

Organizations, Programs and Resources for Energy Efficiency and Resource Productivity in the Cement Industry



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We are the partner of choice for companies and governments—whether the need is best practice information or a tailored approach to implementing an initiative.

The Institute for Industrial Productivity works across the globe with a near-term focus on China, India, and the USA to ensure industrial stakeholders have access to the most effective energy efficiency technology, policy and financing approaches. We do this by:

- sharing best practices and providing access to a network of international experts;
- developing original research, analysis and databases; and
- bridging the gap between government policy and industry implementation.

Companies, industry associations and governments can leverage our expertise to achieve their goals.

Many companies, industry associations, and governments are aware that increasing energy efficiency cuts costs and helps achieve sustainable economic growth, and they establish goals to boost energy productivity. The Institute for Industrial Productivity helps these organizations understand which technologies, policies and financing options will help them achieve their vision. Our integrated technology, policy and financing model and our broad network of experts makes us the partner of choice for governments, and companies that share our goal of competitive industries through a low carbon future. The Institute for Industrial Productivity is a nonprofit organization independently funded by the ClimateWorks Foundation, serving as its Best Practice Network partner for the industrial sector.



Preface

In order to increase industrial energy productivity in energy-intensive sectors, the Institute for Industrial Productivity (IIP) has developed a package of databases that give industry and government decision-makers access to best practices in technology, policy, financing and supply chains. IIP's Industrial Efficiency Technology Database (IETD), which is publicly available and offered free of charge, delivers rich and relevant information about the latest and best available technologies, tools and management systems to facilitate the accelerated and full commercial deployment of energy efficient and low-carbon technologies and practices in industry. As part of the IETD, IIP has a digital library of global best practices for the cement industry that builds upon input from the Lawrence Berkeley National Laboratory. This document provides an overview of cement resources in the IETD. For more information, see <http://ietd.iipnetwork.org/content/cement>



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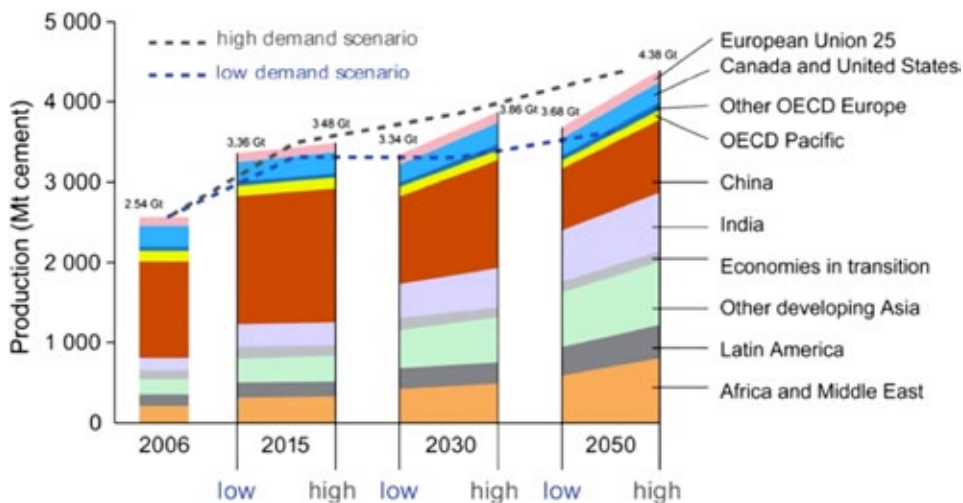
Introduction

The cement industry accounts for approximately 5% of current global anthropogenic CO₂ emissions (WBCSD/IEA, 2009a). Global cement production and demand is increasing, with annual cement production expected to increase from around 2,540 million tonne (Mt) in 2006 to between 3,680 Mt (low estimate) and 4,380 Mt (high estimate) in 2050. The major share of this growth will be happening in China, India and other developing countries in Asia (Figure 1) (WBCSD/IEA, 2009b). This significant increase in cement production is associated with a commensurate rise in absolute energy use and greenhouse gas

(GHG) emissions.

In 2010, approximately 3300 million tons of cement were produced globally. China, India, U.S., Turkey, and Brazil were the top five cement producing countries. China accounted for 55% of world production, the share of the next largest producer, India, was only around 7% (USGS, 2012). Holcim, Cemex, Lafarge, HeidelbergCement, and Italcement are the top five cement producing companies with operation in many countries around the world.

FIGURE 1: Annual world cement production



SOURCE: WBCSD/IEA (2009b)



Why Compile Best Practices for the Cement Industry?

There are many studies worldwide that identify a wide variety of sector-specific and cross-cutting energy efficiency improvement opportunities for the industrial sector, particularly for the cement industry. Therefore, there is a need to consolidate the available information on energy efficiency technologies for the cement industry available from all major sources. This will help engineers, researchers, policy makers, and other interested parties to easily access a well-structured database of information on these technologies.

One of the most important barriers to energy efficiency improvement in industry is the lack of information on energy efficiency technologies. A structured library of electronic resources comprised of relevant and useful information can provide valuable insight for those seeking to research and implement energy efficiency best practices available for the cement industry. Consolidating this information in one convenient location:

- Raises interest in energy savings
- Simplifies access to quality information, taking into account

the purpose and complexity of the materials

- Provides tools for different audiences and different applications in order to effectively implement energy saving projects
- Reduces the costs of generating new materials through shared international efforts
- Identifies “world leading” publications that deserve greater dissemination
- Establishment of a vital database of energy efficiency best practices also provides a destination where important information and evolving techniques can be shared.

IIP has initiated the efforts to compile information on best practices, relevant resources, as well as organizations and programs for the cement industry and makes them available on its publicly available and free [Industrial Efficiency Technology Database](#) (IETD). This document consolidates relevant information on organizations, programs and resources and complements the IETD.



Organizations and Programs for Energy Efficiency and Resource Productivity in the Cement Industry

There is substantial information available to help a range of interested parties, including industrial energy managers, analysts and policy makers, learn best practices related to the cement industry. In this report, information has been collected from international organizations and entities worldwide (China, India, United States, Europe, Japan, South Korea, Turkey, Brazil, and Iran), which are among the top 10 cement producing countries/region. This section is organized: international organizations, national cement industry representative bodies, government institutions, programs or policies, and well-known cement manufacturers and technology providers with significant research and development and information dissemination programs.

International Organizations

Global Superior Energy Performance Partnership (GSEP) - Cement Working Group

http://www.cleanenergyministerial.org/our_work/buildings_and_industry/cement.html

The Global Superior Energy Performance Partnership (GSEP) was established by government and corporate leaders in 2010 in Washington DC. The purpose of the initiative is to accelerate energy efficiency improvements throughout industrial facilities and large buildings and to significantly cut global energy use by encouraging industrial facilities and commercial buildings to pursue continuous improvements in energy efficiency. The initiative also aims at promoting public-private partnerships for cooperation on specific technologies or in individual energy-intensive sectors.

Within GSEP, there are six working groups, one of which is the Cement Working Group, which was established in 2011. (GSEP, 2011). The Cement Working Group is the expanded continuation of the cement Task Force of the Asia Pacific Partnership on Clean Development and Climate. The Cement Working Group convenes experts and leaders from the public, private, and academic and research sectors to exchange information and create practical projects through public-private partnerships.

The Working Group will focus on collaborating on policies, programs, and projects geared toward higher energy efficiency; reducing greenhouse gas emissions from the cement manufacturing process; and promoting sustainable applications of cement and concrete products as tools to enhance energy efficiency and minimize the greenhouse gas footprint across the built environment (Clean Energy Ministerial 2012).

