Certificate of Completion

This is to Certify that the Third Year Students (Batch 2009-10) from the "Department of Commerce & Management" Shillong College under the charge of Miss. Wandabha C. K. Sohliya has completed the Minor Research Project entitled: "Green Marketing Practices for Sustainable Development: *A Case of Star Cement Manufacturing Company Ltd"*

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Minor Research Project

Green Marketing Practices for Sustainable Development:

A Case of Star Cement Manufacturing Company Ltd

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GREEN MARKETING PRACTICES FOR SUSTAINABLE DEVELOPMENT

Star Cement Manufacturing Company Ltd,
Lumshnong, Jaintia Hills, Meghalaya

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CONTENTS

I. Introduction to Green marketing:

The fact that businesses are physical systems which exist within a finite and vulnerable physical environment, has until recently, largely been ignored as a management and marketing issue. Green marketing furthers the evolution of marketing beyond societal marketing, to embrace society's increasing concern about the natural environment. The management process is responsible for identifying the needs of the customers and society and delivering the same in an environmentally friendly, sustainable and socially responsible way.

According to UN forecasts, the world's population could reach 8 billion as early as 2015, a 60% increase from 1985 levels. This would mean that just to restrict the rate of environmental damage to current levels, there would have to be a drastic adjustment either in the standard of living that we enjoy, or in the environmental impact of the technologies used to satisfy our demands for goods and services. If mankind were to continue current rates of population growth, consumption and methods of production, then by 2030 critical natural resources would last less than a decade more, and humankind would generate 400 billion tons of solid waste each year.

(Ken Peattie and Martin Charter, Green Marketing, 2000, CIM)

The second factor is the arrival of a new generation of more environmentally literate consumers, employees and investors.

Green demand and green marketing is likely to evolve in three phases:

a) **Substitution-** Characterized by green consumers differentiating between products on the basis of per perceived eco-performance, much confusion over concepts and terminology, and with a great deal of sales and public relation activity dressed up as green marketing. The results has been increasing consumer cynicism, as demonstrated by Gerstman and Meyers' third annual environment survey finding that 91% of U.S. consumer rated marketers as the least concern about the environment. There has also been a great deal of 'spot lightning', the singling out of particular industries, companies and products for praise or condemnation, sometime with little relation to the actualities of eco performance . Environmental improvements are often limited to end-of- pipe changes to production systems, the substitution of damaging ingredients such as CFCs and the elimination of excess packaging.
b) **Systemization**-The establishment of BS7750 and ISO 14001 standards for Environmental Management Systems and the EC Enclosable Scheme should move the entire 'game' on to a new plan of recognized performance criteria and evaluation. Business will move towards the redesign of products and production system, and the

implementation of environmental reporting and management systems. Better information for consumers will allow more information and provision for the recycling of products will become standard practice, and governed by increasingly stringent legislation.

c) **Societal change**-Within societies, concern about the environment is generally increasing and is being reflected in a number of ways including:
   i. ***Changing values:*** Social attitudes towards the environment have changed, so that it is perceived as vulnerable, valuable and in need of protection. This has been reflected in changes in the values associated with products and their features. For e.g. Kodak's disposable camera therefore was transformed into a recyclable camera.
   ii. ***Pressure group activity:*** The 1980's show a considerable increase in the size; budgets and sophistication of environmentally relate d pressure groups. For example the companies that have found themselves the targets of high –profile campaigns include Shell and McDonald's. The 1990's has been characterized by companies such as McDonald's adopting a partnerships, rather than adversarial, relationship with environmental groups.
   iii. ***Media interest:*** An increasing amount of media output is devoted to nature an environmentally related messages an examples of poor eco performance are a favorite target for investigative journalism. As Mulhall (1992) notes 'The massive impact of instant media in accelerating the massage of gross environmental incompetence by our leaders can be summarized in three letters – CNN ,It means that a company's reputations can destroy globally in one day'.
   iv. ***Political and legal interest:*** The environmental agenda of green political parties has been increasingly absorbed by mainstream political parties, and this has led to an increase in the volume and rigors of the environmental legislation that companies must respond to. Companies that relied on mere compliance risk being left behind by the upward 'ratcheting' of legislation. In the USA, the trend towards forcing CEO's of polluters to make personal court appearances, and in some cases jailing them, has helped to focus corporate minds.
   v. ***Public opinion:*** EU surveys tracking publics attitudes to the environment for more than 15 years have revealed that a majority of people are increasing concerned about the state of the global and national environment (in both the short and the long term) and also consider that protecting the environment and preserving natural resources are essential to economic development.

On particularly sensitive issues all of these dimensions of increase societal concerned can combine to present any companies involved with a considerable strategic, marketing and public relations challenges, as Shell discovered when trying to decommission the Brent Spar oil rig.

II. Scope of Green Marketing:

- ***New market opportunities-*** 'Green consumers' is growing concern with the climate change. Going green enables the company to compete on the basis of strong eco-performance and by tapping into customer demand for greener product.
- ***Differentiation opportunities-*** To be branded product must be differentiated. Products are differentiated on the basis of form, varying features, performance quality, etc. Going green enables the company to differentiate their products on the basis of their environmental impact. Products can be promoted as green products.
- ***Opportunities for cost advantages-***Although conventional wisdom associates good eco-performance with investment and increased costs, this is partly a reflection of the 'end-of –pipe' methods used(since adding a catalytic converter onto a car can only increase its costs). Investment using a more radical, clean technology approach is being shown to be capable of reducing material and energy inputs, and cutting inefficient pollution and waste.
- ***Niche opportunities-***A niche is a more narrowly defined customer group seeking a distinctive mix of benefits. Marketers usually identify niches by dividing a segment in to sub segment. By going green, the marketer is targeting the most environmentally aware consumers. This segment of the market is rapidly growing with the rapid rate of climate change.

III. Tools of Green Marketing:

Green marketing incorporates a broad range of activities, including product modification, changes to the production process, packaging changes as well as communicating through advertising and public relation, in short these are tools used in marketing .To begin our discussion, it would be appropriate to start with a discussion on the 5Ps in the context of green marketing.

a) Green product:

Environmental concern is creating demands for new products (such as pollution control equipment) and is causing existing products to be reconsider an in many cases redesigned, reformulated or produced differently. The impact on the products will vary across market. In some cases such as automobile industry (for e.g. Maruti 800 has to be phased out from the market since it could not meet the legislation norms), changes in response to the green challenge are widespread. In others, financial services or computers, example of change are more sporadic.

i. **Raw materials:** The raw materials required for manufacturing the products should be environmental friendly, for example in manufacturing green cement fly-ash, biomass energy are used and concrete is recycled to build dams and bridges etc.

ii. **Process:** The process involved in manufacturing a particular product should use a green methods or technology, for example in green cement industry the following methods are adopted at the different stages of the green cement manufacturing process:

Quarrying: Constructing walls around the mining area to prevent the flow of polluted water to the nearby river

Manufacturing: Fixing filter bag for capturing dust resulting during the process of manufacturing cement.

