GREEN CEMENT

1st Green Manufacturing Summit

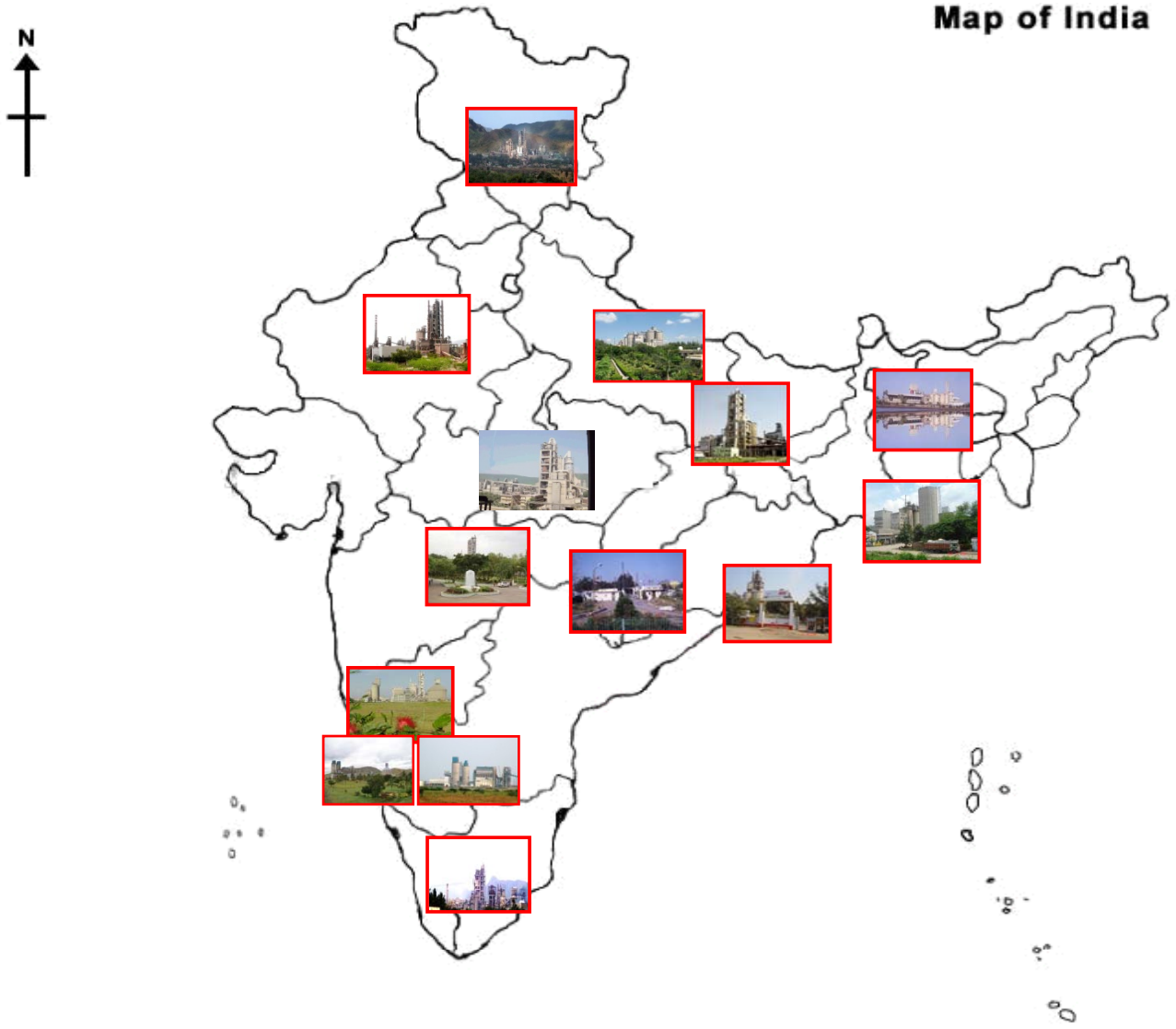
17th -18th March 2011

K N Rao

Director – Energy & Environment

ACC Limited

ACC – PAN India Presence



Brief about ACC

- Pioneer in Cement Manufacturing – Established in 1936 and celebrating 75 years of operation
- ACC has a installed capacity of 30 MTPA of cement, 17 Cement plants all over India
- 1945 First CSR initiative – Rural Welfare Scheme at Sevalia (Gujarat)
- 1961 First production of Slag Cement in India
- First production of Fly ash based Cement in India. Pioneer in blended cement production
- ACC operating the world largest cement kiln at Wadi
- ACC is named as India's "Super Brand" in cement sector
- ACC's green journey started 75 years back

Awards won by ACC in 2010

Energy Awards

- **ACC Chaibasa wins National Energy Conservation Award – 2010**
- **ACC Kymore wins National Energy Conservation Award – 2010**
- **ACC Lakheri wins Rajasthan Energy Conservation Award – 2010**
- **ACC Lakheri and ACC Wadi win CII 11th National Award for Excellence in Energy Management**

Environment Awards

- **ACC Jamul Wins GreenTech Environment Excellence Award – 2010**
- **ACC Damodhar Wins CII – Environmental Best Practices Award – 2011**
- **ACC Kymore Wins CII – Environmental Best Practices Award – 2011**
- **ACC honoured with FE-EVI Green Business Leadership Award 2009-10**
- **ACC receives prestigious Asia Pacific Entrepreneurship award – 2010**
- **ACC Bargarh wins Pollution Control Excellence Award from Orissa State Pollution Control Board – 2010**

ACC's Landmarks during 75 years (1936 – 2011)

ACC green journey started in 1936 and some of the important landmarks of this journey are :

1936 Incorporation of The Associated Cement Companies Limited on August 1, 1936

1955 Sindri cement works used the waste product calcium carbonate sludge from fertilizer factory at Sindri instead of limestone.

