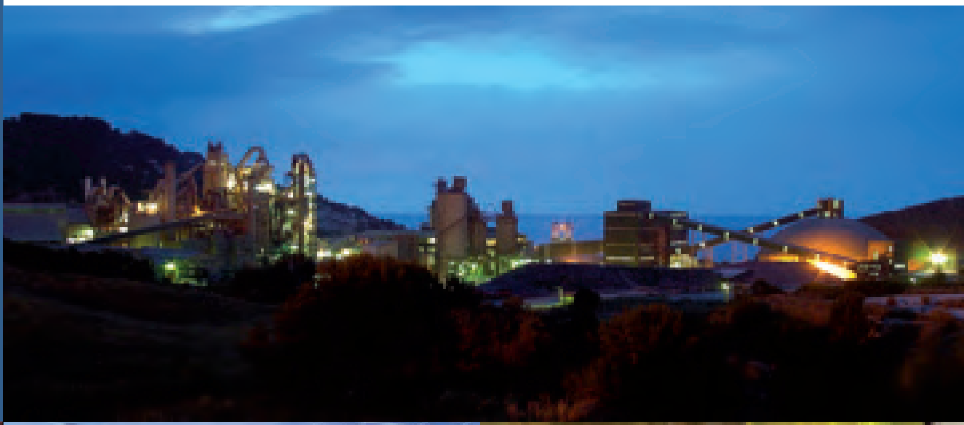
DEDICATED TO MAKING A DIFFERENCE

The Cement Sustainability Initiative



Climate Actions

World Business Council for Sustainable Development

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About the WBCSD

The World Business Council for Sustainable Development (WBCSD) brings together some 200 international companies in a shared commitment to sustainable development through economic growth, ecological balance and social progress. Our members are drawn from more than 30 countries and 20 major industrial sectors. We also benefit from a global network of about 60 national and regional business councils and partner organizations.

Our **mission** is to provide business leadership as a catalyst for change toward sustainable development, and to support the business license to operate, innovate and grow in a world increasingly shaped by sustainable development issues.

Our **objectives** include:

Business Leadership – to be a leading business advocate on sustainable development;

Policy Development – to help develop policies that create framework conditions for the business contribution to sustainable development;

The Business Case – to develop and promote the business case for sustainable development;

Best Practice – to demonstrate the business contribution to sustainable development and share best practices among members;

Global Outreach – to contribute to a sustainable future for developing nations and nations in transition.

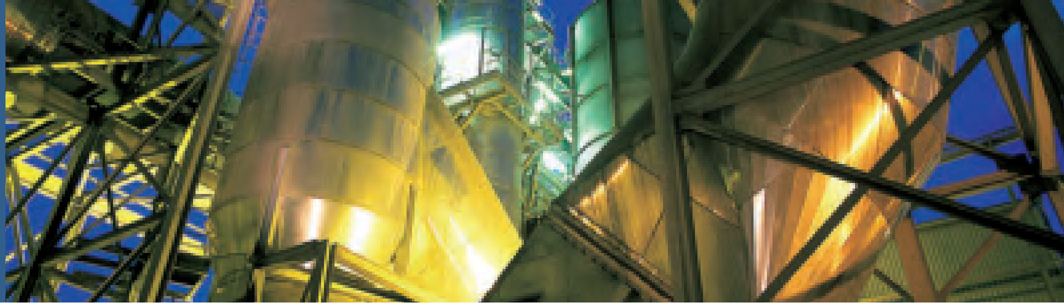
The Cement Sustainability Initiative (CSI)
Climate Actions

The Cement Sustainability Initiative (CSI) is a large global sustainability program begun by several leading cement companies in 1999. The Initiative, operating under the auspices of the World Business Council for Sustainable Development (WBCSD), focuses on addressing the industry's major sustainability challenges. In 2002, it published its *Agenda for Action*, which included pledges by the CEOs of some of the world's leading cement producers to take action in areas such as climate protection, employee health and safety, the use of alternative fuels and raw materials, managing land-use impacts and other emissions.[1] Today the Initiative plays an increasing role working with international policy-makers as an important partner contributing to the next generation of international climate protection policies.