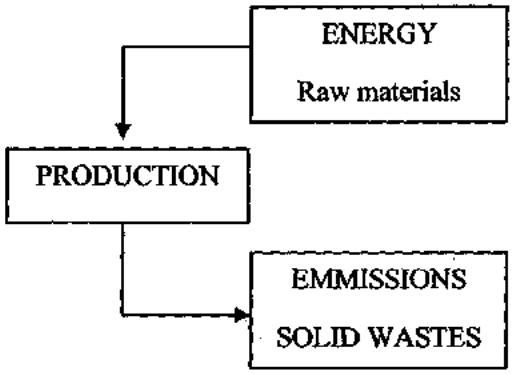
Packaging: Using eco-friendly packaging, for example in cement industry plastic bags are used which are recyclable.

iii. **Product design:**

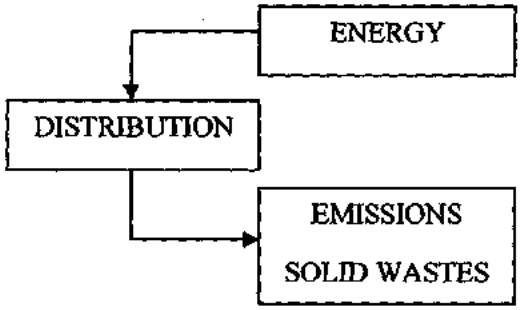
The Product should be design such that, reducing the amount of materials required and saving power. For Environmental safety, recycling is required as part of product designs ensuring the selection of materials and design that can be effectively recycled. The challenges in developing a total green product are to improve eco_ performance while producing acceptably comparable levels of functionality and service, at a competitive price. This approach involves adopting cleaner technologies that design out waste in the manufacturing processes, rather than using end of pipe solution which inevitably represent an added cost.

Design

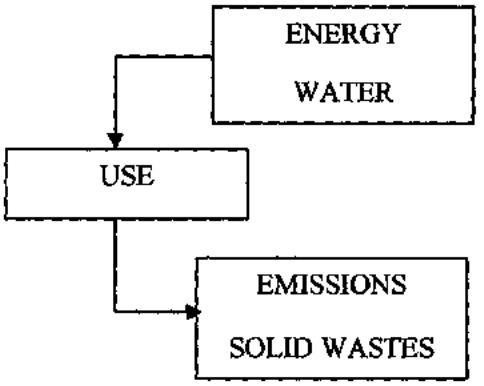
- **Choice of materials.**
- **Extraction of raw materials.**
- **Materials manufacture.**
- **Use of recycled of materials.**
- **Transport of materials and components.**
- **Manufacture of components.**



- Packaging.
- Transport.



- Operation.
- Durability.
- Reliability.
- Detergent use.
- Water use.



- Collection, transport.
- Recycling
- Landfill, incineration.

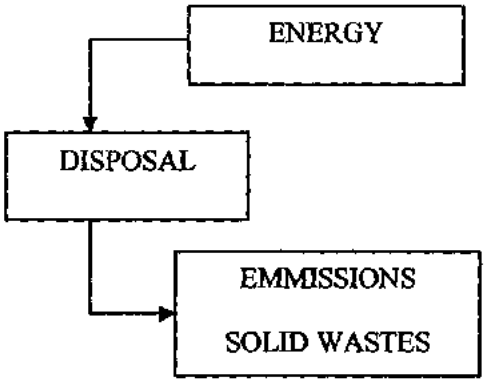


Fig:-Process on green production

b) Green Packaging:

Packaging has been and obvious starting point for many companies' green marketing efforts, since packaging can often be safely reduce without expensive charges to core product or production processes and without a risk of disaffecting customers. Reducing and recycling is also a key feature of green packaging. The company must satisfy the following conditions for designing a green pack:-

- They should observe if the production of the packaging material have an adverse effect on the environment like, if the material comes from a scarce or seriously declining sources, and if the production of the material is energy–intensive.
- They should design or choose packaging where the materials can be easily re-used or recycled and the combination of the materials used for packaging must not creates difficulty for recycling.
- They should ensure that appropriate training be given to the designer, marketer, advertiser, packaging engineers, etc.
- They should ensure that the pack, the information and the overall appearance encourages the efficient use ,re-used and disposal of the contents and the pack. Consumer education materials and advertising should be considered as and accompanying option to the pack.

c) Green Pricing:

Going green may affect the cost structure of a business with a knock-on effect on prices, particularly if pricing is on a 'cost-plus' basis. Developing new sustainable raw materials sources, complying with legislation, writing off old, 'dirty' technology, capital expenditure on clean and the overt head associated with greening the organization can impose a heavy cost burden.(These extra cost are often spoken of as a green premium, although in reality they represent the removal of a subsidy provided to products by the environment and the failure to address the environmental cost) however, these can be counter-balanced by the savings made by reducing raw materials and energy inputs, by reducing packaging, by finding markets for by –products and by switching to lead –free distribution if cost are looked at holistically and managed on a portfolio basis, then wider eco-efficiency process benefits, can counterbalance the cost of greening to make a positive contribution to profitability.

Consumer demand for green products can also allow for the addition of a green price premiums, as applies to free- range eggs. However, marketers should exercise caution in taking advantage of such opportunities, as any suggestion of profiteering may undermine the development of a credible green image.

taking advantage of such opportunities, as any suggestion of profiteering may undermine the development of a credible green image.

d) Green Logistic:

A great deal of the environmental impact of products relates to the fuels consumed and materials used and wasted in transporting products to customers. One of the predictions about the transformation towards a sustainable global economy is a return to an emphasis on more localized production and distribution.

The following are the key components of green logistic strategy, which Star cement can implement for reducing their costs:

- They should implement belt conveyor for bringing in the raw materials to the manufacturing unit from the mining area.
- They should develop centralized distribution which can bring environmental benefits such as reduce vehicle movements and a reduction in transit packaging.
- They should establish the policy and targets and aimed at reducing vehicle emission impacts.
- They should insist that logistics sub-contractors operate and environmental policy consistence and commission their own comprehensive environmental audit.
- They should implement promotion of environmental awareness both within the company logistic departments and its sub-contractors.

(Ken peattie and Martin Charter, Green Marketing, 2000, CIM)

e) Green Promotion:

Many companies have sought to promote themselves and their products through explicit or implicit association with the environment and good eco-performance. There has been considerable concern over whether or not much of the green promotion (Particularly advertising) being used is misleading. However, given the complexities of the issues involved ,messages that are bought straight forward enough for consumers, yet sufficiently comprehensive and qualified to satisfy regulators and activists , can be hard to create. Environmental issues is an area where there are important opportunities in combining with corporate communication efforts, and where a communications approach based on openness and education more than promotion will often pay dividends.

By going green, Star cement can promote itself and its product as green product through:

- ***Advertising:*** Advertise in way that the product lends themselves to convince and distinct their green images from the other product.
- ***Sales promotion:*** Provide incentives to consumers to change their purchasing and product use decision in favor of green products and the environment.
- ***Personal Selling:*** Sales force should be aware of the environmental implications of the company and its products and processes.

IV. Introduction to cement industry:

By definition, cement is a fine grey powder which sets after few hours when mixed with water; and then hardens in a few days into a solid strong material. Virtually all the cement produce globally is mixed with sand, aggregate and water, and used to make concrete and mortals

Cement is a key infrastructure industry. It is second only to water, as the most consumed substance on earth, with nearly 3 tons use annually by each person on the planet .Cement is the critical ingredient and concrete locking together the sand and gravel constituents in an inert matrix. It is therefore a critical part of meting society's needs for housing and basic infrastructure such as bridges, roads, water treatment facilities, schools and hospitals.

Cement industries is responsible for over 3% of carbon emission. This study aims to define a consistent approach to the selection and use of fuels/alternative fuels, raw materials and necessary technological changes in the cement industry, built upon the principles of sustainable development and processing of waste- materials. To promote this approach and associated good practices throughout the industry we have to study the current practices in the cement industry with respect to green management and also provide some possible suggestion of how can the industries adopt the green practices in different aspect of production.

Potential of industrial Ecology Practices in cement Industry:

The following criteria have been developed to assist the industry in determining if the current potential IE (Industrial Ecology) practices will assist in long-term sustainable development. The proposed structure in part 3 considers the options and tradeoffs inherent when implementing projects that have both positive and negatives.

1. True partnership- the relationship should be an active collaboration between two or preferably more industries seeking to preserve the environment and benefit society in a way that is financially positive to all partners operations.

2. All benefit –The benefit of the relationship should be significant for all industries involved. It should not be a service (such as waste disposal) that one is providing the other with relatively small environmental and social value.

