100 per cent, eliminating industrial liquid waste.

Recycling of Water – *The Votorantin Cement Case*

Votorantim Cement adopted a system of water recycling in its largest cement plant located in Rio Branco do Sul (PR). With investments in new technology it now recycles 210 million cubic meters water/day. On the roof of the clinker facility it installed rain water containers and under the limestone facility pipes were installed to channel the captured rain water.

3.3 Raw Materials: Limestone and Clay

The first and most critical stage of cement production is the extraction of raw materials (limestone and clay). Extraction often has local environmental impacts concentrated in small areas, as a result of removal of soil and vegetation, which alters local topography. Impacts on ecosystems and local river basins are also possible.

Certain regions rich in limestone are known for their biodiversity, its fossils or cultural values, especially for local communities. Therefore, environmental and social assessments of mines should not overlook sites with unique biodiversity, or cultural, geological or scenic features (WBCSD, 2005)

Quarry rehabilitation and Monitoring of Land and Fauna – *The case of Votorantim Porto Velho Plant* (Brazil)

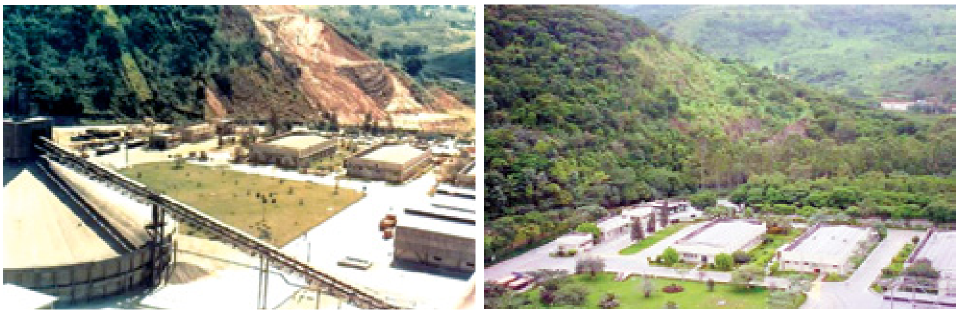
Votorantim Cements has been monitoring land fauna in the surrounding areas of all its plants. This is a valuable procedure as it enables the assessment of the impact of industrial activity on the fauna of the region of the plant. Similar studies are carried out to verify if any alteration of fauna in the area has occurred as a result of the plant's activity.

Quarry rehabilitation
– *The case of Lafarge*

The company has taken a voluntary approach in relation to initiatives which minimize its environmental impact on a global scale. Since 2000, Lafarge has entered into partnerships with the WWF (World Wildlife Fund) to agree on environmental targets and public commitments with it regarding the quarry rehabilitation, maintenance of local biodiversity and the establishment of environmental indicators to assess the performance of the company in several areas, such as water, energy consumption, reforestation, environmental investment and training, among others.

During 2005-2006, access to the Valente mine in Cantagalo (RJ) was restored, by draining river run-offs, recovery of slopes and the planting of Mata Atlantica endemic species.

FIGURE 7. VALENTE MINE – CANTAGALO RJ



In Itapeva/SP, a clay mine was completely restored, with regeneration of local vegetation and creation of a water mirror.

FIGURE 8. DEPOSIT OF CLAY – ITAPEVA SP

Quarry rehabilitation – *The Case of Holcim company*

Limestone quarry of Felicissimo and Ipanema located in the National Ipanema Forest, Municipio of Ipero-SP, were restored and the areas will be released in 2012 to ICMbio Instituto Chico Mendes for Biodiversity Preservation, subordinated to the Ministry of Environment.

The Ipanema National Forest has been a federal conservation Unit since 1992 and is considered a historic legacy. In 1811 the Royal Iron Plant of Ipanema (the birth place of the Brazilian steel industry) was built in this site as magnetite iron ore deposits were discovered in the region, hence its historical value. The forest has 5.18 thousand hectares and is managed by ICMbio, and Holcim has been its concessionary since 1951.

The closing of the mine and the restoration work of 51 hectares at a cost of US$ 5.8 million started in 2001. The company's decision to undertake this restoration was approved by the Brazilian Institute for the Environment (IBAMA). It took place in 2001, as the licensed limestone reserves, were not sufficient for the expansion of the Holcim cement plant in Sorocaba.

Re-vegetation was completed in 2010 and presently the reforested areas are being monitored and maintained along with the return of fauna to the area. The drainage of run-offs from Ribeirão do Ferro stream is also being maintained and the stability of slopes monitored. The plan is to release to ICMbio the area after it is entirely integrated to the Ipanema Forest.

FIGURE 9. FELICISSIMO MINE – IPANEMA NATIONAL FOREST

2002, Decembe

2005, March

2007, March

2010, April

Technical cooperation – *Votorantim case*

In July of 2011, Votarantim Cimentos (VC), the Brazilian Society of Cave Exploration, (CBE) and the Mata Atlantica Biosphere Reserve (RBMA), signed a renewable cooperation agreement valid for 2 years. This agreement seeks to develop, implement and disseminate good mining practices in areas of caverns and surrounding Conservation Units, including Mata Atlantica areas and other remaining native vegetation which contribute to conserve biodiversity and protecting the region's cave heritage.

In addition to this agreement, a work plan was also agreed, including the activities listed below, some of which are already under way:

- Manual/Standard Procedures for Good Environmental Practices
- Research Program on Cave Heritage
- Training Program on Cave Heritage
- Conservation and management of Caves, Areas of Mata Atlantica with rain water enriched by carbon dioxide

FIGURE 10. CHICO PERNAMBUCO CAVERN – BA

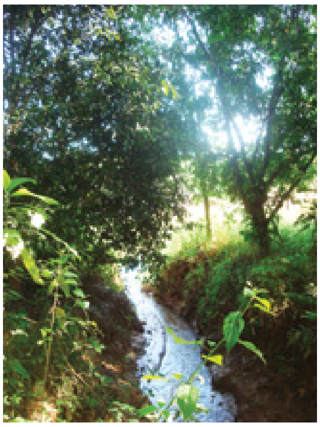
Photo of Chico Pernambuco (BA) cavern, placed 3rd in a Photo competition on Brazilian Caverns which took place in 2011, sponsored by "Cooperação Técnica VC/SBE/RBMA", which produce a calendar of 2012 with the winning photos of the competition.

3.4 Preservation of Biodiversity

The case of Cimpor Company

One of Cimpor's plants is located in the Cajati (SP) municipality, part of the Vale do Ribeira Region. River Jacupiranguinha, part of the River Ribeira do Iguape basin, is the main river running through the municipality. This entire region is located in one of the most important remnants of Mata Atlântica. As such and due to its largest repositories of bio-diversity around the world, it is widely known as among the areas at most risk.

FIGURE 11. RIPARIAN FOREST-STREAM MARIANO – CAJATI SP



Illegal banana plantation and misuse of natural resources have caused the degradation of soil and vegetation. Since the acquisition of this area by Cimpor it has been investing to reverse this degradation, and restore the region's original features. To that end, it launched a large project, mainly to restore the riparian forest of river Jacupiranguinha.

Due to its importance, the project became one of 20 case studies of environmental restoration of the World Business Council for Sustainable Development , WBCSD (Conselho Mundial de Empresas para o Desenvolvimento Sustentável), and the only Brazilian case. This initiative contributed to the restoration of one of the most important remnants of the Mata Atlantica, a biome with over 20 thousand species of plants, of which 8 thousand are found nowhere else on the planet. The restored areas brought back several bird species and mammals such as the Brazilian armadillo ("tatu"), the "capivara" and otters which have now been seen in these areas.