1961 Started blended cement manufacturing in India. Blast furnace slag used as clinker substitute from TISCO in Chaibasa Unit to manufacture Portland Slag Cement.

1965 Started Manufacture of Portland Pozzolana Cement using Flyash as Clinker substitute which is another variety of Blended cement,

1966 Installed 1st Air Pollution Control Equipment

1978 Introduction of the energy efficient pre calcinator technology for the first time in India. Full scale commercial production based on MFC technology at Wadi in 1979

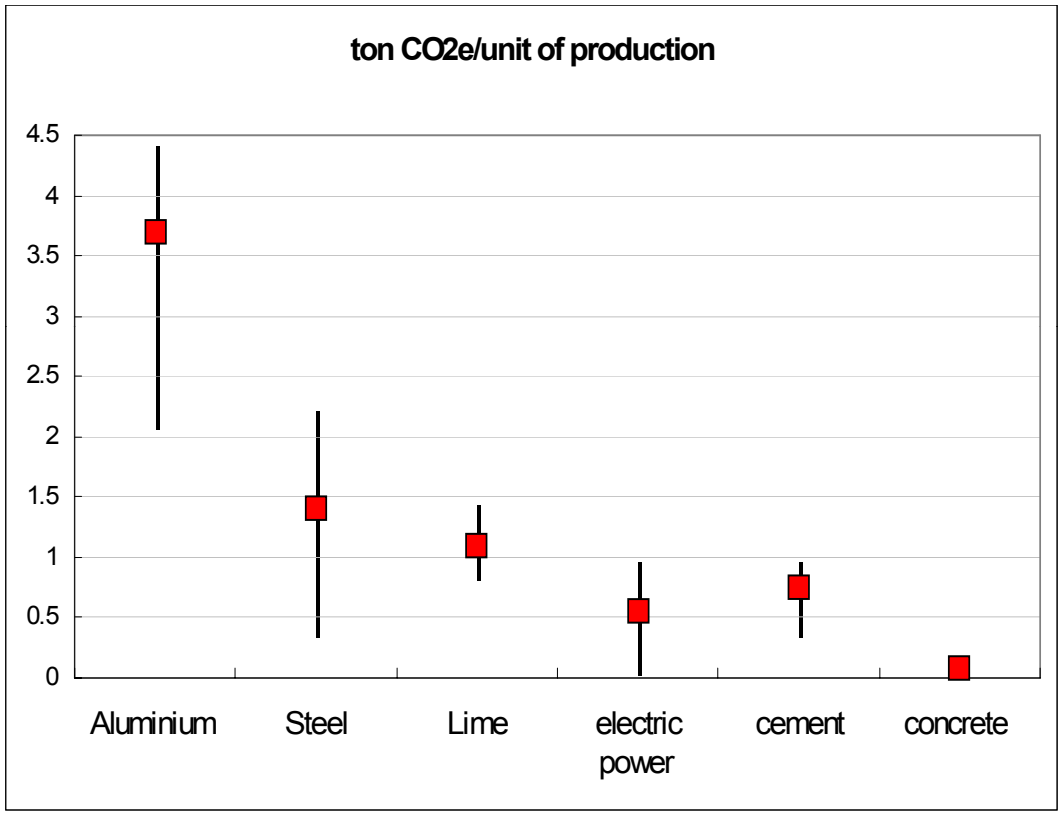
2007 -2010 ACC commissioned its 19 MW Wind Mill Power Stations at different States of India.

2007- Initiation of Sustainability Reporting.

2009 ACC converted their Corporate Head Quarters into a Green Building.

2010 – 2011 ACC commissioned Green Residential complex at Thane and Green control room at ACC Chanda.

Why Cement is More Greener than other Building Materials



- Foundation for society's infrastructure
- Very long useful life time
- Versatile - Easy to use
- Low cost
- Non-hazardous
- Raw materials world-wide
- Simple process & product
- Comparatively low CO_2 and energy per ton product
- Low CO2 per ton of Concrete
- Comparatively high absolute CO_2 emission: 5% of manmade CO_2

Characteristics of Green Products / Processes

The relative greenness of the Product/Process can be compared based on the progress achieved on the following critical parameters:

- Energy Efficiency
- Water Conservation
- Renewable Energy
- Greenhouse Gas Emissions
- Waste Management
- Material Conservation, Recycling and Reliability
- Green Supply Chain
- Product Stewardship
- Life Cycle analysis
- Bio-diversity, Green Building