   Rather, the environmental, financial, and social benefits should be shared at a significant level. The others partners should compensate partners who receive small or even negative financial benefit to the extent that the overall net financial viability of the system in enhanced by their collaborations. Social benefits of IE (Industrial Ecology) should be measured and included in the project assessment.

3. Waste management (pollution prevention) hierarchy –the relationship should follow the principles of pollution prevention; that is, it should promote prevention of waste e generation first, then reuse recycling, and finally environmentally –sound treatment as a last resort. Energy recovery from waste materials is essentially treatment. Exceptions should be judged using appropriate system analyses tools such a life cycle assessment and life cycle costing.

4. Zero waste- Ideally, the goal should be "zero waste" from the organizations involved, either explicitly or on a system level. The partnership should seek to reduce waste output to zero by making it a useful input or others and to reduce resource use by using other facilities unneeded materials.

5. Quantitative benefits –the relationship should result in quantitative benefits, such as emissions reduction, financial savings, and lower natural resources usage. While quantities benefits are important, the partnership should be substantial enough to have specific savings and improvements to the environment and the balance sheet. Quantitative social benefits, such as net co2 emission, virgin material resource use, and landfill like extension, should be included.

6. Innovation and tools-the savings should result from an innovative development or relationship, such as new technology ,tools ,management framework, or partner finding strategy(Internal or external).These new technique will promote creative thinking and new ideas with in the industries wanting to implement IE.

7. Location and Relationship-The facilities that are participating in an industrial eco-system can be co-located (neighbors) or distantly located, owned by the same parent company (sisters) or unrelated, new construction design for IE or exiting plants that are retrofitted. Any of these combination works, although each has its own benefit and challenges.

V. Current trends in the cement industry:

a. Global Scenario:

The total global consumption recorded in 2006 was measured at 2568 Mt, or 2.568 billion tones again of some 9.6% on 2005 totals. By 2007 total consumption had moved up to 2763 Mt, representing a lower annual gain of 7.6% over the previous year. The global financial collapse which reverberated throughout much of the world in 2008, had an immediate impact on the global cement sector, and although cement consumption growth was to continue, moving higher at 2857Mt for the year, the annual upward change over the previous year is now recorded as slowing to just 3.4%.

The worrying, although hardly surprising news for 2009 indicates a further slowdown in global demand growth, sliding to+1.7 %, brought about by sizeable consumption losses across North America and throughout much of Europe. Even china has not been immune from such trends with growth recorded at single figures rather than above the 10% level.

Over the period 2000-2008, compounded annual growth in cement consumption is noted at 7.2%, some 3-4 percentage points higher than the long term global average calculated over the past 20-30 years. As mention earlier, the data for 2008 suggest that the global cement industry may now be showing the first signs of a return to such long term growth trends.

Indeed, if one begins to factor in a higher accountability to global warming and a necessity to limit co2 emission over the next decade and beyond, we might one day even come to view this current decade as a high peak in global cement consumption levels. Clearly, much will depend on what goes on within china, which now makes up almost 50% of global consumption totals. As highlighted in the report, china again continues to dominate world rankings, with consumption levels rising from 1200 Mt in 2006 to 1390Mt in 2008. Such gains are, however, slowing and perhaps indicative that longer –term Chinese cement consumption growth could also be much more limited. China's per capita cement consumption now already stands at over 1000kg somewhat high by world standards, and especially when compare to the world's number two most populous country, India which now has a per capita cement consumption of only 150kg. On a positive note, china is now actively scraping a sizeable percentage of its older polluting production units and beginning to take a more serious stance towards global warming issues.

Carbon dioxide (CO2) is the primary greenhouse gas that drives global climate change and is the only greenhouse gas emitted by the cement industry in a significant amount. The cement industry emits approximately 5% of global, manmade CO2 emissions. When all greenhouse gas emissions generated by human activities are considered, the cement industry is responsible for approximately 3% of global emissions. Due to the unique

nature of the product it manufactures, the cement industry currently emits 0.73 to 0.99 kilograms of CO2 for every kilogram of cement produced. At any emission rate within this range, current proposals to curb CO2 emissions will profoundly affect the activities and finances of the industry. Future proposals will likely call for far more significant reductions.

(Hargreaves D. 01 may 2009, international review and world business council for sustainable development, March 2002)

b. Cement industry in India:

In Indian, this industry has been de controlled from price and distribution on 1st march, 1989 and de-licensed on25th July, 1991. However, the performances of the industry and prices of cement are monitored regularly. The constraints faced by the industry are reviewed in the infrastructure coordination committee meeting held in the cabinet secretariat under the chairmanship of Secretary (Coordination).

For the development of the cement industry "Working Group on cement industry" was constituted by the planning commission for the formulation of ten five year plan. The working Group has projected a growth rate of 10% for the cement industry during the plant period and has projected creation of the additional capacity of 40-62 million tones mainly through expansion of existing plants.

(www.dipp.nic.in/industry/cement.htm).

The Indian cement industry comprises of 132 major Cement plants with a combine install capacity of 166.73 Mt, out of these 23 are in Andhra Pradesh. Actual cement production in 2002-2003 was 116.35 million tones as against a production of106.90 million tons in 2001-2002, registering a growth rate of 8.84%. Major players in cement production are Ambhuja cement, J&K cement and L&T cement. Apart from meeting the entire domestic demand, the industry is also exporting cement and clinker. The export of cement during 2001-2002 and 2003-2004 was 5.14 million tones and 6.92 million tons respectively. Export during April – May, 2003 was 1.35 million tons.

Major exporters were Gujarat Ambhuja cement ltd. and L&T ltd. The planning commission of 10th five year plan constituted a 'working group on cement industry 'for the development of cement industry.

The working group has identified following thrust areas for improving demand for cement:

- Further push to housing development programs;

- Promotion of concrete highways and roads ;
- Use of ready-mix concrete in large infrastructure project.

Further, in order to improve global competitiveness of the Indian cement industry, the department of industrial policy and promotion commissioned a study on the global competiveness of the Indian industry through an organization of International repute, viz. KPMG consultancy Pvt. Ltd. the report submitted by the organization has made several recommendations for making the Indian cement industry more competitive in the International market. The recommendations are under consideration.

Cement industry has been decontrolled for price and distribution on 1st March 1989 and de-licensed on 25th July in 1991.However, the performance of the industry and prices of cement are monitored regularly. Being a key infrastructure industry, the performance and constraints faced by the industry are reviewed in the infrastructure coordination committee meetings held in the cabinet secretariat under the chairmanship of secretary (coordination).Technological upgrading and assimilation of latest technology has been going on in the cement industry. Presently 93% of the total capacity in the industry is based on modern and environment-friendly dry process technology and only 7% of the capacity is based on old wet and semi-dry process technology. One project for co-generation of power utilizing waste heat in an Indian cement plant is being implemented with Japanese assistance under Green Aid Plant. The induction of advance technology has held the industry immensely to conserve energy and fuel and to save raw-material for the production of cement.

(www.economywatch.com/business-and-e)

c. Cement industry in Meghalaya :

Cement industry in Meghalaya is growing in a rapid rate with the annual production of 0.53 million tons. The major players are Star cement (CMCL), Topcem, Jaintia cement, and Mawmluh Cherrapunjee (MCCL) with M/S JUD cement, Aphonic cement, and Amrit cement under construction.

Meghalaya has a rich reserved limestone of 16000 Mt which is the third largest in the country which has the Coal content of 53% and coal deposits of 640 million tons with a calorific value ranges between 6500-7500 k.cal/kg.

The state government offers subsidies such as, on cost of infrastructure, transport, training, and power. The central government has since declared that new units in the north-eastern region will be eligible for exemption from income tax for a period of five years from the date of commercial production.

(Singh R.D. Eastern Panorama Magazine, www.easternpanorama.in/index.php)

- Liberalized State Industrial Policy providing attractive incentives/subsidies with Single Window Clearance facility. Meghalaya provides incentives like tax holiday, etc.