Effective and transparent monitoring, reporting and verification of carbon dioxide emissions are key to climate protection. The CSI has made steady progress over the past eight years with consistent reductions in emissions intensity, i.e. reducing CO_2 emissions per tonne of cement produced. Between 1990 and 2006, CSI members reduced by 12% their average CO_2 emissions intensity. Since 2006 all members have been required to have their CO_2 data audited and verified by an independent third party.

The encouraging progress made by members in measuring, reporting and mitigating CO_2 and other emissions is the driver behind current CSI contributions to the development of more effective international climate protection policies. But these contributions are only possible because of key building blocks developed during the past eight years: a common measuring and reporting **protocol**, **external assurance** of emission reports, a **global database** of plant-specific energy and emissions performance, and company-set **emissions reduction targets**.

The Cement Sustainability Initiative



The CO_2 Protocol

In 2003 CSI members created a sector-specific CO_2 Accounting and Reporting Protocol.[2] The Protocol is an analytical tool that allows reliable, standardized and accurate calculation of CO_2 emissions, considering a wide variety of contributing factors such as fuel type, use of substitute materials, use of biomass, etc. The purpose of this tool is to provide a common language, set of definitions and methodologies to accurately calculate CO_2 emissions and energy use from cement production facilities.

The Protocol has been reviewed by external parties, improved and field tested, and finally adopted in whole or in part by a number of greenhouse gas inventory processes, including the European Union Emissions Trading System, the California Climate Registry, the US EPA Climate Leaders Program and the Asia Pacific Partnership (APP). Eighteen CSI members now report fully according to this protocol.[3]

Figure 1: Selected data from CO_2 reporting protocol

INFORMATION						
General Plant Information				1990	2000	2005
A1	Company					
A2	Co-ownership 1					
A3	Co-ownership 2					
B	Plant country			Automatically filled in from the Launch Macro worksheet		
C	Plant name					
D	Plant type					
E1	Plant description	kiln type				
E2		nominal capacity	(tpd)			
Clinker and Cement Production				1990	2000	2005
	Clinker:					
8	Clinker production		(t/yr)			
21	Total cements + substitutes: Portland, Blendel, Slag		(t/yr)			
21a	Total cementitious products		(t/yr)			
CO_2 EMISSIONS						
Direct CO_2 Emissions				1990	2000	2005
CO_2 from Raw Materials						
35a	Calcination emission factor, corrected for CaO-and MgO imports		(kg CO_2/t cli)			
39	Total CO_2 from raw materials		(t CO_2/yr)			
CO_2 from Kiln Fuels						
41	CO_2 from alternative fossil fuels		(t CO_2/yr)			
CO_2 from Non-Kiln Fuels						
45c	CO_2 from on-site power generation		(t CO_2/yr)			
Direct CO_2 from Biomass Fuels (Memo Item)				1990	2000	2005
50	CO_2 from combustion of biomass fuels (kiln and non-kiln)		(t CO_2/yr)			
PERFORMANCE INDICATORS						
Gross CO_2 Emissions (= total direct CO_2; all sources)				1990	2000	2005
59	Absolute gross CO_2		(t CO_2/yr)			
60	Specific gross CO_2 per tonne of clinker produced		(kg CO_2/t cli)			
62	Specific gross CO_2 per tonne of cementitious produced		(kg CO_2/t cem prod)			
Net CO_2 Emissions (= gross CO_2 minus emissions savings through alternative fossil fuels)				1990	2000	2005
71	Absolute net CO_2		(t CO_2/yr)			
73	Specific net CO_2 per tonne of clinker produced		(kg CO_2/t cli)			
74	Specific net CO_2 per tonne of cementitious produced		(kg CO_2/t cem prod)			
Net CO_2 from Indirect and Biomass Sources				1990	2000	2005
83	Specific CO_2 from biomass fuels (Memo Item)		(t CO_2/t cem prod)			
General Performance Indicators				1990	2000	2005
92	Clinker/cement factor in cement		(%)			
93	Specific heat consumption of clinker production		(MJ/t cli)			
95	Alternative fossil fuel rate (fossil wastes)		(%)			
96	Biomass fuel rate		(%)			
97	Specific power consumption		(kWh/t cement)			
KILN FUELS - DETAILED INFORMATION						
Kiln Fuel Consumption in tonnes per year				1990	2000	2005
108	Alternative fossil fuels (fossil wastes): sum		(t/yr)			
115	Biomass fuels: sum		(t/yr)			

