THE INDIAN CEMENT INDUSTRY - A PERSPECTIVE OF ENVIRONMENT FRIENDLINESS

Indian Cement Panorama

Indian cement industry, which is 84 years old, comprises 120 large cement plants besides some 300 mini plants, with a total installed capacity of about 118 million tonnes and a production of 98 million tonnes (1999), comprising ordinary portland cement, blended cements and others. In an industry in its ninth decade of existence, there is naturally a spread in the age, technology and capacities of the plants but this has steadily been sought to be narrowed down by renewal,modernisation and expansion. Consequently,nearly 91 percent of the plants are based on the dry process technology with suspension preheaters and precalcinators, and 51 plants are of annual capacity 1 million tonnes and over, many of them approaching international benchmarks in specific thermal and electrical energy consumptions.

Development versus Environment

The past decade has witnessed industries the world over redefine their goals and perspectives to make their operations socially more acceptable and resource-wise sustainable, even while retainin and reinforcing their identity as vehicles of economic growth and national development. This is the latest paradigm shift in the continuing polemics of developmental priorities versus environmental imperatives.

Preferred Pathways

The various means and methodologies towards reducing the impact of industry on resource use and environment are best summarised in 'Agenda 21', UNCED's (United Nations Conference on Environment and Development) widely quoted publication, issued at the end of the Earth Summit 1992, in which 170 countries participated. They comprise 'more efficient production processes, preventive strategies, cleaner production techniques and procedures throughout the product life cycle, thus minimising or avoiding wastes'. All of these have been appropriately adopted by Indian cement industry.

Progress - Problems - Solutions Triangle

Cement industry, in popular conception, is one that could be badly polluting. Such an impression a best is a hangover from the cement control regime and the period immediately following it but the situation has vastly improved in the last 15 years. The reasons for this are many. If the dry proces technology ushered in new highs in productivity in output, energy and fuel utilisation, it also entailed the handling of huge volumes of dry powdered materials like limestone, laterite, bauxite, hematite, gypsum, flyash, etc. This had led to the aggravation of the problem of environment with its impact not only on the employees working in the plant but also the community in the neighbourhood of 5-10 km radius. However, advances in dust control technolog like Electrostatic Precipitators (ESP) and Fabric Filters have facilitated the industry successfully grapple with the problem of particulate emissions, on the one hand, and increased efficiency of production resulting from conversion of waste emissions, adding to cement output. In addition, innovations like surface miners and electronic packing system have made their own contribution tc reducing dust nuisance.

The Legal Framework

Industrial operations in the country are subject to regulation through a plethora of legislations enacted from time to time. Important among the Acts which concern cement industry from the environmental viewpoint are:

* Air (Prevention & Control of Pollution) Act, 1986
* The Environmental (Protection) Act 1986
* Forest (Conservation) Act, 1980
* Water (Prevention & Control of Pollution) Cess Act, 1974
* Water (Prevention & Control of Pollution) Cess Act, 1977
* The Public Liability Insurance Act, 1991

Statutory Emission Limits

Pollution Control Boards have been set up by the Government, inter alia, to lay down, control and monitor the various requirements for protecting the environment from the adverse impacts of industrial and other human activity. Accordingly, the Central Pollution Control Board (CPCB) has laid down the following ambient air quality standards for Suspended Particulate Material (SPM) and gaseous emission concentrations.

Table 1
Ambient Air Quality Standards

Area Category	Concentration in ug/Nm^3 air			
	SPM	SO_2	CO	NOx
A: Industrial and Mixed	500	120	5000	120
B: Residential and Rural	200	80	2000	80
C: Sensitive	100	30	1000	30

The emission levels of SPM from cement plant stacks, are as below :

Plant Capacity, TPD	Upper Limit of SPM mg/Nm^3	
	Protected Area	Others
< 200	250	400
> 200	150	250
New Post-1993	115 (A P Only)	

Growing awareness of the problems of pollution and constantly improving technologies have led to progressively lower thresholds. For example, the Government has laid down a limit of 50 mg/Nm^3 for new plants which are now being built.

