7 Environmental Performance

ACC has been a trendsetter in the industry in respect of its environment protection practices. There is evidence to show that quarry rehabilitation, tree plantation, afforestation, water management, pollution control and utilization of wastes were practiced many decades ago.

The Company installed pollution control equipment in its cement plants more than forty years ago. Today each of our plants has state-of-the art pollution control systems designed by the in-house pollution control equipment design team. These systems are capable of keeping emissions well below the statutory levels. All our plants conform to ISO 14001 Certification.

The environment management organization has been strengthened at the corporate as well as plant level. The Environment and Energy Conservation Cell was formed in September 2007 with a clear road map to pursue emission and energy reduction. Earlier these functions were organised differently. Many projects are under implementation to control fugitive emissions and particulate emissions. A large group of 70 environment engineers are deployed across the Company with separate teams for environment related R&D, design and installation of equipment at the central level and separate engineers overseeing maintenance and operation at each plant.

With rampant energy shortages in India, ACC is engaged in making regular modifications in process and technology to adapt to best practices in energy savings on the usage of conventional energy and fuel sources. Efforts are on to seek viable renewable energy and non-fossil fuel sources. The Company made its first foray into Wind energy in 2007.

ACC was first in the country to utilize waste by-products from other industries and deploy them gainfully to manufacture cement. These included blast furnace slag and calcium carbonate sludge from steel and fertilizer industries. The Company led the promotion of Fly ash based cement, which used fly ash, generated as a waste pollutant in thermal power industries. These efforts played an important role in redefining what were once waste pollutants into raw materials compatible for the manufacture of cement.

The Company's Alternate Fuel and Raw Materials (AFR) business was established in 2005 with fuel risk abatement as its prime objective. The department actively promotes the use of alternate fuel and raw materials to reduce dependence on conventional fossil fuels and help in mineral resource conservation. The AFR business offers comprehensive waste management services based on the principle of co-processing the waste in cement kilns. A full fledged research laboratory has been set up for the purpose. Large plantations of Jatropha, Castor and Subabul trees are being laid on barren and wastelands at most of our plants for bio-mass generation to serve as replacement fuel.

Our other environmental initiatives include conservation of natural resources like limestone through cleaner mining operations, quarry rehabilitation, water management and green belt development.

There are regular training and awareness generation programmes on Environment Management, Equipment Operations & Maintenance, Occupational Health & Safety and Waste Management. World Environment Day, Mines Environment & Mines Safety Week are observed with dedication.

Details of raw materials consumed

Raw material	Unit	2007 Quantity	2006 Quantity
Slag	Million Tonnes	1.858	1.751
Gypsum	Million Tonnes	1.075	0.982
Fly Ash	Million Tonnes	3.538	2.992

7.1 Energy

Cement manufacture is an energy intensive process consuming both electrical and thermal energies. Energy constitutes about 15% of our costs. In 2007, we purchased 31% of our electricity requirement while as much as 69% was produced through captive power plants. The company has 225 MW of captive power generating capacity of which 184 MW is thermal while the remaining is mainly liquid fuel based. There are projects under implantation to install 130 MW of thermal based captive power generation capacity.

The global warming challenge is of deep and immediate concern. ACC has constituted a renewable energy division within its Power Management Group. Its first major initiative was to establish a state-of-the-art wind power project in Tamil Nadu to provide an environmentally sustainable energy input to our Madukkarai Plant. The wind farm, commissioned in late 2007, has already generated about 12 million units of green carbon free energy. The Company is exploring other viable opportunities for wind power and has received approval for a wind power project in Rajasthan.

Going forward, the Company aims to pursue other sources of non-conventional green energy such as wind power, waste heat recovery, solar PV energy, solar thermal energy and mini hydel power and build them as sustainable business models through the Clean Development Mechanism. Thus in states where wind farm availability is limited, we are looking at sourcing possibilities from hydel power projects. We have waste heat recovery projects under examination in our Gagal plant in Himachal Pradesh and Kymore Plant in Madhya Pradesh.

We now have a policy of using renewable energy to a specified extent at all our newly built environments such as office buildings, control rooms and residential colonies. Cement House which houses the corporate office in Mumbai is undergoing refurbishment to make it an energy efficient building.

Energy Consumption

	2007	2006
Fuel Consumption (million Tonnes / annum for Cement Production)	2.40	2.57
Coal for onsite power generation (million Tonnes / annum)	1.49	1.38
Process Power consumption (KWH/ tonne of Cementitious material)	89	88
Total Power Consumption (KWH/tonne of Cementitious material) including Colony	94.71	96.26
Specific thermal energy consumption (GJ/tonne of Clinker)	3.14	3.07

7.2 Case Study: Energy Efficiency

Several initiatives and projects have been implemented to optimize the performance of various equipment so as to achieve optimum utilization of electrical and thermal energy. This has helped in reducing power consumption of all ACC Plants including colony power consumption. The average specific energy consumption has reduced from 113 KWH/tonne to 94.71 KWH/ tonne of cementitous material in the last 7 years.

Salient initiatives are listed below:

1. **Mines & Crusher** – Improving the efficiency of dewatering Pumps at Kymore mines and the installation of tertiary crusher at Kymore, and Chanda. Installation of secondary and tertiary crusher at Gagal.

2. **VRM Section –** The output of the vertical roller mill (VRM) at Gagal was increased from design levels of 220 TPH to 360 TPH in a phased manner by
   - Change in separator from Polysius to LNV separator
   - Increase in VRM gear Box speed from 24 RPM to 27 RPM
   - Installation of Hybrid ball mill to grind limestone from separator rejects
   - Conversion of screw feeding system to belt feeding system.

