INSTITUTIONAL RESEARCH

Sector Thematic

Cement

A concrete road for net-zero emissions

In this unique report, we will take you down a less-travelled road! The cement sector, despite its dull appearance, has been aggressively seeking its part in containing global warming to 1.5°C by 2100. This would entail an ambitious goal of net-zero CO_2 emissions by 2050. The factors that have contributed to the Indian cement industry's leaner carbon footprint should continue to drive its active commitment to the aim of 20% reduction in emissions between 2020 and 2030. Policy support on waste management and India's rising green power infrastructure should catalyze these efforts. To accomplish its net-zero goal, the industry is pinning its hopes on the success of carbon capture technologies (to undertake CO_2 heavy lifting from the indispensible limestone). The cement industry also remains responsible for replenishing the scarce water resource. The current decade, thus, will undoubtedly be fascinating as more companies chalk out and execute their net-zero journeys. We will continue to keep a close eye on this space.

Rajesh Ravi
Cement
rajesh.ravi@hdfcsec.com
+91-22-6171-7352

Keshav Lahoti
Cement
keshav.lahoti@hdfcsec.com
+91-22-6171-7353

INSTITUTIONAL RESEARCH

Cement

A concrete road for net-zero emissions

In this unique report, we will take you down a less-travelled road! The cement sector, despite its dull appearance, has been aggressively seeking its part in containing global warming to 1.5°C by 2100. This would entail an ambitious goal of net-zero CO_2 emissions by 2050. The factors that have contributed to the Indian cement industry's leaner carbon footprint should continue to drive its active commitment to the aim of 20% reduction in emissions between 2020 and 2030. Policy support on waste management and India's rising green power infrastructure should catalyze these efforts. To accomplish its net-zero goal, the industry is pinning its hopes on the success of carbon capture technologies (to undertake CO_2 heavy lifting from the indispensible limestone). The cement industry also remains responsible for replenishing the scarce water resource. The current decade, thus, will undoubtedly be fascinating as more companies chalk out and execute their net-zero journeys. We will continue to keep a close eye on this space.

- **Indian cement sector leads in terms of CO_2 footprint:** As the world looks for new ways to combat global warning, the cement sector (which contributes 7% of greenhouse emissions) remains a priority. The Indian cement industry is in a better position than the global average, emitting 9% less CO_2. In the past 15 years, significant clinker substitution, enhanced production efficiency, and accelerated usage of low-cost WHRS power have reduced operational costs and GHG emissions. *Dalmia and ACC have the lowest carbon emissions currently. Heidelberg and Birla Corp are selling more than 90% blended cement. Shree and JK Lakshmi score high on their green power mix.*
- **1.5DS in sight, sector readying for net-zero emissions by 2050:** The recent thrust to limit global temperature rise to 1.5°C by year 2100 necessitates net-zero CO_2 emissions by 2050! The global cement association has outlined an interim milestone of 20% emissions cut by 2030. In our assessment, the Indian cement industry is well placed to achieve its goals through continued clinker substitution, an expected surge in green power availability, and favorable policies on alternative fuels usage. We discuss these factors in detail as well as how different companies are currently positioned.
- **Carbon capture – a key cog in the race to net-zero:** The industry's journey to net-zero emissions between 2030 and 2050 will depend on the adoption of major technologies that can capture CO_2 being released from limestone burning (which accounts for ~55-60% of total CO_2 emissions). Various experiments globally pin their hopes on commercial-scale adoption of carbon capture, storage and utilisation (CCUS) technology. Dalmia's initial assessment at its Tamil Nadu plants adds to optimism. As other industries also ride through the GHG path, flyash and slag supplies will wane, thereby threatening to undo the gains accrued from clinker substitution. Here, limestone calcined clay cement (LC3) is seen as a viable long-term alternative as well as a supplement to the low-clinker portfolio in near term.
- **Rising focus on water positivity:** The Indian cement industry is well aware of this little-discussed yet scarce natural resource. Companies have been investing in crediting more water than they are withdrawing, resulting in improved sustainability. The GCCA member companies are already more than 4x water positive. *Dalmia Bharat and Ambuja take a lead.*

COMPANY	RATING	TP (INR)
UltraTech Cem	BUY	8,490
Shree Cement	REDUCE	28,700
Ambuja Cem	ADD	390
ACC	BUY	2,670
Dalmia Bharat	ADD	2,240
Nuvoco Vistas	BUY	827
Ramco Cem	BUY	1,096
JK Cement	REDUCE	3,210
Birla Corp	BUY	1,634
Heidelberg Cem	ADD	250
Star Cement	BUY	130
JK Lakshmi	BUY	780
Orient Cement	BUY	185
Sagar Cement	ADD	295
Deccan Cement	ADD	785

Companies	Sp CO2 emission	Blended cem %	AFR %	Green power %
UltraTech				
Shree Cem				
Ambuja				
ACC				
Dalmia				
Nuvoco	NA			
Ramco Cem			NA	
JK Cement				
Birla Corp	NA		NA	
Heidelberg				
JK Lakshmi				
Orient Cem				
Sagar Cem				

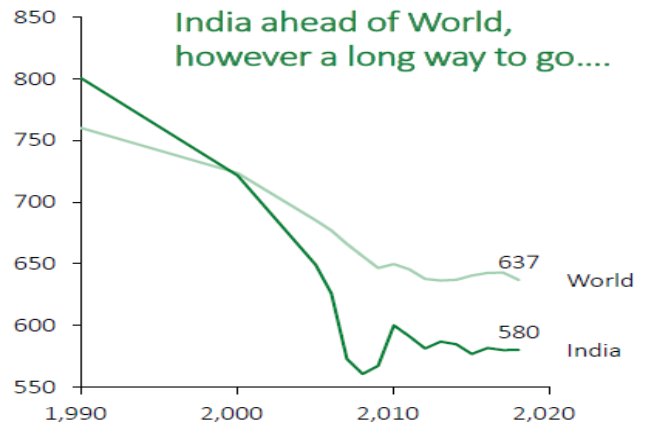
Source: Companies, HSIE Research

Rajesh Ravi
rajesh.ravi@hdfcsec.com
+91-22-6171-7352

Keshav Lahoti
keshav.lahoti@hdfcsec.com
+91-22-6171-7353

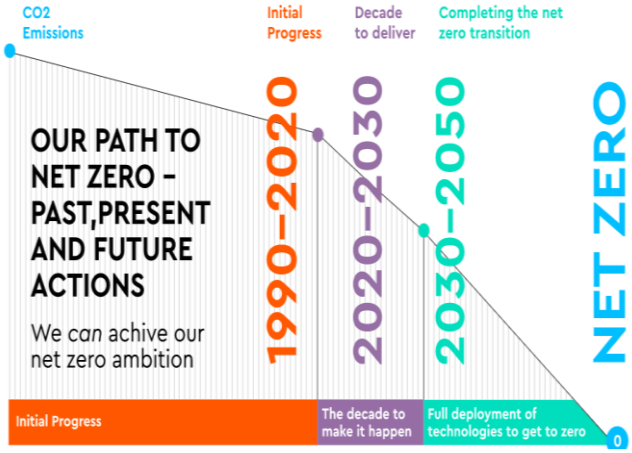
Story in charts

Indian cement sector leads the world on its leaner carbon footprint



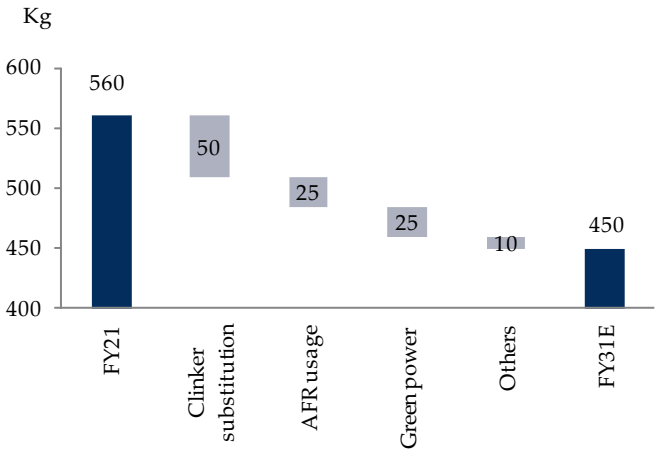
Source: Heidelberg Cement, HSIE Research

GCCA is targeting to reduce total emissions from cement to zero by 2050 (and 20% cut by 2030)