Another biodiversity locale maintained by Cimpor is the Graça farm, Permanent Preservation Area (APP) which it owns, located in Joao Pessoa (PB). The region is known for its important biodiversity, and to preserve it, Cimpor along with The Federal University of Paraiba, worked on cataloguing its animal and plant species. One of the main such studies were on the feeding habits of the white cranes. In an area of approximately 200 hectares covered by Mata Atlantica, the Graça farm, houses the only breeding ground of white cranes of Joao Pessoa.

FIGURE 12. GRAÇA FARM – JOÃO PESSOA PB

The Brazilian Timber Park

The Cimpor plant in João Pessoa covers approximately 400 hectares of which half is covered by Mata Atlântica, mango groves and scenic areas. The Brazilian Timber Park is dedicated to the cultivation of native Brazilian trees at risk of extinction. The area has 100 species selected by their economic and social value to Brazil, many risking extinction. This park represents a symbolic restoration of Brazilian flora, and is the destination for students of environmental matters from local schools.

FIGURE 13. TIMBER PARK – JOÃO PESSOA PB

The Lafarge Case

At present Lafarge Cement Company owns in Brazil two Private Reserves of Natural Heritage, both in Minas Gerais, in its plants of Matozinhos and Arcos. It has also launched approved projects in Montes Claros, also in Minas Gerais, and Cantagalo, in Rio de Janeiro.

The Reservas Permanentes de Preservacao Natural , (RPPNs) Permanent Reserves of Natural Preservation enable the launching of educational projects, such as lectures about the environment, ecological trails and paths, and setting up of environmental centers. The RPPN of Matozinhos has 172.5 hectares (30 percent of the ploughed area) was established in 1996 to preserve the local biodiversity, geology and archeology in view of its location, in Carste de Lagoa Santa, an environmental protection area (Area de Protecao Ambiental , APA). In the Ballet cave one finds a priceless cave and archeological heritage. In addition to its great natural beauty, the Ballet cave has primitive cave inscriptions dating back 8 thousand years, as testified by researchers from the Natural History Museum of Belo Horizonte.

FIGURE 14. PRIVATE RESERVE OF NATURAL HERITAGE (PRNP) – MATOZINHOS MG

FIGURE 15. BALLET CAVE – MATOZINHOS MG

The Lafarge Company also maintains since 2001 a RPPN of 84 hectares in its Arcos plant which represents 43 percent of ploughed area. With a view to preserving forest and rocky biotopes of the cave system of Buraco de Efraim and Posse Grande, Lafarge monitors annually the colonies of rock cockatiels and of birds inhabiting these forests.

FIGURE 16. PRIVATE RESERVE OF NATURAL HERITAGE (PRNP) – ARCOS MG

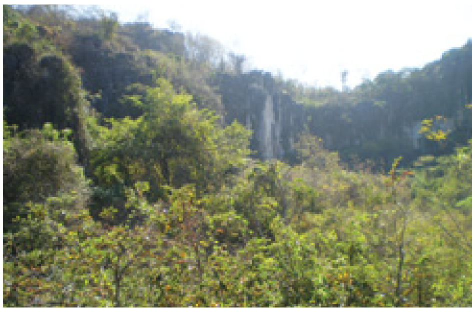


FIGURE 17. EPHRAIM HOLE – ARCOS MG

Results show that the population of mammals found in the region has been growing as a result of the improved preservation of the RPPN areas. The same was found in relation to insect-eating birds. The preservation of this area and the environmental education activities carried out by Lafarge are greatly responsible for preserving this heritage.

Holcim case – Pedro Leopoldo (MG)

The limestone mine of Holcim in Pedro Leopoldo (MG) is located in the region of the environmental preservation area of Carste de Lagoa Santa, a rich cave and of hydrological heritage value. Research by Peter Lund from Norway in the 19th century discover in these caves and caverns fossilized remains of the “man from Lagoa Santa”, of great importance for Brazilian paleontology. With the purpose of contributing to the preservation of this region, an area of 43 hectares belonging to the Campinho Farm, where the limestone mine is located, and another of 9 hectares, where the plant is located in 2001 were transformed into a RPPN.

3.5 Raw materials : Mineral Additions

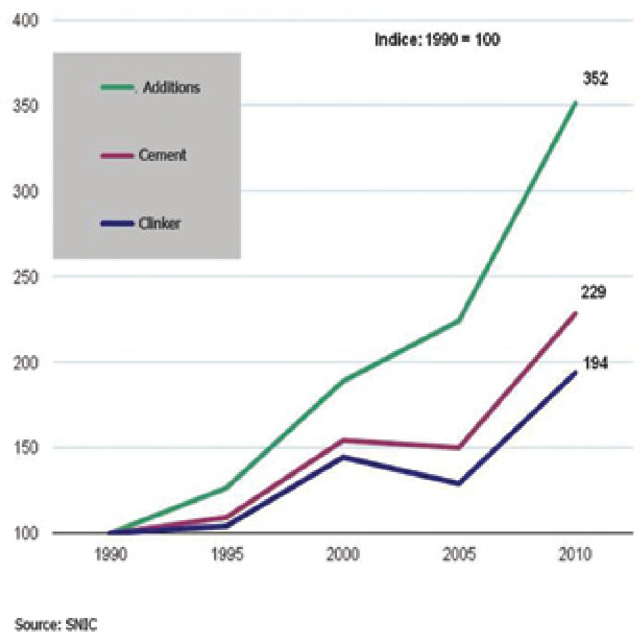
Over the last 50 years, in addition to basic raw materials –limestone and clay- the Brazilian cement industry has been using by-products from other productive activities and alternative raw materials. Over the last few years this practice has been adopted worldwide.

The production of cement with additions to the clinker, with materials such as blast furnace slags, fly ashes , artificial pozollans and carbon fillers diversifies applications and features of cement. It also reduces CO_2 emissions significantly depending on the type of cement produced and the percentage dosage of additions.

Those cements with additions still represent an environmentally adequate solution for the byproducts of other productive processes as blast furnace slags, power stations ashes, further reducing environmental pollution. Moreover, the production of cement with larger percentages of mineral additions preserves mineral deposits, by reduced use of non-renewable raw materials (limestone and clay) in addition to reduced use of fossil fuels due to reduced use of clinker.

The increasing replacement of clinker by mineral additions in cement production is shown in the graph below. Between 1990 and 2010, while the use of additions grew by 252 per cent, the use of clinker grew only by 94 per cent. During the same period the production of cement grew by 129 per cent.

FIGURE 18. EVOLUTION OF CLINKER AND CEMENT PRODUCTION AND USE OF MINERAL ADDITIONS

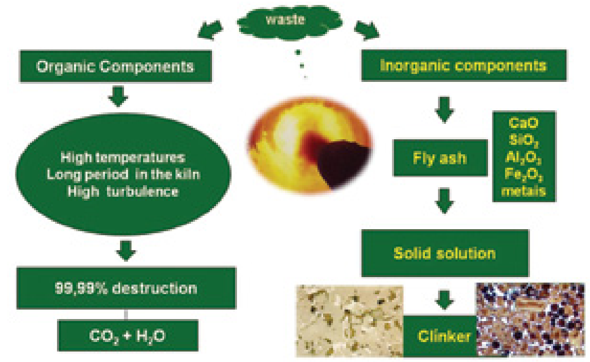


Source: SNIC.

Co processing: Utilization of waste as substitutes of fuel and raw materials

The growing consumption of cement due to the country's development, has directed the industry to further economize in the use of non-renewable resources. Kilns duly licensed for this purpose, use in the productive process solid industrial and urban waste as substitutes of fuel or raw materials.

FIGURE 19. COPROCESSING WASTE SCHEME



Source: ABCP.

Also, co processing waste in cement kilns reduces the demand on landfills and incinerators, which mitigates the adverse impact caused by these technologies, such as underground water contamination, methane emissions and other hazardous waste such as ash from incinerators.