Source: WBCSD/CSI

Climate Actions

A global database of cement plant energy and emissions performance

Because CO_2 is produced in large quantities as a normal consequence of the cement making process, managing CO_2 emissions is a high priority for the CSI. To do this well requires robust data that tracks changes in emissions as a result of changing technologies, fuels and other factors, both regionally and globally. The CSI has launched a system called Getting the Numbers Right (GNR) to collect accurate historical and recent data on the CO_2 and energy performance of clinker[4] and cement production worldwide, which will meet the information demands of business, policy-makers and other stakeholders.

The CSI retained PricewaterhouseCoopers (PwC) to independently design and manage this information system to ensure accuracy of the information, and ensure that adequate safeguards are in place to protect business' confidential information and address anti-trust concerns.

Such a system can help meet many needs, including the need to:

- Have up-to-date and reliable data on CO_2 emissions and energy performance from the cement sector; much existing data is several years or more out of date; some figures may be questionable or unreliable
- Understand CO_2 emissions from the cement sector and how they compare to those from other industries and activities
- Address queries from external stakeholders to the CSI requesting information on the cement sector; the cement sector must be able to provide policy-making bodies and key stakeholders with a clear, accurate picture of its CO_2 emissions
- Aggregate data that provides a sound analytical basis for benchmark setting, either in the context of emissions trading systems, the Clean Development Mechanism (CDM) or in other potential policy approaches to managing emissions.

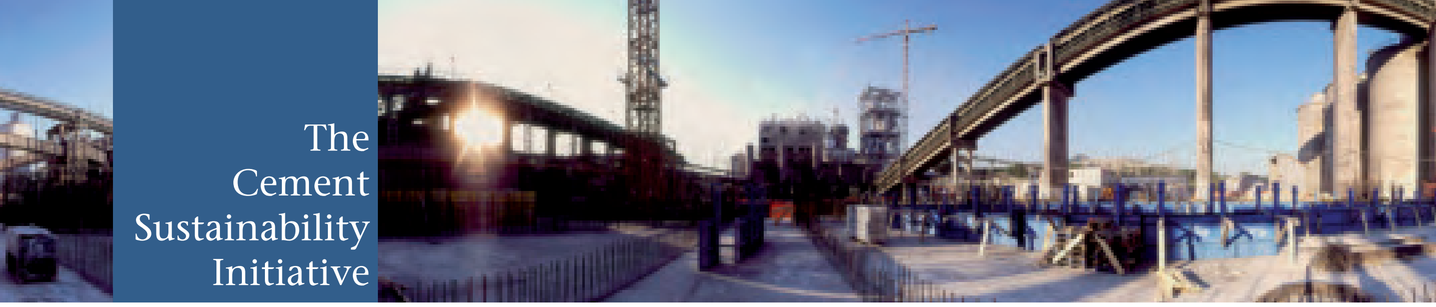
The CSI has, by design, built an open platform allowing for participation by other organizations that could contribute equivalent data in order to build the broadest dataset for analysis and use. In recent months, CEMBUREAU (the European cement association) has joined the GNR system. The Cement Industry Federation (the Australian cement association) will begin participation next year. At present, more than 50 companies provide data to this system. The geographical scope of the current participants provides excellent coverage of cement manufacturing in Europe and North America, and good coverage in Latin America, India and Mexico. Coverage is presently weak in China – a country with 50% of the world's cement capacity.