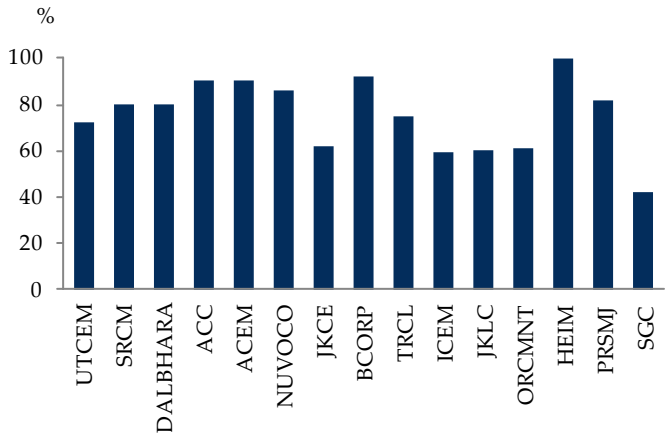
Source: GCCA, HSIE Research

Indian cement sector's 20% emissions cut during 2020-30 should be driven by three major factors



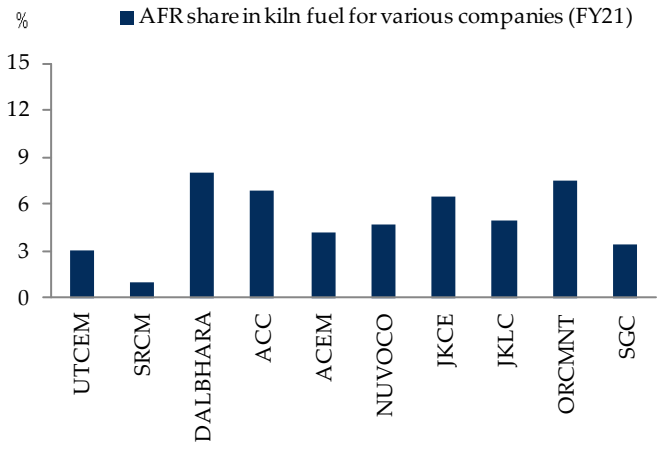
Source: Industry, HSIE Research

Cement companies have already increased their production of blended cement



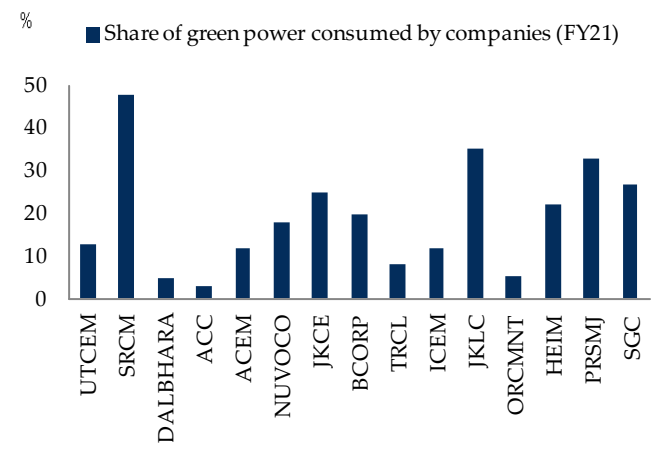
Source: Companies, HSIE Research

Cement companies AFR usage is currently low but are expected to grow significantly over next 10 years



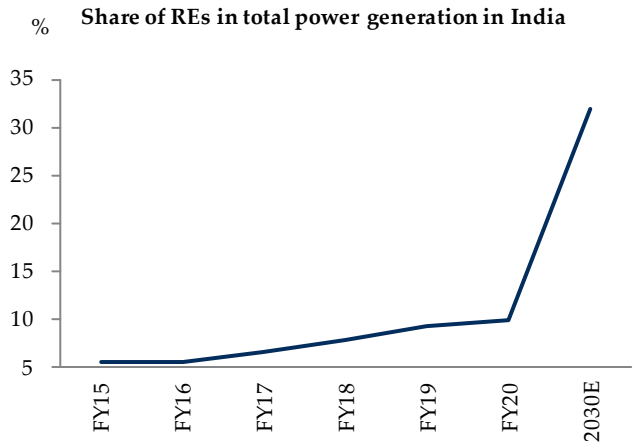
Source: Companies, HSIE Research

Cement companies have been increasing their green power consumption from WHRS and other renewable



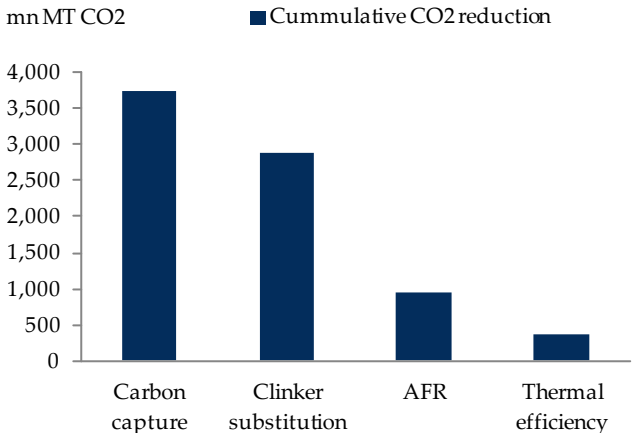
Source: Companies, HSIE Research

Renewable energy capacity is expected to grow at exponential pace, benefitting the cement sector



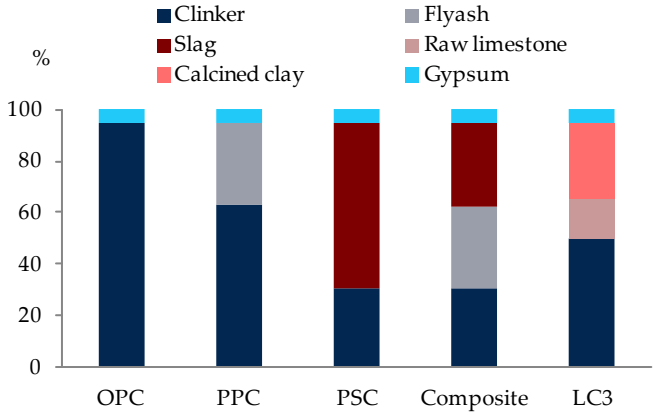
Source: Industry, HSIE Research

Carbon capture will remain a driving force in the industry's net-zero journey beyond 2030



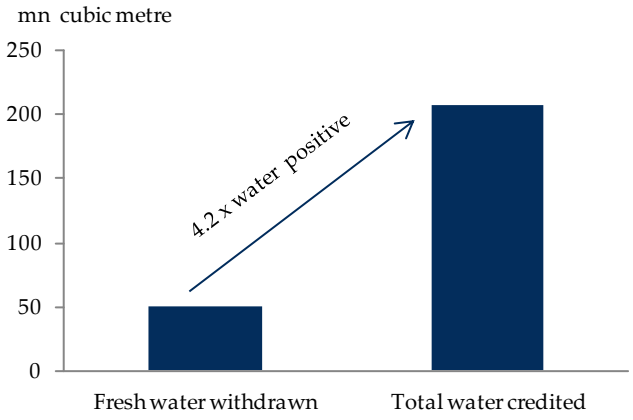
Source: Industry, HSIE Research

LC-3 cement will complement the portfolio of blended cement in near term and substitute other blended cement in long term



Source: Industry, HSIE Research

Cement companies are sensitive to their fresh water usage and have been harvesting more than the industry is withdrawing



Source: GCCA, HSIE Research

Relative positioning of companies (FY21) on their carbon footprint and various factors

Companies	Sp. CO2 emission (kg/MT)	Blended cem %	AFR %	Green power %	Comments
UltraTech Cement					The co is accelarating its green power and AFR usage
Shree Cement					Low carbon foorprint, very high green power usage
Ambuja Cement					Very lean carbon footprint, high blended cement; green power usage to increase
ACC					Low carbon footprint, high blended cement, green power usage to increase
Dalmia Bharat					Very low carbon footprint; high AFR usage and high blended cement
Nuvoco Vistas	NA				Green power usage to pick up, CO2 emission details not available
Ramco Cements			NA		CO2 emissions to reduce, green power usage to pick up
JK Cement					High green power and AFR usage
Birla Corp	NA		NA		High blended cement production, green power share to increase
Heidelberg Cement					Low carbon footprint, high blended cement, green power and AFR usage to increase
JK Lakshmi					High green power and AFR usage
Orient Cement					High AFR usage, green power share to increase
Sagar Cements					High green power usage; blended cement sales is low denting its carbon footprint