3. **Process** - Major process changes were carried out at Chaibasa and Lakheri plants from wet to dry process and at Madukkarai from wet to semi-dry process. This has resulted in substantial reduction in thermal energy consumption with a marginal increase in electrical energy consumption.

4. **Kiln Section**
   - Improvement of Kiln Burners at Gagal, Bargarh and Lakheri plants.
   - Installation of high efficiency seals at discharge end of Kilns at Lakheri, Chanda and Bargarh.
   - Increased utilization of alternate fuels at Lakheri, Gagal and Madukkarai
   - Addition of new pre-heater stream at Lakheri and Gagal
   - Addition of pre-heater stage at Gagal and Jamul

5. **Cement Mills**
   - Installation of pre-grinders for cement mills at Gagal, Chanda & Tikaria
   - Improvement in mill output by modified liners and close circuiting of Mills at Chaibasa, Chanda, Sindri.
   - Replacement of pneumatic conveying system by mechanical conveyor at Madukkarai, Chanda, Tikaria, Jamul and Gagal.
   - Grinding media pattern optimization at Tikaria.
   - Increased fineness of VRM product by reducing Mogen Sensizer finer screen at Tikaria.
   - Installation of new cement mills of higher capacity at Gagal, Kymore, Lakheri and Chaibasa

6. **Cooler** - Improving grate cooler performance at Bargarh, Chaibasa, Lakheri and Kymore Kiln and installation of new grate cooler at Gagal

7. **Packing Plant -** New packers installed at Sindri, Wadi and Gagal.

8. **Coal Mill -** Replacement of coal mill grit separators with dynamic separators at Chanda and Jamul.

7.3 Atmospheric Emissions Control

Sophisticated pollution control equipment and devices and a well equipped environmental laboratory provided at each plant help in the monitoring and measurement of environmental parameters. All our plants are certified with EMS (Environment Management System) – ISO 14001:2004. Internal audits, surveillance audits and reviews are carried out regularly.

Baseline Monitoring

ACC is making substantial investments to monitor and measure the environmental performance of its plants in terms of emissions termed as baseline monitoring. The result of this monitoring provides emission values using conventional fuel and acts as a reference for evaluating the incremental change in emission from the usage of alternate fuels. The activity will also serve to demonstrate to our stake holders the changes in the emission behaviour of the kiln system on account of the usage of AFR.

So far we have conducted base line monitoring in four plants using the services of SGS India, a third party agency certified by the Central Pollution Control Board. Emission parameters that were measured in this exercise are dust, SO_2, HCl, NH_3, H_2O, CO, O_2, Benzene, Mercury, Heavy Metals (Sb, As, Cd, Cr, Co, Cu, Pb, Mn, Ni, Tl, V); Dioxins / Furans (PCDD / PCDF) and Total Organic Compounds.

Continuous Emission Monitoring Systems

Continuous Emission Monitoring System (CEMS) are being installed at all our plants in a phased manner to facilitate continuous monitoring of emissions and ensure environment compliance within the standards. These systems would also allow online monitoring of the associated emissions from co-processing wastes and indicate whether each type of industrial waste used is viable and environment friendly material. The first CEMS is expected to be operational in 2008.

Monthly CO_2 Reporting

Cement industry is among the major emitters of greenhouse gases. Acknowledging this fact, ACC has started reporting the CO_2 emissions from clinker and cement production activities. Gross CO_2 emissions and Net CO_2 emissions is calculated for the company as a whole using data provided by each individual cement plant. The calculation principles and guidelines are based on the Cement CO_2 Protocol developed by the Cement Sustainability Initiative (CSI) of the World Business Council for Sustainable Development (WBCSD). Absolute Gross CO_2 Emissions, Absolute Net CO_2 Emissions, Specific Gross CO_2 Emissions and Specific Net CO_2 Emissions are also calculated for the entire Company.

Atmospheric Emissions

Average specific concentration(g/tonne of cementitious material)

Parameter	2007	2006
NO_x	929.51	Not measured
SO_2	105.06	Not measured
NH_3	1.50	Not measured
Dust	95.12	115.55
Organics	6.53	Not measured
Mercury	0.02	Not measured
Chromium	0.02	Not measured
Dioxins / furans (ngTEQ/Nm^3)	0.003-0.015	Not measured

Note: In India load based standards i.e. g/tonne of cementitious material are still under development, hence there are no standard values for comparison.

CO_2 Emission (Including on-site power generation)

		2007	2006	2005	1990
Absolute gross emissions	Million Tonnes CO_2	13.56	12.80	12.20	5.76
Absolute net emissions	Million Tonnes CO_2	13.56	12.80	12.20	5.76
Specific gross emissions	Kg CO_2 / Tonne Cementitious materials	681	680.00	704	854
Specific net emissions	Kg CO_2 / Tonne Cementitious materials	681	680.00	704	854

CO_2 Emission (Excluding on-site power generation)

		2007	2006	2005	1990
Absolute gross emissions	Million Tonnes CO_2	11.57	10.99	10.4	5.32
Absolute net emissions	Million Tonnes CO_2	11.57	10.99	10.4	5.32
Specific gross emissions	Kg CO_2 / Tonne Cementitious materials	581.00	584.00	586	772
Specific net emissions	Kg CO_2 / Tonne Cementitious materials	581.00	584.00	586	772

7.4 Case Study: Dust Control

ACC has a mix of cement plants that has modern plants as well as those using older technology namely wet, semi dry, long dry kilns and four stage suspension preheater kilns. Over time, when changes took place in cement manufacturing technology, plant and equipment capacities were progressively upgraded. Most of the dust emission control equipment which were installed in the early 1980's to achieve outlet emissions of 150 to 250 mg./Nm^3 became inadequate to handle higher plant capacity and lower emission standards. This necessitated upgradation of the old pollution control equipment, which was not a simple task. Plant layouts posed a constraint in some cases while there were few if any reliable pollution control equipment suppliers willing to take up such complex retrofit projects.