World Business Council for Sustainable Development (WBCSD) - Cement Sustainability Initiative (CSI)

<http://www.wbcdcement.org>

The Cement Sustainability Initiative (CSI) is a global effort by 23 major cement producers, which account for about one third of the world's cement production, and with operations in more than 100 countries. One of the purposes of the Initiative is to identify actions and facilitate steps cement companies can take, individually and as a group, to accelerate progress toward sustainable development. The CSI has developed various materials and tools on energy efficiency, CO₂ accounting and reporting (e.g. the GHG Protocol developed in partnership between the World Resources Institute and the World Business Council for Sustainable Development), co-processing of alternative fuels, and sustainable development in the cement industry, which are all available from WBCSD/CSI 2011 (see reference).

The Cement Sustainability Initiative (CSI) developed the "Getting the Numbers Right" (GNR) system for its members in 2008. GNR is a CO₂ and energy performance information system, based on emissions data from individual cement plants. It aims to develop representative statistical information on the CO₂ and energy performance of clinker and cement production worldwide (WBCSD, 2009). Currently, WBCSD/CSI, together with co-funding from by the Institute for Industrial Productivity and the U.S. EPA, has supported researchers at the China Energy Group of Lawrence Berkeley National Laboratory to develop a report on international best practices in co-processing of the municipal solid waste and sewage sludge in the cement industry (LBNL, 2012).

In addition, the WBCSD/CSI has published a guideline for the selection and use of alternative fuels and raw material in the



cement industry and guidelines for the health and safety in the cement industry (WBCSD/CSI, 2011). In 2005, WBCSD/CSI published a report to provide practical improvements to the shortcomings of the Clean Development Mechanism (CDM) process for the cement industry reflecting the industry's perspective and suggestions (WBCSD, 2005).

International Energy Agency (IEA)

<http://www.iea.org>

The International Energy Agency (IEA) is an autonomous organization, which works to ensure reliable, affordable and clean energy for its 28 member countries and beyond.

Originally, it was founded in 1973 to help countries co-ordinate a collective response to major disruptions in oil supply through the release of emergency oil stocks to the markets. Now, IEA has evolved and expanded to other areas related to energy supply and end use (IEA, 2011).

In addition to hosting various events and workshops on energy efficiency in the cement industry, IEA has also participated in research on energy efficiency and CO₂ emissions reduction in the cement industry such as the collaborative work with WBCSD for the development of the cement technology roadmap (WBCSD/IEA 2009a).

Four key reduction levers to reduce CO₂ emissions in the cement industry are identified, which are: 1. Thermal and electric efficiency, 2. Alternative fuel use, 3. Clinker substitution, and 4. Carbon capture and storage. Achieving the full results outlined in the roadmap requires the full package of policy and technology actions, some of which are described in the roadmap. In addition, several indicators have been identified to help track progress against the cement roadmap. The indicators cover implementation of best available technology, alternative fuels use, clinker substitution and CCS development, demonstration and deployment needs to 2050.

Another IEA report titled "Tracking Industrial Energy Efficiency and CO₂ Emissions", analyzes different cement production technologies as well as the production, energy efficiency, carbon intensity, alternative fuel and material usage of the cement industry in different countries (IEA 2007).

United Nations Industrial Development Organization (UNIDO)

<http://www.unido.org>

The United Nations Industrial Development Organization (UNIDO) aims to promote and accelerate sustainable industrial development in developing countries and economies in transition, and work towards improving living conditions in the world's poorest countries. UNIDO generates and disseminates industry-related knowledge, provides technical support, and implements projects. UNIDO is recognized as a specialized provider of key services in support of the interlinked challenges of reducing poverty through productive activities, promoting the integration of developing countries in global trade through capacity building, fostering environmental sustainability in industry, and improving access to energy (UNIDO 2011a).

UNIDO has organized several workshops on energy efficiency and CO₂ emissions reduction in the cement industry (UNIDO/MITI 1994; UNIDO 2010a). In addition, UNIDO published a report on global industrial energy efficiency benchmarking in which they also presented an estimated benchmark curve for the cement industry in different regions/countries in the world (UNIDO 2010b). UNIDO also played a key role in the development of the ISO management system standard for energy, ISO 50001 (UNIDO 2011b; ISO 2011).

The World Bank

<http://www.worldbank.org>

The World Bank, established in 1944, is a vital source of financial and technical assistance to developing countries around the world. Its mission is to fight poverty and to help people help themselves and their environment by providing resources, sharing knowledge, building capacity and forging partnerships in the public and private sectors.

The World Bank is made up of two development institutions owned by 187 member countries: the International Bank for Reconstruction and Development (IBRD) and the International Development Association (IDA). The World Bank provides low-interest loans, interest-free credits and grants to developing countries for a wide array of purposes that include investments in education, health, public administration, infrastructure, financial and private sector development, agriculture and environmental and natural resource management (World Bank 2011a).



The World Bank has funded various studies/projects, and programs on energy efficiency in industry including the cement industry in developing countries. These include the study on the barriers to CDM projects in the cement industry in Africa (World Bank 2009) that builds on experiences with similar projects in India. World Bank has also supported initiatives aimed at strengthening the institutional capacity for both the management and technical aspects of rational energy use in key industrial sectors, including the cement industry, in China (2001b), and the assessment of the energy efficiency potential in a group of 16 cement plants in Shandong province in China (Price et al. 2009).

World Wildlife Fund

<http://wwf.panda.org>

World Wildlife Fund (WWF) is one of the world's largest independent conservation organizations and is active in over 100 countries. WWF's focus has evolved from localized efforts

in favor of single species and individual habitats to an ambitious strategy to preserve biodiversity and achieve sustainable development across the globe (WWF, 2011).

WWF has also been involved in the energy efficiency in industry including the cement industry. WWF funded the development of the report "A blueprint for a climate friendly cement industry" (WWF, 2008). Since 2000, WWF has been working with Lafarge, one of the largest cement producers in the world, to combine economic constraints, environmental and social responsibility in order to reduce Lafarge Group's environmental footprint. Lafarge and WWF have also launched the environmental campaign named "Climate Savers - Let the clean economy begin" in which leading companies are committed to reduce their CO2 emissions. Once all parties agree that there is a basis for a successful partnership, an agreement is tailored to the specific circumstances and operating sector of each company. Reduction targets are set in absolute terms and within a defined timeframe. Targets and progress are reviewed on a regular basis and publicly communicated (Lafarge 2011a).



China

Cement Industry Representative Body

China Cement Association (CCA)

<http://www.cncement.com.cn>

The China Cement Association (CCA) was founded in 1987 and represents 4000 cement companies with a total annual production capacity of around 1.2 billion tons of cement. Under the Chinese government's commission, the CCA assists the government to formulate strategic plans for industrial development, policies, codes and standards, and provides assistance during implementation of these activities. In a sense, it serves as a bridge between the government and cement companies. Its activities include to review applications for business permits; organize and coordinate research and development in new processes, technologies and products for the cement industry; introduce theories and practices in modern business management; and promote expansion of cement market and development of its members.

In 2011, the CCA provided consulting service to and produced several reports for the Ministry of Industry and Information Technology and the Ministry of Environmental Protection. It organized "CEMENTECH 2011" in Beijing in April 2011, with more than 400 attendees from around the world, in addition to a few seminars aiming to promote energy conservation and emission reduction in the industry (Digital Cement, 2011). The CCA also co-organized the 1st and 2nd Cement Sustainability Initiative's GHG Protocol training workshops in 2008 in Beijing under the APP Cement Task Force program. In addition, under the APP Cement Task Force, CCA helps the organization in a series of training for the use of BEST Cement tool (conducted by LBNL) and GHG Protocol (conducted by WBCSD/CSI).

Government Agencies or Ministries

National Development and Reform Commission (NDRC)

<http://en.ndrc.gov.cn>

The National Development and Reform Commission (NDRC) is a macroeconomic governance agency under the State Council, which studies and formulates policies for economic and social

development, maintains a balance of economic aggregates and guides the overall economic system restructuring (NDRC 2011).