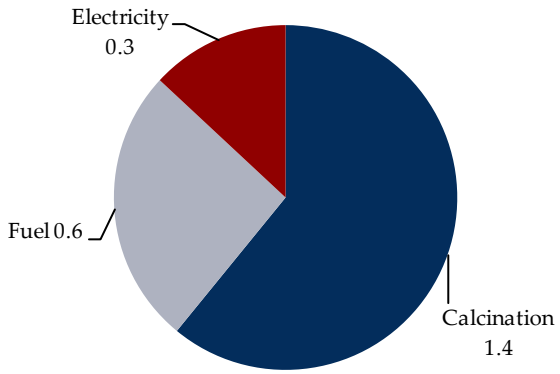
Source: Companies, HSIE Research

Contents

Indian cement industry leading on its carbon footprint

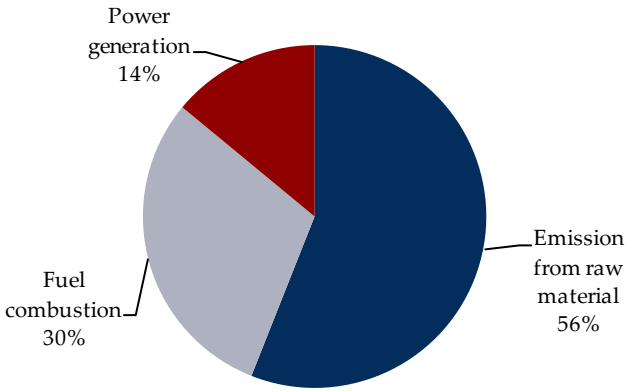
The earth we live on is heating – both land and ocean temperatures have been steadily rising since the pre-industrial era, leading to global warming. Greenhouse gas (GHG) emissions from fossil fuel combustion have exacerbated global warming, mainly in the previous four decades. The cement industry has a major role to play in global efforts to reduce GHC emissions in general. This is on account of the industry's continued growth prospects and its significant contribution to CO_2 emissions. In 2019, the cement industry contributed ~7% of the worldwide GHG emissions of 33bn MT. Chemical reactions during the calcination of limestone (process emissions) accounted for 60% of the 2.3bn MT CO_2 emitted by the cement industry. Another 25% (direct emissions) was accounted for by thermal fuel in the kiln, while the remaining 15% (indirect emissions) was accounted for by electricity consumption.

Cumulative CO_2 emissions by global cement industry in 2019 (bn MT)



Source: Industry, HSIE Research

Break-up of specific CO_2 emissions during cement production



Source: Industry, HSIE Research

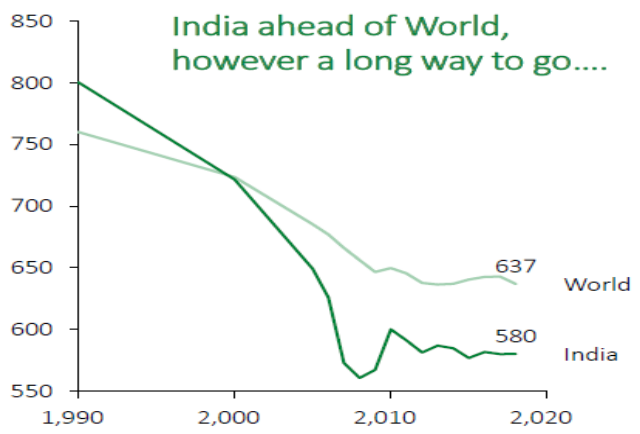
Owing to its large process emissions, cement along with iron/steel are classified as Hard-To-Abate (HTA) sectors. Thus, the industry has been continuously striving to reduce its carbon footprint. In 2009, the World Business Council for Sustainable Development's (WBCSD's) Cement Sustainability Initiative (CSI) member companies, in collaboration with the International Energy Agency (IEA), developed the first-ever roadmap by any industry to identify and implement technologies to reduce cement production energy use and carbon intensity. Subsequently, in 2013, CSI and IEA, in collaboration with the Confederation of Indian Industry (CII) and the National Council for Cement and Building Materials (NCB) and with partial funding support from International Finance Corporation (IFC), jointly developed a customised roadmap for the Indian cement sector called the Low-Carbon Technology Roadmap (LCTR).

The LCTR-2013 aimed at aligning the Indian cement industry's roadmap with the global goal of halving CO_2 emissions by 2050 and becoming carbon neutral by 2070. According to this roadmap's forecasts, the Indian cement sector will reduce direct CO_2 emissions by 45% by 2050, to 350kg/MT of cement, resulting in a substantial CO_2 reduction by 212-367mn MT compared to a business-as-usual scenario.

The Indian cement industry has been a world leader in this area, owing to its focus on energy efficiency and cost reduction. Since 2000, its GHG emissions have remained well below the global average, and the gap between the two has only grown. The LCTR roadmap formalised the industry's commitment to reduce carbon intensity through collaborative efforts.

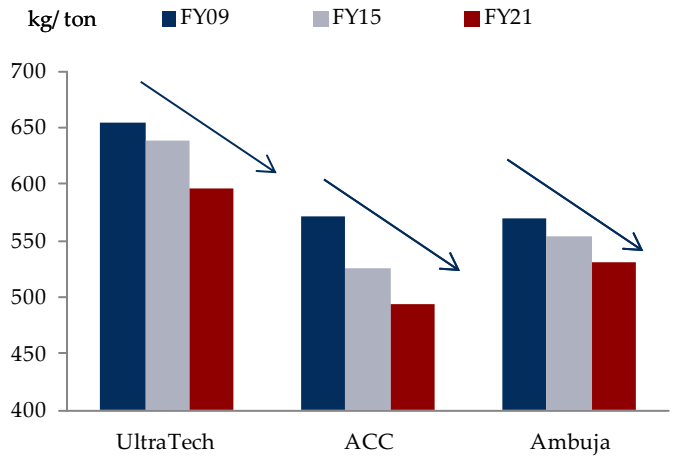
In 2018, the specific CO_2 emissions by the Indian cement industry stood at 580 kg (per MT of cement production), ~9% lower than the world average. With accelerated WHRS adoption under Indian's government's PAT scheme, the cement sector surpassed its target by ~80%, reiterating its position among the world's best in energy efficiency. India also started to increase its alternative fuel usage, albeit slowly – reaching ~3% (of its fuel requirement) by the end of 2017 and ~5% by 2020.

Specific CO_2 emissions: India well below world average for almost 2 decades



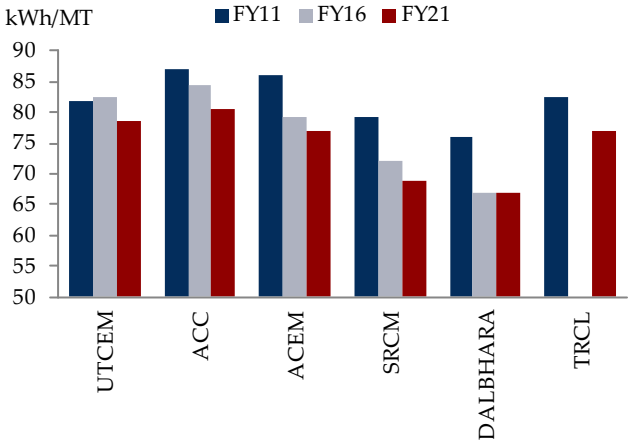
Source: Heidelberg Cement, HSIE Research

Specific CO_2 emissions trend for top-3 companies: all 3 have been reducing their carbon footprints



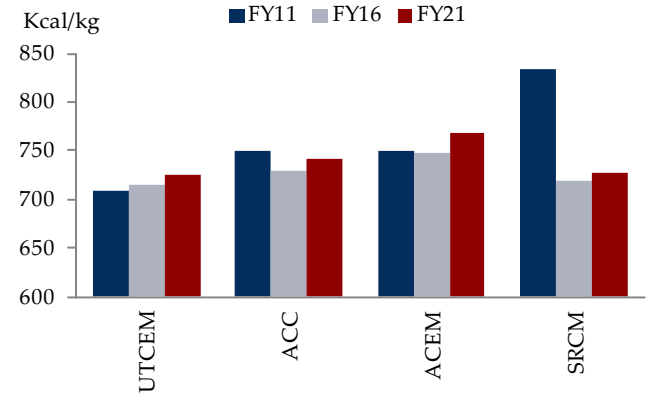
Source: Companies, HSIE Research

Indian cos have reduced their electricity consumption parameters…



Source: Companies, HSIE Research

… also their thermal energy consumption



Source: Companies, HSIE Research

Despite being a hard to abate sector, the Indian cement industry tackled CO_2 emissions on multiple fronts and became the world leader. In the absence of effective technology to completely eliminate the process emissions (from calcination of limestone in kiln), the industry has exploited on the following other levers to reduce its emissions well below the world average:

1. Steady reduction in clinker consumption per MT of cement (thus lowering chemical reaction-led process emissions)
2. Improving thermal efficiencies and incorporating bio-mass and other industrial wastes to part-replace fossil fuels (direct emissions)
3. Increasing electricity efficiencies and accelerating share of green power (indirect emissions)

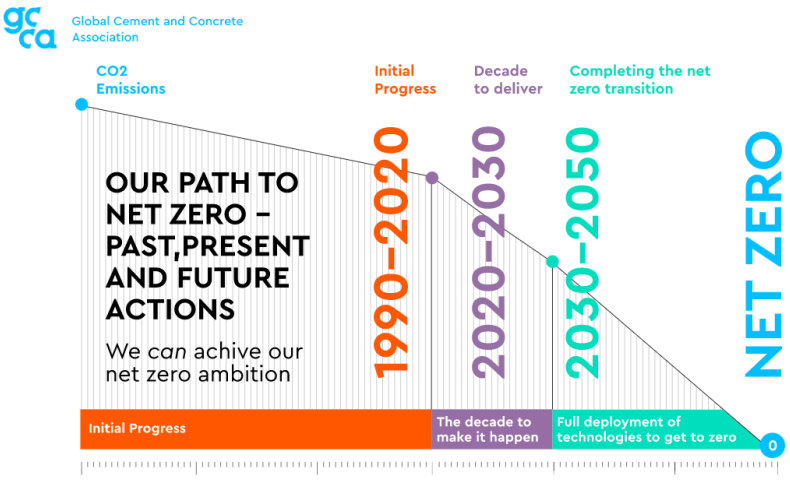
These factors helped India's industry in lowering its emissions intensity to ~560kg in FY21. They have also reduced the industry's operating costs, which has sped up their adoption.

Global cement industry targets net-zero emissions by 2050!

In Sep 2020, the Global Cement and Concrete Association (GCCA) announced its commitment to deliver carbon-neutral concrete by 2050, aligning itself with the ambitious 2015 Paris Climate Agreement to keep global warming to 1.5 degrees Celsius (1.5DS) by year 2100 vs pre-industrial times. The previous climate goal, adopted in 2009, focused on keeping global temperature rise below 2 degrees Celsius by 2100. The LTCR 2013 was aligned to this 2DS scenario. The 1.5DS expects the world to go carbon neutral by 2050!

Nine Indian companies (UltraTech, ACC, Ambuja, Shree Cement, Dalmia Bharat, Orient Cement, Heidelberg Cement, JK Cement and JSW Cement) are among the 40 global cement companies that participated in the net-zero commitment. This makes cement the first industry subsector to commit to a net-zero carbon footprint. In Oct 2021, the GCCA launched its 2050 Net-zero Roadmap, which establishes a pathway and implementation plan for achieving this objective.

GCCA members have committed to totally reduce CO_2 emissions by 2050



Source: GCCA, HSIE Research

As per the GCCA's net-zero roadmap, the factors that contributed towards CO_2 emissions reduction until 2020 (as highlighted earlier) will continue to play a major role in industry's decarbonisation drive through 2030 (*the decade to deliver*). From India's context, these factors are still to be fully exploited. Additionally, there should be increased thrust on technology and innovation with focus on Carbon Capture, Utilisation and Storage (CCUS) technology and infrastructure development. The industry has set a global target of 20% reduction in its emissions by 2030 (over 2020 level).

The third phase (2030-2050: *completing the net-zero transition*) will mostly be riding on (1) the commercial utilisation of CCUS technology, (2) huge penetration of supplementary cementations materials (SCM) as the supply of both flyash and slag would start falling drastically, and (3) by achieving maximum substitution of fossil fuel with alternative fuel and adopting full scale green power. These will ensure a net-zero scenario by 2050, making cement green in the true sense.

India cement companies' net-zero roadmap

Most of the GCCA Indian member companies have already set their net-zero goals for until 2050. Some of them are working on their roadmaps. Our interactions with some of the other big cement companies suggest that most of them will follow suit in the next 2-3 years. We analyse the major factors that will assist the Indian industry to achieve net-zero emissions.

Sensitivity analysis of CO_2 emissions to various factors

Factors	Expected CO_2 emissions cut (kg) per MT of cement
Clinker substitution	For every 5pp reduction in this factor, emissions fall by ~40-45/kg
Alternative fuel (AFR)	For 5% cut in fossil fuel consumption, emissions fall by ~10-15/kg
Green power	For every 10% substitution of conventional power, emissions fall by ~7-8/kg
Thermal efficiency	For every 1% improvement in fuel efficiency, emissions fall by ~2 kg.
Power efficiency	For every 1kWh/MT reduction in power consumption, emissions fall by ~1kg.

Source: Industry, HSIE Research

In our view, the Indian cement industry should be able to deliver its 2030 promise of a 20% reduction in emissions over the 2020 baseline. Almost all of this reduction can be attributed to the ongoing factors sweating. As discussed in detail later in this report, we expect continuous reductions in clinker-factor to help the industry with ~50% of its objective, followed by a surge in alternative fuel and green power usage to drive the remaining emissions cut required by 2030.

Most of the cement companies, barring those predominantly operating in the southern regions, have already lowered their specific emissions to below 600 kg/MT. Owing to a higher share of OPC cement sales (vs other regions), CO_2 intensity in the southern region remains high. While most of the GCCA member companies have committed to achieving net-zero emissions by 2050, we expect other cement companies to also follow suit in the next 2-3 years. Dalmia has set up the most ambitious target for itself: carbon neutrality by 2040 (almost a decade ahead of the global target).

Indian cement firms' CO_2 emissions intensity current levels and targets

Companies	Sp CO_2 emission intensity kg/MT (FY21/CY20)	Sp CO_2 emission intensity target (Year)
UltraTech Cement (UTCEM)	597	462 (2032), carbon neutral (2050)
Ambuja Cement (ACEM)	531	453 (2030)
ACC	493	400 (2030)
Shree Cement (SRCM)**	554	NA
Dalmia Bharat (DALBHARA)	492	370 (2030), carbon negative (2040)
Nuvoco Vistas (NUVOCO)	NA	NA
Ramco Cement (TRCL)	760	To cut CO_2 emissions by 15% by 2025 (over 2020)
Birla Corporation (BCORP)	NA	NA
JK Cement (JKCE)	571	465 (2030)
JK Lakshmi Cement (JKLC)	< 600	NA
Heidelberg Cement (HEIM)^^	513	<500 (2025), 494 (2030)
India Cement (ICEM)	NA	NA
Orient Cement (ORCMNT)	574	NA
Prism Johnson (PRSMJ)	597	NA
Sagar Cement (SGC)	701	NA
Industry	**~560**	**~450 (2030)**

Source: Companies, HSIE Research, NA: data not available, **SRCM (FY20), ^^HEIM (FY19)

India continues to reduce its clinker factor

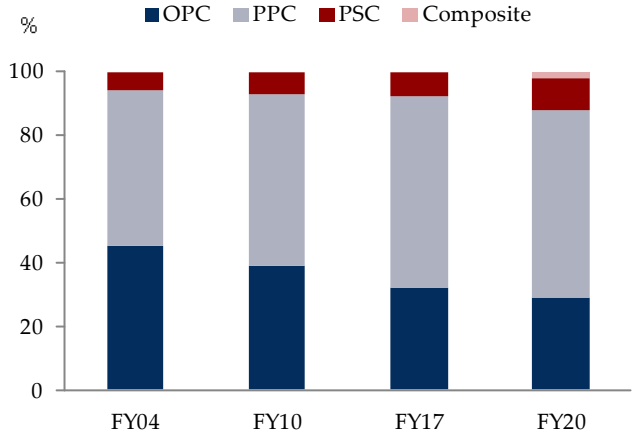
Clinker ratio contracted ~900bps in the last decade

Lowering clinker consumption (per MT of cement) has the highest impact currently on CO_2 reduction. As per industry estimates, every 500bps contraction in clinker factor reduces CO_2 emissions intensity by ~40-45kg.