- Industrial Estates/Areas, Export Promotion Industrial Parks (EPIP) and Growth Centers set up at strategic locations within the State Special tax incentives/concessions for export-oriented units and investment in key infrastructure areas

So far, coal mining in Meghalaya is unscientific in nature. Recently the supreme court have band the unscientific way of coal mining and this band will have an effect to the industries located in this area as they are all dependent on the local vendors for these resources.

Legislations passed in India regarding Co2 emission, The Air (Prevention and Control of Pollution) Rules formulated in 1982, complementing the above Acts is the Atomic Energy Act of 1982, which was introduced to deal with radioactive waste. Water (Prevention and Control of Pollution) Act, 1974, Air (Prevention and Control of Pollution) Act, 1981.All the industries operating in India have to follow these acts while operating.

A ready market in the North East and the neighboring countries like Bangladesh has attracted many investors in the industries thus lead to over exploitation of mineral resources, environmental pollution and rampant unscientific mining practices

VI. Introduction to case:

The concentration of many cement manufacturing units in Meghalaya has lead to the exploitation of minerals resources in order to meet the needs of the industry. As a result, we are witnessing the depletion of mineral resources like coal and limestone. In addition the practices of coal mining are unscientific resulting to the degradation of the environment. Waste and emissions produce by this industry has lead to the further choking of our environment

VII. Objectives of the study:

1. To study the current practices in the cement industry.

2. To study the feasibility of green marketing practices in the cement industry in Meghalaya.

3. To define a consistent approach to the selection and use of fuels/alternative fuels and raw materials in the cement industry. To built upon the principles of sustainable development and processing of waste- materials. We will promote this approach and associated good practices throughout the industry.

VIII. Methodology:

Case: To achieve the above objectives, we have selected cement manufacturing company Ltd. (Star Cement) Lumshnong. Star Cement is the largest producer of cement in North –Eastern region, easily accessible and it produces the best quality of cement in the region, for which they have been awarded continuously for the year 2007 and 2008.

We have collected the primary data through industrial visit, and interviews. Secondary data we have collected data through the internet, newspapers, magazines and journals to evaluate the plant SWOT (Strength, Weakness, Opportunities and Threats) and TOWS (Threats, Opportunities, Weakness and Strength) matrix.

IX. Case Study

Star Cement

Star cement is an ISO 9001 certified company which is the largest manufacturer of cement in the northeast of India. The plant is located at Lumshnong, 125 km from Shilling, spreading over 40 acres of land. It begins its operation in 2005.

At star cement, quality is of paramount importance with a 24 hour automated camera in the burning zone and automatic rotor-packer machine. The plant has state of the art dry process rotary kiln technology that ensures manufacturer of high-grade ordinary Portland cement and Portland Pozzolana cement with its superior product and harnessed commitment star cement within a short span has made a significant in-road in the northeastern market. The total production capacity of the plant is 1800 tons per day. The plant produced two types of cement viz., PPC (Pozzolona Portland Cement) and OPC (Ordinary Portland Cement).

ENVIRONMENTAL ANALYSIS

X. Political, Economic, Social, and Technology (PEST) analysis :

a) Political

Star cement will enjoy the privileges given by the state industrial policy providing attractive incentives/subsidies with Single Window clearance. It will enjoy the special incentives given by the central government for investing in Meghalaya .On the other hand it will have to conform to the various environmental laws and regulations passed by the government such as:

Air (prevention and control pollution Act; 1981).To counter the problems associated with air pollution ,ambient air quality standards were established , under the 1991 act .The act provides means for the control and abatement of air pollution . The act seeks to combat air pollution by prohibiting the use of polluting fuels and substances, as well as by regulating appliances that give rise to air pollution. Under the act establishing or operating of any industrial plan in the pollution control area requires consent from state boards. The boards are also expected to raise the area in air pollution control area, inspect pollution control equipment, and manufacturing processes. National ambient air quality standards (NAAQS) for major pollutants were notified by CPCB in April 1994. These are deemed to be levels of air quality necessary with an adequate margin of safety to protect public health vegetation and property (CPCB 1995 sited in Gupta 1999).the NAAQS prescribed specific standard for industrial, residential, rural and other sensitive areas .industries –specific emissions have also been developed for iron and steel plants, cement plants, fertilizers plants, oil refineries and the aluminum industries. The ambient quality standards prescribed India are similar to those prevailing in many developed and developing countries.

Star cement has to conform to the air prevention and control act 1991 which prohibit the use of Polluting fuels and substances. This will lead the firm to look for alternative fuel such as the use of biogas plant and reduce the use of coal. The use of biogas plant will lead to low production due to the unavailability of raw materials for the biogas plant. Besides the firm has to restructure its entire plant if it has to use biogas plant. This will involve a huge investment for buying the technology to meet the standard of the country and state pollution control boards. Other factors including in the political are:

i. Unscientific mining of coal:

At present coal is extracted unscientifically. Recently Parliament has made a proposal to do away the unscientific mining of coal. The scientific mining of

coal will require huge amount of investment for buying technology for mining purposes. This will lead to shortage of coal supply to the cement plant. It will also raise the price of coal which will in turn increase the price of cement leading to low demand.

ii. Pressure groups:

Pressure groups play an important role in the state. They stand for the right of the local people, influence the government in policy making and proper implementation of different policies. Star cement has to meet the demand of Pressure groups such as hiring suppliers, distributors, conservation of rivers and forests, and providing employment to the local people. It restricts the firm to hire skilled and efficient Labour from outside the state.

iii. Tax holiday and subsidies:

To attract more investors the state government and central government have provided many subsidies to these investors. Tax holiday is one of the subsidies offer by the government which is valid from March 2009 to March 2015. The government also provides different subsidies such as existing infrastructure, social amenities like residential colony, dispensary, shopping complex, school and guest house. As per Northeastern Industrial and Investment Promotion Policy (NEIIP) 2007, the unit will be eligible for excise duty exemption, income tax exemption, capital investment subsidy, interest subsidy, comprehensive insurance and transport subsidy.

b) Economic

Economics refer to all forces which have an economic impact on business. Such as production, infrastructure, national income, per capita income, these will make up the total economic environment. With the development of this company herein Meghalaya will bring a very useful task to the people and can make more effort on its economic growth.

Star cement will raise the par income capita and the GDP of the state. It will do away with the unemployment of the youth to a certain extent; the disposable income of the people will increase. Star cement will contributes to the development of infrastructure of the country by producing cement which is the most important material for construction purposes.

With the hike in fuel prices especially diesel will have an immediate impact on the suppliers as well as distributors costs which ultimately increase the price of cement.

Inflation in the economic trend hits the industry directly because the demand decreases with the downturn in the disposable income of the people.

The change in the climatic conditions affects the storage of raw materials and the finished products. To prevent the raw materials and the finished products from being affected by the climatic conditions, the firm has to maintain a required temperature for storing the raw materials and the finished products. For example cement is very sensitive if proper storage is not maintained it will turn into hard substance.

c) Social

With the coming of star cement there will be movement of the labor from the different places leading to the changes in the lifestyle of the people to purchase the eco-friendly product as they are more concern about the environment and health conscious. The population of Meghalaya is 23, 18,822 (2001 census), Area 22429 sq. km, and literacy rate is 22.7 %(2001 census).Since the population of Meghalaya is growing rapidly along with literacy rate, so people are becomes more aware and conscious of their rights and environment. They started to realize the necessity to conserve environment and prefer eco-friendly products and boycott products which have direct or indirect impact on the environment.

In order to influence the public to buy the product and to gain a public trust, Star cement have to develop a good relationship with the media to present a good image of the company. Star cement have to involve itself in social activities such as making a contribution to the charitable trust, setting up school and health centers, tree plantation, organizing and financing cultural activities and sponsoring sports and events. These activities require huge amount of money. If the public does not response positively it will cause a huge lost to the company.