ACC then decided to set up its own facility for retrofitting and up gradation of this equipment in 1993 at its Thane complex in collaboration with Hamon Research Cottrell, USA. This included a full fledged fluid dynamics laboratory, the first in the Indian cement industry, for carrying out physical gas flow model studies for different equipment. Over the years, most of the equipment were continuously upgraded to meet local statutory emission norms. Apart from upgrading and installing pollution control equipment for ACC, the division also took up consultancy, supply and erection jobs for clients from various industries in India and overseas. In fact ACC gained significant recognition for excellent services rendered. This activity had to be curtailed to cater to increased requirement of retrofitting and supply of pollution control equipment to the company's own plants which were undergoing expansion.

As part of the plan to meet stringent emission standards, the company decided to convert 2 to 3 stage field Electrostatic precipitators (ESP) to Bag Houses which are more efficient in dust control than ESPs. Dust emission control equipments for all our cement plants and captive power plant are designed and upgraded so as to achieve emissions well below statutory norms as well as our internal standards. Some recent case studies where dust emissions were brought down are given here.

Wadi: Conversion of Kiln ESP to Bag House:

Two Kiln ESPs of 1200 TPD were designed for capacity and emission level of 150 mg/Nm^3 whereas they needed to be restricted to less than 30 mg/Nm^3. Both ESPs were converted to Bag Houses with state-of-the-art filter media using pulse jet cleaning system. After successful conversion, the measured emission values were 3.6 mg/Nm^3 & 1.55 mg/Nm^3 for Kilns 1 & 2 respectively, well below the designed value of 30 mg/Nm^3.

Bargarh: Clinker Cooler ESP retrofit and ESP conversion

The existing 3-field ESP supplied by Flakt India was designed to handle clinker cooler gases with a view to achieve dust emission level of 150 mg/Nm^3. Subsequently, flue gases from slag grinding circuit were also introduced into the same ESP. The equipment could not cope with slag dust and a substantial increase in gas volumes. As a result dust emission increased beyond 800 mg/Nm^3.

An independent Bag Filter was installed for the slag grinding circuit and these gases were delinked from the ESP. The ESP internals were retrofitted with new discharge electrodes and an additional field was provided at its inlet. The dust conveying system was also refurbished. The job was completed successfully and emission levels dropped to less than 16.4 mg/Nm^3.

To provide better environmental conditions, it was decided to convert the ESP to a Pulse Jet Bag House. The conversion project successfully brought down dust emission levels to 1.9 mg/Nm^3 against the design level of 30 mg/Nm^3.

7.5 Mineral Components & Blended Cements

ACC has successfully demonstrated re-channeling the use of industrial wastes such as fly ash and slag to make premium quality blended cements. Today it is the largest producer of blended cements in the country, offering two varieties of blended cements namely; Fly-ash based Portland Pozzolana Cement and Portland Slag Cement. Fly Ash is generated as a waste by Thermal Power Plants, while Slag is a waste by-product from steel plants.

Fly-ash based Portland Pozzolana Cement (PPC) is made by intergrinding high strength clinker with processed fly ash. This imparts a greater degree of fineness to the cement and improved workability properties while mixing. Concrete made of this cement is more corrosion resistant and impermeable which together provide better long-term strength and durability of structures.

Portland Slag Cement (PSC) is manufactured by blending and inter-grinding OPC clinker and granulated slag in suitable proportions as per approved norms of consistent quality. Portland Slag cement imparts strength and durability to all structures. PSC has many superior performance characteristics which give it certain extra advantages when compared to Ordinary Portland Cement

The manufacture of blended cements using pollutant industrial wastes is among the most publicly recognized eco-friendly practices demonstrated by the cement industry. ACC has been a trend-setter in the industry in this respect with as much as 85 % of its total production comprising these environment friendly 'green' cements. Following our lead, the share of blended cements in total production has been growing steadily in the last few years. Blended cements involve less combustion and hence less emissions. The use of these materials to make value-added cements is acknowledged as serving many benefits –conservation of limestone (a precious mineral), energy conservation, recycling of pollutant industrial wastes and reduction of greenhouse gases.

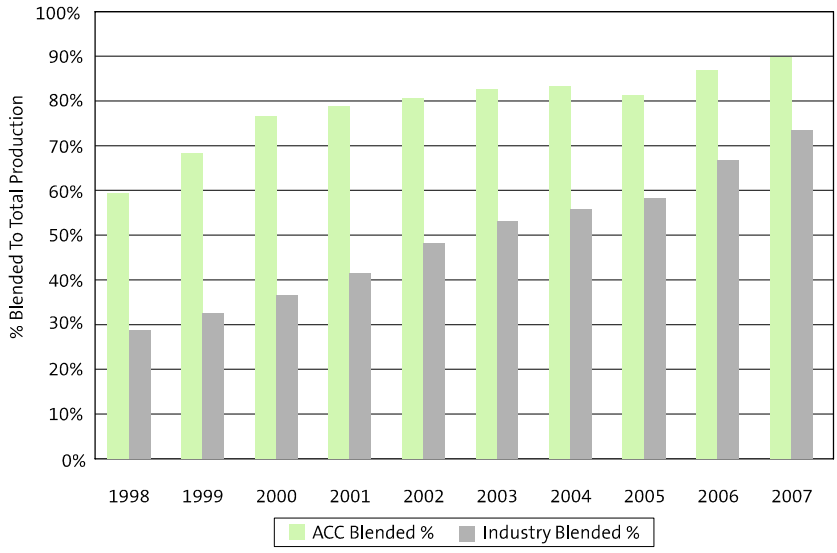
Clinker Factor: ACC has been able to reduce the clinker factor to 67.58% by utilizing other compatible industrial wastes like blast furnace slag and fly ash.