Elsewhere, these limits vary between a minimum of 50 mg/Nm^3 in some countries like Australia, Germany, Switzerland to about 100 mg/Nm^3 in Japan, South Africa and Portugal.

Monitoring Requirements

The current monitoring requirements for cement industry are summarised in Table 2 below :

Table 2
Monitoring Requirements for Cement Industry

		Frequency of

Plant capacity ,tpa	Ambient air quality	source emission monitoring
Less than 100,000 and including mini cement plants	Not required	Once in 8 weeks
100,000 up to 300,000	2 stations	Once in 4 weeks
300,000 up to 600,000	3 stations	Once in 2 weeks
600,000 and above	4 stations	Once in a week

Currently, manual stack monitoring kit is used for measurement of dust emissions from various stacks in the cement plants. Many plants are switching over to on-line continuous stack monitoring with data logging.

Dust Control Technologies

The type of dust collectors used in cement industry include settling chambers, cyclones and multicyclones, fabric filters and electrostatic precipitators (ESPs). Cyclones and multi-cyclones are used as precollectors while fabric filters and ESPs are the main dust collectors. The costs of investment and operation of bag houses exceed those of ESPs for a one-million-tonne cement plant. There are, however, a number of problems for the smooth running of ESPs, which are briefl discussed below.

Present Dust Emission Status

Although considerable effort has been put in by the cement industry to control particulate emissio with an investment of more than Rs. 1400 crore, the industry is well aware that more efforts are needed to consolidate this and further improve the situation.

A study conducted has shown that 92 per cent of stack emissions arise from kiln stack, 5 per cent from raw and cement mills, 1.5 per cent from coal mills and 0.9 per cent from packing plant.

Environmental Interface of Cement Manufacture

Cement manufacture involves two main areas of environmental concern, namely, dust pollution of the atmosphere and emission of Green House Gases (GHG), besides the ecological concern arising from the degradation of mined-out areas. A brief recapitulation of the nature and extent of these problems will be in order.

Cement industry does not generate any hazardous or toxic emissions or effluents which are injurious to health. On the contrary the industry absorbs a large volume of different agro-industria wastes such as flyash from thermal power stations, blast furnace slag from iron and steel industry chemical gypsum (phospho and fluoro gypsum) from fertiliser and chemical industries. Besides ric husk, bagasse, and to some extent diesel sludge are used by some plants. The extent of absorptio of such wastes by cement industry are given in Table 3.

Table 3

Waste absorption by Cement Industry in 1998-99

Waste	Quantum Consumed, Million tonnes
Flyash	9-0
Blast furnace slag	11
Granulated slag	04
Red mud	2.5
Waste gypsum	5.5
Lime sludge	6.5
Agro wastes	47

Dust Sources and Means of Abatement

Dust is generated through emissions, handling, spillage, leakages, jammings, etc at every stage o cement manufacture, starting with the quarrying of the major raw material limestone and ending with the packing and despatch of cement from the plant. The dust sources can be broadly divided into process related and fugitive sources:

Process related dust sources

*Drilling and blasting
*Crushing and grinding - Limestone, coal and clinker
*Kiln
*Clinker cooler

Fugitive dust sources

* Conveyor transfer points
* Open material stock piles
* Discharge from hoppers
* Leaking joints
* Raw material transport and handling through dumpers and pay loaders

Although the dust from all these operations is generally non-toxic, non-corrsive, non-inflammable, non-explposive and not hazardous, it does constitute, if not controlled, a nuisance within the plant and the surroundings. All modern cement plants have effective dust control measures through installation of suitable equipment. So much so, the industry has also achieved 100% compliance ir recent years and have become fully enviornmental friendly. This will be apparent from a comparison of the industry's performance in 1994 and 1999 as stated in the following table (Source, NCB and CPCB).

