

GOING Green

The thrust on Infrastructure development will drive the demand for cement and concrete. However, the crucial challenge before the world today is reducing carbon emissions. **Construction Times** takes a peek into the preparedness of the industry to contribute to zero emissions by adopting technology and environment friendly practices.



India is one of the fastest growing economies in the world. It is also the second largest producer of cement globally and accounts for more than 7% of the global installed capacity. The initiatives taken by the governments both at the Central and the state levels for development of infrastructure in the country, are expected to further accelerate the demand for cement.

SECTOR OVERVIEW

As per the data of IBEF, in 2018-2019, India had an annual cement consumption of 337 million tonne and this is expected to increase up to 550 million tonne by 2025. This increase is attributed to various developmental schemes launched by the Indian Government including the Smart City Mission, Housing for All, Bharatmala Pariyojana, Pradhan Mantri Gram Sadak Yojana, Urban Transport Metro Rail Projects, etc.

The per-capita consumption of cement in India is

240 kg, which is well below the global consumption of 530 kg (DIPP, 2020). This signifies that there is a huge economic opportunity to cater to the unmet demand in future.

As per statistics, cement production reached 329 million tonnes (MT) in FY20 and is projected to reach 381 MT by FY22. However, the consumption stood at 327 MT in FY20 and will reach 379 MT by FY22. As India has a high quantity and quality of limestone deposits through-out the country, the cement industry promises huge potential for growth.

As per Crisil Ratings, the Indian cement industry is likely to add 80 million tonnes (MT) capacity by FY24, driven by increasing spending on housing and infrastructure activities.

MARKET DYNAMICS

The past few years have seen a huge shift from unorganised to organised sector as manufacturing units compulsorily require BIS certification which

requires heavy investment to maintain quality. Also, unorganised market in this sector is very much controlled as it is a capital-intensive sector and the brand awareness among the users is very high.

"The cement and concrete industry is a dynamic pricing market. Some of the factors that influence the dealers are considering the brand that will yield more returns, followed by the brand name, sales, customer preference, etc. While a consumer is influenced by his social class, membership groups, peer groups, psychological factors, etc. Moreover, the perception of an average consumer is that a bag of cement



PRASHANT JHA
Chief Ready-Mix
Concrete Officer
Nuvoco Vistas Corp.

sold at a premium price is better than those sold at low price," said **Prashant Jha, Chief Ready-Mix Concrete Officer, Nuvoco Vistas Corp.**

According to **Ganesh W Jirkuntwar, National Manufacturing Head, Dalmia Cement (Bharat)** manufacturing is a capital-intensive sector with a very



GANESH W JIRKUNTWAR
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high level of importance given to quality. Therefore, the presence of an unorganized sector is at a bare minimum. Besides being a capital-intensive sector, brand awareness among users is also very high. Hence, the entry of unorganized players is very much restricted.

"In the case of the concrete industry, one can say that the major occupancy is by the unorganized sector which requires dependency on labour and aggregates for the concrete application as per client requirements. But this is also changing with new innovations in the concrete industry by specialized and experienced players in the field. For example, the introduction of sustainable building technologies as a new approach that focuses on reducing the impact on the environment," he added.

ENVIRONMENT CHALLENGES

With the rising demand for cement, comes the challenge of damage to the environment due to greenhouse gas (GHG) emissions. As per the statistics, the cement industry alone is responsible for 8% of the total national emissions. These

emissions are a predominantly due to electricity usage, combustion of fossil fuel and the conversion process of limestone into lime, which accounts for 13%, 31%, and 56% respectively. There has been a significant rise in CO2 emission since the last few years. The emission of the Indian cement industry in 2018 was 576 kg CO2/ton of cement produced whereas the global average is 634 kg CO2/ton of cement produced.

According to the Global Cement and Concrete Association (GCCA), around 14 billion cubic metres of concrete are cast each year. Cement production alone accounts for as much as seven percent of global CO2 emissions -- three times the emissions produced by aviation.

Cement continues to be treated as a consumer product and therefore technical awareness among consumers remains low. In such an environment consumer awareness specially in the area of sustainability is missing.

The onus lies on the shoulders of the manufacturers who should come forward and explain to their consumers the difference between cements that are environmental friendly and those that are high on CO2 emission.

"It is a long road which cement manufacturers must start traversing, sensitizing consumers about the future impact of using cements that are high on CO2. Today our country produces close to 65% blended cements which is environment friendly and the balance 35% requires to be converted. This is a reasonable gap which the cement industry can recover in the next 5 years," observed **Jamshed Cooper, Managing Director, Heidelberg Cement India.**



JAMSHED COOPER
Managing Director
Heidelberg Cement India

USE OF ALTERNATE MATERIALS

As the awareness of the hazards of carbon emission has spread, concerted efforts are being taken to use alternate materials in construction.