Mineral Component and Clinker Factor

	2007	2006
Clinker factor (%)	67.58	69.43
Blast Furnace Slag consumption (Million Tonnes / annum)	1.86	1.75
Coal fly ash consumption (Million Tonnes / annum)	3.54	2.99

In 2006, the company was felicitated by three ministries of the Government of India (Power, Environment & Forests and Science & Technology) for registering the country's highest utilization of fly-ash.

Graph showing trend in blended cement production



7.6 Waste Management Services

ACC has embarked wholeheartedly on a trend setting path of promoting the use of Alternate Fuel and Raw Materials. The AFR team offers total solutions for waste management including testing based on co-processing. This is an environmentally sound technology to avert environment damage cost, threats to human health and other risks and liabilities. It is a new concept for Indian industry.

Co-processing refers to the use/disposal of waste materials in industrial processes as alternative fuels and raw materials to recover energy and material value from them, if any. Co-processing of hazardous wastes in existing cement kilns provides a simple, sustainable, local and immediate solution to the problem of disposing hazardous wastes without affecting the environment, and without huge investments. Co-processing is indeed a more environmentally sustainable method of waste disposal as compared to the conventional methods of land filling and incineration because it involves reduced emissions and there is no resultant residue from it.

ACC now extends co-processing services in the country as a safe and environment-friendly method for management of wastes to industry and society. We are capable of accepting not only those wastes which have some raw material or fuel value, but also other wastes which are difficult to handle and dispose. All types of wastes can be effectively disposed off in this way without any harmful emissions, due to the high temperature and long residence time of the material in cement kilns. An efficient cement kiln can thus provide an environmentally sound and cost-effective recovery or disposal option for most wastes including hazardous and non-hazardous ones but excluding banned wastes. These banned wastes comprise anatomical hospital wastes, asbestos-containing wastes, bio-hazardous wastes, electronic scrap, entire batteries, explosives, high concentration cyanide waste, mineral acids, radioactive wastes and unsorted municipal garbage.

AFR Policy

ACC's Vision for AFR Business is to be the most respectable service provider to the waste generators in India. The company has an AFR Policy that governs its behaviour and operations in co-processing various kinds of wastes in cement kilns. In order to comply with the principles listed in the policy as also to provide better services to our customers, ACC is setting up essential infrastructure and facilities including ISO 17025 certified AFR testing laboratories for speedy and accurate evaluation of wastes, continuous emission monitoring systems on kiln stacks, waste specific feeding arrangements and pre-processing platforms at different locations.

Total Solutions

In order to provide our customers with long term solutions for their entire waste disposal problem, we enter into long term legal contracts with them which cover all aspects of service provision. Special attention is paid to Occupational Health and Safety. Management and employees are trained in handling and processing of wastes. Risk Assessment Procedure (RAP) and Crisis Management Plan (CMP) documents are formulated for different streams of wastes after joint discussion with the safety personnel at both ends. All findings and developments of co-processing are well documented and transparently communicated to all stakeholders.

Stakeholder Meets

The ACC-AFR team has organized regional stakeholder meets in different parts of the country in association with Ambuja Cement Limited, Holcim, GTZ, Central and State Pollution Control Boards. Representatives from leading industries and various cement plants have participated in the events and speakers from various eminent organizations like GTZ, Holcim, CMA, NCBM, Ramky, CPCB & SPCB have shared their experience of hazardous waste management at these forums. In 2006 two stakeholder meets were held at New Delhi and Jaipur. Subsequently two more stakeholder meets were organized at Bangalore and Ahmedabad in 2007.

New Initiatives

The following are some highlights of the initiatives taken by the AFR team in 2007:

- A national level agreement with a leading company in fast moving consumer goods business to dispose of their expired products at ACC's Kymore plant in Madhya Pradesh.
- Madhya Pradesh Pollution Control Board was the first to grant permission to ACC Kymore works for the trial burn of ETP sludge and poly residue waste at Kymore Works. In order to demonstrate the safe and environment friendly disposal of these waste materials to various stakeholders ACC undertook a successful co-processing trial with these materials.
- Memorandum of Understanding (MoU) with Indian Centre for Plastics in the Environment (ICPE) for Joint Industrial Research Project on Co-processing of Plastics Waste as Alternate Fuel in Cement Kilns.
- The Wadi plant in Karnataka successfully disposed of an entire generation of spent activated carbon from a reputed refinery.
- Long term agreements finalized with a premier multinational automobile group in Karnataka. Long term agreements have also been signed with leading food and beverages manufacturing, pharmaceutical and machinery manufacturing companies.
- The Madukkarai plant in Tamil Nadu safely disposed an entire generation of calcium fluoride sludge, a hazardous waste from fertilizer industry.

Other achievements

The State Pollution Control Boards of Orissa, Rajasthan and Himachal Pradesh have invited ACC to provide them support for management of hazardous waste in

their states. The company has posted a number of issues in the Draft Hazardous Materials (Management, Handling and Trans-boundary Movement) Rules, 2007 as inclusion of the definition of co-processing in the rules, acceptance of co-processing as a waste management solution, etc. The draft was rigorously analyzed and the concerns were submitted to the Ministry of Environment and Forests and represented through Federation of Indian Chambers of Commerce and Industry (FICCI), Confederation of Indian Industry (CII) and Cement Manufacturers' Association of India (CMA).