NDRC is responsible for major energy policies in China such as Revision of the Energy Conservation Law and Medium And Long-Term Plan For Energy Conservation, which sets out specific targets for the industrial, transportation, and buildings sectors. This includes establishing a system for monitoring, evaluating, and public reporting of energy intensity and elimination or reduction of production from inefficient industrial facilities, and shifting production away from energy-intensive industries.

Another major policy is the Five Year Plans (FYP), which announce the national goal of reducing energy intensity over five year periods and the means to achieve this target. Another main program is the Implementation Measures of 10 Key Projects in 11th FYP. The ten key projects are focused on reducing energy use in industry and buildings and include 10 specific technologies some of which applicable to the cement industry such as the efficiency in electric motor systems and waste heat recovery. Top-1000 Energy-Consuming Enterprise Program during 11th FYP and Top-10000 Energy-Consuming Enterprise Program during 12th FYP are the other major energy policies in China set by NDRC which targets the largest energy consuming enterprises, including many cement companies, and set mandatory targets for energy intensity reduction while supporting the enterprises with various incentives and resources such as the Financial Rewards for Energy-Saving Technical Retrofits program which is a program of the Ministry of Finance (MOF) and the National Development and Reform Commission (NDRC) to reward enterprises for energy savings achieved through technical renovation projects and the "Ten Key Projects" program. In the ten key project program, Ministry of Finance and National Development and Reform Commission (NDRC) give award to enterprises at a rate of 200 RMB¥ (\$29) for every tonne of coal equivalent (tce) saved per year for enterprises in East China to 250 RMB¥ (\$36) for every tce saved per year for enterprises in Mid or West. (Zhou et al. 2010; IIP 2012).



Ministry of Industry and Information Technology (MIIT)

<http://www.miit.gov.cn>

The Ministry of Industry and Information Technology (MIIT) is a ministry under the State Council that supervises industrial enterprises and their operation through formulating and implementing plans, policies and standards concerning industry development. The MIIT also promotes R&D of key technological equipment and technological renovation; regulates the telecommunication industry; provides guidance to the penetration of information technology; as well as coordinates in safeguarding information security concerning national interests. The ministry's key work includes industrial energy conservation and emission reductions, closeout of industrial plants whose production capacities are way behind standards, upgrade and transformation among the industries (MIIT, 2011).

The ministry lately announced to pursue more rigorous control on the growth of industries with high-energy intensity and high carbon emissions, i.e. iron and steel, cement and non-ferrous metal industries, during the 12th Five Year Plan (2011-2015) (CCement.com, 2011).

Research Institutions and Universities

China Building Materials Academy (CBMA)

<http://www.cbma.com.cn/english/cn/O3jsjcp/zycp.htm>

The China Building Materials Academy (CBMA) is one of the leading research institutes in China working on cement materials, techniques and equipment. CBMA conducts research on cement production, manufacturing technology of special types of cement, new techniques and equipment in cement manufacturing, and in use of low-grade raw materials, alternative fuels and industrial wastes. In addition to the cement-related research, CBMA also conducts high-level research on the following areas (CBMA 2011):

- Concrete and new building materials
- Glass materials and specialty glass
- Glass fiber and fiber composites
- Refractory materials
- Ceramic materials and equipment

- Environment engineering materials
- Precision instruments, electro-mechanic and automation technology
- Engineering design and general contract
- Quality supervision, test and certification

Institute of Technical Information for Building Materials Industry of China (ITIBMIC)

(Website is not available)

The Institute of Technical Information for Building Materials Industry of China, founded in 1958, is a research unit under the State Council, which is funded by the central government and managed by the China Building Material Industry Association (CBMIA). It comprises departments dedicated to research on cement, glass, ceramics, new building materials and non-ferrous metals, and has publications particularly on cement itself and building material industry. ITIBMIC is one of the key organizations working on cement technologies and materials, with direct relevance to energy efficiency.

The institute is the organizer for eight nationwide building materials professional networks with network members coming from over all the country. Each year, it produces dozens of research reports, and has more than 1000 publications since 1958, with emphasis on macro-economic operation and market dynamic analyses of the building material industry as well as new corporate products and technologies (China Building Materials Industry, 2011). The institute has 24 databases of various areas of focus and operates the website of Building Material Information (BMI 2011).

Lawrence Berkeley National Laboratory – China Energy Group

<http://china.lbl.gov/>

The China Energy Group at Lawrence Berkeley National Laboratory is committed to understanding the opportunities for energy efficiency improvement in China, and to explore their implications for policy and business. It works collaboratively with energy researchers, suppliers, regulators, and consumers in China and elsewhere to better understand the dynamics of energy use in China, to develop and enhance



the capabilities of Chinese institutions that promote energy efficiency, and to create links between Chinese and international institutions.

The LBNL's China Energy Group has conducted and published several studies on energy efficiency in the Chinese cement industry. For example, Galitsky and Price (2007) explored the opportunities for energy efficiency and pollution reduction in cement kilns in China. Hasanbeigi et al. (2010) developed a bottom-up model to assess the energy saving potential in a group of 16 cement plants in Shandong province of China. In addition, LBNL in collaboration with the Energy Research Institute in China developed a process-level energy-intensity benchmarking tool for the cement industry in China called Benchmarking and Energy Savings Tool (BEST) Cement (LBNL/ERI 2008). The LBNL researchers have trained more than 400 Chinese engineers and academia for the use of BEST-Cement tool.

Tsinghua University

<http://www.tsinghua.edu.cn>

Tsinghua University is considered by many to be the top engineering school in China. It is also one of the universities with a large number of international cooperation activities. At present, the university has 14 schools and 56 departments with faculties in science, engineering, humanities, law, medicine, history, philosophy, economics, management, education and art. The University has now over 25,900 students, including 13,100 undergraduates and 12,800 graduate students.

Tsinghua University has been very active in conducting research in the field of energy efficiency, and has published several studies on energy efficiency in the cement industry. In 2006, researchers from Tsinghua University and the Center for Clean Air Policy (CCAP) published an assessment of the GHG emissions and mitigation potential for China's cement industry which produced marginal abatement cost curves for 2010, 2015, and 2020 and documented the costs and emissions reductions from the adoption of 12 mitigation options under three scenarios (Tsinghua and CCAP, 2006). In 2009, Tsinghua University and CCAP published the follow up report on Analysis of Implementation of GHG Mitigation Measures in China (Tsinghua and CCAP, 2009).

Policies and Programs

Top-10,000 Energy-Consuming Enterprises Program

<http://iepd.iipnetwork.org/policy/top-10000-energy-consuming-enterprises-program>

The Top 1,000 Energy-Consuming Enterprises Program, which targeted the largest 1,000 enterprises in China, successfully achieved and surpassed its energy-saving target of 100 million tons of coal equivalent (Mtce) during the 11th FYP (2006-2010) with reported savings of just over 150 Mtce. During the 11th FYP, the Top 1,000 Program was gradually expanded at the local level. Provinces established energy conservation programs to cover smaller enterprises in the local "Double-Hundred" programs or provincial "Top 1,000" programs. This built the foundation for expanding the Top 1,000 program to the Top 10,000 Program under the 12th FYP.

The Top 10,000 Program aims to cover two thirds of China's total energy consumption, or 15,000 industrial enterprises that use more than 10,000 tonnes of coal equivalent (tce) per year, and around 160 large transportation enterprises (such as large shipping companies), and public buildings that use more than 5,000 tce per year. The total number of enterprises covered by this program may reach up to 16,000 to 17,000.

The target of the Top 10,000 Program is an absolute energy-saving target of 250 Mtce by 2015. The 250 Mtce saving target will be disaggregated to local provinces and cities. Local governments will evaluate the progress of local enterprises toward their energy-saving target and publicize the results. For the enterprises that do not meet their annual energy-saving target, mandatory energy audits will be conducted and adjustment/retrofits will be required. The key elements of the Top 10,000 Program include:

- implementation of the target responsibility system,
- conducting energy audits,
- implementation of energy audit systems,
- conducting energy efficiency benchmarking,
- establishment of energy management systems,
- expansion of the energy managers training pilots,
- implementation of energy utilization reporting system,



- acceleration of energy conservation retrofits; and
- improvement of energy management skills (IIP 2012).