"We should understand that environmental conservation and energy savings, as the fundamental assumptions for sustainable development, and financial savings are possible through the use of new, non-standard materials and technologies in the building and maintenance of roads. Different types of waste materials and industrial by-products may be used in road construction as an alternative to standard materials. The use of alternative materials is significant from both the ecological and economic perspectives.



Ecologically, the use of alternative materials means a lesser need for the exploitation of natural resources and the quantity of waste accumulated in landfills is reduced," Jirkuntwar said.

For making it as a successful environment friendly approach, alternative materials must meet certain engineering characteristics, show an acceptable level of execution, and be economical in comparison with traditional materials. There has been various success trends for making this concept for variety of uses in the construction of roads and highways through demolition waste, recycled asphalt, crushed concrete, fly ash and slag from thermal power plants, metallurgical slag, cement and lime kiln dust, silica fume, foundry sand, waste-rock, ash from incineration plants for solid municipal waste, by products of quarries, roofing shingle waste, old rubber, sewage sludge ash, glass and ceramics, plastics waste etc.

According to Cooper, over the years the traditional asphalt roads have been replaced with concrete roads and the reason for this is the durability factor which cement concrete roads offer.

"In the past, asphalt was a cheaper material compared to cement which was because of the low crude oil prices. Under the current circumstances when crude oil is close to USD 80 cement becomes a better commercial alternative offering a lower life cycle cost. As of now there are no proven materials that could replace concrete roads given the increasing density of traffic and the higher carrying capacity of the vehicles," he added.

Jha noted that the use of alternative materials reduces the cost and improves one or more technical properties of concrete. The various studies conducted by laboratories, found that alternative materials like fly ash and slag when mixed with concrete make the mixtures more economical, increase the compressive strengths, durability and reduce permeability or influence other concrete properties. More importantly, the alternative materials can lead to a significant reduction of the carbon footprint of concrete, and hence, are essential

to achieve sustainability.

Recently, JK Cement announced signing a long-term strategic memorandum of understanding (MoU) with Punjab Renewable Energy Systems (PRESPL), India's largest biomass aggregation and densification company with forward integrated value chain with a view to decarbonize its operations and aims to significantly scale-up the use of biomass-based and alternate fuels as a replacement to fossil fuel like coal in its manufacturing operations.

"Long-term planning for supply of biomass and agro-waste is key to our sustainability goals – where we have taken the ambitious target of reducing current emissions from 593 kg/T of cementitious product in FY20 by more than 20% till FY30. This will support us in replacing our fossil fuel consumption by more than 35% TSR by 2030, thereby leading to our significant milestone of being net-zero in carbon emissions by 2050. Beyond the considerations of GCCA and SBTi criteria and recommendations for use of biofuel / biomass feedstock, it is our own commitment to work towards a cleaner and greener environment. This will not only help in reduced consumption of fossil fuels, but also provide more sustainable opportunities for waste treatment and management. PRESPL has significant experience in building bio-energy solutions, and it is my firm belief that we can together come up with innovative solutions which will have a long-term positive impact. We look forward to working together with PRESPL on this journey and support the nation on this path to sustainability," **Colonel Rajnish Kapur, COO, JK Cement** said.



COLONEL RAJNISH KAPUR
COO
JK Cement

TECHNOLOGY & DIGITISATION

A recent report by ratings agency Crisil highlighted that the potential benefits of digitisation and automation in terms of increasing productivity and quality cannot be ignored. For instance, productivity of the top 4-5 cement players improved from 3,000 tonne per employee in fiscal 2016 to 4,000 tonne per employee in fiscal 2021, because of improved process efficiency and control derived through digitisation and automation.

Jirkuntwar explained that there has been an advanced approach in cement production technology which has led to greater consistency and improved performance of traditional cements. Some of the technological advancements in cement and concrete industries are as follows:

Dry Kilns with Multistage Pre-heaters, Pre-calciner and low pressure drop cyclones, highly efficient process fans, advanced process control and automation, robotics in laboratory for fast and reliable quality analysis, GPS enabled vehicles in Mines and Logistics, variable frequency drives, Waste Heat Recovery for Power Generation, Conversion to High-Efficiency Grate Coolers, highly efficient roller mills etc.

Similarly, huge advances in Concrete technology can be seen for their remarkable developments in the technology of cementitious materials, mineral additions and admixtures, coupled with advances in production methods, have led to a wide range of high-performance concretes that can provide cost-effective, environmentally sound solutions for the most demanding applications. Advance Concrete is a computer-aided design (CAD) software application was developed by GRAITEC, but is now an Autodesk product, used for modeling and detailing reinforced concrete structures. Advance Concrete is used in the structural / civil engineering and drafting fields. UHPC is popularly known as the new concrete technology. It contains numerous novel ingredients specifically the fibers but still retaining 80 % of the overall traditional concrete. The fibers often differ in strength when it comes to stainless steel and polyester. 3D printed concrete is a special type of concrete that can be used for construction just with a 3D printer. Since the traditional technology including setting up formworks and vibrating are not required for 3D printing, the 3D printed concrete combines the advantages of spray concrete and self-compacting concrete.