The AFR team is represented on the Technical Team of India's 11th Five Year Plan, which will consider AFR as a national initiative. The team is working in association with GTZ and Pollution Control Board for formulating guidelines for obtaining TSDF status for cement kilns.

Testing facilities

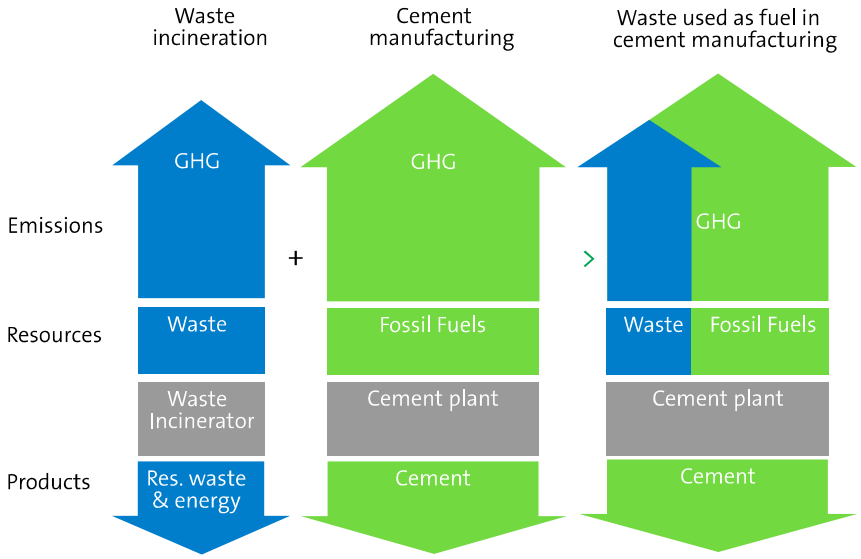
ACC is setting up ISO 17025 certified AFR testing laboratories at its Wadi, Madukkarai and Kymore plants and at the Technical Support Services in Thane- near Mumbai, for prompt and accurate determination of waste characteristics. Construction work on the laboratories is near completion and most of the testing equipment has already reached the plants. They will be manned by trained chemists. Over 600 samples from different industries have been tested so far.

Reduction of Green House Gases (GHG) emissions

The usage of AFR in cement process does not lead to any additional emissions. This fact is reinforced through the trial runs that have been conducted by third party monitoring agency which demonstrates that all emissions in the kiln stacks including the heavy metals, POPs, PCDDs and PCDFs are well within the norms prescribed by CPCB for the incinerators. In fact, some of the emissions (such as NOx) were reduced by disposing/using the wastes in the cement process. The overall CO2 emission also decreases.

Thus, ACC is going a long way in promoting co-processing as an environmentally sustainable solution for the management of hazardous and non hazardous wastes from the industries. Further, the cement plants already exist, so there is no need to invest in infrastructure development for waste disposal, and this reduces the usage of public funds. Considering the cost towards environmental remediation and the expenses related to health and well being of the society, co-processing offers the most economical solution for the management of wastes."

Reduction of Green House Gas Emission



7.7 Mining & Quarry Rehabilitation

ACC has a rich and long experience in mining, being the largest user of limestone in the country. Limestone is the principal raw material for cement manufacture whereas shale, clay and quartzite are required in smaller quantities being additives for correction. Most of our limestone requirement is met from our captive mines. ACC operates twelve limestone mines which are captive to its cement/clinker manufacturing plants. The company holds mining leases for limestone, clay, quartzite and shale in the states of Himachal Pradesh, Rajasthan, Maharashtra, Karnataka, Tamil Nadu, Orissa, Madhya Pradesh, Chattisgarh and Jharkhand. Limestone, clay and shale occur together and mined proportionately based on the requirement.

Limestone production during 2007 was about 19.2 Million Tonnes whereas total material handled was about 27.7 Million Tonnes. An additional 8.5 Million Tonnes was handled as overburden to expose subsurface limestone.

Mining operations start with drilling and blasting. Mines development is an activity undertaken to expose subsurface limestone for use as raw material for clinker manufacture. The next stage is the raising or production process, followed by loading and transportation. During the mining of limestone, overburden is encountered in the form of soil, shale, sandstone and other material that cannot be used in the cement process. Such material is stored separately in overburden dumps. It is used later for backfilling and reclamation of worked out and used mines Similarly top soil collected while removing overburden is also stored and stacked separately for use in afforestation.

Sub grade limestone encountered in the mining process is not discarded but enriched with high grade limestone. Such blending of limestone helps in the conservation of this mineral.

ACC has a mechanized method of opencast mining which uses shovel dumper for loading and transportation of limestone and overburden. Drilling is performed with integrated DTH drilling rigs. ACC was first in the country to use several mining equipment such as the hydraulic drill, high capacity excavator (7 cubic metres bucket capacity) and high capacity (85 Tonnes) dumper at its Wadi mine. These were inducted to achieve higher production as well as for reduction of fuel consumption.

Fuel (Diesel) consumption by our mines on a company wide basis in 2007 was 0.39 litre per tonne of material handling. The equipment sizing for shovel/ excavator and dumper varies from 2.8 cum to 7 cum for excavator and 35 T to 85 T in case of dumper, depending on the size of the mine. The smallest mine in ACC produces about 45000 tonnes per month while largest produces about 600,000 tonnes per month.

Mines Safety

Safety in mines receives overriding preference irrespective of the size and scale of operations at the mine. All mining personnel - whether in maintenance, production, operation or administrative jobs - have to undergo specific on-the-job training and a safety orientation before being allowed to resume routine work.