Energy Efficiency

Cement Manufacturing is high energy intensity and high energy cost and is going through a continuous transformation and currently reached a level of more than a 50% reduction in the specific energy consumption (Thermal energy from 1400 Kcal/Kg of clinker to 650 Kcal/Kg of clinker and Electrical energy from 140 kWh/Ton of cement to 60 kWh/Ton of cement)

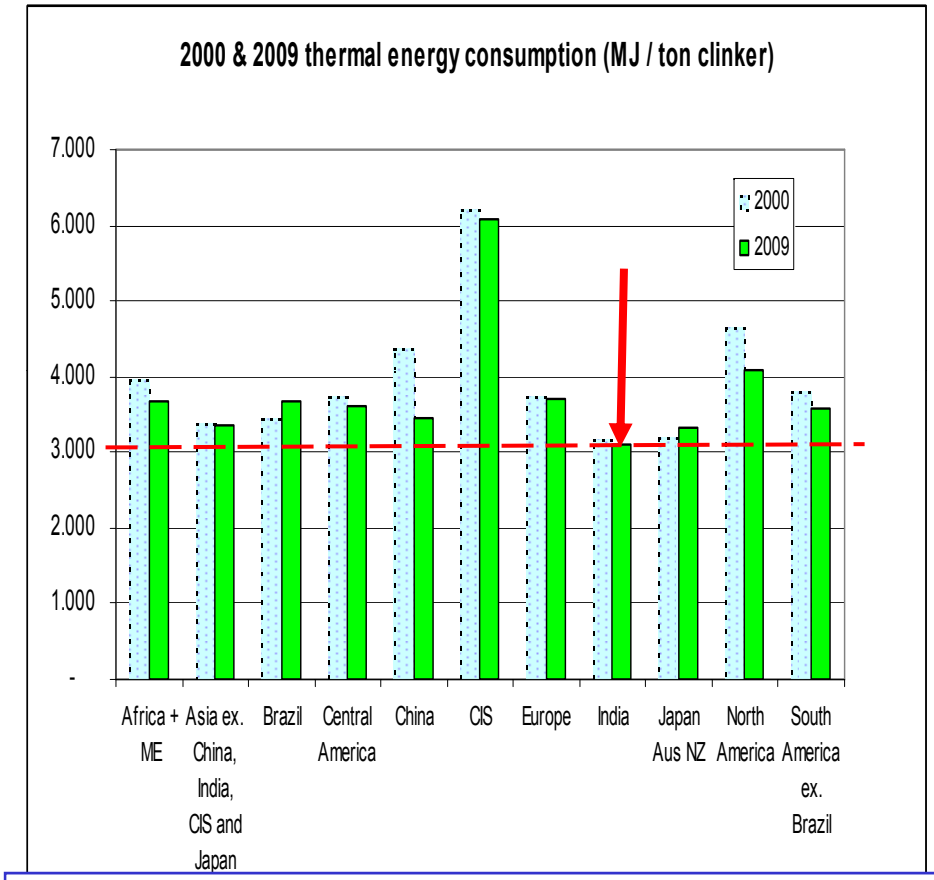
The major landmarks for the transformation journey in the Rotary Kiln cement manufacturing processes are

Wet Process → Semi-Wet Process → Long-dry Process → Dry Process with Preheater (2-stage, 3-stage & 4-stage) → Dry Process with 4-stage Preheater & Calciner (ILC & SLC) → Dry Process with 5, 6 & 7 – stage pre heaters with Waste Heat Recovey System (WHRS)

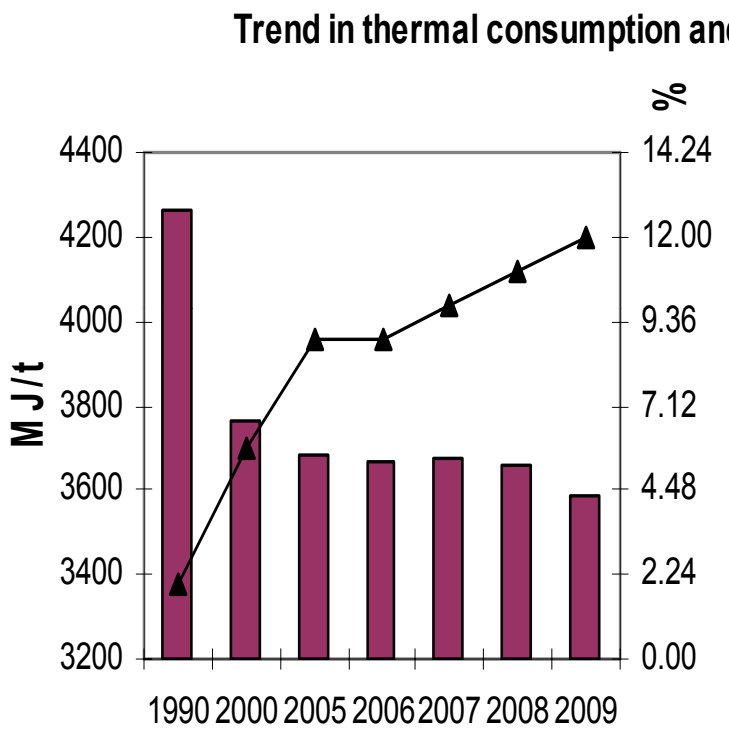
Capacity of the Kiln increased from 100 TPD to 12500 TPD