Year	Total No. of Plants	No. of plants surveyed	Plants complying	Plants partially not complying	Plants not complying
1994	106	106	82	20	4
1999	120	103	103	Nil	Nil

The sources and levels of emission before treatment and methods of dust suspension in different section of a cement plant are stated below:

Crushing

A preliminary operation for reducing the size of the run-of-the quarry material from 500-1000 mm to a size of about 15-16 mm, acceptable for raw meal grinding, crushing generates dust consisting of coarse particles to the extent of 5-15 g/Nm^3. The system for dedusting generally adopted here to draw off the air-borne dust through hoods and ducts into a dust collector by means of a fan operating downstream of the collector, which provides the necessary suction to draw off the air stream. Cyclone or bag filter is the type of dust collector mainly employed. The former are more economical but their efficiency is not high enough to meet the standards stiputated by the Pollutio Control Board.

Raw Mill

Raw mill grinds raw materials to a size up to 90 microns for being fed to the kiln. Ball mills or rolle mills are used for the purpose, the former being the choice where the raw materials are relatively dry, while roller mills achieve both drying and grinding, using kiln gases as sources of heat for drying. Bag type filter is used with ball mills, whereas electrostatic precipitator (ESP) functions as dust collector in the case of roller mill. In some cases, cyclones/multiclones are used as a pre-collector in order to reduce the load on the final dust collectors like bag filter or ESP

Kiln

Kiln exhaust gases constitute the major source of particulate matter in any cement plant. The burning process inside the kiln, the kiln's rotation, and the rapid flow of gases, cause the raw mea particles to become airborne. The kiln exhaust gases are normally vented out through tall stacks, after utilising their heat to the exent possible. It may however be mentioned that the pollutant mass flowing out of these stacks is far smaller compared to, say, thermal power plants, and the cement plants themselves rather scattered, to make the stack emissions significantly contribute to the regional air pollution. Since there are three types of processes viz., wet, dry and semi-dry, the dust collectors too vary accordingly.

(a) In the case of wet process kilns, the gas temperature is normally below 200° C, and the dust resistivity also moderate, ideal for the use of ESP. Use of dust settling chamber/cyclone is ruled ou as the exhaust from them can not meet the mandatory emission standards. Fabric filters also are unsuitable owing to condensation of gas and resultant clogging of the bags.

(b) In dry process kilns, exit gas temperature from suspension preheater is 330 to 360°C and the dust concentration is generally 50 - 75 g/Nm^3. The exit gases have to be cooled before they can b passed through any dust collector. When kiln gases are used for raw meal drying, cooling and humidification take place which result in ideal operating conditions for ESP, as the temperature drops below 200°C. Fabric filters can also be used after the gases have been cooled to a temperature of 230 - 250°C.

(c) In semi-dry process kilns, the exit gas conditions are suitable for ESP operation as the temperature is 100 - 150°C.

Plant size-wise, small plants, say up to 600 tpd, use heat exchanger (if necessitiated by dilution) and pulse-jet bag filter, whereas medium and large plants use ESP's with gas conditioning towers. The current trend in almost all new plants is to use reverse air bag houses with woven fibreglass fabric. However, since such fabric can not be used over high gas temperature of 260° C, the gas is cooled either by atmospheric air dilution or by radiant cooler.

The kiln (as well as cooler) ESP's are provided with electronic instruments called ESPMS (ESP Management System) and opacity meter at the chimney for constant monitoring of emission. EPMS continuously regulates the current and voltage of the ESP to keep the emission below the specified limits, on the basis of feedback signal from opacity meter. The combination of opacity meter and EPMS keeps the emission always below the specified limits with optimum power consumption.