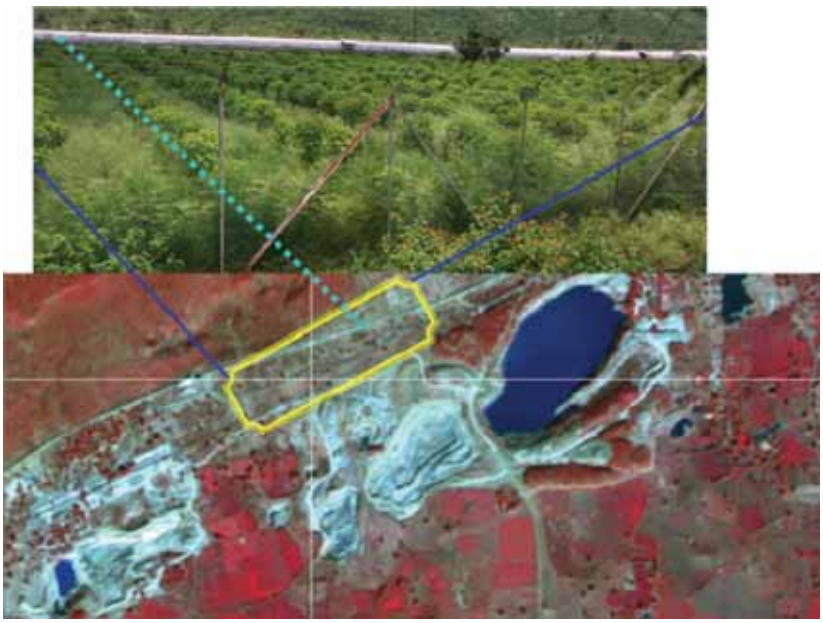
Mining activity is supervised, controlled and managed by qualified Engineers so as to conform to standard procedures, meeting regulatory norms of Directorate General Of Mines Safety for safety, health and welfare matters of all mines employees and norms of the Indian Bureau of Mines for conservation and utilization of mineral.

Afforestation Activities

The overburden dump once matured is afforested through plantation. Non mineralized areas are also brought under plantation.

National Remote Sensing Agency

ACC requested National Remote sensing Agency (NRSA), an agency under Department of Space, Govt. of India, to carry out land use assessment studies

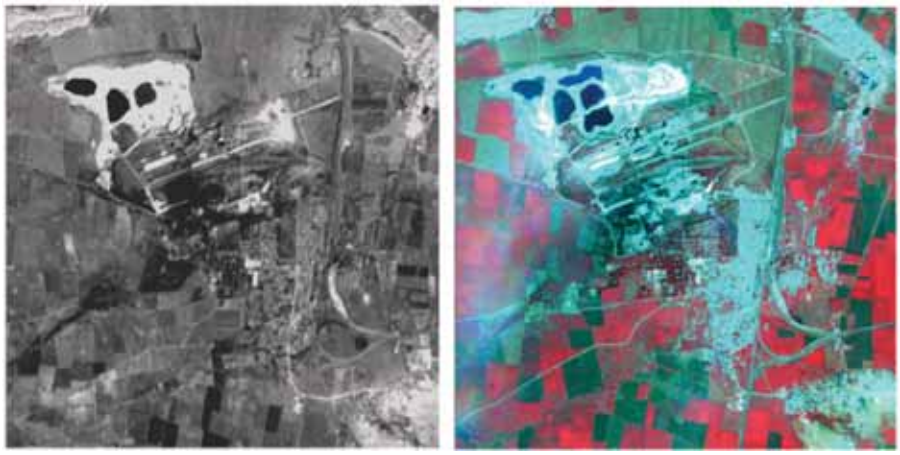


Kymore: The satellite image shows a canopy of green belt created along the conveyor belt transporting limestone from the mines to the Plant

around its cement plants and captive mines as part of an Environmental Impact Assessment with a view to assess changes in the mine and surrounding environment. The study covered land use and land cover in a radius of about 25 km around the mine and plant with respect to built-up areas, agricultural land, wasteland, forest areas, mining and water bodies. NRSA used remotely sensed satellite derived data with different multi-spectral bands in different spatial resolutions. The studies compared satellite images of the year 2001-2002 with similar images of 2006-2007.

NRSA was assigned to carry out studies for all 9 integrated Cement plans of ACC. As on April 2008, they have carried out studies for Kymore, Wadi, Chanda and Jamul, the final report on Kymore & Jamul has been submitted.

The report concludes that land use and land cover pattern of the area around Kymore and Wadi plants reveals that there has been a significant increase in the area under dense forest during 2006-2007 as compared to 2001-2002. There is an improvement in the double cropped area as well as in surface water spread which could be attributed to adoption of soil and water conservation measures.



Wadi: Satellite image depicts land cover in and around Wadi Plant in 2001 and the changes in 2005

Kymore

The satellite image shows a green belt created along the conveyor belt transporting limestone from the mines to the plant.

Wadi

IRS image depicts land cover in and around Wadi plant in 2001 and the changes in 2005.

Before:
ACC planted 1 million trees on barren hills near our Kymore plant in collaboration with the State Forest Department in February 2003.

After
In December 2006 the same hill range became lush with greenery and inhabited by wild life..

7.8 Greening

ACC has won several prizes and certificates of merit for its programmes involving 'greening,' afforestation, reclamation and rehabilitation, top soil management, noise abatement and other visible measures such as tree plantation and water management. ACC has proudly showcased its successes with reclamation of lands abandoned as mines and quarries. Some of these desolate tracts have been transformed into green parks, orchards, forests and even a bird sanctuary with a picturesque lake.