Thermal Energy Performance of World & Different Countries

Different Countries



World Trend



- **The average energy efficiency of the Indian cement industry is world-wide best in class**
- **ACC reached thermal energy performance of 3119 MJ/ Ton of clinker which is far better than Indian national average performance and ACC reduced specific thermal energy by 34.66% in the last 20 years**

Energy Efficiency

Grinding Technology changes

Tube mills → Ball mills → Vertical Roller mills / Roller Press

Energy Efficient conveying systems, mining equipment & other size reduction equipments

Centrifugal Fans – Radial fans → Backward curve → Aerofoil

Compressors – Reciprocating → Screw → Centrifugal

Energy efficient pumps

Process automation to ensure the reliability, consistency, quality & safety of the operation

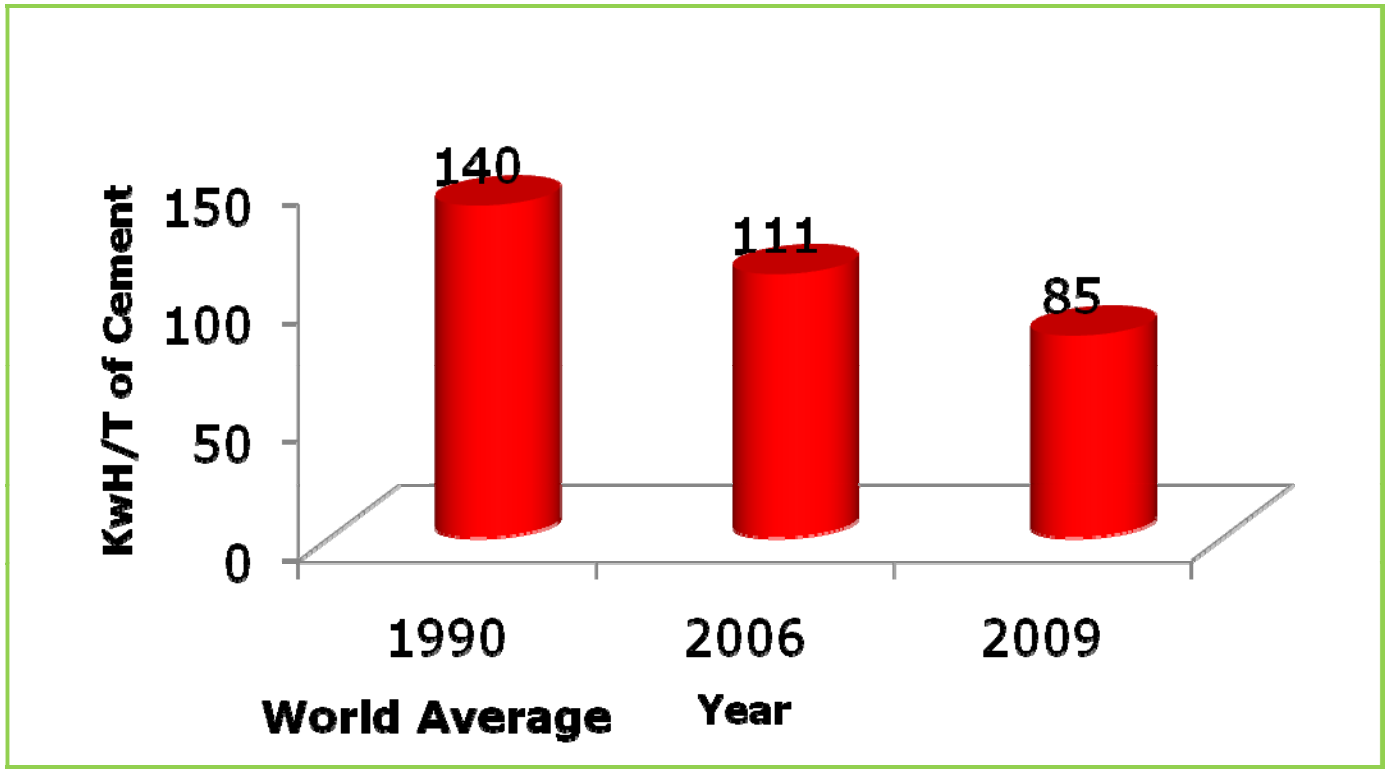
High efficiency motors & Variable Speed Drives

PLC's based systems → DCS

Energy Management Systems

Energy efficient lighting (CFL & LED's)

Electrical Energy Performance Comparison



- **ACC reduced specific electrical energy by 34.60% in the last 20 years**

Water Conservation

Cement Industry moved from wet process technology to dry process technology which resulted reduction in specific water consumption from approximately 1400 lit/Ton of clinker to the current best practice of 75 lit/Ton of Clinker. Major water demand reduction initiatives includes:

- ✓ Conversion of Wet to Semi dry by using filter process and feeding cake into the Kiln instead of slurry.
- ✓ Feeding dry limestone instead of cake or nodules
- ✓ Replacement of Gas Conditioning towers with ESPs with Bag Houses.
- ✓ Waste Heat Recovery systems for the Kiln and Cooler gases
- ✓ Utilization of Air Cooled condensers in Captive Power Plants instead of conventional cooling towers/
- ✓ Usage of air cooled condensers for the plant air conditioning
- ✓ Many water conservation measures for domestic use in the plant and colonies
- ✓ Adoption of dry technologies for the dust control
- ✓ Usage of air for the process cooling
- ✓ Usage of green building concepts in Plant, colonies
- ✓ Concrete : Usage of Blended/green cement reduces the water consumption by 20%

ACC's - Water Harvesting

Cement Industry carrying out water harvesting in the mined out pits, plant & colony for the purpose of plant, colony and community use. ACC is practicing this approach for many years.