Co processing enables the use of energy contained in several waste such as scrap tires, biomass and industrial residues, representing an important part of environmental management.

FIGURE 20. TYPES OF WASTE FOR COPROCESSING

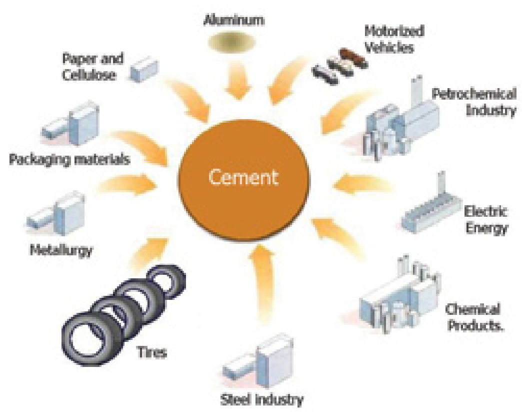


FIGURE 21. EVOLUTION OF COPROCESSING REGULATION

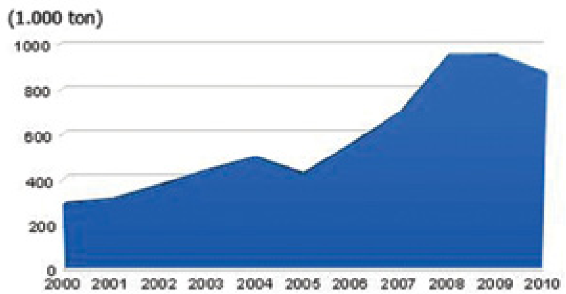
Source: ABCP.

Official approval nation-wide of co-processing by way of Resolution n. 264 of the National Environmental Council (CONAMA) gave way to numerous applications for licensing this activity in plants.

Presently there are 37 plants licensed to run co processing. In 2010, 870 thousand tons of industrial waste from different industries were co processed in cement kilns with 198 thousand used as raw material substitutes and 672 thousand as energy inputs, representing a thermal substitution of 13 per cent.

From the start of co processing in the nineties up to the present, the cement industry has contributed to environmentally appropriate disposition of approximately 7.5 million tons of waste.

FIGURE 22. COPROCESSING EVOLUTION



Source: ABCP, 2011.

The Holcim case

Resotec, the Co Processing Division of Holcim has two plants for waste preparation located in Cantagalo/RJ and Pedro Leopoldo (MG). Through investments of US$ 16.5 million, each of these plants has the capacity to process 140.000 tons of waste per year.

FIGURE 23. WASTE AFTER HOMOGENIZATION

Both plants are equipped with modern laboratories enabling it to properly characterize each of the lots of waste received, preventing any undesirable waste (legally, process or product) from being improperly co processed.

After their characterization, waste are processed so as to transform the different flows into homogeneous material, appropriate for their use in cement kilns. Homogenization of residues is a key safety and productivity factor of furnace operation, in addition to guarantying cement quality.

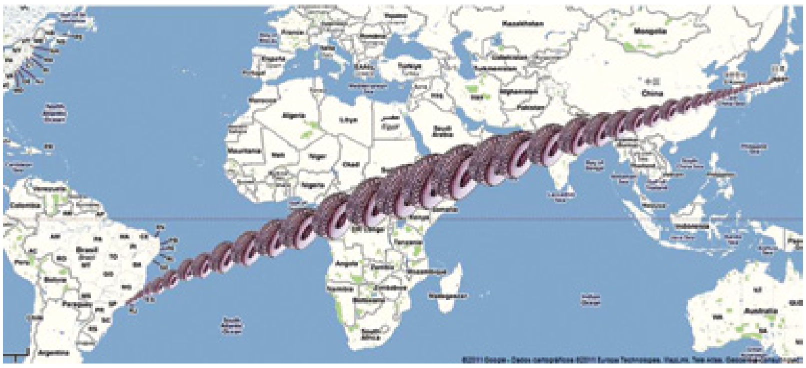
3.6 Co processing of scrap tires

CONAMA issued in 1999 Resolution 258/99, revoked in 2009, which mandates manufacturers or importers of tires to properly dispose of scrap tires. It further forbids their disposal in sanitary landfills. Improper discarding of tires creates serious environmental, social and public health hazards. Exposed to the elements discarded tires can take up to 150 years to degrade, in addition to being a fire hazard. Channeling them to cement kilns is the option to dispose of a large number of unusable tires either whole or ground.

A single kiln with 1000 tons/day production capacity can consume up to 5.000 tires per day in a safe and efficient manner. Tires hold energy potential higher than coal and, if burned in a controlled manner there is no increase in emissions, but can, in some cases, be reduced.

In 2010 183.500 tons of tires were processed by cement kilns, the equivalent to 36 million automobile tires. If lined up the co processed tires in Brazil can extend from Sao Paulo to Japan in a straight line.

FIGURE 24. REPRESENTATION IN KILOMETERS OF THE AMOUNT OF TIRES COPROCESSED IN 2010



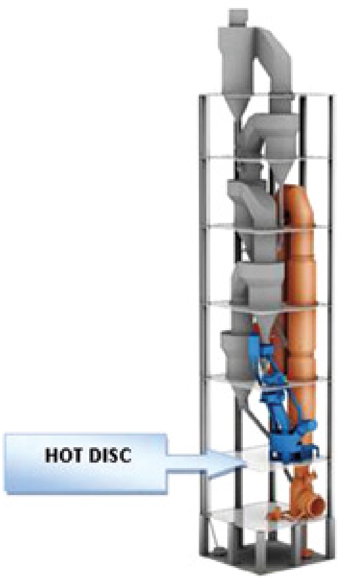
The use of tires in clinker kilns, in addition to solving the problem of their disposal, substitutes conventional fuels and contributes to the reduction of dengue (a tropical fever caused by the “aedes aegypti” mosquito) , a major public health problem in Brazil.

The Votorantim Cimentos case

The co processing pioneering plant in Votorantim Cimentos was Cimento Rio Branco, located in the city of Rio Branco do Sul (PR) which started operating with the first tests in 2001. Considered as a reference in co processing, this plant serves as a pilot for several environmental programs: co processing, contaminated soil, tires, oil sludge, rubber coated items, contaminated materials and solvents.

In its plant of Salto de Pirapora (SP), Votorantim Cimentos attached to the alternative fuels project a unique and pioneering device: the “Hot Disc”, which enables the co processing of 6 tons of tires per day, equivalent to 12 thousand tires.

FIGURE 25. HOT DISC



The Lafarge case

Almost all of the Lafarge cement plants use alternative fuels and waste from other companies. Lafarge, in partnership with CBL Reciclagem (recycling), has had since 2009 tire recycling facilities in its plants in Matozinhos (MG) and Nova Iguaçu (RJ), which also receive tires collected in neighboring municipalities, by way of agreements with these municipal governments. Each plant has the capacity to grind 10 tons per hour, the equivalent of almost 2 thousand automobile tires.

In 2011 some 230.000 tons of waste were used as alternative fuel and raw material, reducing by more than 300.000 tons of CO_2 emissions into the atmosphere.

3.7 Co processing of treated urban solid waste

A study undertaken by ABRELPE – Associação Brasileira de Empresas de Limpeza Pública e Resíduos Especiais (Brazilian Association of Waste and Residue Collection Companies) shows that Brazil produced almost 61 million tons of solid waste in 2010, 6.8 percent more than the volume recorded in 2009. Of this total, almost 23 million tons ended up in landfills causing considerable environmental damage, with contamination risks of both soil and water (ABRELPE – Panorama dos resíduos sólidos no Brasil – 2010)

Law 12.305, of 2010 which enacted the National Policy on Solid Waste, foresees the banning of landfills until 2014. Waste will only be allowed to be disposed of in landfills after all possible uses of it have been exhausted. Hence the cement industry is one of the environmentally friendly alternatives for the energy recovery of these waste as mandated by law.