With the fear of natural disaster such as earthquake, People prefer to have a house build devoid of cement materials. This will lead to low demand for cement.

In order to produce the desired quality of cement, the company has to study and make a research of the markets to find out the opinion of the public regarding the quality require by them. This requires a lot of time and money to be spent.

With the rise in the income level of the people, demand for the cement will increase due to capability of the people to construct huge building for more comfortable life.

d) Technology

Star cement will have access to the new and up- to-date technologies through the various schemes/subsidies and incentives given by the government.

On the other hand the factory will stop operating with the breakdown of the machineries due to the unavailability of the spare parts within the state

New technology used in cement industry:

Cement industry has made a tremendous stride in technological up gradation and assimilation of latest technology .At present 93% of the total capacity in the industry is based on modern and environment-friendly dry process technology and only 7% of the capacity is based on old and wet semi dry process technology. Some of the new technologies are:

The Eco-cement testing plant: Eco-cement is a new technology adopted by MITI'S "High Grade Processing of Consumer Industry Waste /Research & Development of Effective and Applicable Technologies" the main feature of Eco-system are as follows:-

- ***Prolonged landfill site usage:*** The landfill site's reclamation burden is greatly reduced because incineration ash is for completely recycled as natural resource.
- ***Completely decomposes dioxins:*** High temperature calcinations at 1350°C completely decompose dioxins contained in incinerator ash.
- ***Collection of heavy metals:*** Heavy metals contained in incinerator ash collected by an adjoining heavy metal collector facility can be gathered as metals contained within calcimined fly ash and reconstituted as a raw material through reclamation processes in a refinery, thus reducing waste from Eco-cement manufacturing facilities to Zero.
- ***Energy conservation:*** To turn incinerator ash into a raw material, calcinations is done at a temperature around 100°C lower than the calcifying temperature for normal cement. These results in saving energy around 10% and reduce CO2 than normal cement.

(Ebaracorporation, Tokyo japan, http://www.ebara.co.jp)

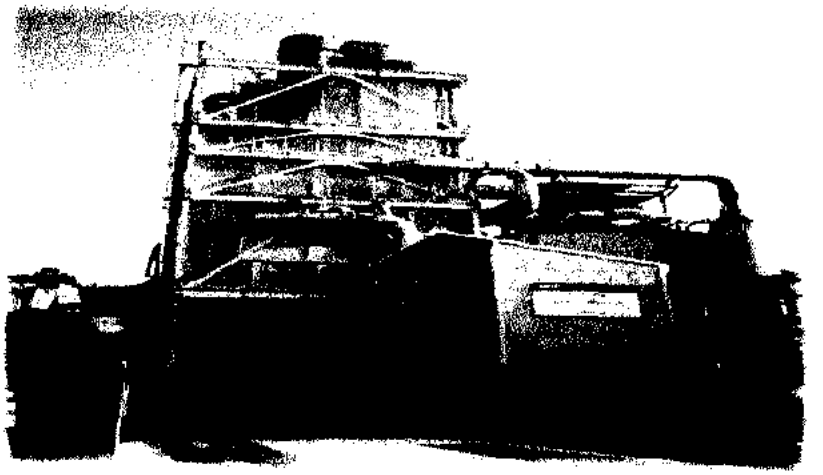


Fig: **The Eco-cement testing plant**

XI. Process:

Raw Materials, sources and quantity used or required in the production of cement are given in the table below:

Raw materials	Sources
Limestone	Local
Coal	Local
Sand	Local
Gypsum	Bhutan
Fly ash	Guwahati / west Bengal
Clay	Local
Slag	Guwahati / west Bengal

Energy used by Star Cement is hydro electric power supplied by MeSEB and captive thermal power plant with a capacity of 41MW.

The main process routes in the manufacturing of cement are:

a. Quarrying.

b. Raw materials preparation.

c. Fuels preparation.

d. Clinker burning.

e. Mineral additions preparation.

f. Cement grinding.

g. Cement dispatch.

a. Quarrying:-

Raw materials such as limestone, marl, and Clay/shale are extracted from quarries which, is located close to the quarry site and transported to the cement plant for intermediate storage, homogenization and further preparation.

In star cement, raw materials like limestone, clay, etc. are quarried by the company itself from the nearby areas.

b. Raw materials preparation:-

After intermediate storage and pre-homogenization, the raw materials are dried and ground together in defined and well-controlled proportions in a raw mill to produce a raw mill for the dry and semi-dry process

The resulting intermediate product – i.e. raw mill or raw slurry (or their derivatives) – is stored and further homogenized in raw mill silos, storage bins or slurry basins to achieve and maintain the required uniform chemical composition before entering the kiln system.

c. Fuels preparation:-

Fuels preparation – i.e. crushing, drying, grinding, and homogenizing – usually takes place on site. Specific installations are required such as coal mills, silos and storage halls for solid fuels, tanks for liquid fuels, and the corresponding transport and feeding systems to the kilns. The thermal fuel consumption is largely dependent on the basic process design applied in the burning of clinker.

Fig: Coal mill house

d. Clinker burning:-

The prepared raw material ("kiln feed") is fed to the kiln system where it is subjected to a thermal treatment process consisting of the consecutive steps of drying/preheating, calcinations (e.g. release of CO2 from limestone), and sintering (or "clinkerisation", e.g. formation of clinker minerals at temperatures up to 1400 °C).

Fig: Burning of clinker.

Fig: Heat controller

The burnt product "clinker" is cooled down with air to 100-200 °C and is transported to intermediate storage.

The kiln systems commonly applied are rotary kilns with or without so-called "suspension pre-heaters" (and, in more advanced systems, "pre-calciners") depending on the main process design selected. The rotary kiln itself is an inclined steel tube with a length to diameter ratio between 10 and 40. The slight inclination (2.5 to 4.5 %) together with the slow rotation (0.5–4.5 revolutions per minute) allow for a material transport sufficiently long to achieve the thermal conversion processes required.

Exhaust heat from the kiln system is utilized to dry raw materials, solid fuels or mineral additions in the mills. Exhaust gases are de-dusted using either electrostatic precipitators or bag filter systems before being released to the atmosphere.

e. Cement grinding:-

Portland cement is produced by inter grinding cement clinker with a few percent of natural or industrial gypsum in a cement mill. Blended cements (or "composite" cements) contain other constituents in addition such as granulated blast-furnace slag, natural or industrial Pozzolana (for example, fly ash from thermal power plants), or inert fillers such as limestone.

Mineral additions in blended cements may both be inter-ground with clinker or ground separately and mixed with Portland cement. Grinding plants may be located remotely from the clinker production facility. The different cement types have to be stored separately in cement silos prior to bagging and dispatch.

Fig: Cement silo

f. Mineral additions preparation:-

Mineral additions from natural or industrial sources intended to be used in blended cements may need to be dried, crushed or ground in separate installations on site. Separate "grinding plants" where mineral additions and blended cements only are produced may also be located remote from the clinker production facility.

g. Cement dispatch:-

Cement may be shipped as bulk cement or – usually to a lesser extent – packed into bags and palletized for dispatch. Transport methods used (i.e. road, railway, waterways) depend on local conditions and requirements.

- **Transportation:**

  Star cement depends solely on road transportation.

- **Competitors:**

  The competitors of Star cement within the Eastern region are as follows:

  1. Topcem Cement Private Ltd. located in Jaintia Hills, Lumshnong, with advance dry process rotary kiln technology has the capacity of 3000 tons per day. They have a captive power plan of 10MW.
  2. Jud cement Private Limited; which is under-construction in Jaintia Hills, Wahiajer, plans on expansion which involves clinker capacity from 0.3mpta to 1.65mpta and cement capacity to 2.54mtpa capacity and a captive power generation unit of capacity 2*20 MW.
  3. Holcim (Assam) a Switzerland based cement giant, plans to ship around 3000 tones or 60000 bags of cement to Guwahati.
  4. MCCL (Mawmluh Cherapunjee Cement Limited):MCCL(Mawmluh Cherapunjee Cement Limited) is located in sohra. Mawmluh Cement plant and limestone mining project Rs.62 crores with acapicity of 6 hundreds tons per day.