The world's first cement CO_2 and energy database contains information from over 800 cement plants worldwide, covering 800 million tonnes of cement production. CO_2 and energy performance data include:

- Gross and net CO_2 emissions[5] per tonne of clinker and per tonne of cement produced
- Absolute gross and net CO_2 emissions
- Thermal energy consumption per tonne of clinker
- Electric energy consumption per tonne of cement
- Fuel mix (fossil fuel/fossil waste/biomass)
- Clinker to cement ratio.

This first review of GNR data is based on production, energy use and CO_2 emissions information provided by 18 CSI member companies, as well as other participating companies within CEMBUREAU.

A portion of the database will be made available on the CSI website, www.wbcsdcement.org. A full analysis and report is being developed and will also be made available on the website allowing a number of online queries. Other more complex inquiries can be made by contacting gnrpmc@wbcsd.org.



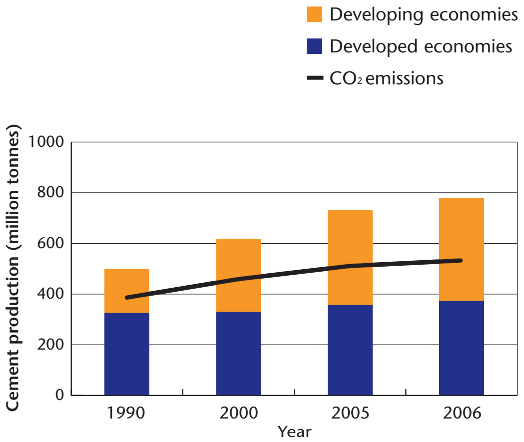
Key results

Data has now been collected and analyzed from the years 1990, 2000, 2005 and 2006. Compliance with anti-trust laws encourages using data that is at least one year old. The data collected reveal several clear trends, which we highlight in this brochure.

1. Emissions increasing

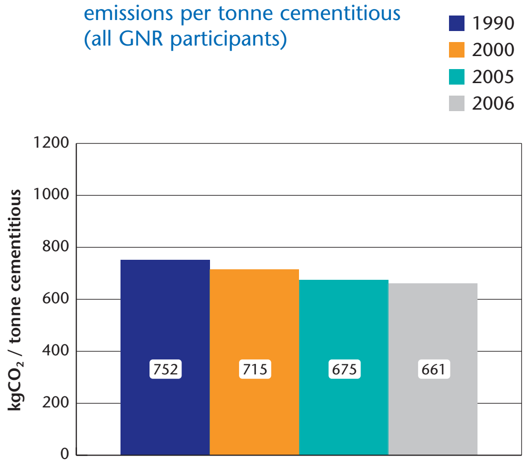
Cement production and accompanying CO_2 emissions are increasing, particularly as developing countries build much-needed infrastructure, including housing, roads, hospitals and schools for their growing economies and populations. We know that 80% of future CO_2 emissions from the cement sector will come from developing economies. However, CO_2 emissions (the black line in Figure 2) do not rise as rapidly as cement production because of improvements in the emissions intensity of the cement making process. In 2006 there were only 661 kg of CO_2 produced with each tonne of cementitious product,[6] compared to 752 kg in 1990[7] (See Figure 3).

Figure 2: Cement production and accompanying CO_2 emissions (all GNR participants)