The Lafarge case

A pioneering experience in Brazil started in 2008, is already bearing fruit in the Cantagalo municipality in the North-central region of Rio de Janeiro: the use of solid waste and composting of urban waste, as a source of energy used in the production of cement. After the collection of sorted out inactive waste (which cannot be recycled) by the city government it is crushed and used as fuel in the cement kiln of the Cantagalo plant of Lafarge.

Of the 350 tons of waste discarded in the municipality, 15 per cent is used in the productive process. The remainder is divided among materials to be recycled: (a) organic which will be transformed into compost for agricultural use and (b) a small amount which is landfilledBefore this project, around 300 tons of residential waste was disposed of in the municipal landfill, which could create an environmental hazard in the form of soil and water contamination, in addition to being a health risk to the population.

FIGURE 26. URBAN SOLID WASTE – MUNICIPAL TREATMENT PLANT – CANTAGALO RJ

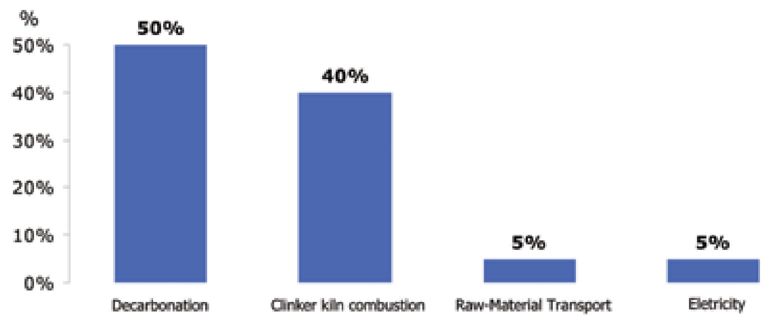
FIGURE 27. URBAN SOLID WASTE – WASTE SHED – CANTAGALO RJ

4 CLIMATE

Worldwide, approximately 90 percent of CO_2 emissions from cement production take place during the production of clinker, either during calcination/decarbonatation of the raw material or during the burning of fuels inside the kilns. The remaining 10 percent are as a result of transport of raw materials and the indirect emissions from the consumption of electric energy by the plant. Due to Brazil's predominant reliance on clean and renewable hydroelectric power, this share is even smaller.

The graph below shows the average distribution of green house gases (GEE) from the worldwide cement industry:

FIGURE 28. SOURCES OF CO_2 EMISSIONS IN THE CEMENT INDUSTRY



Source: CSI – WBCSD.

4.1 Cement Industry's main contribution to the fight against Climate change

Several features of cement production in Brazil, in addition to measures adopted by the sector over several decades and more recently, have contributed to the reduction of CO_2 emissions. This places the cement industry as a leader reference in the fight against green house gas emissions (GHG). These features are:

a) A modern and efficient Industrial park

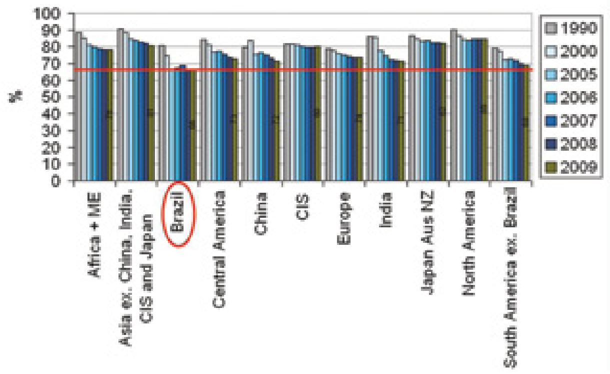
The Brazilian cement industry, as explained in the Chapter on Energy, has a modern and efficient industrial park. Its plants operate with low fuel consumption and consequently lower CO_2 emissions, as compared with other countries. Since emissions from fuel burning represent somewhat less than half of the emissions of the industry, the search for higher energy efficiency is one of the pillars of its efforts to reduce emissions.

b) Cement with mineral additions

The production of cement with mineral additions to clinker, with blast furnace slag, fly ash, artificial pozzolan and limestone filler, besides diversifying the uses and specific features of the cement, allows the reduction of CO_2 emissions since it reduces clinker production and consequently the burning of fuels and CO_2 emissions by calcination/ decarbonation.

The increasing use of mineral additions to cement in Brazil has represented over many years one of the most efficient measures of control and reduction of CO_2 emissions of the industry. Studies by Cement Sustainability Initiative (CSI), taking into account the clinker /cement proportions and the resulting percentages of used mineral additions, places Brazil as an international standard in the search for cement production with less CO_2 emissions.

FIGURE 29. CLINKER/CEMENT RATIO



Source: CSI – Getting the Numbers Right.

Kilns with low CO_2 emissions – *The Votorantim Cements Case*

Two Votorantim plants of Porto Velho (RO) e Nobres (MT) already have pozzolan kilns, raw-material which does not emit CO_2 as a result of limestone calcination. When using part of this input in producing cement, a reduction of 50 per cent of emissions is estimated, in addition to substantial reduction in costs.

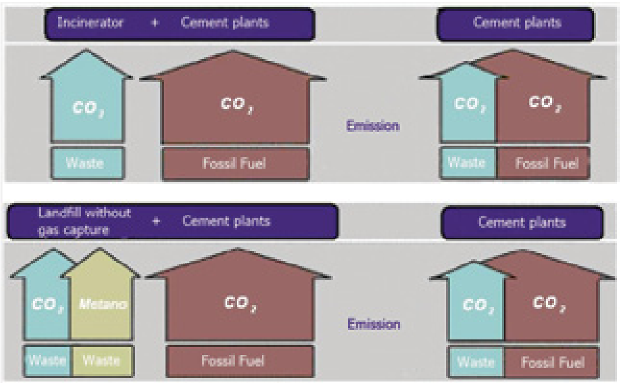
By using these kilns, in 2010, VC reached an average of 400 kilograms of CO_2 per ton of cement produced, whereas a conventional kiln emits over 800 kilograms of CO_2. In kilns of the most sustainable cement companies, associated with CSI, this volume can reach over 650 kilograms per ton of produced cement.

c) Alternative fuels

Co processing contributes to the reduced emissions of CO_2 and to the elimination of environmental liabilities. Many used waste emit less CO_2 per unit of energy generated, when compared to traditional fossil fuels. That is, they emit less CO_2 to generate the same amount of energy.

Likewise, co processing of waste prevents green house gas emission if these same residues were disposed of in landfills or burned in incinerators, as the figure below shows.

FIGURE 30. CO-PROCESSING AND GREENHOUSE GASES REDUCTION



Source: Cenbureau.

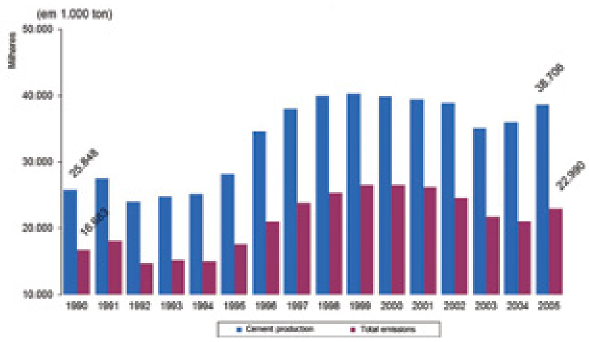
As concluded by studies of CSI, with 9 percent of its energy coming from biomass (considered to be carbon neutral) Brazil is also the country which most uses it in the production of cement.