Tree plantation is a regular and committed activity. Vacant land available in the plant, mines and colony at each of our factories is used to develop greenery of various species. Some of our plants have developed as much as 40 per cent area for green belts as compared to the statutory requirement of 30 per cent. Each cement plant has its own success story of tree plantation, greening activities, horticulture, flower and fruit cultivation and water conservation.

- Kymore has undertaken greening of the desolate Kaimur Hills – an ambitious project where 1,50,000 trees are already planted with a survival rate of more than 95 per cent. Elsewhere volunteers at Kymore have planted a record 1,00,000 saplings in a single day.
- At Gagal in Himachal Pradesh, 1.1 million plants and saplings were planted in waste lands.
- Chaibasa distributes saplings to local people free of cost on Independence Day. 1,50,000 trees have been planted over an area of 24.9 hectares.
- In Chanda around 5000 trees are planted every year.
- Fruit orchards and plantations flourish in Jamul, Katni and Gagal.

Rocky areas in mines have been rendered suitable for plantation by over-spreading topsoil obtained from mining activity. Afforestation programmes at our units have helped transform the once barren and dry ambience of our plants into lush greenery. 'Each One Plant One' has been an inspiring message practiced by many of our employees. The total plantation undertaken across ACC is more than 3.3 million numbers of trees, with an average survival rate of 85 per cent and spread over an area of 10,000 acres in mines, factories and residential townships.

Tree plantation and green belt development programmes have also been extended to cover adjoining areas in the vicinity of our plants for the benefit of the entire local community.

Bio Diversity: Among the most satisfying results of the company's horticulture, rehabilitation, greening and afforestation activities is the opportunity it provides to enable natural life to flourish. This is most evident in the many water bodies created in abandoned mines or the dense forests and orchards grown on arid and barren lands where migratory birds, insects and plants thrive.

There are no known instances of any endangered wild life or plant species around our locations. No formal study has as yet been undertaken to assess the impact of our operations on the flora and fauna around plant and mines. However we aim to take up this task within the next two years.

Wild life conservation plans have been made and submitted for two of our locations in the states of Jharkhand and Orissa. These include suggestions in respect of the protection of flora and fauna along with the creation of some basic infrastructure for water-harvesting, support for anti-poaching measures and livelihood generation assistance for tribals in forest areas.

7.9 Case Study: Plantations for bio-mass

Coal is the principal fuel used in cement manufacture. As this non-renewable fuel gets scarce and costly, serious efforts are being made to identify substitutes. Agro wastes are an attractive and renewable alternative fuel, rich in calorific value and available in abundance. ACC has been using agro wastes as fuel in its cement process for many years. The biomass used is rice husk, cashew shell, mustard stems, wood waste, tamarind shell and cow dung flakes.

Use of biomass reduces overall CO_2 emissions. Biomass is considered as a carbon neutral entity, as trees both sequesters carbon and releases it on combustion. Additionally, the use of biomass prevents its decay which releases the green house gases CO_2 and NH_3 in the atmosphere.

At ACC, we aim to plant 5 million Jatropha saplings by 2009. Almost 1.2 million of Jatropha plantations have been undertaken in our waste lands areas. These trees yield fruit, biomass, de-oiled cake and raw extracted oil (without esterification) which produces thermal energy on combustion. Jatropha have a life of 25 to 30 years and require little maintenance. Such plantation helps in restoration of vast tracts of degraded lands around the works.

Our Kymore plant uses Parthenium, a wild and deleterious weed as another type of biomass. Parthenium grass is an alien invasive species eroding the native biodiversity. It competes with agricultural crops in the fields and depletes the soil of its fertility. Parthenium's miniscule pollen particulates are a threat to humans and cause severe respiratory disorders. ACC has engaged the local community through co-operative society for collection of this wild weed. This is a win-win situation for the villagers who get their fields cleared of the weed, earning money by selling these weeds to us and getting employment. For ACC, this means an abundant supply of biomass from surrounding areas and reduced dependence on fossil fuels.

Plantation of other fast growing trees is being undertaken so that tree prunings from these may serve as an economical and sure supply of coal substitutes.

7.10 Water Management

Our water conservation efforts have been noteworthy, with important contributions from nearly all our plants. The company maintains a norm of Zero Water Discharge at all cement units. Water is used in the plants as industrial cooling and the entire water is recycled through cooling towers, water ponds and tanks.

Ground water encountered during mining operations at our mines together with any other rain or surface water, is pumped out of the mines to keep it dry for operation. ACC cement plants have converted old abandoned mines into huge reservoirs by collecting rain water from different catchments around mines. The collected water is then channelled into the abandoned mines forming water storage areas. The capacity of each such reservoir is approximately 6 to 10 lakh cubic metres. The reservoir water is further treated in the plant and colony before it is used. Old worked out mines have thus been converted into water reservoirs at Kymore, Jamul, Chaibasa and Wadi plants. These reservoirs meet the water requirement of our plants and help improve ground water tables in surrounding areas. Rain water harvested at Lakheri mine is utilized for irrigation of surrounding areas.

As a result of these initiatives, we now have several examples of outstanding achievements in water harvesting and in the creation of reservoirs in abandoned mines and quarries. Some of our plants have become self-reliant with respect to their water requirements for use in the plant, mines and colony.

7.11 Case Study: Waste Water Treatment

ACC's Gagal Cement Plant in the North Indian state of Himachal Pradesh was the first to set up a Bio-Tech Root Zone treatment Plant for managing domestic sewage and waste water using a natural process which is simple and cost-efficient.