Rain water harvesting at Wadi

Rain water harvesting at Bargarh

Renewable Energy

Current Energy options followed in the world Cement Industry other than Coal based Thermal Power and Nuclear Energy

- ✓Hydro Energy
- ✓Wind Energy
- ✓Solar Energy
- Biomass
- Energy Plantation

ACC currently installed 19 MW of Wind Mill Stations in the last 3 years

- ✓Tamilnadu – 9MW
- ✓Rajasthan – 7.5 MW
- ✓Maharashtra – 2.5 MW

ACC is operating solar power generation from all three green buildings for the purpose of hot water and lighting.

CEMENT INDUSTRY'S JOURNEY TOWARDS *"GREENHOUSE GAS EMISSIONS"*

The current Global cement production as of 2009 is 3060 Million Tons.

The Global GHG Emissions from the cement industry in 2009 is 1.88 billion Tons which approximately works out 5% of the total man made emissions.

The GHG Emissions from the Indian Cement industry is approximately works out ~10% of the total man made emissions.

Cement Industry reduced Specific CO2 emissions from 1120 Kg/T of Cement to 820 Kg/T of Cement*

ACC Specific CO2 emissions of Cement Industry reduced from 812.28 Kg/T of Cement to 544.73 Kg/T of Cement between 1990 and 2009

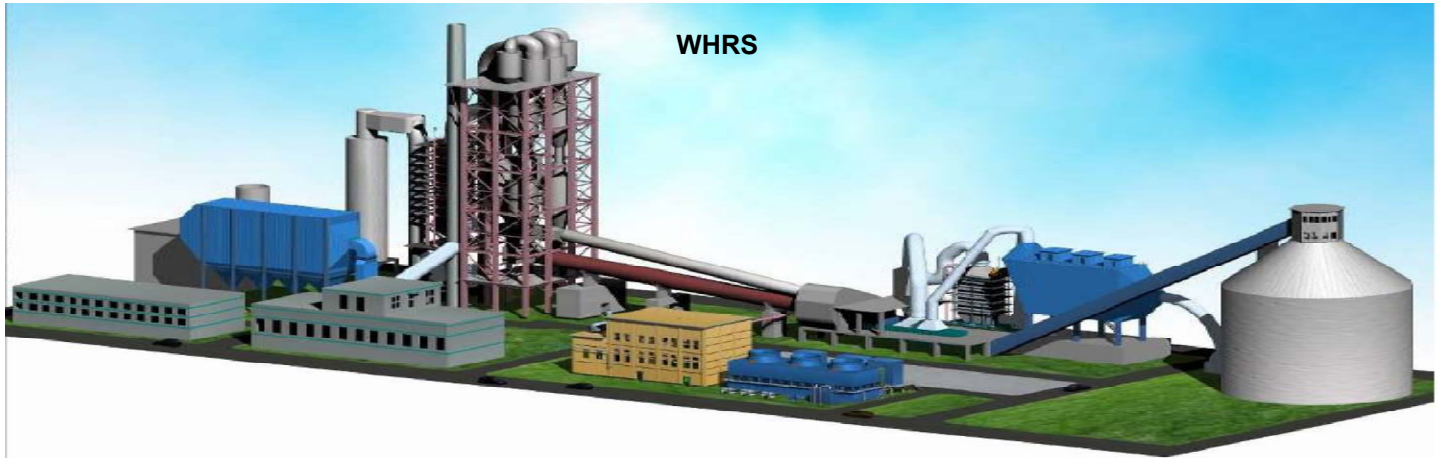
The Specific GHG emissions of Indian Cement Industry is better than Japan and this could be achieved through the following initiatives:

- ✓ Adopting latest technologies for the new plants and retrofitting existing plants with modern technology
- ✓ Utilization of industrial waste like Fly ash & Slag as Clinker substitution materials
- ✓ Utilization of various Alternative raw materials for substituting Lime Stone