Small Plant Closures and Phasing Out of Outdated Capacity Program

In 2007, China’s State Council announced a Comprehensive Working Plan of Energy Conservation and Emission Reduction to accelerate the closing of small plants and phasing out outdated capacity in 14 high energy-consumption industries including the cement industry. The Economic Commission in a county or municipality identifies enterprises that violate national and provincial guidelines on industrial equipment and production capacity standards. After receiving the approval of the mayor, the Commission publishes a list of small plants that are old and inefficient, and lists timeframes for "voluntary" closure. Some closed enterprises or enterprises that shut down outdated production equipment receive compensation of around 20 to 30 percent of the closed enterprise or production line value, but the majority does not. In 2010, the scope of the program was expanded to include six additional industrial sectors and the targets – in terms of the minimum capacity that is subject to closure – were increased.

In 2011, the first year of the 12th FYP, the phasing-out of outdated production capacity continued. Phase-out targets have been allocated to local enterprises by local governments.

The Ministry of Industry and Information Technology (MIIT) publicized the list of affected enterprises and equipment. The list covers 18 industrial subsectors and in total 2255 enterprises will be involved (IIP 2012). The Ministry of Finance (MOF) provides certain fiscal incentives to local governments to support the phasing-out. The exact incentive amount is determined based on various factors, including the budget of the central government, phasing-out targets of local governments, progress of target completion in previous years, and the use of incentives by local governments.

Industrial Energy Performance Standards Program

Industrial energy performance standards set minimum allowable energy efficiency values for existing plants and newly constructed plants, taking into account different types of raw materials, fuels, and capacities. Aside from the mandatory minimum energy efficiency standards a set of voluntary, more advanced, “reach standards” have been established. Table 1 below shows the minimum allowable energy efficiency values for the cement plants in China.

Monitoring and evaluation under this program will have three phases: self-evaluation, local supervision, and national-level spot-checking. The enforcement method remains unclear in case the plants do not meet their targets. However, it may become more explicit as implementation of the 12th Five Year Plan (2011-2015) progresses (IIP 2012).

TABLE 1: Minimum Allowable Energy Efficiency Values for Cement Plants in China

Sector	Standard	Product / Process / Size	Unit	Minimum Existing	New Plants Minimum	Advanced Minimum
Cement	GB 16780-2007	2,000-4,000 tpd	kgce/t	109	100	97



India

Cement Industry Representative Body

Cement Manufacturers' Association (CMA)

<http://www.cmaindia.org/portal/index/index.aspx>

The Cement Manufacturers' Association (CMA), a high-level body of cement manufacturers in India, was established in 1961. Both the private and public sector cement companies are members. CMA's main objectives are to:

- Promote the growth of the cement industry.
- Protect the consumer interests.
- Identify new applications of cement usage.
- Establish contacts with similar bodies abroad for exchange of information, data, publications etc.

Confederation of Indian Industry (CII)

<http://www.cii.in/>

The Confederation of Indian Industry (CII) is an industry-led and managed non-government, not-for-profit organization. Founded over 116 years ago, it is India's premier business association, with direct membership of over 8,100 organizations from the private as well as public sectors including SMEs, and an indirect membership of over 90,000 companies from around 400 national and regional sectoral associations.

CII catalyzes change by working closely with government on policy issues, enhancing efficiency, competitiveness and expanding business opportunities for industry through a range of specialized services and global linkages. It also provides a platform for sectoral consensus building and networking. With 63 offices including ten Centres of Excellence in India, and seven overseas offices in Australia, China, France, Singapore, South Africa, UK, and USA, as well as institutional partnerships with 224 counterpart organizations in 90 countries, CII serves as a reference point for Indian industry and the international business community.

CII - Sohrabji Godrej Green Business Centre (CII - Godrej GBC)

<http://www.greenbusinesscentre.com/site/ciigbc/index.jsp>

CII – Godrej GBC is one of the ten Centres of Excellences of the Confederation of Indian Industry (CII). CII – Godrej GBC offers advisory services to the industry in the areas of green buildings, energy efficiency, water management, environmental management, renewable energy, green business incubation and climate change activities. The Centre sensitizes key stakeholders to embrace environmentally sustainable practices and facilitates market transformation, paving the way for India to become one of the global leaders in green business by 2015.

The Centre has carried out various valuable studies on energy efficiency for industry, with particular focus on cement and pulp and paper industries. Publications on these studies are available for purchase on the organization's website.

With the support from WBCSD/CSI and International Finance Corporation, CII's Green Business Centre and the National Council for Cement and Building Materials (NCBM) developed a report on energy efficiency technologies for the cement industry which will be used for the development of "low carbon technology roadmap for the cement industry in India" (WBCSD 2012).

Government Agencies or Ministries

Bureau of Energy Efficiency (BEE)

<http://www.beeindia.in>

The Bureau of Energy Efficiency (BEE) of India is an agency under the Indian Ministry of Power. The primary aim of the agency is to reduce energy intensity in the Indian economy by developing, deploying and increasing public and corporate awareness about energy conservation measures and practices. BEE focuses on eleven industrial sectors, which are: aluminum, cement, chemical, coalmine, fertilizer, furnaces, HVAC, automobile, petrochemical, steel and textile (BEE, 2011a).

The Bureau of Energy Efficiency coordinates the National



Energy Conservation Awards (NECA) scheme of the Ministry of Power. The Awards were given away for the first time in December 14, 1991. NECA are given to selected industrial units who have made systematic and serious attempts for efficient utilization and conservation of energy. BEE publicizes the enterprises that receive the award as well as the projects they implemented in their industrial units. This has generated a valuable pool of energy efficiency case studies available for various industries including the cement industry (BEE, 2011a). Finally, the Perform, Achieve, and Trade (PAT) energy-trading scheme (see below) is designed and implemented by BEE.

BEE also hosts a number of case studies and presentations on energy efficiency initiatives in cement industry. These are available here at http://www.beeindia.in/content.php?page=industrial_sectors/industrial_sectors.php?id=2

Research Institutes

The Energy and Resources Institute (TERI)

<http://www.teriin.org>

The Energy and Resources Institute (TERI) was formally established in 1974 and over the years evolved into an organization working to develop and diffuse sustainability solutions in the fields of energy, environment and current patterns of development. The Institute relies on entrepreneurial skills to create benefits for society through the development and dissemination of intellectual property. While also identifying intellectual challenges to sustainability that are interdisciplinary, TERI supports research, training and demonstration projects leading to development of specific problem-based advanced technologies that help carry benefits to society at large. (TERI, 1012) TERI has a presence in different corners and regions of India as well as in North America, Europe Japan, Malaysia and the Persian Gulf.

TERI has a long-term relationship with the Bureau of Energy Efficiency, and provided active inputs in the design of various policy mechanisms, such as India's energy efficiency certificates (white certificates) scheme known as the Perform, Achieve, and Trade (PAT) scheme. TERI will also be involved in undertaking baseline energy audits of approximately 40 large industrial consumers under the PAT mechanism of the National Mission on Enhanced Energy Efficiency (NMEEE).

TERI has been involved in number of projects and workshops on energy efficiency and GHGs emissions reduction in the Indian cement industry. For instance, TERI in collaboration with U.S. EPA and World Resources Institute (WRI) participated in the development of cement sector greenhouse gas emission calculation tool for Indian Cement Industry (TERI, n.d.). The tool can be downloaded from GHG Protocol (2005).