The system involves running contaminated water into trenches filled with certain reeds such that the water passes underground through the root zone of specially designed reed beds. The reeds and reed beds together create a remarkable effluent treatment factory beneath the surface of the soil. Dirty water flows into the system only to emerge as clear water that has been made environmentally acceptable using a basic natural process.

The reeds of the species, phragmites, are essentially wetland plants, that have a capacity to absorb oxygen from the air through stomatal openings behind their leaves. The oxygen is pushed through the porous stems of the reeds into the hollow roots, where it enters the root zone and creates optimal conditions for the growth of numerous bacterial and fungi.

Bio diversity is the key to the root zone process. More than 2000 types of bacteria and tens of thousands of fungi exist in the reed bed. These microbial organisms oxidize impurities in the wastewater and decompose the contaminants to their basic

A Root Zone Biotech plant at ACC Gagal that enables treatment and recycling of waste water.

form. Phosphates, sulfur compounds and nitrogenous materials reduce to their elemental forms. Heavy metal precipitates are bound into the soil matrix. The outcome of this constructed marsh is treated waste water which is not only environmentally acceptable but much cleaner.

The process is very efficient and environment friendly as it is in itself completely natural. It involves minimum energy. No mechanical equipment is needed to pump the water as it is made to flow into the reed beds by gravity. The star cleansers are these reeds which are bio-degradable and renewable. There is no odour and no toxic chemicals are used. Since all the sewage flows are subsurface, no foul smell emanates from the waste water and there is no breeding ground available for mosquitoes and flies. In fact the plants are very adaptive and can respond to wide changes in the quality of wastewater. A two hectares wetland plot with reed plantations can tackle effluent from a population of around 4500 persons.

The Gagal root zone plant has a capacity to treat 100 cubic meter of domestic sewage per day. Root zone treatment is a cost-effective and eco friendly solution to waste water treatment.

7.12 Towards Greener Technologies

ACC has initiated several steps to reduce CO_2 emissions through various means such as upgradation of technology, usage of alternative fuels and raw materials, reducing clinker factor by using materials like fly ash, slag and various energy conservations means. The company has registered two of these projects under Clean Development Mechanism (CDM).

Blended Cement Project: This project seeks to conserve limestone through an increase in the proportion of fly ash blend in cement. Considerable research was involved to successfully increase the proportion of fly ash in the blend beyond general conventions without compromising the strength characteristics of cement. Generally in India, 18-20% is the fly ash proportion, whereas ACC has increased this proportion to 30%.

ACC has put in considerable investments in implementing this project activity at site. The major investment is in increased capacities of fly ash feeding silos, conveyor systems, feeding systems, and synchronization of project activity with centralized monitoring and management system.

ACC has successfully implemented this CDM Project at four Cement plants. In doing this, several environmental issues have been addressed.

- Lower consumption of limestone, a natural resource, thereby reducing the GHG emissions resulting through the processing of carbonaceous materials.
- Utilization of fly ash, a pollutant byproduct of thermal power plants which is difficult to handle and dispose in an eco-friendly manner.
- Reduced power consumption in cement processing thereby reducing the load on grid power supply and coal or diesel based captive power plants.

Wind Mill Power Project: ACC successfully commissioned its first Wind Energy Farm located in Udayathoor in Tirunelveli district, Tamil Nadu. This initiative is part of the company's efforts to adopt clean and green technologies to reduce dependence on conventional fossil fuel based energy sources.

The wind power plant comprises six modern wind turbines each of capacity 1.5MW. The Udayathoor Wind Farm is located near Kanyakumari, a region that experiences winds of enough speed to support wind energy installations. Wind power generated here is wheeled to ACC's Madukkarai Cement plant in Coimbatore through a suitable arrangement with the state grid. Excess power not utilized by Madukkarai plant will be offered to the grid. So far the farm has generated 12 million units of energy.

Electricity generated from wind power is Green energy. It is renewable; non-polluting, relatively noise-free and leads to no direct emissions. Wind energy projects are eligible for Clean Development Mechanism (CDM) benefits under certain specific conditions. ACC is exploring other viable locations for setting up wind farms. Approval has been received for a windmill to be located in Rajasthan.

Industrial farming Of CO_2: We have initiated a project to sequester CO_2 generated by cement kilns to produce high energy oil bearing algal biomass, which can then be reused as fuel in cement kilns. Conservation of fossil fuel and CO_2 mitigation are the two main driving goals of the project. The plan is that the algal biomass produced by the bioreactor, through recycling of the CO_2 from the cement kiln stacks, will be directly fired in the captive power plants and the cement kilns. The targeted goal of this project is to harmonize the algal production rate with the CO_2 emission rates, and ensure continuous recycling of CO_2, thus providing continuous algal biomass fuel for the kiln and power plants. It involves the screening of appropriate high and fast yielding algae cultures, the development of a bioreactor on a lab bench scale, scaling up the technology to a pilot plant and then demonstrating the same commercially. The project calls for a multi disciplinary approach and involves microbiologists, algae experts, bio-technologists, engineers and other professionals. The company is working with other agencies to take up trials of different industrial systems to identify the best algae strains and most appropriate culture methods for incorporation into the cement production process.

Waste Heat recovery: In dry process cement plants nearly 40 percent of total heat input is rejected as waste heat from exit gases of pre-heaters and grate coolers. In most plants the waste heat is utilised for drying raw material or pre-heating air required for coal combustion. But even after covering these applications, there is still some heat available which can be utilised for electrical power generation. Tapping this energy offers much potential. Waste Heat Recovery Systems are known to be working successfully in cement plants in some countries. The power generated in this way can be enough to operate the kiln section on a sustained basis. ACC is exploring power generation based on waste heat recovery from cement kiln and cooler gases.