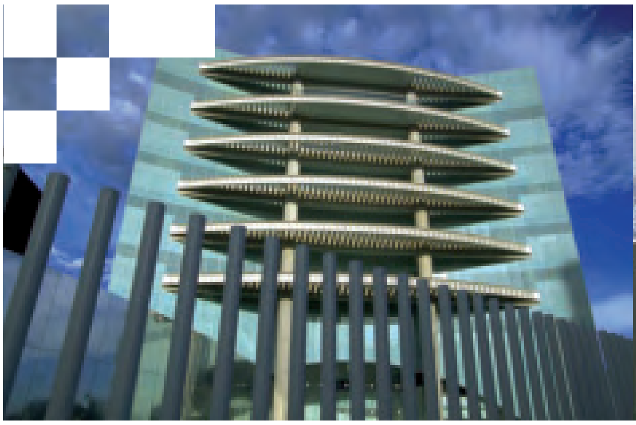


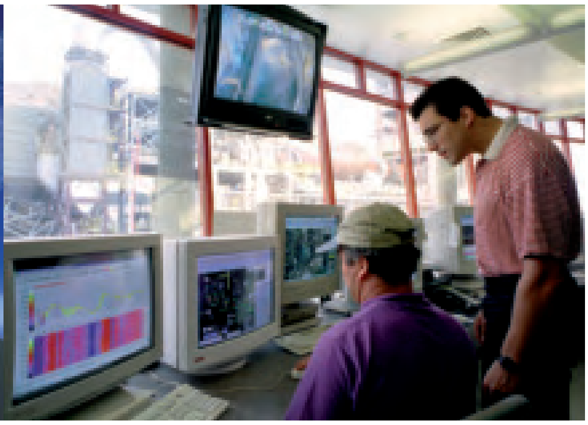
Source: GNR database

Figure 3: Worldwide average net CO_2 emissions per tonne cementitious (all GNR participants)



Source: GNR database





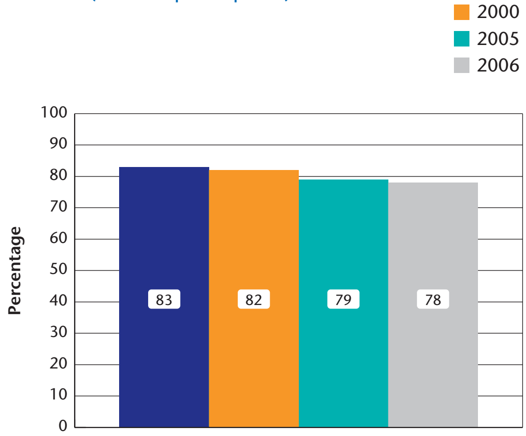
2. Emissions and energy efficiency improving

Cement producers continue to become more efficient in making cement, using less energy and producing less CO_2 per tonne of product. They have accomplished this using a number of techniques, including:

- Increasing the use of clinker substitutes, such as slag and fly ash, which reduces the amount of clinker used to make cement (Figure 4).
- Increasing the use of lower carbon or carbon neutral alternative fuels, such as biomass and waste fuels that might otherwise be landfilled or incinerated.
- Upgrading plant technology – dry kilns with preheaters and precalciners are now industry standard, and have replaced some (but not all) older technologies. The more modern kilns use significantly less energy than older wet-process technology. Figure 5 shows the clear "march" of dry, preheater kiln technology replacing less efficient kilns over the past 16 years so that today more than half the clinker from CSI members is made with this modern technology.

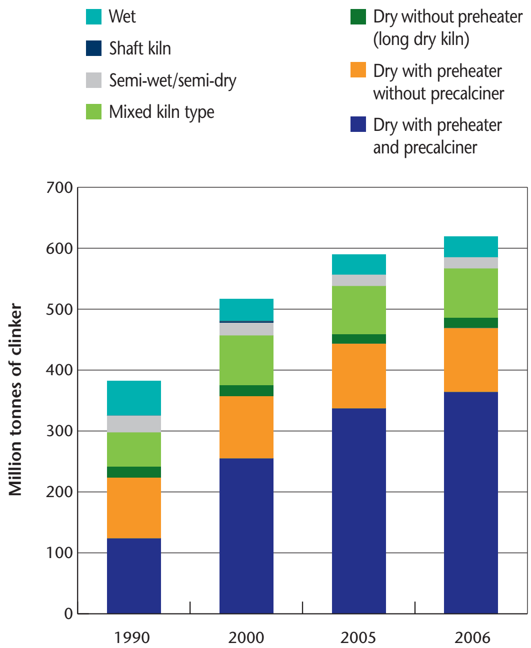
The photograph shows tires at the end of their useful life being fed in to a cement kiln in Japan. Using waste tires as an alternative fuel recovers the energy and mineral content and can reduce NO_x emissions from the combustion process compared to burning coal. Every year more than 1 billion tires are discarded worldwide.