Policies and Programs

Perform, Achieve, and Trade (PAT) program¹

<http://iepd.iipnetwork.org/policy/perform-achieve-trade-pat-scheme>

The Perform, Achieve, and Trade (PAT) program is a trading scheme aimed to improve energy efficiency in industries across India using a market-based mechanism. PAT has been introduced under the National Mission on Enhanced Energy Efficiency (NMEEE). The 2010 amendment to the Energy Conservation Act (ECA) provides a legal mandate to PAT. Participation in the scheme is mandatory for Designated Consumers under the ECA. Nine sectors have been identified for the initial phase, of which seven industrial sectors, including the cement industry. The power sector and railways are also covered. In total more than 700 plants could be covered by the scheme.

The scheme imposes mandatory specific energy targets on the participating companies. It allows using purchased excess energy savings from other participants in the form of white certificates for compliance. PAT will create a domestic market for white certificates and will secure cost-effectiveness in meeting the total energy savings target under the system. The first phase of commitment and trading is three years. The approach is as follows:

- Specification of specific energy consumption (SEC) norm for each designated consumer in the baseline year and in the target year
- Verification of the SEC of each designated consumer in the baseline year and in the target year by an accredited verification agency

¹ Excerpt from IIP (2011) (<http://iepd.iipnetwork.org/policy/perform-achieve-trade-pat-scheme>)



- Issuance of Energy Savings Certificates (ESCerts) to those designated consumers who exceed their target SEC reduction
- Trading of ESCerts with designated consumers who are unable to meet their target SEC reduction after three years
- Checking of compliance, and reconciliation of ESCerts at

the end of the 3-year period. In case of non-compliance, a financial penalty is due

The scheme is being designed and implemented by BEE, under the Ministry of Power of India. A newly established company Energy Efficiency Services Ltd (EESL) will administer the trading (IIP 2012).



Europe

Cement Industry Representative Body

CEMBUREAU, the European Cement Association

<http://www.cembureau.be>

CEMBUREAU, the European Cement Association based in Brussels, is the representative organization of the cement industry in Europe acting as spokesperson for the cement industry before the European Union institutions and other public authorities, and communicates the industry's views on all issues and policy developments. Currently, its Full Members are the national cement industry associations and cement companies of the European Union (with the exception of Cyprus, Malta and Slovakia) plus Norway, Switzerland and Turkey.

CEMBUREAU plays a role in the worldwide promotion of cement and the ready-mix and precast concrete industries in co-operation with Member Associations and other relevant organizations. The Association regularly co-hosts conferences on specific issues aimed at improving the market perception of the concrete industry and promoting the use of generic cement and concrete products. In addition, the Association regularly commissions studies to evaluate specific issues of importance to the industry.

CEMBUREAU has been involved in the promotion of energy efficiency and the use of alternative fuels in the cement industry. For instance, CEMBUREAU has published a report on the co-processing of alternative fuels and raw materials in the European cement industry (CEMBUREAU 2009). In another report by CEMBUREAU, it discusses the environmental benefits of using alternative fuels in cement production (CEMBUREAU 1999).

Public Agencies and Institutions

European Commission Directorate General (DG) Enterprise and Industry

http://ec.europa.eu/enterprise/index_en.htm

The European Commission Directorate General (DG) Enterprise and Industry promotes the EU's strategy for smart, sustainable

and inclusive growth. Therefore, it is working to strengthen Europe's industrial base and promote the transition to a low-carbon economy and to promote innovation as a means to generate new sources of growth and meet societal needs. DG Enterprise and Industry provided studies on the competitiveness of various industrial sectors including the cement industry (DG/EI 2011).

European Integrated Pollution Prevention and Control Bureau (IPPCB)

<http://eippcb.jrc.es/>

The European Integrated Pollution Prevention and Control (IPPC) Bureau was set up to organize an exchange of information between Member States and industry on Best Available Techniques (BAT), associated monitoring and developments in them. The Bureau is an output-oriented team, which produces reference documents on Best Available Techniques, called BREFs. BREFs are the main reference documents used by competent authorities in Member States when issuing operating permits for the installations that represent a significant pollution potential in Europe. There are about 50,000 of these installations in Europe. The IPPC Bureau has already published an updated BREF document covering Cement Industry in 2010. This is a comprehensive technical report on cement and lime manufacturing process as well as the technologies for energy efficiency and reduction of CO₂ and other pollutant emissions (European Commission 2010).

Research Institutes

European Cement Research Academy

<http://www.ecra-online.org>

The European Cement Research Academy (ECRA) was founded in 2003 as a platform on which the European cement industry supports, organizes and undertakes research activities within the context of the production of cement and its application in concrete.



ECRA's activities include seminars, workshops and dedicated research projects. The seminar programs cover process- and concrete-oriented issues of high concern to the cement industry. The Academy is steered by a Technical Advisory Board staffed with representatives from major European cement producers.

In 2009, the Cement Sustainability Initiative (CSI) and the European Cement Research Academy (ECRA) published a report on state of the art technologies for the cement industry (CSI/ECRA 2009), which formed the foundation of the IEA/WBCSD-CSI joint publication on Cement Technology Roadmap 2009. In 2007 and 2009, ECRA published two reports on Carbon Capture and Storage (CCS) for the cement industry (ECRA 2007, 2009). The first of these reports provides an extensive technical review and cost and barrier analysis of various CCS technologies. The second report focuses on oxy-fuel and post-combustion technologies, which are identified as feasible alternatives for the cement industry in the previous study, and provides more detailed technical and economic investigations and assessments.

Policies and Programs

European Union Emissions Trading Scheme (EU ETS)

http://ec.europa.eu/clima/policies/ets/index_en.htm

The European Union Emissions Trading Scheme (EU ETS) is a cap and trade system that caps the total amount of greenhouse gases that can be emitted from factories, power plants and other installations. Within this restriction, companies receive emission allowances, which they can sell to or buy from one another when needed. At the end of each year, a company must possess enough allowances to cover all its emissions otherwise heavy fines are imposed. If a company manages to reduce its emissions, it can keep the allowances for future or can sell to another company that is short of allowances.

The EU ETS covers cement as well as paper and pulp, iron and

steel, glass, bricks and ceramics, power plants, oil refineries and combustion plants. The EU ETS has encouraged the industries to reduce emissions by providing an economic incentive to make substantial financial gains as well as by making them responsible for social sustainability. The EU ETS covers some 11,000 power stations and industrial plants in 30 countries. (EU ETS 2011). The European Commission also published a sector-specific guidance on the harmonized free allocation methodology for the EU ETS post-2012. The cement industry is included in this guidance and the product benchmark of grey cement production is 0.766 allowances/tonne of clinker (European Commission 2011).

Integrated Pollution Prevention and Control (IPPC) Directive

<http://ec.europa.eu/environment/air/pollutants/stationary/ippc/summary.htm>

The IPPC Directive was adopted in the EU in 1996 in order to set common rules for permitting and controlling industrial installations across the EU. The Directive requires both existing and new facilities to acquire an environmental permit from designated authorities. Approximately 52,000 installations are covered by the Directive.

An important element of the IPPC Directive is that the permit conditions, including the Emission Limit Values (ELVs) are required to be based on Best Available Techniques (BAT). Sector specific BATs that are compiled through extensive stakeholder consultation and published as reference documents by the European IPPC Bureau, form the foundation of permit issuance or renewal. Permit applicants are required to provide an assessment of BAT applicability for their plants as well as a plan for the adoption of relevant BATs. As of November 2010, IPPC Directive is part of the recast Directive on Industrial Emissions.

The cement industry is among the industries covered by the IPPC directive, and the Directive is believed to have facilitated the adoption of energy efficiency and emission reduction measures in this sector.



Japan

Cement Industry Representative Body

Japan Cement Association (JCA)

<http://www.jcassoc.or.jp/cement/2eng/ea.html#>

The Japanese cement industry has 18 cement companies with 32 cement plants. The total clinker production capacity of these plants as of April 2009 was around 63 million tons. Founded in 1948, the Japan Cement Association is the representative body of the Japanese cement industry (JCA 2011). JCA also implemented the Keidanren Voluntary Action Plan Program, which is explained below.