Clinker Cooler

The clinker produced in the kiln is required to be cooled. Grate-type coolers require dust collection as only part of the hot air leaving the cooler is used as secondary air and the rest is vented to the atmosphere through a dust collector. The exit gases from grate coolers contain coarse particles and their temperature is about 200° C. The exhaust air from grate coolers is traditionally dedusted by means of cyclones or small diameter multiclones, which, however, do not dedust completely. For higher efficiency, three different types of dust collectors, viz., bag filters, gravel bed filters and ESP, are used. ESP has the advantages of a low pressure drop and low maintenance cost. Bag filters are also used having a high ratio pulse jet polyester as a fabric material, preceded by heat exchanger. Emission of cooler ESP is 40-65 mg/Nm^3.

Coal Mill

Coal mills grind raw coal to fine particles for use in the kiln. As coal contains moisture, hot air is used for drying it inside the mill itself. Coal mill gases are generally dedusted by installing bag filters or ESPs. The dust contents of the exhaust gases from the coal mill are in the range 25 - 60 g/Nm^3 and the dust is usually of a very fine nature.

Cement Mill

Like raw material grinding, cement grinding too generates considerable amount of dust. It is estimated that 7 - 10 per cent of cement is normally lost due to uncontrolled emissions from the cement mill. Ball mills, either with gravity discharge arrangement or air-swept type design, are used for grinding. The dust concentration after the mill is 50 to 100 g/Nm^3 for gravity discharge and 200 to 500 g/Nm^3 for air-swept mills. The exit temperature of gases leaving the mill is about 80 - 100°C. Two types of dust collectors are generally employed for dedusting vent gas/air from the cement mill, viz., bag filters and ESPs. Use of ESPs is more common in cases where internal water spray system is used for cooling. For external water spray cooling system, both bag filter and ESPs can be used.

Packing

In the packing area, dust from various dust generating points like hoppers, handling points, etc., is collected through proper hoods and ducted to a common dust collector. The dust concentration is usually 20 - 30 g/Nm^3. As the volumetric flow rate is low, fabric filters are generally preferred.

Fail-safe mechanisms

It is noteworthy that the ESP's and Bag dust collectors in most cement plants are interlocked with the main process equipment operation with the help of high tech instrumentation network. The respective pollution control equipment are switched in the auto-mode, no sooner the start command is given to the process equipment from the central control room. In case of cement mill and coal mill, the mill trips along with the ESP and can not be restarted without recharging the ESP. In case of tripping of the kiln ESP, owing to CO higher than 0.6 per cent, the ESP is interlocked to recharge in auto-mode after 1.5 minutes of controlling the CO level, and if it is not recharged within 15 minutes, the kiln automatically trips.

Annex-1 lists the types of pollution control equipment intalled in the various sections of select cement plants and the respective stack emission levels, where available.

Table 4 provides data on actual measurement of stack emission at 23 select plants :

Problems Faced in Operating Dust Collection Systems

Constraints faced by the cement industry in complying with the emission regulations could be classified as :

a. External ones like poor quality of coal and power, non-availability of spare parts, etc, which should be tackled at national level; and
b. Internal ones, such as problem of layout in retrofitting dust collector equipment in existing layout, non-availability of trained manpower, etc, which could be easily rectified by the plant management.

Table 4

Stack emissions (post treatment) as measured in a few cement plants

Process Section	**Kiln and raw mill**	**Cooler**	**Coal mill**	**Cement mill**	
Plants	mg/Nm^3	mg/Nm^3	mg/Nm^3	Gravity discharge mg/Nm^3	Airswept mg/Nm^3
Best Values	5.0	30	25	50	100
1.	12.4	112	138	134	-
2.	14.2	113	98	-	118
3.	12.5	135	110	128	-
4.	14.0	120	130	124	-
5.	12.6	72	122	118	-
6.	12.4	98	102	-	108
7.	14.2	102	124	-	111
8.	12.8	120	128	-	108
9.	13.2	118	134	122	-
10.	13.0	110	73	120	-
11.	14.8	103	110	112	-
12.	13.2	90	98	110	-
13.	14.4	102	122	112	-
14.	13.2	118	134	122	-
15.	13.0	110	73	120	-