Figure 4: Clinker to cement ratio
(all GNR participants)



Source: GNR database

Figure 5: Clinker volumes by technology
(all GNR participants)



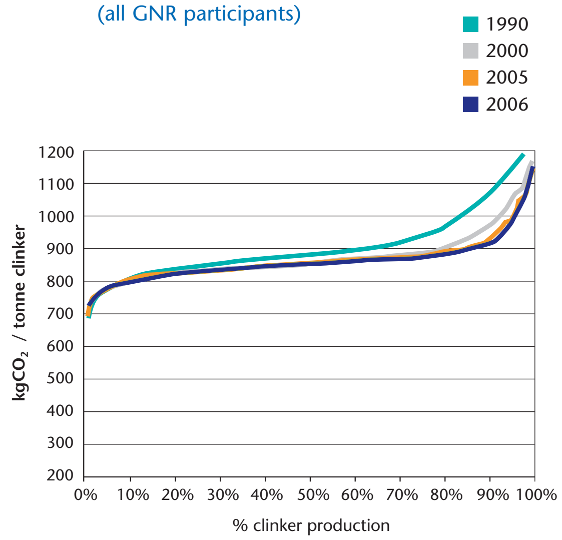
Source: GNR database

3. Modest opportunities for performance changes with existing technology

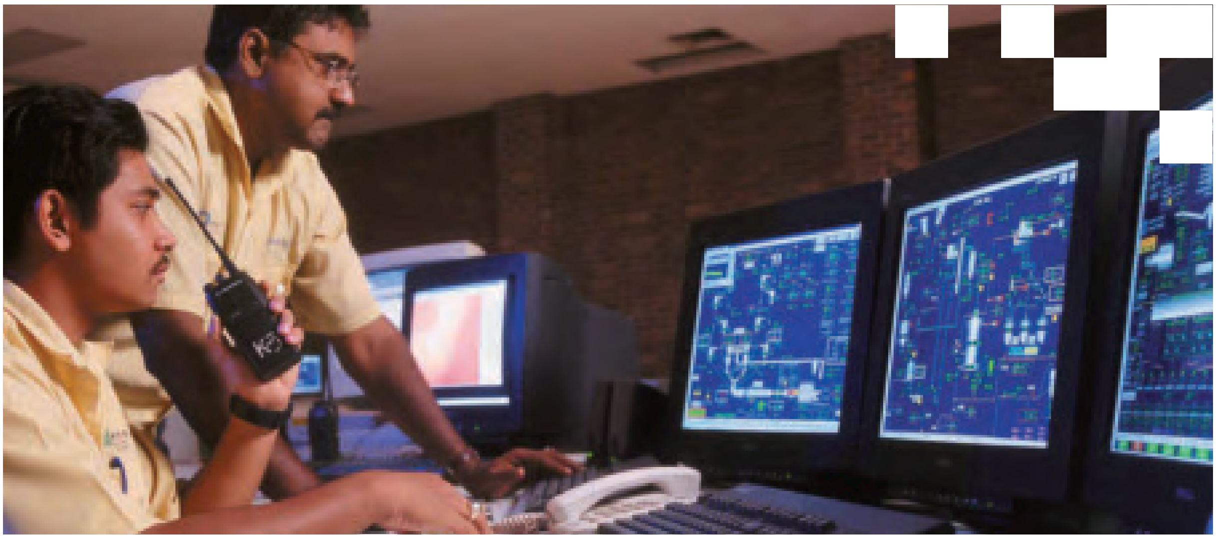
Flat Performance Curves – Figure 6, below, shows the cumulative frequency distribution curves of gross CO_2 emissions per tonne of clinker in each of the years 1990, 2000, 2005 and 2006. The curve is obtained by ranking all the cement plants in order of their emissions intensity from highest to lowest, and dividing this ranked list into 10 equal tranches. The best performing 10% (lower emissions) are plotted on the far left, followed by the next best 10%, and so on, until the worst performing 10% are shown on the right. At the right hand side of the diagram, the curves progress downward from 1990 to 2006, showing progressive improvement in performance (lower CO_2 emissions) in each year.