In the past 15 years, the cement industry has increased its production of blended cement, thereby reducing its clinker factor. The trend gained pace, mainly driven by increased availability of low cost substitutes – flyash and slag. Tightening disposal norms for flyash (waste from coal-based power plants) and slag (waste from steel plants) has been a win-win proposition for all three industries (cement, power plants and still mills). As these continued to substitute clinker (and, hence, lower need for limestone calcinations), cement industry benefitted from reduction in both process emissions and direct emissions from burning of kiln fuel.

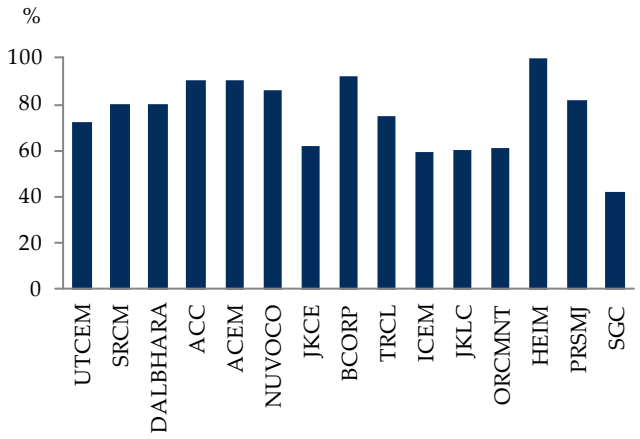
We have tabulated the blended cement proportion of most of the cement companies, as in FY21. Companies with significant focus on retail markets have greater proportion of blended cement sales. Heidelberg leads with 100% blended cement sales, followed by Birla Corp (>90% blended). Even ACC and Ambuja are selling ~90% blended cement. East focused Nuvoco and Dalmia also have high share (80% and more). Sales of blended cement in south is lower (compared to rest of India), which dilutes the overall blended cement share of players with higher sales exposure to the south (Ramco Cements, India Cements, Orient Cement and Sagar Cement).

There has been consistent rise in blended cement production in the past two decades in India



Source: Industry, HSIE Research

Share of blended cement production by various cement cos in FY21

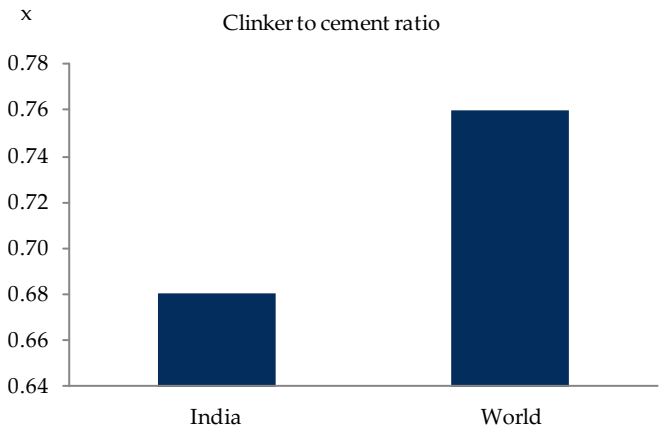


Source: Companies, HSIE Research

We estimate clinker factor to reduce further by ~500-600bps by 2030

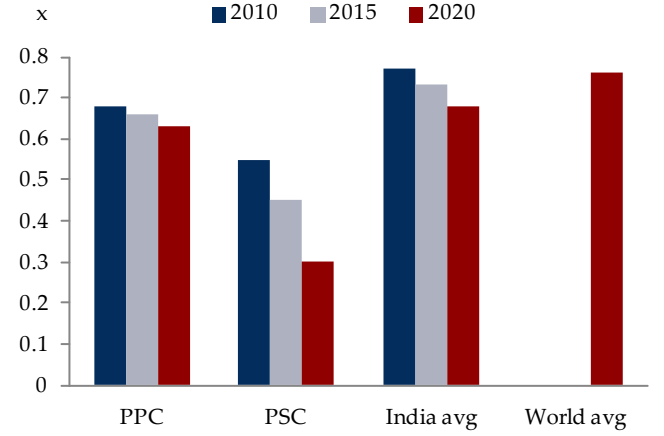
We expect companies to continue to increase the blending proportion of flyash and slag in their blended cement. Composite cement's market acceptance is also increasing, owing to its superior properties. Further, blended cement sales in non-trade market is on the rise. Historically, clinker factor has been the highest in the south market, because regional demand is skewed towards OPC. However, this trend is reversing, and share of blended cement share is increasing. All these factors have the potential to reduce clinker factor by ~5-6pp to below 63% by 2030, compared to ~68% in 2020, and thus contribute ~50% of the industry's CO_2 reduction target between 2020 and 2030.

India cement companies lead the world with much lower clinker factor



Source: Industry, HSIE Research

Clinker ratio continues to fall in India as companies improve their blending intensity in both PPC and PSC

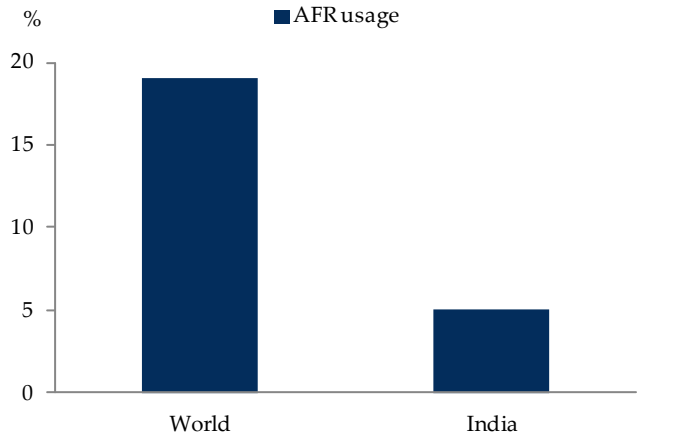


Source: Industry, HSIE Research

Alternative fuel slowly finding its way in Indian kilns

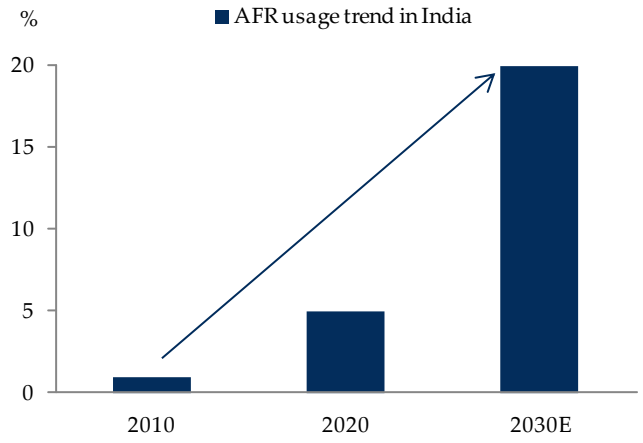
For every 5% substitution of kiln's fossil-fuel with alternative fuels (industrial, municipal), specific CO_2 emissions fall by ~10-15kg. AFR comprises biomass waste and hazardous industrial wastes (as they have decent calorific value). AFR usage in Indian cement industry has picked up in the past 10 years, from near zero to ~5% currently. However, it significantly lags the world average of ~20%. While there has been the issue of availability of wastes in India, the logistics and waste segregation have remained challenging for the industry, leading to cost escalations.

Currently India lags world average in AFR consumption



Source: Industry, HSIE Research

We estimate AFR usage to accelerate in this decade

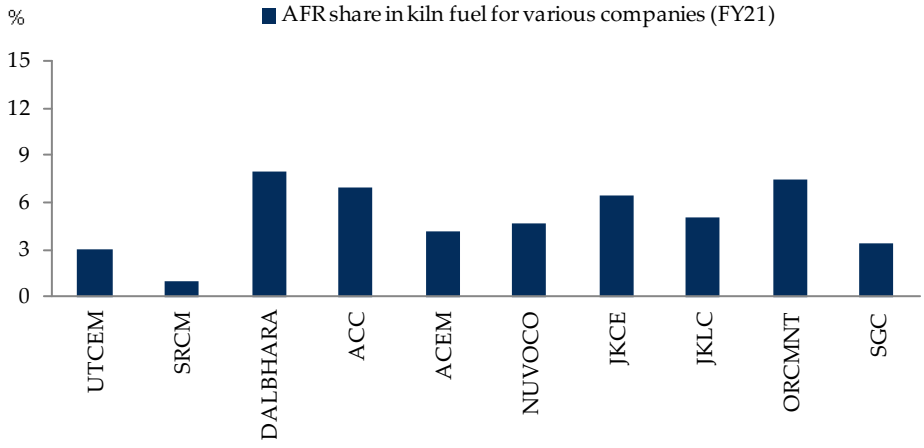


Source: Industry, HSIE Research

Stricter implementations/ streamlining of waste management policies and rising awareness towards safe disposal of wastes should increase access of alternative fuels to the cement industry, in our view. Thus, by 2030, we expect AFR usage in kilns should expand to at least 20% by 2030. This should contribute ~25% of the 2030 emissions reduction goal for the Indian cement industry.