16.	14.8	103	110	112	-
17.	13.2	90	98	110	-
18.	14.4	102	122	112	-
19.	10.8	68	88	-	-
20.	14.0	62	95	54	-
21.	11.8	79	76	-	-
22.	13.2	78	91	60	
23.	13.0	74	80	71	-

External Constraints

Poor quality coal - There is wide variation in the quality of coal received by the cement plants. The ash content varies from 22 to 45 per cent and the calorific value from 3000 and 5000 kcal/kg coal This leads to improper and ever changing combustion conditions, and proper control of air flow rat becomes difficult, thereby causing occasional high CO concentration in the exit gas which may cause explosion in ESP. Very often the CO concentration even exceeds the explosion limit of 0.4-0.6 per cent mainly owing to the poor and variable quality of coal; as a result, the ESP trips causing high dust emission. Feeding uniform quality coal to the kiln could be an answer to this. Th will be possible through stabilising coal supplies, such as coal washing and recourse to coal blending. Cement plants in one cluster in Central India are now in a position to obtain washed coal from the Dipika Coal Washery in Madhya Pradesh. As for coal blending, many cement plants are in the process of installing the necessary equipment.

Poor quality of power - For smooth operation of ESP, continuous and good quality power is the prime requisite. Long duration of low voltage, voltage and frequency glitches, unscheduled power cuts, etc. cause ESPs to trip resulting in higher emissions. It takes some time for Diesel Generatin sets/captive power units to be started and take over the combined load of the kiln and the ESPs.

Gaseous Pollutants

Gaseous pollutants are not a problem in cement industry, since the emission of such gases is prevented in the process itself. Four gases particularly are considered harmful, viz. carbon monoxide, NOx, sulphur dioxide, and hydrogen sulphide. Rotary kilns in India are found to emit such gases in traces only.

In developed countries, limits have already been prescribed for NOx and, SO_2 in the kiln stack . However, in India only two states, namely, Meghalaya and Gujarat have done this. CPCB is reported to be contemplating to fix the emission limits for SO_2 and NOx.

Noise Pollution

In cement plants, noise is generated by various machinery, such as crushers, grinding mills, fans, blowers, compressors, conveyors. The noise levels emitted in cement plants is known to vary in general from 70 to 118 dB (decibels). The standards for noise levels prescribed for Indian industry are 40 to 75 dB.

Cement Industry and Green house Gas (GHG) Emissions

Concern has been mounting the world over on the increasing emission of GHG's, such as CO_2 and methane owing to its implication for global climate. India's CO_2 emission is a little below 1000 MT per year (1995) which is still negligible on a per-capita basis compared to many developed countries. Cement industry's emission of CO_2 is next only to thermal power plants (coal based). Cement kilns burn coal and limestone both of which generate CO_2. And then indirect emissions result from the use of electricity if fossil fuels had been used for its generation. The approximate contributions of each of the CO_2 sources are :

Calcination 50 - 55%
Fuel combustion 40 - 50%
Electricity 0 -10%

Total CO_2 emissions per tonne of cement (assuming a 0.95 : 1 clinker to cement ratio) ranges about from 0.85 to 1.15 tonne, say one tonne. Table 5 gives the CO_2 emission level in some energ efficient plants.