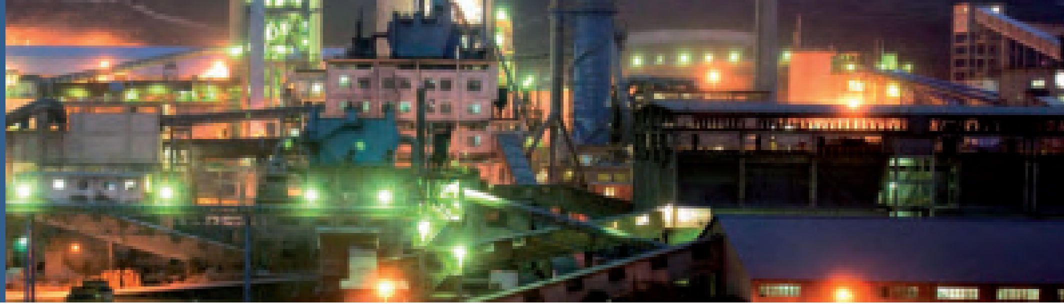
In the region between 10% and 70% the curves are relatively flat and show relatively small changes over the period, indicating that most clinker kilns have similar performance, with little difference between those with performance putting them in the 10-20% tranche, compared to those in the 60-70% tranche. There have been improvements since 1990, but most of the benefits have been captured. Existing clinker-making technologies do not provide further potential for significant emissions reductions.

Figure 6: Gross CO_2 emisions per tonne clinker (all GNR participants)



Source: GNR database





Climate Actions

The Clean Development Mechanism: A new approach

The Clean Development Mechanism (CDM) encourages industrialized countries to develop projects that reduce greenhouse gas emissions in developing countries as an alternative to more expensive emission reductions in their own countries. The current CDM system requires project-by-project assessment of baseline setting and proof of "additionality"[8] on the basis of a rather subjective assessment of the project developers' intention. This subjective approach has resulted in difficulties with project approval and high transaction and monitoring costs. The current methodologies have also attracted wide criticism because of difficulties in ascertaining true additionality of projects.

The CSI has developed a new CDM methodology that uses GNR data to help benchmark cement plant performance and determine if a proposed CDM project is providing "additional" emission reductions compared to benchmark performance within a region surrounding the proposed project. A full description of the methodology will soon be available on the project website, www.wbcsdcement.org.

This new methodology, to be proposed to the CDM Executive Board and Methodology Panel, allows cement CDM projects to demonstrate additionality in a more rapid, objective and credible manner, reinforcing the environmental integrity of the CDM system and making it possible to reduce both the delays and transaction costs associated with the current approach. Such changes would encourage developers to take on more projects, and increase the role of the CDM in reducing CO_2 emissions from the sector.

Sectoral approaches

In anticipation of the expiration of Phase I of the Kyoto Protocol in 2012, policy-makers are looking at a variety of potential policy options. The CSI has proposed the possibility of including the cement industry as a specific sector in the new global, post-2012 international climate framework. Since the G8+5 group of countries[9] produce most of the world's cement, a large portion of emissions from the cement sector could be addressed by dealing with a relatively small number of major cement producing countries and companies. A smaller group would hopefully be able to reach agreement on appropriate actions more quickly than can be done with global agreements like the Kyoto Protocol which require action by 194 countries.

Under a sectoral approach, an industry sector such as cement, rather than a country or a single facility, might take on an emissions limit or efficiency performance objective on a global, regional or national scale. Performance objectives could be differentiated at a regional level, taking into account regional and national historical emissions and performance. The overall goal is to reduce the sector's total emissions compared to what is expected under a business as usual scenario.

Another benefit of this approach is that it could encourage developing economies to consider implementing climate protection actions dealing with individual sectors one at a time, instead of dealing with changes to their entire economy. Without participation from developing economies, it will not be possible for many sectors to make meaningful progress in reducing CO_2 emissions. 80% of future cement demand will come from developing economies, which are rightfully providing new infrastructure and housing to their rapidly urbanizing populations. It is expected that by 2030 developed economies (Annex I countries in the Kyoto Protocol) will contribute only 10% of CO_2 emissions from the sector.