CO_2 emissions of the Brazilian cement industry

The second survey of Green House Gases of Brazil, which measured emissions between 1990 and 2005, assessed CO_2 emissions from the cement industry during decarbonation (Chapter on Industrial Processes) and from the burning of fuels in (Section on Energy).

Below are listed gross emissions of the industry during this period, (sum of the amounts due to Industrial Processes and Energy) and the cement production in the same period.

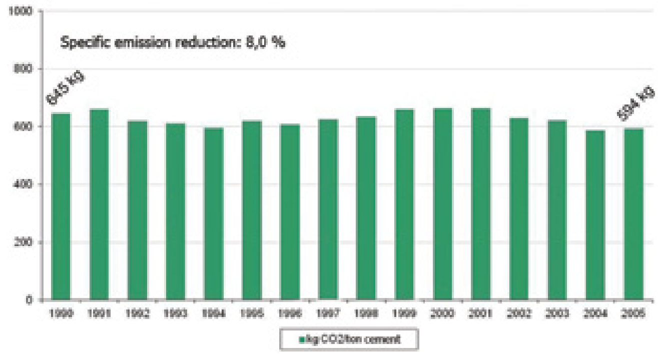
FIGURE 31. CEMENT PRODUCTION X CO_2 EMISSIONS



Source: 2º Inventário Brasileiro de GEE (2005).

During this period it is noteworthy that cement production went up by 50 percent, CO_2 emissions changed by only 38 per cent, as a result of CO_2 specific emissions (CO_2/ton of cement), which dropped by 8 per cent.

FIGURE 32. SPECIFIC CO_2 EMISSIONS



Source: 2º Inventário Brasileiro de GEE (2005)

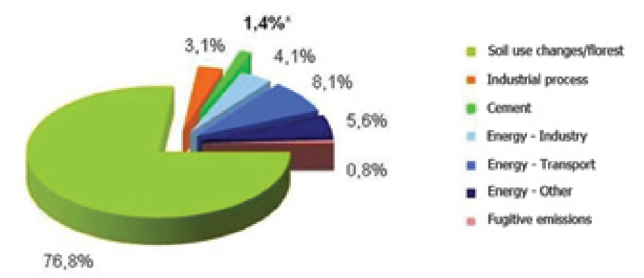
This 38 per cent variation of CO_2 from cement is well below those of other sectors surveyed during the same period, including relative to the total national variation which was of 65 per cent.

FIGURE 33. VARIATION OF CO_2 EMISSIONS BY SECTOR	
Setor	**∆% (1990/2005)**
Energy	74%
Soil use changes/florest	64%
Industrial process	45%
Cement	**38%**
Total Brasil	**65%**

Source: 2º Inventário Brasileiro de GEE (2005)

The share of the industry in total Brazilian emissions in 2005 was of 1.4 per cent (Industrial Process plus Energy)

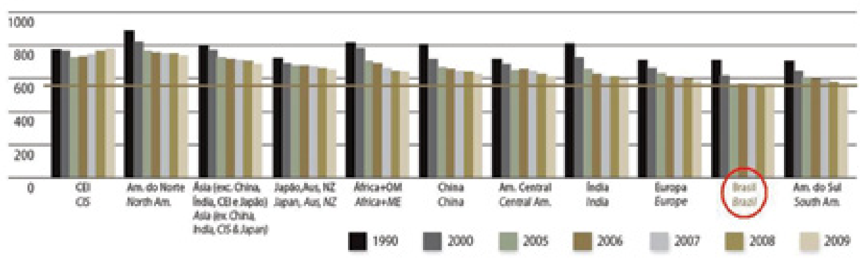
FIGURE 34. SHARE OF THE CEMENT INDUSTRY IN TOTAL BRAZILIAN CO_2 EMISSIONS IN 2005



Source: 2º Inventário Brasileiro de GEE (2005).

Comparatively, the share of the cement industry worldwide is of approximately 5 per cent, according to CSI. CO_2 emissions of the Brazilian cement industry are world reference. Surveys conducted by CSI, on the basis of more than 900 manufacturing plants of 46 industrial conglomerates operating worldwide, identified Brazil as the one with the lowest specific CO_2 emissions.

FIGURE 35. AVERAGE CO_2 EMISSIONS PER TON OF CEMENT

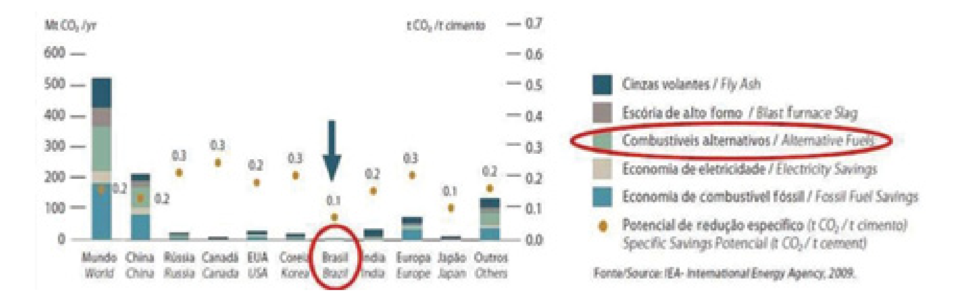


Source: CSI – Cement Sustainability Initiative.

A study conducted by IEA – International Energy Agency, quoted above which reviewed among others the potential for CO_2 emissions reduction of the main cement producing countries, singled out Brazil as that with the lowest potential for emission reduction, based on best practices and technologies available, in view of the degree of excellence already achieved.

The limited potential for improvement, according to the study related to the greater use of alternative fuels as substitutes for non-renewable fossil fuels

FIGURE 36. CO_2 EMISSIONS SAVING POTENTIAL IN THE BRAZILIAN CEMENT INDUSTRY



Source: IEA – International Energy Agency.

Emissions

In addition to CO_2, the main emissions from cement production are particulate material, sulfur oxides (SOx)and nitrogen oxides (NOx) CSI developed a protocol for the monitoring of emissions which is binding on participating companies in regards to the monitoring of the main emitted pollutants and other substances, such as dioxins and furans, volatile organic compounds, etc.

Each company set individual targets and committed to monitoring and publishing annually emissions since 2006, enabling stakeholders to have clear and reliable information on the type of emissions, their impact and the measures to reduce them.

The Brazilian cement industry has been reaching substantial reductions of its emissions, as a result of process changes and of investments in highly efficient monitoring equipment. With expert assistance, most plants installed a system which continuously monitors these emissions, and conducts periodical measurements.

The cement industry is regulated by legislation designed to protect the environment, health and safety, in addition to the quality of the product. The main environmental regulations applied to the sector cover control of emissions and co processing.

In regards to emissions control, Resolution 382 of CONAMA went into effect in 2006, which establishes limits for air pollutant emissions from stationary sources, whose installation licenses were applied for after 01/02/2007, when the resolution was issued and published. For the cement industry maximum limits for emissions were set for particulate material and nitrogen oxides. In December of 2011, CONAMA issued resolution 436 which sets maximum limits for sources already installed or with applications for installation from before 01/02/2007.

Waste Generation

Cement plant operations are not large generators of waste and discarded materials have appropriate uses. Some waste, such as the dust collected from the pollution monitoring equipment, as bag filters, electrostatic precipitators are a mix of partially calcinated and unreacted raw materials which are mostly reinserted into the production process. The use of dust from monitoring systems reduces the need for limestone and other raw materials, contributing to the preservation of natural resources and saving energy.

Main technological/innovation and managerial transformations incorporated into production by the sector

In the old cement industry kilns, all thermal energy was furnished by the main burner. With the evolution of the process, the kilns were equipped with preheaters, enabling the start of calcination of the raw materials to take place before entering the kiln.