Table 5

CO_2 Emission values of some energy efficient cement plants

Plant No.	Location	Capacity MTPA (TPD)	Production MTPA (1998-99)	Specific heat consumption kcal/kg	Specific power consumption kWh/ clinker cement	Suspended particulate material (SPM)* mg/ tonne of Nm^3	CO_2 Emission during the year MT	CO_2 Emission/ tonne of cement
1.	Rajasthan	0.825 (2500)	0.884	720.5	105.6	80.6	0.728	0.82
2.	Gujarat	1.06 (3200)	0.651	735	105.8	119.6	0.504	0.775
3.	Madhya Pradesh	2.05 (6225)	1.64	780	92.5	127.5	1.412	0.86
4.	Madhya Pradesh	2.33 (7050)	1.93	706	105.5	86.2	1.352	0.70
5.	Rajasthan	1.95 (5900)	1.29	728.5	80.0	124.5	1.054	0.812
6.	TamilNadu	0.89 (2700)	0.76	832	110.6	110.0	0.587	0.77

*Prescribed limit 150 mg/Nm^3

Limiting CO_2 emissions

Though there is no obligation on the Indian cement industry to limit these emissions at present, in the long term interests of the planet, the industry is voluntarily moving to an eco-efficient system. The measures in this regard fall broadly under Process modification and Product modification.

Process modification measures include substitution of coal by lower carbon fuels like lignite and natural gas, use of washed coal, improved kilns, multiple-stage preheater, precalciners, cogeneration, etc. Many cement plants in the south are already using lignite as part substiute of coal, while a start has been made in the use of washed coal by cement plants in Central India. One cement plant is reported to have put up its cogeneration plant. Use of renewable sources of energy like solar, wind energy also come under this category. Four cement plants in the South already have installed a total of 80.25 MW in their wind farms which feed their output into the grid. Noteworthy of mention is afforestation and planting of trees in the plants' environs by many cement plants; these act like a "sink" for GHG's.

Product modification, on the other hand, includes blended cement manufacture and increased use of pozzolana in concrete. This is recognised as the most cost effective emission reduction method. Each tonne of pozzolana or cementitious material used reduces CO_2 emissions by one tonne. It is worthwhile mentioning that blended cements account for nearly 30 per cent of Indian cement industry's total output, which figure is bound to go up in future with the increasing awareness of the merits of blended cements in concrete construction.

Mines and Mining area

In the cement industry, limestone mining area is spread over 600 to 1000 acres of land and regularly subjected to various operations like drilling, blasting, crushing of limestone and movement of heavy earth moving equipment in the area. These operations result in heavy dust emission, and unless preventive measures are taken, they adversely affect productivity of mining. In order to develop Environment Tailored Mine (ETM), the mines area are classified as : Used Mine Area, Effective Mining Area, Planned Mining Area, Future Mining Area. The reclamation measures practised here comprise -

* Refilling of mine pits with overburden, and plantation of trees like Babul, Botigainvillea, Cadamba, etc.
* Fruit gardens in unutilized areas and refilled areas and fishponds to beautify the area
* Fountains
* Green grass landscape with flower plants and waterfall arrangements.

Indeed, more than 15 million trees have been planted in the mined-out areas of the plants. Rajashree Cement, Adityanagar, Karnataka, is one of the plants who have adopted this activity as mission.

While the foregoing measures mitigate the ecological damage resulting from conventional limeston mining, surface miners promise a totally environment friendly alternative by eliminating drilling, blasting and primary crushing, all of which cause heavy dust emission. Surface miners are successfully operating in three cement plants. However only soft type deposits can be worked with surface miners.

The exemplary measures of ecological conservation adopted by cement plants in their limestone mines have received repeated acclamation from institutions like Indian Bureau of Mines. The awards made in this regard recognise the achievements in distinct departments of conservation, such as reclamation, rehabilitation and waste dump management; afforestation and utilisation of topsoil, and protective measures for control of air, water and noise pollution. Annexe 2 lists top awards won in recent years by various cement plants.

Environmental Impact Assessment and Environmental Audit

It is a statutory requirement to have environmental impact assessment (EIA) study carried out for any green-field project or expansion of existing plants and the necessary clearance from the Ministry of Envronment and Forests are required to be obtained.

It is also a statutory requirement to conduct environmental audits for existing plants once a year and submit the environmental statement to the concerned State Pollution Control Board.