* Source: CMA Data year 2006

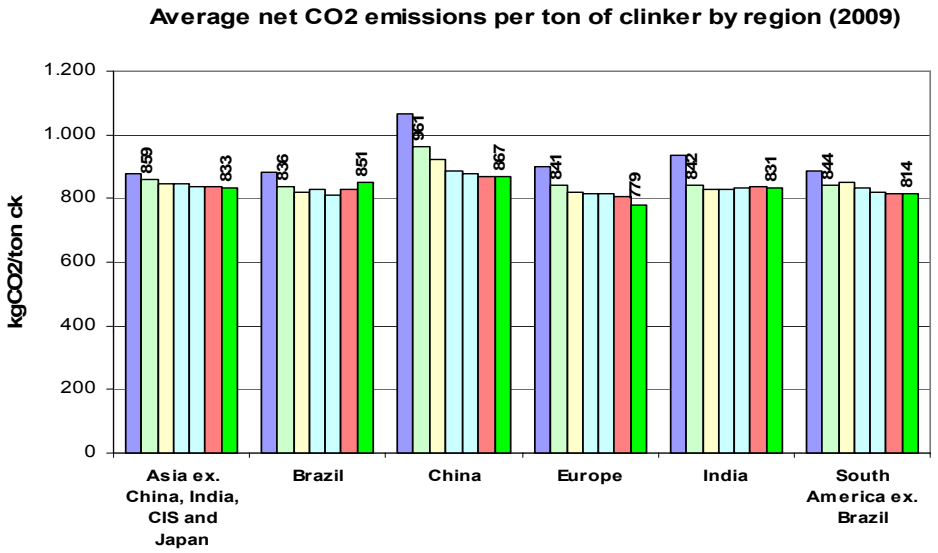
CEMENT INDUSTRY'S JOURNEY TOWARDS
"GREENHOUSE GAS EMISSIONS"

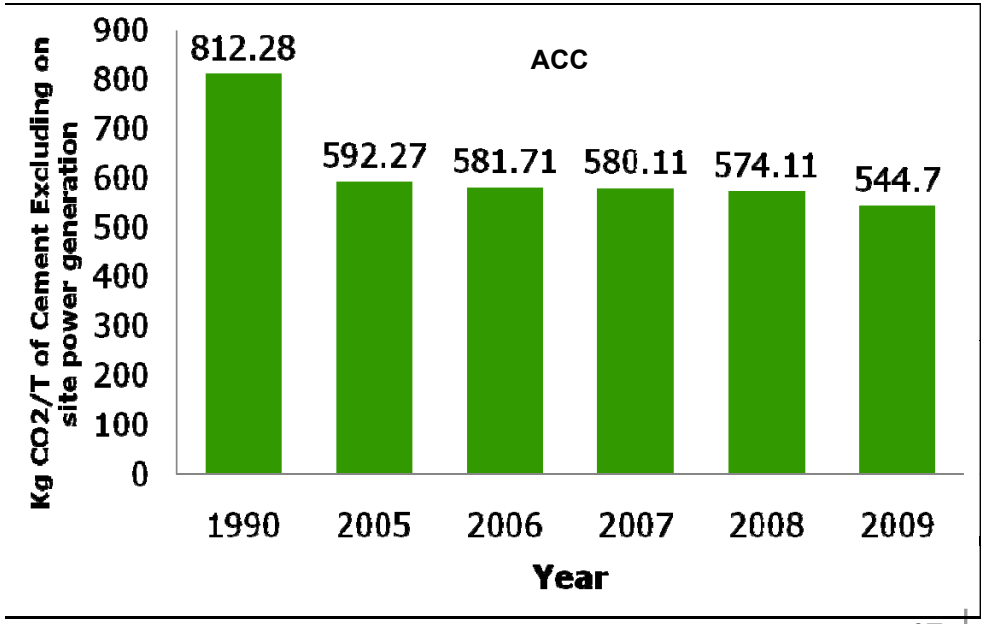
- ✓ Utilization of Alternative fuels like Biomass, Various industrial wastes, Plastic items, types etc in various areas like Kiln, CPP, Dryer etc..
- ✓ Utilization of renewable energy like Wind, Micro hydel power
- ✓ Utilization of energy generated from Waste Heat Recovery systems(ORC and steam rankine cycle) utilizing the waste heat from Kiln, CPP etc.,
- ✓ Shift towards Bulk Transportation by using Sea / Rail routes



CEMENT INDUSTRY'S JOURNEY TOWARDS
"GREENHOUSE GAS EMISSIONS"

Comparison of Global CO2 emissions on Per Tonne of Clinker Basis





Source: CSI

CEMENT INDUSTRY'S JOURNEY TOWARDS *"MATERIAL CONSERVATION, RECYCLING AND RECYCLABILITY"*

Clinker percentage in Cement and substituting with Fly ash and slag

- ✓ World Cement Industry moved from 95% Clinker to 79% Clinker.
- ✓ Indian Cement Industry moved from 95% Clinker to 74% Clinker
- ✓ ACC moved from 95% Clinker to 65.34% Clinker

Usage of Alternative Fuels: Cement Kilns are the most environment friendly incinerators without consuming additional energy and the industry is safely co-processing the most of the hazardous / non-hazardous industrial waste, municipal waste worldwide. Indian Cement Industry has made a beginning in this exercise in the recent years and there is a lot of potential to safely co-process these wastes without any additional GHG emissions.

Usage of Alternative Raw Materials: Mill scale, Marble slurry, Lime sludge & other categories of Industrial waste.