The more modern kilns are also equipped with precalcinators, where almost the entire decarbonation of inputs takes place, therefore entering the furnace practically calcinated. Other equipment such as coolers and grinding mills were technologically transformed for better performance and reduced energy use. Consumption of electric energy of grinding mills is in the order of 20-50 percent less. Furthermore, burners have undergone significant improvements. At present the multichannel burners are able to burn up to three types of fuel simultaneously, depending on the number of channels.

Information dissemination and transparency initiatives regarding the socio-environmental performance of the sector

Companies associated with CSI are committed to making available all information required for the follow up and inspection of sustainability measures. The reporting and transmission of performance indicators and of joint and specific targets enable access and evaluation of progress by each company.

Commitments by companies associated with CSI:

- Integrate sustainable development programs with existing management, monitoring and communication systems.
- Issue documents/studies on business ethics
- Establish systematic communication with stakeholders so as to understand their expectations and respond to them.
- Report on progress of communication with its public
- Develop an auditable environmental management system for all plants.

FIGURE 37. SUSTAINABILITY REPORTS

Certification and self-regulation initiatives of the Sector

The Brazilian industrial park uses modern quality, health, safety and environmental management, upholding the highest international standards.

5 SOCIAL AND ENVIRONMENTAL RESPOSIBILITY

5.1 Initiatives coordinated by the Brazilian Cement Portland Association

With a view to promoting sustainable development, the cement industry undertakes activities related to corporate environmental and social responsibility and improvement of its productive processes

The sustainable development fair in north-central Rio de Janeiro/RJ

In the north-central region of Rio de Janeiro state in the municipalities of Cantagalo, Cordeiro and Macuco there are three cement plants with a combined annual production of 4 million tons. With the goal of increasing awareness of sustainable development and improved relations with the local community, the industry with coordination by ABCP and in partnership with respective municipal governments, and their Education, Environment and Health Secretariats have been holding sustainable development fairs involving educational, cultural and health activities .

Three such fairs have taken place where the main activity were school competitions based on topics related to the environment.

FIGURE 38. SUSTAINABLE DEVELOPMENT FAIR – CANTAGALO RJ

Low Income Housing

One of the main foci of ABCP in the last 10 years has been the development of low income housing programs, with well designed projects, quality building materials, comfortable, and appropriate cost. With that in mind, ABCP launched in 2001 the house project 1.0 (an analogy with the popular automobile), which has as its driving rationale to build quality housing at a low cost accessible by low income individuals. More than 40.000 housing units have been built under this project.

PVC Concrete Housing in São Luiz do Paraitinga

A few months after the floods that devastated São Luiz do Paraitinga (SP), the city has been rebuilding, mainly with investments for socially targeted housing.

In September of 2010, 151 such houses were delivered, with concrete walls and PVC frame. The system was selected on account of the need to build the houses in record time for those left homeless by the damages caused by the floods.

FIGURE 39. HOUSES IN SÃO LUIZ DO PARAITINGA – SP

ABCP, in partnership with CDHU, BRASKE and a Royal do Brasil Technologies, provided technical guidance during the construction of the houses. Concrete and PVC were selected for their flexibility, being industrialized and appropriate to meet the challenge of building many houses in a short period of time.

The Reform Club

The Reform Club, created in 2010 by ABCP is a campaign that brings together, companies, associations, academic institutions, social organizations and movements to seek improvements in low income housing. Its work rests on the union of sector agents and the membership who try to meet the socio-economic challenges relating to housing -reform and expansion-. The National Union for Low Income Housing is one of the founders of the Reform Club, which works on four fronts: technical assistance, communication, credit and expansion.

Late in 2011 a study was launched with the purpose of developing a proposal for the government, and sensitizing important players in the housing sector. The final report should demonstrate the importance of the reform sector for the economy of Brazil and its impact on the quality of life.

Permeable Pavement

Permeable pavement can help mitigate the effects of floods, which have caused devastation and loss of life in urban centers, mostly during the summer season. Recommended for use on sidewalks, streets with light traffic, residential, commercial and industrial yards, and parking lots cement-based permeable pavement, enables water to infiltrate into the ground and reduces the flow and surface accumulation of water up to 100 percent.

ABCP, which is committed to improving construction systems and quality of life developed the technology and makes available its technical staff to help solve the permeability problem of cities. Permeable pavement also helps to reduce underground contamination by garbage and other forms of solid waste carried by rain.

Solution for cities

Since 2009, ABCP has been working on the Solutions for Cities Program, which seeks to support governments in housing, urban transit and sanitation/sewerage activities.

ABCP and the municipal government of São Sebastião do Paraíso (MG) signed an agreement which provides technical assistance by the Association to implement public policies on low income housing and facilities, urban transit, basic sanitation (sewerage), in addition to drafting a project to redesign the bottom of the valley. allowing the municipality to build a linear park. Early in 2011 a procurement process was launched with published calls for bidders. After selection, a contractor was retained to carry out a diagnostic study and guidelines, with a view to organizing and proposing solutions to problems of urban transit, non-motorized transport, inter-municipal circulation and vehicular traffic.

For the development of the project to build a linear park, a partnership agreement was signed between ABCP and the University which proposes guidelines for the preservation of green areas and riparian areas surrounding the urban streams. The purpose of the park is above all to assist in urban drainage; in addition to enabling them to become an Area of Permanent Natural Preservation (APPN). The area is still underutilized and the project also proposes its use as a sports and recreational park.

5.2 Industry Initiatives

Brazilian cement industries play an important role in communities where they are located, contributing substantially with local economies by means of employment generation, and tax revenues besides working to respond to the needs and concerns of these communities. Cement companies have been investing in the improvement of quality of life with professional training, education, sports and preservation of cultural and historic legacy programs.

5.3 Votorantim Cimentos

- Community Council: mechanism for communication and relationship between the plant and the community, enterprise training, community leadership focusing on socio-economic development of cities and application of external social investments according to the needs identified by the community.
- Evolve "Evoluir" Program: technical and professional education, aligned with modern labor market for low income youth of municipalities with limited educational opportunities.
- Future in our Hands Program: training and skills development for young masons of Votorantim Cimentos.
- Rio + 20: partnerships with companies associated with Brazilian Business Council for Sustainable Development CEBDS Conselho Empresarial Brasileiro para o Desenvolvimento Sustentável, training of 50 professionals for civil construction and of 100 residents of the community Comunidade Chapéu da Mangueira in Rio de Janeiro in self-construction
- Institute Votorantim: incentives to debate and practice corporate social responsibility, support to the sustainability strategy and the relationships with strategic stakeholders, guidance and qualification of external social investments of corporations of the Votorantim Group focused on youth of 15-29 years old and in local development.
- Social Investment: Votorantim Institute defines its programs focused on youth with "paths". Each one of them is part of an itinerary offered to youth in the area of Education, Labor, Culture and Sports, as well as support to young talents which stand out among the socio-cultural projects around the Country.

FIGURE 40. SOCIAL PROGRAMS – VOTORANTIM CEMENT

Rota da Educação

5.4 Cimpor Cements of Brazil

- Professional training:
    - ◊ Fishing Project: professional training for youth- Nova Santa Rita community
    - ◊ Dealing with handicaps: Professional training for individuals with special needs- São Miguel dos Campos.
- Education
    - ◊ Support to primary education: Supply of school lunches and snacks – Brumado
    - ◊ Employee education : Adult Literacy and skill development – Campo Formoso
- Community Support:
    - ◊ Revitalization of Ilha do Bispo: Collaborate with the revitalization of Rio Sanhauá and donation of an area of 15.900 square meters for housing improvements – João Pessoa
    - ◊ Community Promoting Life: Support to communities through professional training and community services – João Pessoa
- Restoration of the Graça Chapel
    - ◊ Partnership with School Shop of João Pessoa dedicated to the restoration of the Graca Chapel ,historical heritage which was legally protected against demolition (tombado) as of 1938.
- Voluntary work
    - ◊ Provides assistance to vulnerable individuals or communities through collection and donation of funds or the promotion of specific fund-raising events.