The CSI has begun economic modeling and simulation exercises to assess how a sectoral approach might reduce CO_2 emissions by the cement sector compared to other policy options. Preliminary modeling results emerged in the fall of 2008, and more detailed work will be completed in the first half of 2009. This work is meant to answer policy-makers' main questions:

- Would a sectoral approach be environmentally effective? Can real emissions reductions be achieved?
- Would it dampen competitive effects caused by the current emissions management systems, i.e. could it limit "leakage" in which manufacturing capacity is moved from high carbon cost countries to lower carbon cost countries?
- Would it help developing countries begin to address climate change and emissions management?

The CSI has worked on sectoral approaches with key stakeholder governments like the EU and Asia-Pacific Partnership nations,[10] and organizations and think-tanks such as the International Energy Agency (IEA), the Centre for European Policy Studies (CEPS) and the Center for Clean Air Policy (CCAP).

A sectoral approach for the cement sector may help align the industry's action on climate change. The United Nations climate change meeting in Bali at the end of 2007 officially expressed support for sector-specific approaches as a means to enhance technology development and sharing, and to contribute to greenhouse gas mitigation globally.

The CSI believes that any sectoral approach must meet several important criteria. It should:

- Be set within the UNFCCC framework
- Be compatible with existing and future mechanisms
- Include major developed and developing economies
- Use simple metrics and methodologies
- Use verified emissions data to track compliance
- Be mandatory; government involvement is needed to enforce agreed sectoral actions
- Provide a mechanism to review/adjust objectives over time
- Enhance technology development
- Encourage capacity building in developing economies.

It is clear that the world will need a variety of policy options to address the major changes demanded by climate change. The CSI's cement sectoral approach project could help pave the way toward a broader global framework for climate protection by providing transparent emissions data, tools for implementation, and consistency of mitigation opportunities.

The Cement Sustainability Initiative

Notes

1. The CSI members, now numbering 19 cement producers, reported on how the Initiative has delivered against its pledges in all these areas in its recently published Progress Report. The Report, the subject of independent third-party verification, highlights significant achievements in the area of climate protection (see www.csiprogress2007.org).

2. The WBCSD/CSI CO_2 reporting protocol and format are available from www.wbcsdcement.org/climate.asp. This protocol was adapted from the greenhouse gas reporting protocol developed by the WBCSD and WRI in 2001.

3. The CSI's 19th member – Camargo Corrêa Cimentos – joined the initiative in October 2008 and will soon begin reporting their CO_2 emissions using the Protocol, in line with agreed actions in the CSI Charter.

4. Clinker is an intermediate product in cement manufacturing. It is formed as a result of the calcination of raw materials in the cement kiln.

5. Gross CO_2 emissions exclude carbon emissions from biomass. Net CO_2 emissions exclude carbon emissions from both alternative fuels and biomass.

6. Cementitious product is a generic term used to designate the whole range of products supplied to be used for its cementitious (cement-like) properties (cement, but also other products like blast furnace slag or pulverized fly ash used by the ready-mix concrete industry).

7. Note that the GNR system's coverage of China – which produces 50% of the world's cement – is currently weak. The figure does not include the majority of Chinese cement production.

8. "Additionality" means going beyond business as usual. In the context of the CDM, a project is "additional" if its outcomes would not have occurred under normal business activities. Assessing additionality requires a projection of how the future may unfold and the motivations of the project developers.

9. The G8+5 consists of Canada, France, Germany, Italy, Japan, Russia, the United Kingdom and the United States (the G8), plus the 5 leading emerging economies - Brazil, China, India, Mexico and South Africa.

10. Australia, Canada, China, India, Japan, Republic of Korea and the US.

Design: Crealis Sàrl, Switzerland
Photo credits: CSI participating companies

ISBN: 978-3-940388-32-2

Printer: Atar Roto Presse SA, Switzerland
Printed on paper containing 50% recycled content and 50% from mainly certified forests (FSC and PEFC). 100% chlorine free. ISO 14001 certified mill.

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