- ✓ World Cement Industry uses <12% substitution of fossil fuels
- ✓ Indian Cement Industry currently uses < 0.5%
- ✓ ACC currently uses ~0.5%

Green Cement - Benefits

- ***Waste Utilisation***

✓ Conversion of waste to useful product : Waste Fly Ash from thermal power plants and Slag from steel plants is absorbed in green cement

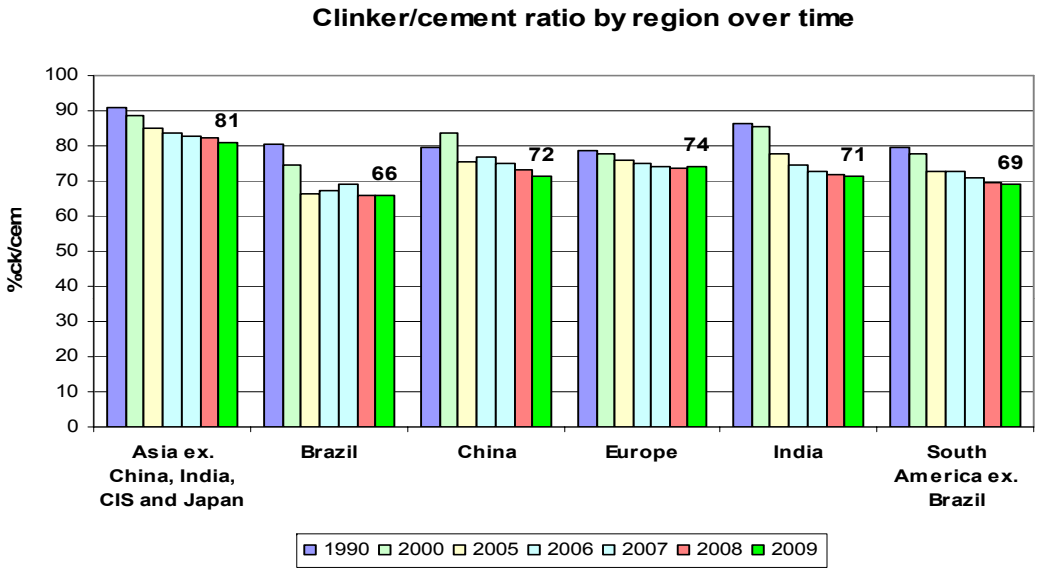
- ***Reducing the need to mine Virgin Materials, reduction in mining activities, thereby enhancing the life of the limited National Limestone Reserves (current estimate mine able reserves is 35 years)***
- ***Elimination of Fly ash disposal on land – India would require 1000 sq km land by 2015 for Ash disposal (source: World Bank)***
- ***Green cement reduces the water consumption – 50% in manufacturing stage, 20% at usage level (in concrete)***
- ***Prevention of leaching of heavy material – When Fly ash is used in cement , it encapsulates heavy material in matrix of concrete***
- ***Helping other Industries to dispose of their waste in an environment friendly manner by co-processing them in cement Kilns, and reducing the usage of fossil fuels in the Kilns***

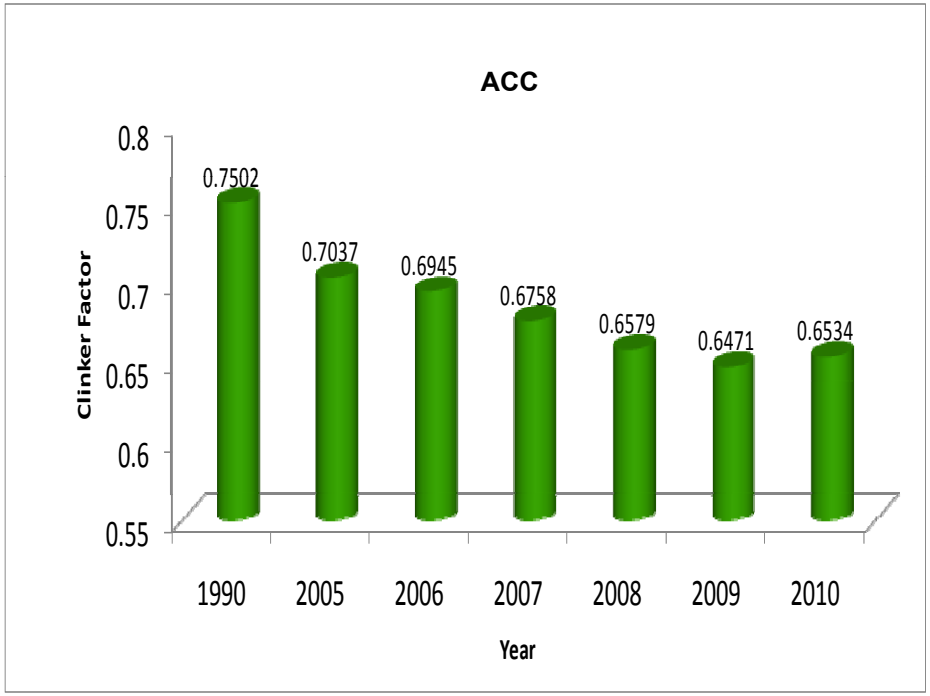
List of Industrial Waste Co-Processed by ACC