FIGURE 41. RESTORATION OF THE GRAÇA CHAPEL – JOÃO PESSOA PB

5.5 Holcim Company

Holcim Institute: strengthening the relationships with communities and promotion of local development focusing on culture, environmental education, education for the labor market and generation of employment and income.

Total of Projects in 2010: 29; 8 on local development, 10 on income generation, 3 on education for the labor market, 5 on environmental education and 3 on culture.

Main Projects:

- Training of Association staff and leadership: Improve management capacity and strengthen local leadership – Barroso (MG) e Cantagalo (RJ)
- Green Education: train teachers, raise awareness of students and involve families on environmental matters of the municipality – Barroso (MG) e Cantagalo (RJ) e Pedro Leopoldo (MG)
- Family enterprises: Increase household income, whose children have special needs – Barroso (MG)
- Employability: Ensure employability and social inclusion, via labor market, for young adults – Barroso (MG)
- Neither luxury nor Garbage: Develop a sustainable program for income generation for youth of the district – Cantagalo (RJ)
- Green Rebirth: Promote community activities which may minimize the environmental and health risks of the resident of São José – Cantagalo (RJ) district.
- Entrepreneurial Community: Promote the strengthening of small enterprises in the food sector and local development of the north in municipality of – Pedro Leopoldo (MG)
- Holcim Community: Contribute to civil awareness of children – Pedro Leopoldo (MG)

FIGURE 42. ENVIRONMENTAL EDUCATION CENTER – HOLCIM MG

FIGURE 43. EDUCATING GREEN – HOLCIM RJ

5.6 Holcim Awards

Created by the Holcim Foundation for Sustainable Construction, Holcim Awards is considered the largest incentive/award program for sustainable construction in the world. It seeks to recognize and reward projects which combine: innovation, and efficiency vision for this segment. This foundation has its headquarters in Switzerland and carries out the competition for the award simultaneously in five different regions of the world: Europe, North America, Latin America, Africa and the Middle East, and Asia and the Pacific. Over 6.000 projects from 146 countries competed in the third round of the Holcim Awards.

As a whole, Holcim Awards will distribute a total of US$ 2 million in prizes for the best projects in sustainable construction in the categories Gold, Silver, Bronze and Next generation. The competition is organized in partnerships with well known universities: Swiss Federal Institute of Technology (ETH Zurich), Switzerland, Massachusetts Institute of Technology (MIT) in Cambridge, MA, USA; Universidad Iberoamericana (UIA) in México City, México; Ecole Supérieure d'Architecture of Casablanca (EAC), Morocco; Indian Institute of Technology (IIT Bombay) in Mumbai, India; Tingyi University (TJU) in Shanghai, China; Universidade de São Paulo (USP), Brazil , and University of the Witwatersrand (Wits) in Johannesburg, South Africa.

A multifunctional public building in the favela (slum) of Paraisópolis in São Paulo, Brazil, was awarded first prize along with a grant of US$ 100 thousand. The *Grotão – Fábrica de Música* (music factory) prevents the continuation of erosion and dangerous mudslides of embankments, and builds social and cultural infrastructure and facilities for a community that is in effect detached from the formal city.

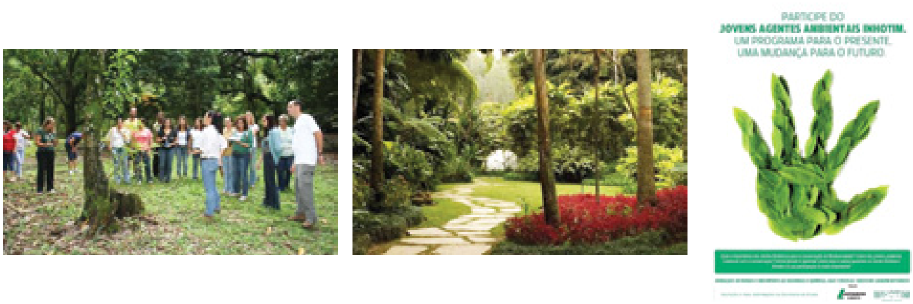
5.7 Lafarge

The partnership which Lafarge maintains with the Instituto Cultural Inhotim is based in the affinity of principles underpinning matters which involve the environment, society, education and culture. It was launched this year and has been gradually gaining strength with small joint initiatives.

In addition to the socio-cultural activities, Lafarge/Brazil with communities around its plants carries out programs of education and increased environmental awareness, such as:

- Replanting of native vegetation in partnership with the Instituto Estadual de Florestas, which maintains a seedlings nursery for the recovery of planted areas or for donation to neighboring communities.
- Lafarge Center for Environmental Education: operating in plants located in Minas Gerais, it holds symposia and scientific events and lectures for the community.
- Environmental Education Program: In the Cantagalo/RJ unit the project "A Tua Ação Ambiental" (Your Environmental Initiative)is sponsored in partnership with city hall and the NGO, CASA-Centro de Ação Sócio-Ambiental (Socio-Environmental Action House)
- Student visits: a regular program of visits by students from public schools, with the purpose of showing how a system of water recycling works, the monitoring of air quality and recovery of cultivation fields
- College entrance examinations Lafarge: Held in partnership with municipal technical schools where plants are located. Fellowships are offered to students between the ages of 15-18, selected through tests and interviews.

FIGURE 44. ENVIRONMENTAL EDUCATION – LAFARGE RJ



5.8 InterCement

Concern for the progress and development of the regions where it operates is part of the legacy of the Group Camargo Correa and its business units and companies, as the case of InterCement. With an eye on the future, this company invests systematically in sustainability practices in all of its operations. This policy evolved over time, and has lead it to further integration with its surrounding communities, launching practical projects and encouraging its staff to become involved in voluntary initiatives.

2006 saw a big push for sustainability, which includes social activities, when shareholders in the company expressed their wish for the Group to be as successful in the socio-environmental area as it is in its business.

This aspiration, expressed in the “Carta da Sustentabilidade: o Desafio da Inovação” (The Sustainability Charter: The Innovation Challenge), proposes a new challenge for the company’s executives: the company would favor the balance between its economic, social and environmental pillars. 12 principles were then adopted which guide its corporate policy on social responsibility. Since then the focus has been to create solid foundations to carry out well defined activities, which includes dissemination of the sustainability concept, investing in the competence of its professionals and to mobilize the entire company in an effort to carry out a diagnosis of its reality, by collecting indicators and systematizing practices.

InterCement applies in different locations methodologies to prioritize and map themes and stakeholders, which are then assembled into a plan of engagement with stakeholders, updated every year.

In the last five years, the Group as a whole and InterCement in particular experienced a sharp rise in the practical application of sustainability concepts. In Brazil the initiatives relating to social programs are designed under the guidance of the Instituto Camargo Corrêa (ICC). In Argentina they are conducted with the support of the Foundation Loma Negra (FLN), entities which operate with a common vision.