Star cement is using the Integrated Management System (IMS)

Product quality- The ISO 9001 (QMS) quality policy is a formal statement from management, closely linked to the business and marketing plan and to customer needs. The quality policy is understood and followed at a level and by all employees. Each employee needs measurable objectives to work towards ISO9001 includes:-

- A set of procedures that cover all key processes in the business;
- Monitoring processes to ensure they are effective;
- Keeping adequate records;

- Checking output for defects, with appropriate and corrective action where necessary;
- Regularly reviewing individual process and quality system itself for effectiveness and
- Facilitating continual improvement.

Protection of environment- The ISO 14000 (EMS) is a series of environmental management standards develop and published by the international organization for standardization (ISO) for organization. The ISO14000 standard provides a guideline or framework for organization that needs to systematize and improved their environmental management efforts. The ISO14000 standards are not designed to aid the enforcement of environmental laws and do not regulate the environmental activities organizations. This ISO specifies requirement of an environmental management system (EMS) for small to large organizations. An EMS is a systemic approach to handling environmental issues within an organization.

Safety and Occupational Health- The ISO 18001 (SAOH) was created via the concerted effort from a number of world's leading national standards bodies, certification bodies and the main driver for this was to try to removed confusion in the work place from the proliferation of certifiable. The main aim of occupational health is to promote and maintain of the highest degree of physical, mental and social well being in all occupations, prevention among workers of departures from health caused by the working concern, protections of workers in the employment from risks resulting factors and adverse to health. Placing and maintenance of the worker in an occupational environment adapted to his physiological and psychological capabilities and to summarize the adaptation of work to man and of each man to his job.

Special Features-

- Very good quality of limestone which contains 52% Calcium compared to other states of India which is only up to 45%. This provides Star Cement with the advantage of obtaining much high quality cement as compared to other states.
- Coal used by star contains15-25 % ash and 3.5 % sulphur
- Quality control system: Star uses a Press Pellet Machine and Total Cement Analyzer to control the quality of cement.
- Uniformity of raw materials, i.e., there is a constant flow of raw-materials from various suppliers.

Manufacturing par excellent

Star cement prides itself on its highly evolved manufacturing method, a complex yet efficient system that seamlessly mesh human expertise with advanced technology. The plant procures high quality clinker from reputed international manufacturers. The manufacturing process combines the latest Japanese and German technologies with management expertise to ensure high standards of operation and maintenance.

Raising the quality bar

Star cement superior standards frequently set industry benchmarks, whether it is the quality of materials, sophistication of the manufacturing technologies, or the final product itself.

This uncompromising approach to quality has well recognized by the customers as well as leading industry organizations.

XII. Precaution taken by Star Cement:

1) Prevent dust by reducing blasting intensity and providing back filters.

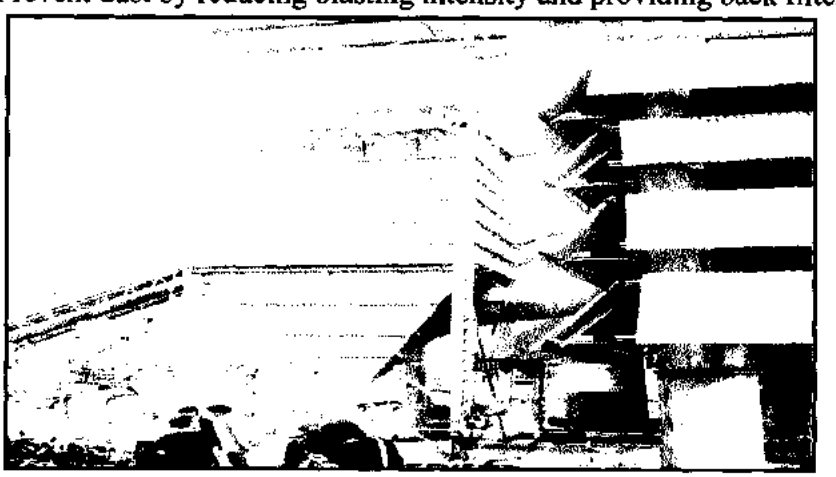


Fig: Back Filter

2) Using Eco - friendly explosive item in order to reduce dust as well as noise pollution.
3) Preventing the flow of water from mining areas to the river through building of check Dams.
4) Noise management by keeping sensor wherever required within the plant.
5) Implementation of ISO 9001, to maintain standard quality.

6) Implementation of ISO 14001, to maintain the environmental management.
7) Automatic control of quality in case of any defect in the Mixing of substances.
8) In cement packing section ventilation are provide for Packing hall .Back filter are also provided in all cement Packing system .
9) Plantation of 15,000 trees in the company quarries of lime stones.
10) Treating of domestic waste water and reusing it for watering of the plants.

Fig:B.O.D.Incubator

Fig: Respirable Dust Sampler

XIII. Strength, Weakness, Opportunities and Threats (SWOT) analysis:

a) Strength-

- Availability of raw materials
- High brand image in the market
- ISO 9001-2000
- Eco-friendly production

b) Weakness-

- Lack of power.
- Lack of skilled labor.
- Insufficient raw materials.
- Lack of infrastructure.

c) Opportunities-

- High demand in the market
- Emission reduction credits
- Use of alternative , low-carbon fuels
- CO_2 capture and sequestration or possible resale

d) Threats-

- Competition within the market.
- Competition from outside the market.
- Unavailability of spare parts in the state itself.
- Possibility of imposed technological control.

XIV. Tows Matrix:

	Opportunities:	**Threats:**
	1) High demand in the market. 2) Emissions reduction credits. 3) Used of alternatives low-carbon fuels. 4) CO2 capture and sequestration or possible resale.	1) Competition within the market. 2) Competition from outside the market. 3) Unavailability of spare parts, 4) Possibility of imposed technology control. 5) Lack of infrastructure.
Strength: 1) Availability of raw-materials (Locally). 2) High brand image. 3) ISO9001-2000. 4) Eco-friendly production	**Maxi-maxi Strategy(SO):** 1) Increase the production capacity. 2) Improve on the company's strength and production.	**Maxi-mini Strategy(ST):** 1) Promotion. 2) Pricing. 3) Used of eco-friendly technology.
Weakness: 1) unsustainablity of power. 2) Lack of skilled labour. 3) Insufficient raw-materials.	**Mini-maxi Strategy(WO):** 1) Bio-mass energy. 2) Conveyor belt (Inbound logistic). 3) Backward integration. 4) Recycling of concrete.	**Mini-mini Strategy(WT):** 1) Shift to more sustainability energy (Bio-mass). 2) Training (Local people) & recruitment from outside the state. (Based on the Legislation of the government). 3) Inventory management.

XV. Strategies:

1) Increase the production capacity since there is high demand in the market and easy availability of raw materials (like coal and limestone).

2) The strength of star cement are high brand image, ISO 9001-2000 and eco-friendly product, star cement can improve on its strength and promotes the company on this basis to win more customer's preferences and market share.

3) For sustainable source of energy, star cement can use biomass energy instead of thermal and conveyor belt for inbound logistics.

4) Star cement purchase coal and sand from the local suppliers. This creates a problem because the company cannot satisfy the demand of the suppliers (for example: the company cannot meet high price demand by the suppliers). To solve this problem the company can adopt backwards integration (i, e., buy their own mining fields for coal and sand).

5) Star cement can shift to a more sustainable energy like biomass. As the supplement energy which is sustainable in the manufacturing process, so as to reduce the using of other energy like thermal energy which are unsustainable in nature and which also create problems to the environment.