We have charted the AFR usage of various cement companies whose data are available. In our view, almost all companies are trying to source and consume as much of waste materials as possible, thereby replacing their fossil fuel requirements. Using waste materials as fuel results in lower costs (vs fossil fuel), in addition to reducing CO_2 footprint. However, the usage is not uniform across the industry due to various factors such as proper segregation, availability, and logistics.

AFR usage by various cement cos in FY21



Source: Companies, HSIE Research

Green power sourcing – fast adoption

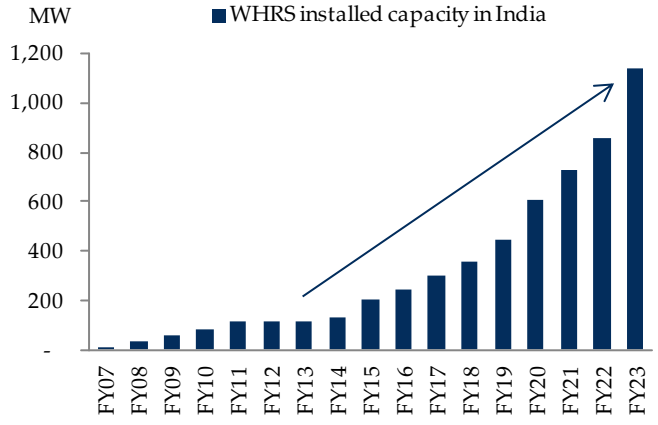
Incorporating green power (renewable and WHRS power) also has strong bearing on the industry's decarbonisation journey. As electricity consumption contributes ~15% of total emissions from a cement plant, every 10 percentage point replacement of fossil-fuel-generated power with green power can potentially reduce CO_2 emissions by ~7-8kg per MT of cement production.

WHRS accounted from ~13% electricity in FY21; should continue to rise

Over the past five years, the industry has significantly ramped up WHRS installations. From 80/200MW installed capacity in FY10/15, WHRS capacity has grown to ~730MW in FY21. Thus, from meager ~2/6% share of WHRS power in total electricity consumption by the sector in FY10/15, it expanded to ~13% in FY21.The industry has been both retrofitting WHRS at their existing kilns wherever possible and also commissioning a WHRS with new expansions.

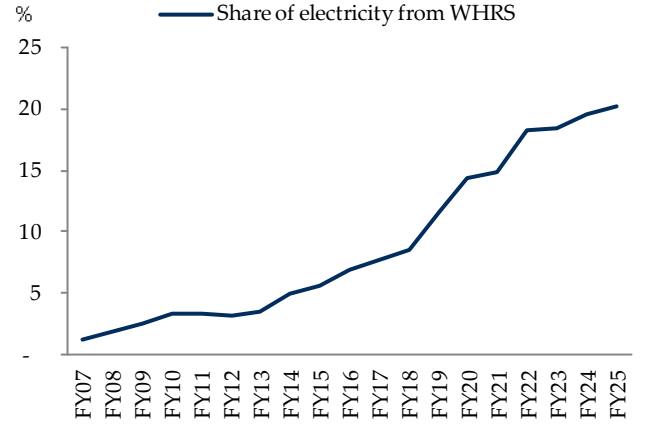
While a WHRS entails large upfront capital expenditure, the payback period of a WHRS is very lucrative – 3 to 5 years, depending upon the kiln utilisation (higher the kiln utilisation, better the WHRS output) and moisture content in the limestone (lower the moisture content, higher the WHRS output). WHRS efficiency in the north and central regions is higher as limestone in these regions has lower moisture content compared to that in Tamil Nadu and Gujarat. Attractive payback period has driven massive adoption by the industry in the past five years and the trend continues.

WHRS installations in India is growing at exponential rate



Source: Industry, HSIE Research

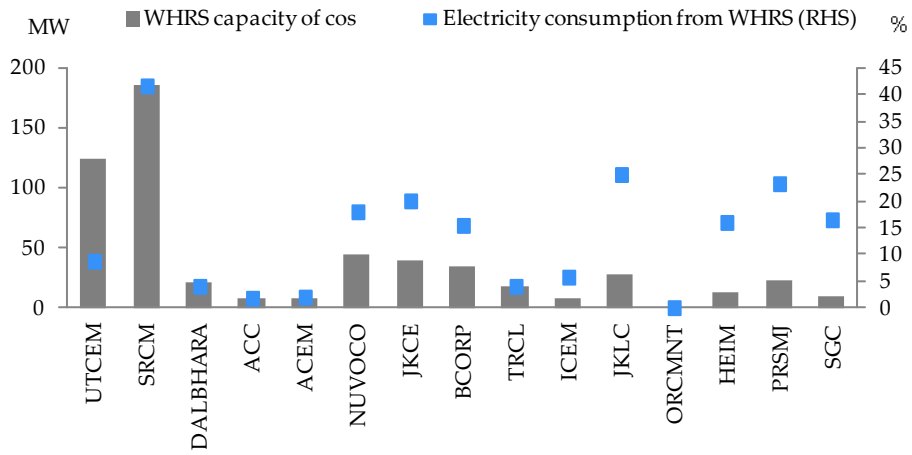
Share of electricity from WHRS has been growing at fast pace



Source: Industry, HSIE Research

As charted below, Shree Cement is the leader with the largest WHRS installations in India. It also draws ~40% of its electricity from WHRS (in FY21), which is 3x the India average. Many mid-sized companies have also scaled up their WHRS-led electricity generation to ~20%. Others are scaling up their WHRS capacities to augment their low-cost, low-carbon electricity consumption. The industry continues to add WHRS, with practically all new kiln installations. Wherever possible, companies are retrofitting WHRS into their existing plants. Thus, by 2025, the industry's share of power sourced from its WHRS should easily surpass ~20%.

Share of electricity consumed from captive WHRS by various cos

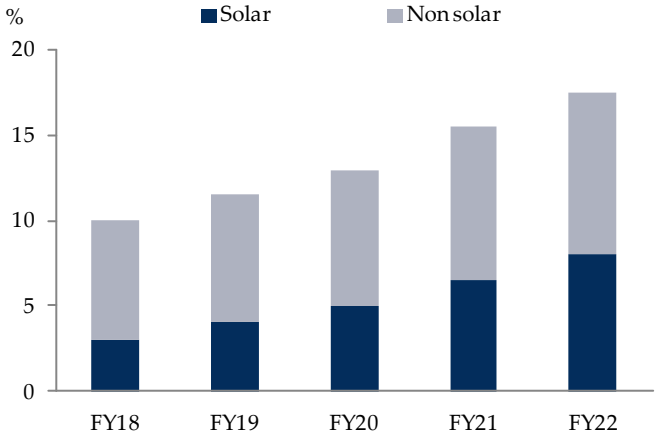


Source: Companies, HSIE Research

Green power usage to surge as renewable capacities growing at exponential pace

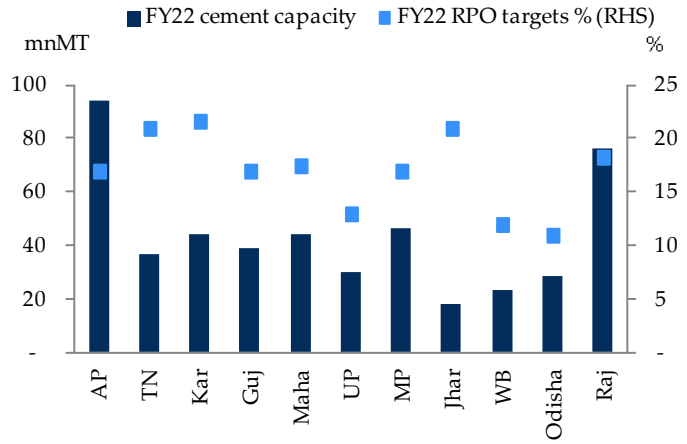
Over the past five years, cement companies are also ramping up consumption of renewable power from solar, wind, hydel, and biomass based thermal power. These are being driven by both push and pull factors. The government mandates various carbon-intensive industries (including cement) to source a part of their electricity consumption from renewable sources (solar, wind, hydel, biomass-based thermal power plants) under the Renewable Purchase Obligation (RPO). This mandates entities to consume certain percentage of both solar and non-solar renewable power every year. And this percentage target is rising every year. Currently, different states have different RPO targets.