Training and Development

The proper use and maintenance of the array of ESP's and bag filters installed in cement plants is no less demanding than the operation and maintenance of main line cement plant and machinery. Indeed, smooth operation of environmental management systems (EMS) has come into its own as a distinct discipline, as will testify the ISO 14000 standards. So much so, training of personnel in this area has become a priority activity for Indian cement industry. This role is eminently being fulfilled by the Regional Training Centres for cement industry, founded under the DANIDA project. Earlier, in 1996, ACC on its own, organised a 10-month residential training programme in IIT Mumbai, specially tailored to cement industry's needs. The 10 engineers so trained are now in charge of environmental management in ACC's plants.

Environmental Management Systems and ISO 14000

Recently introduced Environmental Management Systems (EMS) certification is a mechanism by which cement companies can acquire the label of environmentally sound enterprises and also derive the benefits of improved performance. The EMS does not lay down specific environmental performance criteria but requires an organisation to formulate policies and objectives, taking into account information about significant environmental effects for continual improvement. Many cement plants have already introduced EMS and the following 17 plants have so far secured ISO 14001 Certification while five more are known to be in the process of doing so.

(i) Lafarge, MP
(ii) Vikram Cement
(iii) Binani Cement
(iv) Rajashree Cement, Malkhed
(v) Grasim Cement, Raipur
(vi) Century Cement
(vii) Orient Cement
(viii) Gujarat Ambuja Cement
(ix) ACC, Gagal
(x) ACC Madukkarai
(xi) ACC, Kymore
(xii) ACC, Jarnul
(xiii) JK Cement, Nimbahera
(xiv) Satna Cement,& Biria Vikas, Satna
(xv) Aditya Cement
(xvi) Biria Super Cement, Hotgi
(xvii) Reymond Ltd., Cement Div.

Recognition and Awards for Excellence

For promoting competitive improvement in environmental conservation and pollution control amongst all manufacturing industries, awards are given by state as well as non-government organisations. Noteworthy amongst these won by cement units are the World Environment Forum' Golden Peocock Environmental Award, FICCI's Award for Corporate Initiative in Environment Conservation & Pollution Control and the National Award for Prevention of Pollution. Lately, the Tata Energy Research Institute (TERI) has started an eco rating scheme for manufacturing industries. Cinder this, one cement plant has been awarded the Gold-Eco-Star status in recognitio of its facilities adjudged to be conforming to national and international benchmarks.

From Eco-friendliness to Eco-efficiency

Just as any dynamic concept grows into newer dimensions, so has cement industry's eco-friendliness led on to eco-efficiency. If producing a commodity without harming ecology is eco-friendliness, optimising the inputs for the purpose becomes eco-efficiency. Which is best exemplified by the utilisation of pozzolanas, slags with its twin advantage of lower limestone consumption owing to partial substitution of clinker by the cementing materials, and conservation of thermal energy corresponding to the clinker so substituted. There is then the spin-off in the valorisation of the wastes like fly ash whose dumping and satisfactory disposal would otherwise require ever increasing land area and resources.

Indian cement industry consumes an estimated 3.3 million tonnes of fly ash and around 3 million tonnes slag for making blended cements. However, seeing that a total of 25 MT fly ash is generated at 75 thermal power stations (which may cross the million-tonne mark by 2001 requirin 50,000 acres of land for its disposal), the recent enhancement in the limit for pozzolonic materials in the Indian Standard for cement will enable the industry to absorb more fly ash. Likewise, the steel plants in the country generate around 11 MT of slag out of which the cement industry currently uses around 3.3 MT, a 30 per cent. Here again relaxation of the upper limit beyond 55 per cent by BIS would provide the only means for greater slag utilisation in this sector.

The industry's foray into wind farms merits special mention as a pioneering endeavour in eco-efficiency. Four cement plants, by installing a total of 80-25 MW capacity of wind power, have clearly given a lead to the rest of the industries in tapping this form of energy which is at once nor polluting and renewable too.