6) Star cement can provide training program for the current/unskilled labor for improvement. For specific post/jobs which involve highly specialization they can recruit from outside the state keeping in mind the policy and legislation provided by the government.

7) In order to meet the material requirement of the company, a proper inventory management should be set up.

XVI. Suggestions:

a. ***Guidelines for the selection of fuels and raw materials:***

The operator should develop a fuels and raw materials evaluation and acceptance procedure that includes the following features:

- **In clinker burning process, exhaust heat from the kiln system can be utilized to dry raw materials, solid fuels or mineral additions in the mills. And by using Bio-Mass as a substitute for fuel in the kiln system.**
  The raw material for biomass can be collected from domestic waste, rice husks, and agricultural waste.
- **In case of quarrying, Star cement can implement the suggestion of using modern computerized methods available to evaluate the raw material deposits and to optimize the long-term and short-term production schedule.**
- **Each material supplier should be required to prepare a sample of fuel or material, which will be used to evaluate the fuel or material before delivering it to the plant.**
- **This should include a datasheet detailing the chemical and physical properties of the fuel or material being supplied, information on relevant health, safety, and environmental considerations during transport, handling, and use, and a typical sample of the material. It should also specify the source of the particular shipments being made.**
- **The sample's physical and chemical characteristics should be tested and checked against specifications.**

*b. **Guidelines for key areas of operations:***

Installation design General design considerations

- **Assess operations for health and safety risks or concerns to ensure that equipment is safe and to minimize risks of endangering people or installations, or damaging the environment.**

- Use appropriate procedures to assess risks or hazards for each stage of the design process. Only competent and qualified personnel should undertake or oversee such hazard and operability studies.
- Carefully consider plant layout to ensure access for day-to-day operations, emergency escape routes, and maintainability of the plant and equipment.
- Apply recognized standards to the design of installations and equipment. Any modification to installations and equipment should meet requirements set in the standards. Thoroughly evaluate existing equipment refitted for a different service from a safety and performance
- Stand point before resuming commercial production.
- Document modifications to installations and equipment. Reception and storage of materials
- Establish suitable and safe transfer systems from transportation to the storage area to avoid risks from spillage such as fugitive emissions or vapor displacement. Suitable vapor filtration and capture equipment should be in place to minimize impact to the reception point and surrounding areas from unloading activities.
- Assure that storage facilities fit their purpose. Appropriate storage for liquids should meet relevant safety and design codes for storage pressures and temperatures.
- Solid materials handling systems should have adequate dust control systems.
- Storage design should be appropriate to maintain the quality of the materials: for solids, prevent build-up of old materials; for liquids, mix or agitate to prevent settlement, etc.
- Design transfer and storage areas to manage and contain accidental spills into rainwater or firewater, which may be contaminated by the materials. This requires appropriate design for isolation, containment, and treatment.
- Appropriate storage for liquids should have adequate secondary containment. Material handling and feed systems
- Handling systems and feed systems should be appropriate to the fuel and raw material used. The feed systems should allow stable and controlled input of materials to the kiln.
- The operator should assess risks from fugitive emissions; equipment failure modes and appropriate safeguards should be incorporated into the design to prevent environmental pollution, health, and safety problems. Delivery and on-site transport
- Use appropriate vehicles and equipment to transport fuels and raw materials.
- Personnel involved in transportation should be adequately trained and qualified.
- The transport provider (including in-house transport) should document maintenance and operator training. Selection and reception of materials

- Select fuels and raw materials only after the supplier, and the chemical and physical properties and specifications of the materials have been clearly identified.
- Stop vehicles carrying fuels and raw materials upon arrival at site and make the necessary identifications. Such vehicles should be weighed in and out of the site. Deliveries should be recorded.
- Check documents relating to vehicles carrying waste and determine their compliance with site acceptance specifications and regulations. Document checks may cover waste certificates, transport certificates, etc. A vehicle found not to comply should not be allowed to enter the site.
- Instructions for unloading, including safety and emergency instructions, should be provided in due time to vehicle drivers.
- Sample and analyze vehicle loads once on site according to the frequency and protocol defined in the site control plan; check agreement with site specifications according to the plan of control.
- Fuels and materials can be accepted once their properties are confirmed to agree with specifications.

	Conventional raw materials		Alternative raw materials		
	High limestone	Natural gypsum	Fly ash	Slag	Synthetic gypsum
Wet basis	50,000 t	120,000 t	150,000 t	400,000 t	2,30,000 t
Moisture	9.6%	7.5 %	0.2%	5.4%	4.5%
Dry basis	45200 t	111000 t	149700 t	378400 t	219650 t

Fig: Temperature for Storage of raw material

c. *On-site handling and storage:*

- There should be written procedures and instructions in place for the unloading, handling, and storage of the solid and liquid fuels and raw materials used on site.
- Relevant employees should be trained in the company's operating procedures, and compliance with such procedures should be audited regularly.
- Storage facilities should be operated in such a way as to control emissions to air, water, and soil.
- Designated routes for vehicles carrying specified fuels and raw materials should be clearly identified within the site.

- Appropriate signs indicating the nature of materials should be in place at storage, stockpiling, and tank locations.

d. Guidelines on Employee training Safety, health, environment and quality:

- As fresh concrete and mortar continue to be alkaline, however, persons handling it must wear suitable protective gloves and take precautionary skin care measures all the same. This combination of measures is the only way of effectively combating allergies to chromate
- The company should develop and implement appropriate documented training programs for employees to be trained in issues relevant to their jobs. New employees should be trained during an induction process.
- Such training programs should be given to contractors and, in some instances, suppliers. Personnel reporting to work on site for the first time should be trained through a site induction program.
- Training records should be kept on file.

(www.wbcsd cements .org/health. asp.)

e. The training program should include the following:

- General and job specific safety rules;
- Safe operation of equipment;
- Details of the site emergency plan;
- Procedures for handling alternative fuels and raw materials;
- Use of personal protective equipment.

f. Guidelines on Stakeholder communications and engagement:

We earn our license to operate from our stakeholders, particularly those who work on our sites and live in communities around them.

As well as building goodwill, working with local groups, national NGOs, and regulators can result in better informed and more business that is effective planning. It can be particularly useful in addressing local environmental and social issues. Effective, open, and transparent communication with stakeholders is essential if we are to play a responsible role in society's waste and resource management systems. We recommended that companies and sites develop and implement a stakeholder engagement program and policy that includes specific reference to the use of fuels and raw materials. Site managers may choose to work with their local or regional headquarters to develop and implement this program. It should contain the following elements.

g. Guidelines on Stakeholder identification and analysis:

The site or company should identify its main stakeholders, and understand their expectations of and their relationship with the company and the cement industry locally, nationally, and internationally. Site community engagement program At site level, management should provide opportunities for stakeholders to express their concerns, listen to and understand those concerns ,and build trust with the community through active engagement Reporting performance Building trust with stakeholders requires both transparency and accountability in company and site operations.

The production of regular reports on performance in areas of interest helps to provide key stakeholders with the information they need to make a fair and balanced judgment of the company's or site's activities and performance.

(Guidelines for the selection and use of fuel and raw material in the cements manufacturing process, December 2005, world business council for sustainable development)

Recomendation:

Modernization and technology up-gradation is a continuous process for any growing, industry and is equally true for the cement industry. The Indian cement industry today is by and large comparable to the best in the world in respect of quality standards, fuel and power consumption, environmental norms, use of latest technology and capacity. The productivity parameters are now nearing; the theoretical best and alternate means, like alternate fuels and raw materials have to be found to ensure further improvement in productivity and reduced production costs.