Research Institutes

New Energy and Industrial Technology Development (NEDO)

<http://www.nedo.go.jp>

As Japan's largest public R&D management organization, the New Energy and Industrial Technology Development Organization (NEDO) coordinates technology development activities in collaboration with the industrial, academic and governmental sectors. NEDO has placed particular emphasis on energy and environment fields since its foundation in 1980. NEDO aims to promote technology development to further improve efficiency and reduce the cost of new energy sources and has played an important role in industrial technology development. NEDO is working towards the development, practical implementation and dissemination of key medium- to long-term and market-led technologies in areas such as material systems, biotechnology and machinery systems by focusing on the growing fields of "green innovation" (NEDO 2011). NEDO published a report on Japanese technologies for energy efficiency and GHG emissions reduction for different industries including the cement industry (NEDO 2008).

Research Institute of Innovative Technology for the Earth (RITE)

<http://www.rite.or.jp>

The Research Institute of Innovative Technology for the Earth (RITE) is a foundation authorized by the Ministry of Economy, Trade and Industry and was established in 1990. Its objective is to contribute to the preservation of global environment and the development of world economy by conducting research on industrial technologies.

RITE carries out research in the areas of (1) scenario-making for global warming mitigation, (2) CO₂ separation, capture and storage, (3) CO₂ fixation by plants and its effective use (RITE 2011). In 2008, RITE published a report on international comparison of energy efficiency in power generation, steel and cement industries (RITE 2008).

The Institute of Energy Economics, Japan (IEEJ)

<http://eneken.ieej.or.jp>

The Institute of Energy Economics, Japan was established in June 1966 and is certified as an incorporated foundation by the Ministry of International Trade and Industry. The aim of its establishment is to carry out research activities in the area of energy supply and end use. Its work is focused on analyzing energy problems and providing basic data, information and reports necessary for the formulation of energy policies in Japan.

IEEJ has expanded its scope of research activities to include other areas such as environmental issues and international cooperation that are closely related to energy (IEEJ 2011). Among other works, IEEJ published a report on CO₂ reduction potential by globally adopting energy efficient technology in energy intensive industries, including iron and steel, cement and pulp and paper (IEEJ 2006).

Policies and Programs

Japan Cement Association's Keidanren Voluntary Action Plan Program

The Keidanren Voluntary Action Plan is an initiative of the Japan Business Federation. Through the Japanese Cement Association, all cement companies have joined this program and set a target to reduce their specific fossil and purchased energy



consumption by 3.8% by 2010, as compared to levels in 1990. It covers all of its 18 member companies. Key activities that are prioritized in order to meet the targets under this program include the sustained introduction of energy efficient equipment and the increased use of alternative fuels (JCA 2008).

Mandatory energy efficiency benchmarking in industry

(Website not available)

The Act on the Rational Use of Energy (amended in April 2010) has introduced mandatory energy efficiency targets in the form of benchmarks, to be specified in secondary legislation. It has also introduced a 1% annual energy efficiency improvement obligation for all businesses. For designated sectors (steel, electricity, cement, paper & pulp, oil refinery, chemical), targets have been set at the energy efficiency level of the best performing companies (top 10% - 20%) within that industrial sub sector.

The target specified for the cement industry is 3.891 GJ/tonne. These targets must be met in the medium (2015) and long term (2020). A higher-level target can be adopted in the future if further energy saving potentials can be taken into account. The benchmarks are based on sector studies and are negotiated between government and the sector, although it is unclear whether international or domestic benchmarks are being used.

Every year, companies must report progress on: status of the benchmarking indicator, energy intensity reduction (by at least 1% annually) and the status of its energy management system. Based on companies' reports, the indicator's average value and standard deviation for each sub sector will be published by the government. The names of companies performing well (beyond the target) will be also published. Those industries which have taken early actions and have achieved the benchmark target level can ask for exemption from the annual 1% energy efficiency improvement target by helping small and medium-sized companies achieve higher energy efficiency levels (IIP 2012).



United States

Cement Industry Representative Body

The Portland Cement Association

<http://www.cement.org>

Founded in 1916, the Portland Cement Association represents cement companies in the United States and Canada. It conducts market development, engineering, research, education, and public affairs programs (PCA 2011). PCA is one of the main sources for information on the cement industry in the U.S. and Canada.

In 2008, PCA published a report on a review of CO₂ control technologies including: conventional, pre-combustion, oxy-fuel, and post combustion technologies; and hybrid systems (PCA, 2008).

Government Agencies

US DOE's Advanced Manufacturing Office (AMO) (formerly Industrial Technologies Program (ITP))

<http://www1.eere.energy.gov/industry>

The Advanced Manufacturing Office (AMO) – formerly known as Industrial Technologies Program (ITP) – was launched by the Office of Energy Efficiency and Renewable Energy (EERE) within the United States Department of Energy (DOE). It is the successor of the Industrial Technologies Program (ITP), which aims to increase energy efficiency in the United States' industrial sector. AMO supports research, development and deployment of innovative technologies that companies may use to increase their energy efficiency, decrease environmental emissions and as a result may gain competitive advantage (US DOE/AMO 2011a).

AMO has published both sector-specific and cross-cutting reports for energy efficiency in the cement industry. In 2003, AMO published a report on energy and emissions reduction opportunities for the cement industry (US DOE/ITP 2003). AMO has also published extensive and highly valuable materials (guidebooks and tools) on energy efficiency in cross-cutting industrial energy systems such as process heating, steam, and motor systems, etc. (US DOE/AMO 2011b).

In 2009, the AMO convened at the Cement Energy and CO₂ Reduction Opportunities workshop. The purpose of this collaborative two-day workshop was to help develop a national perspective to identify the opportunities, barriers, and pathways to significantly increase energy efficiencies and reduce CO₂ emissions from the cement production process.

Non-Governmental Agencies and Research Institutions

World Resources Institute – Greenhouse Gas Protocol Initiative

<http://www.ghgprotocol.org>

The Greenhouse Gas Protocol (GHG Protocol) is the international accounting tool for government and business leaders to understand, quantify, and manage greenhouse gas emissions. The GHG Protocol is the product of a decade-long partnership between the World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD).

The GHG Protocol provides the accounting framework for many GHG standards and programs in the world – from the International Standards Organization to the Climate Registry – as well as hundreds of GHG inventories prepared by individual companies. The GHG Protocol offers two different tools for estimating GHG emissions from cement manufacture (WRI 2011):

- US EPA tool: A cement-based tool requiring data only on annual cement production. Emissions are calculated using clinker to cement ratios and CaCO₃ to raw metal ratios. This tool is based on the U.S. EPA's ClimateWise program.
- CSI tool: A clinker based tool suitable for when the amount of clinker consumed is known.

Lawrence Berkeley National Laboratory (LBNL)

<http://www.lbl.gov>

Lawrence Berkeley National Laboratory (LBNL) is a member of the national laboratory system supported by the U.S.



Department of Energy through its Office of Science. It is managed by the University of California (UC) and is charged with conducting unclassified research across a wide range of scientific disciplines. Berkeley Lab employs approximately 4,200 scientists, engineers, support staff and students.

In the last two decades, researchers at the energy analysis department of the environmental energy technology division of LBNL have conducted various studies on the energy efficiency and CO2 emissions reduction in the cement industry in the US, China, India, Mexico, and other countries (Worrell et al. 2000; Hasanbeigi et al. 2010; Sathaye et al. 2010; Schumacher and Sathaye 1999). LBNL has also developed guidebook on energy efficiency technologies for the cement industry (Worrell et al. 2008).

Policies and Programs

US DOE's Better Plants Program

http://www1.eere.energy.gov/manufacturing/tech_deployment/betterplants/

The Better Plants Program is a voluntary initiative in which industrial plants can participate by registering a voluntary commitment to reduce energy intensity by 25% over ten years. Participating companies gain recognition and technical support from the U.S. Department of Energy (DOE). The Better Plants Program builds on the former Save Energy Now LEADER program, which was launched in 2009 to contribute to the goal of achieving a 25% reduction in industrial energy intensity by 2017. The Better Plants Program's key program requirements are the same as the LEADER program.