Improvement through TPM, Benchmarking

The concept of Total Productive Maintenance (TPM) has gained a definite foothold in operations at the progressive plants. This practice of looking at productivity from the Japanese Management viewpoint, e.g. Kaizens or incremental improvement, has yielded significant results in employee involvement in the improvement of the plant. In some plants, certain projects of environment protection and improvement are included under small group activity (SGA) of TPM which are carried out by involving all the people at the plant.

Cement Manufacturers' Association (CMA) has taken up a project for Productivity and Energy Efficiency Improvement through Benchmarking and Rating in Indian Cement Industry. Undertaken jointly with USAID and the International Resources Group (IRG), the first phase (Pilot Phase) of th project was completed in September 1999. Eight cement plants belonging to 6 companies participated in the pilot phase. A computer model has been developed, based on the data from the 8 plants, which can evaluate and benchmark a plant's energy and environmental performance. The model provides an effective tool for analysing the overall performance and management practices in a plant. In the II Phase of the project already launched, 20 other plants are being involved. This will enable further improve and refine the computer model for wider application in the entire sector.

CO_2 Emissions in the Global context

Global concern over climate change has led to newer concepts like 'Clean Development Mechanisms' (CDM) and 'Emission Trading' (ET) or carbon trading. These are special vehicles for providing access to financial resources from developed countries for helping developing countries adopt cleaner technologies with lower CO_2 emissions. CMA's aforementioned Benchmarking Projec will help identify areas for which CDM-based projects can be designed for the cement sector in general and individual units as necessary. In other words, technological improvement can be undertaken in cement plants through CDM/ET. Meanwhile, the operational framework for CDM is under elaboration through international debates. The computer models for benchmarking and performance analysis/evaluation being developed/refined will greatly aid in designing CDM-based Clean Technology Projects.

Indian Cement Industry, An Exemplar in Environment Friendliness

Care, concern and commitment have characterised Indian cement Industry's attitude towards the community and the nation at large whom it has endeavoured to serve best at all times. Competence now adds to these the way it has addressed with alacrity the environmental and ecological challenges. The panoply of measures adopted for the purpose range from alleviation of environmental stress through conservation and protection of the environment, on the one hand, tc a pro-active contribution to the restoration and regeneration of the environment, on the other. Which may be said to anticipate the new millennium's corporate environmental strategy under which "Environmental performance is not just a legal requirement, moral imperative or even cost (doing business but a part of surviving in a competitive world economy, and that companies neede(to recognise long term economic growth that was environmentally sustainable."

Acknowledgements

The technical information and data supplied by the following 16 cement companies is gratefully acknowledged.

1. The ACC Ltd
2. Satna Cement Works and Biria Vikas Cement
3. Gujarat Ambuja Cements Ltd.
4. Lakshmi Cement
5. Saurashtra Cement Ltd
6. Century Cement, Baikunth
7. Diamond Cement, Damoh
8. OCL India Ltd.
9. Shree Cement Ltd.
10. Biria Cement Works and Chittor Cement Works
11. Kanoria Industries Ltd
12. Manikgarh Cement
13. Cement Corporation of India Ltd
14. Durgapur Cement Works
15. Prism Cement Ltd
16. Narmada Cement Co. Ltd

References

1. A.L. Kapur, Keynote Address, IDBI Seminar on Energy Efficiency and Environmental Management, Hyderabad, 11th April 1998
2. R. Partha Sarathy, Panel Discussion, IDBI Seminar on Energy Efficiency and Environmental Management, Hyderabad, 11th April 1998
3. K. Nagender Rao, Green Productivity: The Case of Cement Industry, Productivity, Jan-Mar.1997
4. S.J. Joshi, Air Pollution Control in Cement Industry, Indian Cement Review, June 1999
5. Michael Nishet, A Source of Competitive Advantage ? World Cement. March 1999.

Source: Cement Manufacturers' Association