Cement industry being energy intensive, the energy conservation and alternate cheaper, renewable and environmentally friendly sources of energy have assumed greater importance for improving productivity. The major challenges confronting the industry today are raging insecurity in indigenous fuel availability, perennial constraints like higher ash content, erratic variations in quality of indigenous coal and inconsistent power supply with unpredicted power cuts. Keeping these challenges in view, the efforts by the industry towards energy conservation and finding alternate cheaper, renewable and environmentally friendly sources of energy are given utmost importance.

Our implementation for STAR CEMENT towards reducing costs, emission reduction, and recycling of co2, alternative fuel and raw materials, is through:-

1. *TECHNOLOGY CHANGE:*

Cement industry has made tremendous strides to technological up gradation and assimilation of latest technology. At present 93% of the total capacity in the industry is based on modern and environment-friendly dry process technology and only 7% of the capacity is based on old wet and semi-dry process technology. There is tremendous scope for waste heat recovery in cement plants and thereby reduction in emission level. Star cement must implement a co-generation from waste heat for utilization in the plant. Besides, the Japanese cement industry is using other superior technologies by utilizing solid waste for producing eco-cement. Technology transfer in the field of energy conservation and environment protection will help to improve efficiency of the star cement industry on the other hand the induction of advanced technology will help the industry immensely to conserve energy and fuel and to save materials substantially.

(http://siadipp.nic.in/publicat/cement.htm)

2. *NEW CEMENT BURNING TECHNIQUE:*

FAKS or Fluidized Bed Advanced Cement Kiln System from KHIL is an innovative technology in cement burning, must be implement by star cement which will help in replacing the conventional rotary kiln system. Some of the features are:

a. High flexibility in fuel choices: Various coals are available, from low calorific value to low volatile coal such as petroleum coke.
b. Better thermal efficiency: 10-25 per cent reduction in heat consumption due to the configuration of the burning and cooling process by utilizing the fluidized bed reactor.
c. Low environmental impact: 10-25 per cent reduction in co2 emission, 40 per cent or more reduction in NOx emission.
d. Superior changeover productivity: Shorter changeover production time compared with conventional systems.
e. Economical advantages: 10-30 per cent of construction cost saving and around 70 per cent reduction in installation space, lower maintenance and running cost compared with conventional systems.

3. *TECHNOLOGY AND INNOVATION:*

Together with a harmful of other industries, the star cement industry is in the spotlight of the current international climate change agenda to develop solutions to reduce harmful greenhouse gas (GHG) emission. New plants are being built using best available

technologies leading to high expectations for GHG reductions. New technologies are not being developed as rapidly as desired or do not have the expected climate impacts. It offers an international platform for about 30 industry specialists, equipment suppliers and academic institutions to exchange views and experience on the future technology needs of the cement sector and to better understand what different parties are doing or could be doing to address GHG emission, resource and energy efficiency.,

The star cement should discuss the future technology needs, highlight current developments, and identify key action needed to move forward. This will certainly touch upon how industry sector approaches could encourage more efficient program designs and energy efficiency target implementation or facilitate the research and development possibilities for innovative technologies.

By using all the three technique which are mention above can leads the company to be viable in nature by using outmoded plant which must be refitted with clean technology. Once the outmoded plants are refitted with clean technology, their emission for each ton of cement produced declines and also the energy consumption for each ton of cement produced is expected to drop by 53 per cent. Implementing or by applying all these new techniques by star cement will lead their plant to become one of the sustainable business plant.

The guidelines below are in no way meant to replace local, national, or international laws, regulations, and conventions. These guidelines represent a minimum set of good practices to be used in managing fuels and materials. They can be augmented with successful company operating experience, where acceptable performance can be documented. Successful substitution of fuels and materials in cement manufacturing is hard work. Guidelines alone cannot ensure adequate performance.

Execution of these guidelines requires well-trained staff, knowledge of current environmental regulations, and well-maintained and well-operated facilities. Appropriate monitoring and reporting systems must be in place to provide good plant control, measure performance, minimize impacts, and make adjustments where needed. Considerations when selecting and using fuels and raw materials many cement plants operate nearby quarries that supply raw materials such as limestone, marl, and clay. High transport costs mean that cement production is usually a localized activity. Where choices of raw materials and fuels are greater, the selection of these can be a complex process.

Selection is a result of subjective as well as objective valuation of alternatives, and we must often manage trade-offs among a variety of factors: availability, transport costs, calorific value, mineral content, CO_2 emissions, equipment requirements,

etc. Each facility's circumstances are unique, and the selection of fuels and raw materials can rarely be made from a simple list.

This guidance does not set limits for specific chemical content or other characteristics, because these will be determined by the company in the light of the required characteristics of the final product, the parameters of the process, and the limits set for emissions. Decisions must be made by each plant on a case-by-case basis, within the broad framework of sustainable development considerations.

(Reference-World business council for sustainable development)

XVII. Limitations of the study:

One of the limitations of this study is the unavailability of sufficient data to estimate the cost of installing new technology in cement plants.

Insufficient time and data for analyzing the uses of biomass as a substitute for coal in cement kiln.

XVIII. Conclusion:

Time constrain is another limitation of this study. Sufficient time is needed for in-depth study in this field as it is a very complicated and very long process.

The main downstream product for cement -- is the world's second most consumed material behind water, but its recycling rate varies wildly by region The industry produces 1.5 billion tons of cement annually-a 'glue' which holds together much of our modern global infrastructure; from roads to houses, from dams to water treatment systems, from schools to hospitals. It is hard to envision a society without cement. ***(GreenBiz.com, 20 July 2009)***

Cement industry plays a very important role in the development of infrastructure as well in the economic development of the country, because it provide employment as well as convert the zero value product to value added product that is raw lime stones to cement after undergoing certain process. It depends from company to company how they implement the new technology as well as they upcoming substitutes to reduce costs and to make their business more sustainable and viable for their consumers as well as for the company.

Through processing the company can go green by emphasizing their raw materials more on slack and fliers which are the waste materials of steel and iron company.

By using them they are protecting the environment from those hazardous solid wastes as well as they are minimizing the consumption of lime stones and gypsum. Thus the consumer

will get the product which is more environmental friendly and they won't mind paying more for it, which will automatically lead the company to more sustainable and viable business. In the process of production, that is while burning of lime stones substitutes of coal can be used such as husks ,tires ,pet cokes , biomass as a substitutes for power supply etc,. Concrete, which is the cheapest source of raw materials, can be used for the production of quality product thus the company can cut cost through the implementation of this system. In concrete's life cycle, recycling is present from the beginning.

Many wastes and industrial byproducts like fly ash that would otherwise clog landfills can be added to concrete mixes. These by-products also reduce reliance on natural (virgin) raw materials and can improve the concrete products. According to the American Coal Ash Association, in 2006 the concrete industry used 15,000,000 metric tons of fly ash—a byproduct of coal combustion at electric power utility plants. Concrete is easy to use and can be readily recycled. Delivered and prepared for each specific project, concrete typically produces very little waste. Finally, when a concrete structure has served its purpose, it can be recycled as aggregate in new concrete paving, backfill, or as road base.

Even the reinforcing steel in concrete (which often is made from recycled materials) can be recycled and reused Fuels preparation – i.e. crushing, drying, grinding, and homogenizing – usually takes place on site. Specific installations are required such as coal mills, silos and storage halls for solid fuels, tanks for liquid fuels, and the corresponding transport and feeding systems to the kilns. The thermal fuel consumption is largely dependent on the basic process design applied in the burning of clinker. Recovery can pertain both to the material and energy contents. The type of recovery that is more environmentally compatible is given preference. In cement plants both the energy and the material content of waste is recovered. In addition to that, rotary kiln plants in the cement industry comply with the requirements for combustion efficiency.

The principle governing waste disposal is that recovery of waste must take precedence unless disposal represents the more environmentally compatible solution. In this context, the following factors must betake into account:

- Potential emissions,
- Preservation of natural resources,
- Consumption and generation of energy,
- Pollutant enrichment in products, waste for recovery, or products made from them.

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