As part of this program, companies are also invited to take part in the Better Plants Challenge, which is a national, multi-sector energy efficiency leadership initiative. Challenge Partners receive additional recognition from DOE by committing to:

- Enhanced levels of transparency and innovation in their approaches to energy efficiency
- A significant, near-term investment in an energy saving project or set of projects (US-DEO/AMO, 2012).

Environmental Protection Agency (EPA) - Energy Star program

<http://www.energystar.gov>

ENERGY STAR is a joint program of the U.S. Environmental Protection Agency and the U.S. Department of Energy to promote energy efficient products and practices. EPA's ENERGY STAR partnership offers an energy management strategy that helps in measuring current energy performance, setting goals, tracking savings, and rewarding improvements. These guidelines for energy management can assist organizations in improving its energy and financial performance.

The EPA has an Industrial Energy Management Information Center designed to be a useful resource for industrial energy managers, and contains energy management information tailored to industries or focused on specific plant utility and process improvements. In addition, the EPA ENERGY STAR program published a guidebook for energy saving opportunity for the cement industry (Worrell and Galitsky 2008). Furthermore, EPA has developed the ENERGY STAR Plant Performance Indicators (PPI), which are sector-specific energy performance benchmarking tools that provide an ENERGY STAR score. Annual energy and plant operating data is entered to receive an energy efficiency score for a plant on a scale of 1 to 100. Plants that score above the 75th percentile are considered to be energy efficient. The PPI tool is developed for various industrial sectors including the cement industry and is available at U.S. EPA (2012). Finally, U.S. EPA also worked with the World Resources Institute for the development of GHG emissions accounting tool for its ClimateWise program (WRI 2011).

Climate Leadership Awards

<http://www.epa.gov/climateleadership/awards/index.html>

The Climate Leadership Awards (CLA) is a national awards program that recognizes and incentivizes exemplary corporate, organizational, and individual leadership in response to climate change. In February 2012, the first-ever awards were presented to one individual and 20 organizations from across the U.S. who are leading the way in the management and reduction of GHG emissions - both in internal operations and throughout the supply chain.

The program gives awards in the following recognition areas:

- Excellence in Greenhouse Gas Management (Goal Setting Certificate): Recognizes organizations that publicly report and verify corporate GHG inventories and publicly set aggressive GHG emissions reduction goals.



- Excellence in Greenhouse Gas Management (Goal Achievement Award) Recognizes organizations that publicly report and verify corporate GHG inventories and achieve aggressive GHG emissions reduction goals.
- Supply Chain Leadership Award: Recognizes organizations that have their own comprehensive GHG inventories and aggressive emissions reduction goals and can demonstrate they are at the leading edge of managing GHGs in their organizational supply chains.
- Organizational Leadership Award: Recognizes organizations that not only have their own comprehensive GHG inventories and aggressive emissions reduction goals but also exemplify leadership both in their internal response to climate change and through engagement of their peers, competitors, partners, and supply chain.
- Individual Leadership Award: Recognizes individuals exemplifying extraordinary leadership in leading their organizations' response to climate change and/or affecting the responses of other organizations.

Superior Energy Performance

<http://www.superiorenergyperformance.net/>

Superior Energy Performance is a certification program that provides industrial facilities with a roadmap for achieving

continual improvement in energy efficiency while maintaining competitiveness. The program will provide a transparent, globally accepted system for verifying energy performance improvements and management practices. It is anticipated that Superior Energy Performance will launch nationally in 2012. A central element of Superior Energy Performance is implementation of the global energy management standard, ISO 50001, with additional requirements to achieve and document energy performance improvements.

Participating companies' performance can be recognized according to two "energy pathways": 1) a pathway for companies new to energy management: they must demonstrate savings of at least 5% over a three-year period; and 2) a mature pathway for companies with longer experience: these companies must demonstrate at least 15% savings over the last ten years and receive a minimum score according to the "Best Practice Scorecard" [1]. The pathways are further illustrated in Table 2 below.

The Government will leverage the Superior Energy Performance program to deploy federal energy programs, e.g., Save Energy Now LEADER. DOE's Advanced Manufacturing Office is conducting State/Regional Energy Management Demonstration Projects with Save Energy Now LEADER companies to pilot the SEP. ITP has funded 23 state awards starting in 2009 to help industry save energy (IIP 2012)

TABLE 2: Superior Energy Performance Pathways

Performance Characteristics		Silver	Gold	Platinum
Energy Performance Pathway	Energy Performance Improvement	Meets 5% energy performance improvement threshold over the last 3 years after the baseline period	Meets 10% energy performance improvement threshold over the last 3 years after the baseline period	Meets 15% energy performance improvement threshold over the last 3 years after the baseline period
	Energy Performance Improvement	Demonstrates an energy performance improvement of 15% or more over the last 10 years after the baseline period	Demonstrates an energy performance improvement of 15% or more over the last 10 years after the baseline period	Demonstrates an energy performance improvement of 15% or more over the last 10 years after the baseline period
Mature Energy Pathway	Score on Superior Energy Performance Industrial Facility Best Practice Scorecard <i>Includes credits for energy management best practices and energy performance improvements beyond 15% over the last 10 years after the baseline was developed.</i>	<ul style="list-style-type: none"> • Meets a score of at least 35 out of 100 total points for Superior Energy Performance Industrial Facility Best Practice Scorecard • Minimum of 30 points required for the energy management best practices. 	<ul style="list-style-type: none"> • Meets a score of at least 61 out of 100 total points for Best Practice Scorecard • Minimum of 40 points required for the energy management best practices and 10 for energy performance. 	<ul style="list-style-type: none"> • Meets a score of at least 81 out of 100 total points for Best Practice Scorecard • Minimum of 40 points required for the energy management best practices and 10 for energy performance.

SOURCE: Superior Energy Performance



South Korea

Cement Industry Representative Body

Korea Cement Association (KCA)

<http://www.cement.or.kr>

Since its establishment in 1963, the Korea Cement Association (KCA) has acted as the hub to the advancement of cement and concrete industries in Korea. Representing 11 member companies, KCA plays a wide range of roles including making recommendations to the government authority with innovative policies, enhancing competitiveness of the cement industry, collecting and providing information on the cement and construction industries, boosting cooperation among the member cement companies (KOSA, 2011).

Government Agencies

Korean Energy Management Corporation (KEMCO)

http://www.kemco.or.kr/new_eng/main/main.asp

Established in 1980, Korea Energy Management Corporation acts as a national institution in implementing various projects on end-use energy efficiency, developing and supplying renewable energy technologies, etc.

KEMCO was designated by the United Nations Framework Convention on Climate Change (UNFCCC) as a CDM operational entity in several areas such as transportation, forestation, and mineral production. The designation has allowed the corporation to provide verification and certification services to businesses in and out of the country and intending to implement CDM projects across all 15 areas of CDM projects. Korea Energy Management Corporation has participated in many overseas project certifications such as a Chinese cement factory's waste heat recovery project (KEMCO 2011).

Brazil

Cement Industry Representative Body

Brazilian Portland Cement Association (Associação Brasileira de Cimento Portland) (ABCP)

<http://www.abcp.org.br>

Brazilian Portland Cement Association (Associação Brasileira de Cimento Portland) (ABCP) was founded in 1936 in order to promote studies on the cement and its applications. It is a nonprofit, maintained by the Brazilian cement industry, which makes up their membership. ABCP is active in different areas such as:

- Promotion of courses and training seminars and technical events
- Partnership with dozens of universities, colleges and research institutions of the country
- Publication of books, journals and technical documents
- Support the generation of Brazilian technical standards (ABCP 2011).