- ✓ HUL Waste
- ✓ Plastic Waste
- ✓ Spent Carbon
- ✓ ETP Sludge & ETP Bio Sludge
- ✓ Paint Sludge
- ✓ Nivea Waste
- ✓ CIL Waste
- ✓ Acid Tar Sludge
- ✓ Mattel Toys
- ✓ Plant & Colony Waste
- ✓ Laminated Waste
- ✓ SRF Waste
- ✓ Trade Rejects
- ✓ Scrap Tyres
- ✓ Chemical Sludge
- ✓ Phosphate Sludge
- ✓ Footwear Scrap
- ✓ Green Mash with Resin
- ✓ Godrej Waste
- ✓ ITC Waste
- ✓ SEP Sludge
- ✓ N Butanol Salt
- ✓ Spent Wash
- ✓ Liquid wastes

CEMENT INDUSTRY'S JOURNEY TOWARDS *"MATERIAL CONSERVATION, RECYCLING AND RECYCLABILITY"*

Reduction of Clinker content in cement





- **Compared to other countries, the Indian cement industry has a relatively low clinker content in cement**
- **But it is largely fly ash based**

Pictures of Industrial Waste Utilization as an Alternative Fuel

ACC's - Clientele

FMCG

Hindustan Unilever Limited

Toys

Food Products

Narmada Gelatines Limited

Pharmaceutical

Automobile

Machinery

Footwear

Petroleum

Chemical

Narmada Chematur Petrochemicals

CEMENT INDUSTRY'S JOURNEY TOWARDS
"GREEN SUPPLY CHAIN"

In developed countries, Cement Industry in the world has moving into Green Supply Chain concept. Indian Cement Industry is using more recycled materials as fuels and raw materials which conserves natural resources and fossil fuels.

The Clinker substitution by alternative materials is comparable with Brazil which is best in the world cement industry.

ACC using Clinker factor of 65.34% against the Indian average of 74%.

Most of the Indian Cement plants are put up in split locations to take care of the green logistics (using major distance by Rail and minor distance by Road).

Promoting bulk cement

Usage of Chemical Gypsum, Petcoke to conserve natural resources like mineral Gypsum, Coal.

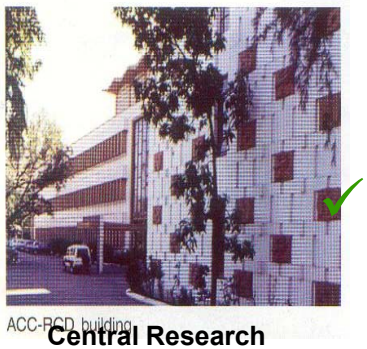
Some of the best practices in India includes sea bulk transport of cement

In the year 1992, India has established Bulk Cement Corporation of India, a joint venture with Government of India

ACC using their own rakes for increases use of rail transport.

ACC'S JOURNEY TOWARDS
"PRODUCT STEWARDSHIP"

- ✓ ACC has upgraded the plants to ensure the consistency in the quality of their product along with testing facilities for all inbound raw materials, intermediates and end products about the toxicity.
- ✓ In the year 1965, ACC established a Central Research Station in Thane along with pilot Kiln along with advanced laboratory equipment for the product development and testing of the raw materials, fuels (fossil and alternative fuels) , intermediates and finished products and training of Cement Professionals.
- ✓ Include the land mark achievements like PSC, PCC, Oil well cement, masonary cement, special application based cementatious products for different industries including defence and Nuclear power.
- ✓ ACC conducts training programs at all levels of entire supply chain and also to the Customers, dealers, retainers, masons, architects, structural designers etc.,
- ✓ ACC is publishing Concrete General of India at Thane Complex



Central Research Station - Thane

Way Forward ...

- Composite Cement
- Ensuring Fly Ash & Slag to cement industry
- Mandatory usage of Blended Cement
- Segregation of municipal waste & co- processing in cement Kilns
- Stop waste going to Land Fills
- Technology development for usage of low grade Limestone
- Further emphasis of water usage reduction in all areas of cement life cycle
- Recycling of old concrete to conserve natural resources
- Reducing energy intensity in cement manufacturing
- Increased fossil fuel substitution rate
- Promoting Green buildings
- Higher usage of electricity from renewable energy sources
- Bio diesel for mining equipments and internal transport
- New processes for cement production

"BIO-DIVERSITY – MINES REHABILITATION"

Bio-diversity

Cement Industries following best practices of bio-diversity management while rehabilitating the mined out lime stone quarries through afforestation and developing water bodies and restoring natural habitat.

"BIO-DIVERSITY"

ACC has carried out many activities resulting in lot of greenery and thus paving the way for the Bio diversity . Few of these initiatives are as given

OUT BELOVED GUESTS AT GAGAL

"BIO-DIVERSITY – MINES REHABILITATION"

ACC has carried out many activities resulting in lot of greenery and thus paving the way for the Bio diversity . Few of these initiatives are as given below:

MINES REHABILITATION

"BIO-DIVERSITY – MINES REHABILITATION"

THEN

NOW

"GREEN BUILDINGS"

ACC Corporate Head Quarters– Cement House

"GREEN BUILDINGS"

ACC La Residency – Thane

"GREEN BUILDINGS"

ACC Chanda Control Room

“Let us work together for GREEN INDIA”