There have been significant developments in the use of alternative fuels that reduce the environmental impact of cement production, which remains an energy-intensive process that, by the very nature of the chemical reactions involved, produces CO₂. However, the cement industry has been successful in reducing the amount of CO₂ released during manufacture, and the often-quoted statistic that each tonne of manufactured cement releases an equivalent weight of CO₂ is no longer true, with

many manufacturers claiming to have reduced CO₂ output by 30% or more. The last 30 years have seen a dramatic increase in the availability and use of supplementary cementitious materials, Jirkuntwar noted.

GREEN CEMENT

As things stand today, many cement producers are introducing green cement and the sector is committed to produce net zero concrete by 2050 and has already started to address this challenge.

"The cement and concrete industry have undergone rapid and phenomenal development in the past few years in India. The industry has also made significant reductions to its carbon emissions by adopting different technologies. Reduction in the clinker to cement ratio has the second-highest emission reduction potential. The CO₂ emissions are reduced by replacing clinker % in cement with waste materials like blast furnace slag and coal ash.



To reduce carbon footprint, operational advances, such as energy-efficiency measures, have largely been implemented, and the emissions-reduction potentials are being explored by using more and more alternative fuels to further cut down the emissions," Jha noted.

At Nuvoco, to strengthen its commitment to sustainability, the company has launched several eco-friendly products such as Concreto Green cement, which consumes 25% less water and increases strength of concrete up to 70%. Another product, ConcretoEcodure or Green Concrete, uses pozzolanic additive to increase strength of the structure and prevent sulphate ion and chloride attacks on reinforcements.

"On CO₂ reduction, the company has one of the best blended cement ratios, our C/K ratio at 1.7 is significantly better than the industry average at 1.4, further we are committed to improving the C/K through an accelerated plan for introduction of composite cement. All plants in Nuvoco are



using fly ash as the major alternative material to produce Portland Pozzolana Cement. The company will continue its efforts to reducing energy consumption and the emission of greenhouse gases, thus, minimizing the environmental footprint," Jha added.

According to Cooper, the chemical composition of cement has not undergone much change from the time it was invented. However, over time manufacturing technologies have evolved and that has improved the strength and durability parameters of the product.

"With digitization gaining pace, cement industry is witnessing changes in the manufacturing process. Going forward we should expect deployment of Artificial Intelligence (AI) which will result in reduction of fuel and power at the same time optimize consumption of raw materials and deliver better quality cement. HeidelbergCement India has the distinction of producing 100% blended cement which is a Green cement. We also have Green Pro and Green Co certifications," Cooper added.

Speaking about the green initiatives taken by Dalmia Cement (Bharat), Jirkuntwar said the company manufactures cement products that are best in quality and are as per customer requirements.

"Our efforts are making it green and sustainable that's why our product portfolio mainly consists of blended cement. Our CO₂ generation per ton of cement is the lowest in world. We are very positive about our future plans to expand and maximise the use of supplementary cementitious materials and the identification of alternative supplementary cementitious materials," he said.

For this, Jha said the company's dedicated R&D team is continuously working to grow the use of

supplementary cement materials and related binder technologies. "Our R&D strategies continuously facilitate the transfer of these emerging and next-generation materials and technologies from the research arena into final Industrial implementation. Other enablers in our sustainability journey included the co-processing and use of hazardous and non-hazardous industrial and municipal wastes of alternative fuels which we called Green fuel in cement manufacture in order to reduce dependence on fossil fuel," he added.

Jha continued that Dalmia Bharat has already taken the initiative by creating and following the "Grey to Green roadmap for carbon negative transition". "Our mantra is, 'clean and green is profitable and sustainable'. The main pillars for our sustainability success in a phased manner will be: usage of 100% renewable power under fossil free electricity initiative by 2030 (RE 100), double energy productivity by 2030 (EP 100), use of renewable biomass, hazardous waste, hydrogen and Municipal Solid Waste to fully replace fossil fuel by 2035, carbon capture and utilization (CCU) to make value added products; carbon sequestration and adoption of other advanced green technologies by 2040," Jha added.

WAY FORWARD

According to IBEF, due to the increasing demand in various sectors such as housing, commercial construction and industrial construction, cement industry is expected to reach 550-600 million tonnes per annum (MTPA) by the year 2025. A number of foreign players are also expected to enter the cement sector owing to the profit margins and steady demand. 