6 CHALLENGES AND OPPORTUNITIES FOR THE SECTOR IN ITS PATH TO SUSTAINABILITY

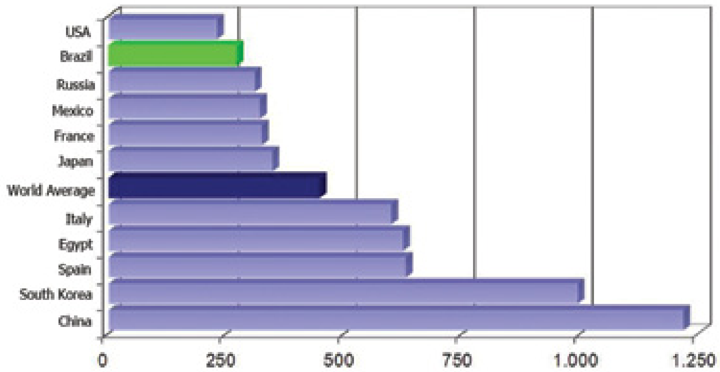
6.1 Expanding its installed capacity

Today Brazil's cement production is in the order of 63 million tons/year (2001) and until 2020 an estimated demand of 100 million tons /year will have to be met, leveraged by an estimated average annual economic growth of 6 per cent. This estimate is based on the country's projected development, which include not only the large real estate investments by the private sector but especially by government with demands by such large programs such as: Minha Casa Minha Vida (My house, My Life), works under PAC (Accelerated Growth Plan) I and II, the works in preparation for the soccer World Cup of 2014 and the Olympic Games –Rio, 2016 and other events to take place until 2020.

The country needs to face up to the infrastructure needs in water and sanitation, highways, tunnels, railroads, underground transportation systems, ports and harbors, hydroelectric plants, among others, in all its regions. It will also need to meet demands in the areas of services, commerce such as for office buildings, stores and shopping centers, which will require more from the civil construction market.

The per capita consumption of cement in Brazil, of 311 kg/person (2010) is still very low relative to several other countries, as shown in the table below. The expectation is that Brazil's growth will by 2020 reach a rate of consumption of 400 kg/person, still below the world average.

FIGURE 45. *PER CAPITA* CONSUMPTION OF CEMENT



Source: SNIC.

The estimation of this demand has lead companies operating in Brazil to announce important investments in their installed capacity, with an expansion estimate at 111 million tons by 2016 (source SNIC). The great challenge for the sector in the short to medium run is to produce cement to meet its demand while continuing to seek greater energy efficiency and emission reductions.

6.2 Co-processing: Enhancing energy substitution

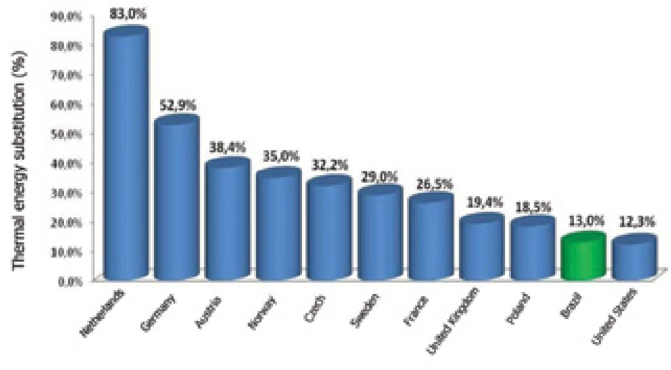
Since the early 2000s the use of waste in cement furnaces has grown considerably. However, comparing the current level of substitution in Brazil with other countries, one sees that there is still great potential for the use of waste as energy sources.

As shown in the figure below, the energy substitution rate reaches 83 per cent in Holland and 53 per cent in Germany (2007), whereas in Brazil it is around 13 per cent (2010)

In certain countries cement kilns have been utilized as an integral part of residue management, representing a safe option of disposal.

The law on the National Policy on Solid Waste establishes that residues can only be disposed of in landfills after all use options have been exhausted. Therefore, the use of waste as alternative fuel in cement kilns (co processing), with a lower CO_2 emission rate than conventional fuels becomes a convenient environmental solution for the energy recovery of these waste.

FIGURE 46. THERMAL ENERGY SUBSTITUTION RATES: INTERNATIONAL COMPARISON

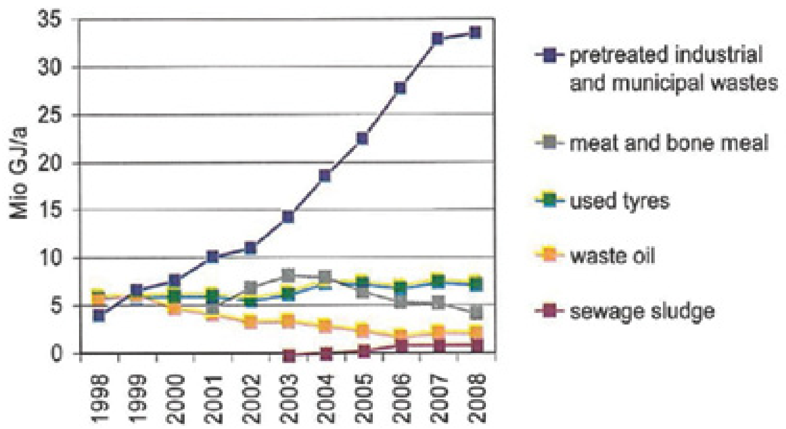


Source: Sustainability report – Canadian Cement Association – 2010. – Reference 2007.

6.3 Co processing of treated urban solid waste

The energy use of organic fractions of urban solid waste in cement kilns, a common practice in Europe and still in its infancy in Brazil, should be adopted by the sector, consolidating the technique as one of the tools for environmental management of this waste. In Germany there has been a significant increase in the use of treated solid waste as a consequence of the banning of the disposal of non-treated waste in landfills.

FIGURA 47. THERMAL ENERGY SUBSTITUTION IN GERMANY



Source: VDZ, 2010.

6.4 Emissions of Green House Gases

The increase of demand for cement in Brazil will be in higher rates than those of available resources to abate the emissions of its production (slag, ash, residues, and biomass). Brazil as a developing country has an important infrastructure program and the greatest challenge for the cement industry is to produce the necessary amounts of cement, maintaining the already low levels of CO_2 emissions per ton, which currently serve as a world benchmark.

Since the alternatives for CO_2 abatement known today will soon reach their operational limit, with negligible progress, there are international research projects under way in search of CO_2 abatement technology for the long run.

The sequestration and storage of carbon (CCS), is a technology which consists of capturing green house gases and its storage underground. It has been studied as an alternative to CO_2 abatement measures; however it is still not viable for the industry.

There are some pilot projects on the substitution of conventional fossil fuels with algae which have a greater CO_2 absorptive capacity by area and time and by planted area than other types of biomass, such as planted forests. These projects however, are still experimental and there is no certainty as to the viability of the use of algae on an industrial scale.

CNI – NATIONAL FEDERATION OF INDUSTRIES

DIRECTORY OF INSTITUTIONAL RELATIONS

Mônica Messenberg Guimarães
Director of Institutional Relations

ENVIRONMENT AND SUSTAINABILITY UNIT

Shelley de Souza Carneiro
Executive Manager – Environment and Sustainability Unit

Technical Support
José Quadrelli Neto (Environment and Sustainability Unit – CNI)
Luciano Emmert (Environment and Sustainability Unit – CNI)
Marcelo Fernandes (Fundação Dom Cabral)

Editorial Support
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SINDICATO NACIONAL DA INDÚSTRIA DE CIMENTO – SNIC
Departamento Técnico e Econômico – DTE

Gonzalo Visedo
Analista ambiental

VOTORANTIM CIMENTOS LTDA
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Roberto Pinho
Meio Ambiente Corporativo

HOLCIM (BRASIL) S.A
Gerência de Meio Ambiente

Valéria Soares A. Pereira
Gerente de Meio Ambiente

INTERCEMENT

Comunicação Corporativa
Fernanda Guerra

Luiza Pastor
Redação final

Aline Santos Jacob (Normalização)

Grifo Design (Projeto gráfico e diagramação)

SNIC

Associação
Brasileira de
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