The RPO targets have been increasing YoY



Source: Industry, HSIE Research

RPO targets across major cement producing states in FY22

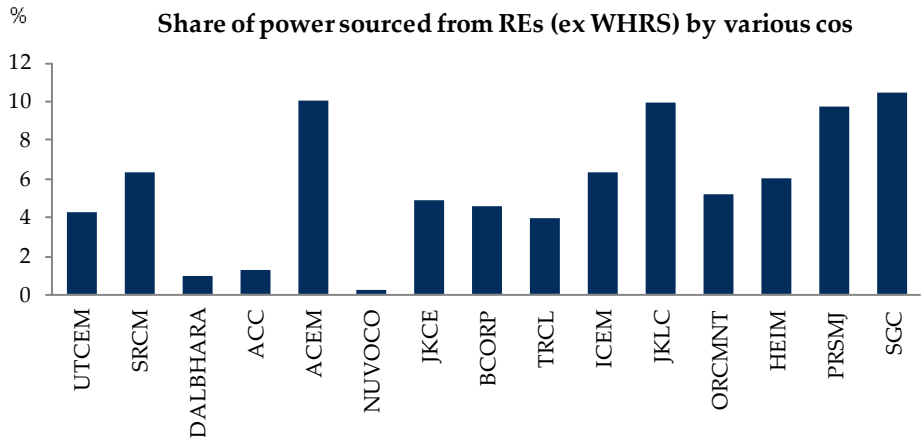


Source: Industry, HSIE Research, Odisha data is for FY20

As this regulation does not recognise WHRS power as green power (for RPO calculations), companies have to compulsorily source renewable power either through captive means or from outside. If companies are not able to meet the RPO, they have to meet the deficit through purchase of Renewable Energy Certificates (RECs), which effectively leads to additional cost of ~INR 1-2.4/kWh towards shortfall. RECs are market tradable certificates, traded on the Indian Energy Exchange (IEX) and Power Exchange of India (PXIL). Electricity distribution companies (discoms) and large power consumers like steel and cement industries have been mostly recognized as obligated entities.

We have charted the renewable power (non-WHRS) consumption trends for various companies in FY21. There is wide variance in these, mainly due to availability factor. Ambuja Cements, JK Lakshmi, Sagar Cements and Prism consumed ~10% and more. Barring a few major names (Dalmia, ACC and Nuvoco), others could use 5% or more renewable power in FY21.

Share of electricity consumed from renewable sources (excluding WHRS) by various cos

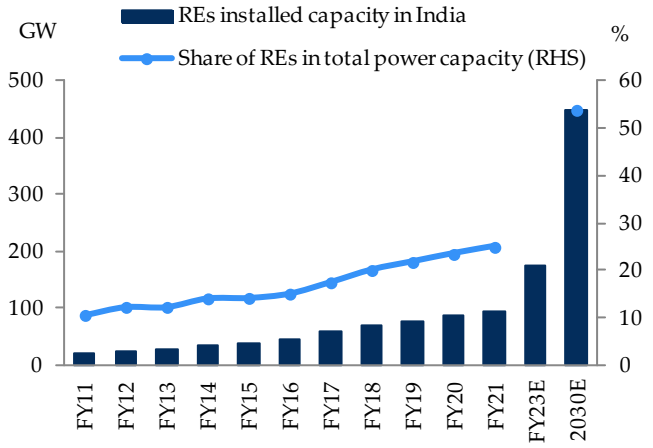


Source: Companies, HSIE Research

In the recent years, availability of commercial renewable power has been improving. Even cement companies have been adding solar power plants, both captive and through PPA route. Companies are setting up captive solar unit at their plants (more suited at split grinding unit locations) as well as tying up with other players for solar power supply. Despite 15-25% PLF for both captive solar and wind projects, the payback period is attractive (3-5 years). Large scale solar adoption, however, is currently restricted as it requires a large parcel of land to set up solar panels, which may not be possible at all of the cement plant locations. Further, in the absence of a proper "banking" and/or storage facilities (at various plants), the electricity generated is not accessible around the clock and, hence, can only be used as a back-up resource. Even windmills are not suited across all locations, as they require favourable wind flows.

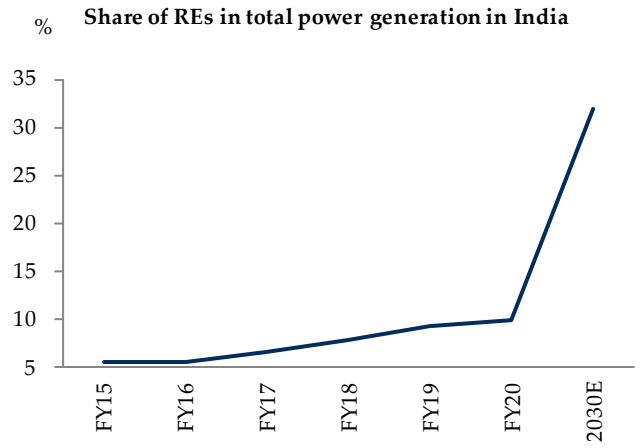
Despite these challenges, cement companies have been able to slowly increase their non-WHRS based renewable energy consumption to ~5% in FY21. As solar power is available during daytime, companies prefer to use it mostly for cement grinding, which is a flexible operation as compared to operating the kiln.

Renewable power installation trends and their share in total India's total installed capacity



Source: Industry, HSIE Research

Share of renewable power consumption is growing at fast pace



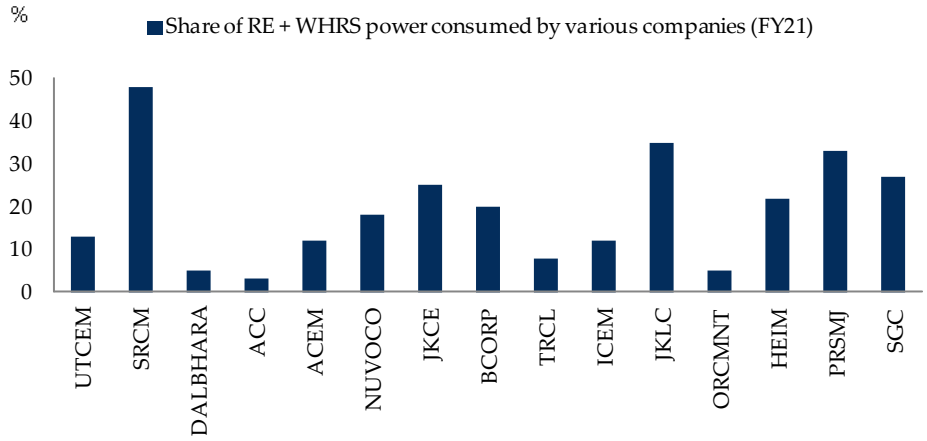
Source: Industry, HSIE Research

Over the next 10 years, renewable capacity additions will grow by ~400% to ~450GW by 2030. Their share in India's total electricity capacity will more than double to 54%, from current level. Similarly, renewable share in electricity generated will more than treble to ~32% in 2030 vs ~10% currently. Additionally, cement companies will also expand their captive solar installations (at a much smaller scale though). The expected surge in capacity installations and improvement in related banking and storage infrastructure should accelerate the non-WHRS electricity consumption by the cement industry too.

By 2030, cement companies' green power consumption should expand to ~40-50%

In FY21, the overall green power consumption was ~18%. Shree Cement leads with ~48% of green power (of their electricity requirements). More than 50% of the listed cement companies met at least 20% of their power requirements from green sources. Even the others are working aggressively to reduce their conventional power consumption – by commissioning WHRS and solar power plants and through increased purchase of renewable power. Thus, combined with WHRS power, we expect total green power to account for ~40-50% of their total electricity requirement by 2030, as against ~18% in 2020. This can then support the remaining 25% of the total CO_2 emissions reduction target set for 2030.