The National Union of the Cement Industry (Sindicato Nacional da Indústria do Cimento) (SNIC)

<http://www.snic.org.br>

The National Union of the Cement Industry (SNIC) conducts and disseminates research and performs legal representation of the cement industry in Brazil. The union represents the general interests of the industry and the individual interests of its members. Its main tasks are collaborating with the state as a technical and advisory body regarding the issues related to the cement industry, and the provision of technical and legal assistance to members in relation to economic issues and safety (SNIC 2011).



Turkey

Cement Industry Representative Body

Turkish Cement Manufacturers' Association (TCMA)

<http://www.tcma.org.tr>

Established in 1957, Turkish Cement Manufacturers' Association (TCMA) is the representative of the Turkish cement sector. It represents a total of 67 enterprises in Turkey, 48 of them have integrated cement and clinker production and 19 are only the finish grinding mills. TCMA provides solutions to enterprises for their research and development activities, analysis and quality control and training services, and makes common initiatives for legal and administrative regulations. TCMA became a member to the European Cement Association (CEMBUREAU) in 1972 with the mission of advancing the Turkish cement industry in their contacts with the international platform (TCMA 2011).

Government Agencies and Ministries

The Ministry of Energy and Natural Resources (MENR)

<http://www.enerji.gov.tr/index.php?dil=en>

The Ministry of Energy and Natural Resources (MENR) has the overall responsibility for energy efficiency policy in Turkey. Within the ministry, this work is delegated to the Electrical Power Resources Survey and Development Administration (EIE). An important multi-stakeholder body is the Energy Efficiency Co-ordination Board (EECB). It was set up in 2007 and has three main areas of responsibility: it prepares national energy efficiency strategies, plans and programs; it monitors their implementation and assesses their effectiveness; and it steers energy efficiency studies carried out by the EIEI (IEA

2009; MENR 2011). In 2009, EIEI, in collaboration with the TCMA, has carried out a study on energy efficiency in cement plants in Turkey.

Policies and Programs

Energy Efficiency Law of Turkey

Energy efficiency measures in industry are based on the 2007 Energy Efficiency Law and its two related by-laws. This law requires industrial plants consuming at least 1,000 toe per year to nominate one of their employees as the energy manager. Plants consuming more than 50 ktoe per year must set up an energy management unit, and so must specific industrial zones. The companies are obliged to report on their energy management activities to EIE. Industrial plants consuming more than one ktoe per year and power plants with at least 100 MW of installed capacity must also report on energy consumption to the Electrical Power Resources Survey and Development Administration EIE. Cement companies are covered by this law.

Energy efficiency measures in the manufacturing industry focus on energy management, financial support, voluntary agreements, monitoring, and training and awareness. The program includes the cement industry among other sectors. It provides investment support for energy efficiency projects with a maximum payback period of five years. This support covers at most 20% of eligible project costs up to a maximum of TRL 500,000. For industrial establishments that have volunteered to reduce their energy intensity by 10% on average over three years, the program will reimburse up to 20% of their energy costs (to a maximum of TRL 100,000) for the first year (IEA 2009).



Iran

Cement Industry Representative Body

Iranian Cement Industry Association

<http://cementassociation.ir>

The Iranian Cement Industry Association (ICIA) is the representative body of the cement industry. ICIA's goals are to study and investigate the issues around manufacturing, material control and products and to improve quality in manufacturing. It is also active in trade issues and cooperation with related ministries and agencies. ICIA is one of the main sources of information on the cement industry in Iran (ICIA 2011).

Government bodies

Iranian fuel conservation company (IFCO)

<http://ifco.ir/english/index.asp>

The Iranian Fuel Conservation Company (IFCO), a subsidiary of National Iranian Oil Company (NIOC), was established in 2000 with the mission to regulate the fuel consumption in different sectors through review and survey of the current trend of consumption and executing conservation measures nationwide. IFCO is trying to introduce a modern energy consumption reform to all Iran's economic subsystems and make the way to achieve the goals set for conservation in all energy carriers defined in sustainable energy program of the country. IFCO has implemented one of the country's most comprehensive energy efficiency programs in different industrial sectors including the cement industry.

Research Institutions and Universities

Iran University of Science and Technology- Cement Research Center

<http://www.iust.ac.ir>

Established in 1996, the Cement Research Center (CRC) serves as a joint venture between the Iran University of Science and Technology and Iran's Ministry of Industries and Mines and as the country's interdisciplinary leading center for research and development in science and technology of cement material and production process. It conducts research in the various fields including special and new cements, durability of cement-based materials, process and energy optimization, environmental aspects, etc. (IUST – CRC 2011).

Policies and Programs

Standards for energy consumption in the cement industry in Iran

<http://ifco.ir/industry/industryParts/mine/cement.asp>

IFCO along with the Power Ministry in Iran has set energy consumption standards for different industries. For the cement industry, the standard is set for the Ordinary Portland Cement (OPC) with the fineness of 2800 cm²/g. The standard specifies the electricity and fuel intensity for different types of cement production processes (IFCO 2011). More information on the values set by this standard are available here at <http://ietd.iipnetwork.org/content/standards-energy-consumption-cement-industry-iran>



Major Journals Publishing Articles on Energy Use and Savings in the Cement Industry

(Note: This list is not exhaustive)

Cement and Concrete Composites

<http://www.journals.elsevier.com/cement-and-concrete-composites/>

Cement and Concrete Research

<http://www.journals.elsevier.com/cement-and-concrete-research/>

Energy-The International Journal

<http://www.journals.elsevier.com/energy/>

Energy Policy

<http://www.journals.elsevier.com/energy-policy/>

Journal of Cleaner production

<http://www.journals.elsevier.com/journal-of-cleaner-production/>

Renewable and Sustainable Energy Reviews

<http://www.sciencedirect.com/science/journal/13640321>

Energy Conversion and Management

<http://www.journals.elsevier.com/energy-conversion-and-management/>

Applied Thermal Engineering

<http://www.journals.elsevier.com/applied-thermal-engineering/#description>

Energy Efficiency

<http://www.springer.com/engineering/energy+technology/journal/12053>

Resources Conservation & Recycling

<http://www.journals.elsevier.com/resources-conservation-and-recycling/>

World Cement

<http://www.worldcement.com/>



Information Gaps on Energy Efficiency Technologies for the Cement Industry

There are a number of areas where there are significant gaps either in the availability or the quality of information that is important for energy efficiency decisions in the cement industry. These are listed below.

An area where there is significant information scarcity is related to the cost of technology. Information on the capital cost as well as the operating and maintenance (O&M) cost is generally scarce. Even if the cost data could be obtained from a few case studies, it is hard to apply those cost data to the implementation of the energy efficient technology in other countries. Thus, despite its key importance, country-specific costs information usually is often not available.

In some cases, there is a lack of information on the energy saving that can be achieved by the implementation of certain technologies. In addition, for some technologies that can save both electricity and fuel, there is lack of information on the energy saving by energy type (electricity and fuel), separately. Because of the price differences between the electricity and fuel, having a disaggregated energy saving would be useful in the analytical studies.

In some cases, while performance information is available, there

is insufficient information on the boundaries and the specifics of the system where the technology is applied and the energy savings are calculated. This lack of clarity deteriorates the usefulness of information.

Another area where there are significant information gaps is the quantitative ancillary benefits achieved by the implementation of the technology. Non-energy benefits such as productivity benefits, water saving, material saving, product quality improvement, higher productivity, improved working condition, etc. are important factors in the investment decision making processes, but are seldom quantified.

Last, but not least, there is a scarcity of country-level penetration of the energy efficiency technologies.

Information on implementation and operation costs, achievable performance levels, and expected energy and non-energy benefits of technical options in particular contexts are key ingredients for industrial investment decisions as well as for policy analyses. Consequently, initiation or the facilitation of the efforts which can help fill the above-listed information gaps can play a significant role in catalyzing energy efficiency decisions and actions.



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