Consumption share of total green power by various companies in FY21



Source: Companies, HSIE Research

Dalmia has set up an aggressive target of moving to 100% renewable power by 2030. UltraTech expects to reach there by 2050 (and ~34% by 2024). JK Cement is aiming to reach 75% green power usage by 2030. ACC and Ambuja, which are currently low on their green power consumption, are also adding WHRS and will be augmenting their external RE power purchases to increase their renewable power consumption share to one-third of their medium-term requirements (i.e. next 3-4 years). Ramco Cements has a huge wind portfolio (166MW capable of meeting ~25-30% of company's power requirements) and is the early user of renewable power in India (by a cement company). However, Ramco's total green power consumption was low at ~8% in FY21 (~4% from wind) as it has to wheel a large chunk of its RE power requirement to state discoms. As the company is augmenting its WHRS capacity, we estimate its green power consumption should cross 30% by FY24E. Even Orient is planning to increase its green power usage to ~20% by FY25E, as it will be adding WHRS.

We believe the pace of green power consumption by the cement industry will largely follow the timely commissioning/ execution of the mega power projects.

Green power usage – current and targets of various cement companies

Companies	Green power share in FY21 (%)	Green power consumption targets (%)
UltraTech Cement	13	34 (2024), 100 (2050)
Dalmia Bharat	5	25 (FY24), 100 (2030)
ACC	3	~1/3rd in medium term
Ambuja	12	~1/3rd in medium term
JK Cement	25	75 (2030)
JK Lakshmi	35	~35-40% (FY25)

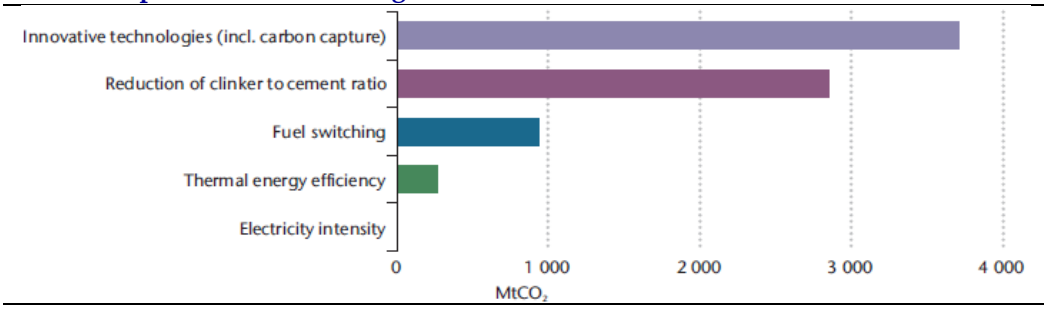
Source: Companies, HSIE Research

Technology deployment key to industry's net-zero by 2050

As discussed earlier, cement is a hard-to-abate sector in terms of its CO_2 emissions. While increased availability of non-fossil fuel and green power can totally meet the industry's requirements, process emissions will continue. Even this would reduce, but it would still remain the dominant cause of CO_2 emissions. So, carbon-capture utilisation and storage (CCCU) technology become the next major source for the industry to completely decarbonise cement production.

In fact, innovative technology adoption, including carbon capture and clinker substitution, has been recognized as two major ways in the journey to net-zero, since they would reduce cumulative CO_2 emissions by ~48% and 37% respectively.

Carbon capture is critical to migrate to net-zero

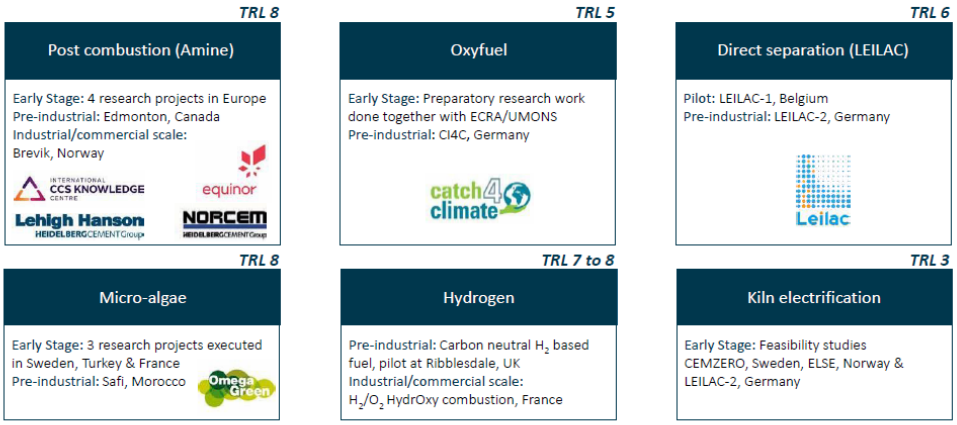


Source: IEA, CSI, HSIE Research; Expected cumulative CO_2 emissions reduction during 2020-50

Carbon capture – various projects underway

Globally, multiple demonstration and pilot CCUS projects are underway in cement factories and other GHG emitter industries. Work on many of these projects has started as long as two decades ago, and some of them are well on their way to achieving a high level of technology readiness. Most applicable CO_2 capture technologies (commercially applied in other industries) for cement industry are post combustion and oxy-fuel combustion technologies. Post-combustion technologies are preferred as they are commercially available and do not disrupt cement production.

Carbon-capture: various technologies are being evaluated



Source: Heidelberg cement, Industry, HSIE Research, TRL: Technology Readiness Level, 1=low 10=high

Dalmia Bharat's pilot project in Tamil Nadu raises hope

Back home, Dalmia Bharat initiated a similar project at its Tamil Nadu cement plant in Sep-19. Recently, the company released a white paper detailing its findings. The report noted that "It is technologically feasible to build and operate a 0.5mn MT per year CO_2 capture plant at the Ariyalur plant, using chemical absorption with amine-based solvents. A conceptual design for an amine-based solvent carbon capture plant was completed with major equipment sizing and costing." The study found urea production from the captured CO_2 as the most feasible option.

A CCUS will be capital intensive project as a 0.5mn MT capture plant would entail Capex of ~USD 365mn and can potentially lead to capacity of 0.68mn MT pa urea production (as revenue stream).

As per the report, for this CCUS project to be independently viable, selling price for the produced urea should be at least USD 325/MT (this was also the prevailing price in India during H1CY20) and the project should be able to source electricity at not more than INR 3/kWh. In this case, the project offers NPV of USD 112mn and an IRR of 20%. A larger-sized project (1mn MT CO_2 capture) would benefit from economies of scale and deliver positive NPV at a lower urea selling price. The assumptions also factor in 12% as cost of debt. A low-cost sustainability fund for such projects can reduce the hurdle rate and improve the IRR. Thus, the biggest impediment appears to be the high upfront investment required. Further, the long-term demand supply of urea must be evaluated separately.

Given that the industry has time in hand, technological disruptions, low-cost sustainability funding, and carbon credits will all make this technology feasible over the next two decades.

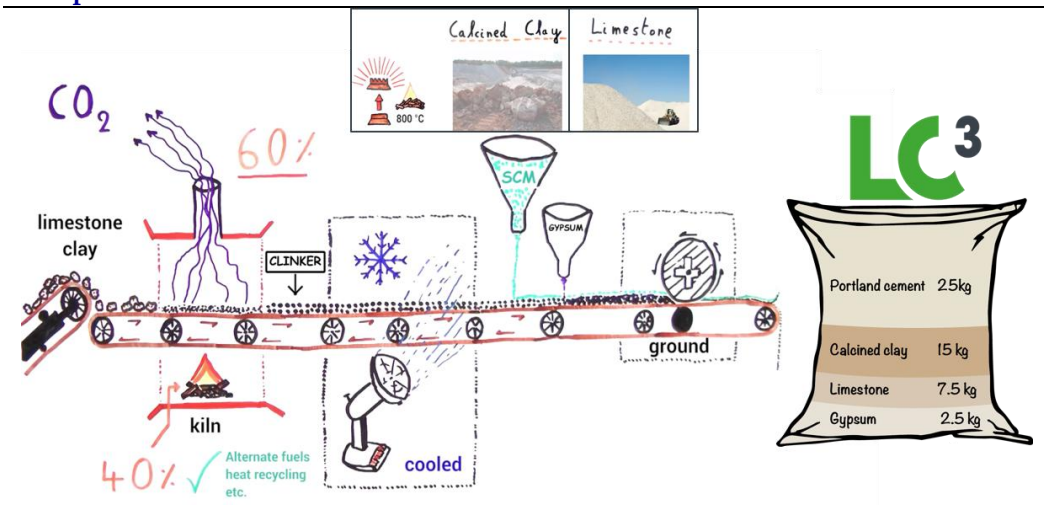
LC3 – long-term alternative to keep clinker factor low

Slag and flyash are by-products from steel manufacture (from crude steel) and electricity generation (from burning coal); hence, their availability is at risk in the long run (2030-2050: completing the net-zero transition). As both of these additives for cement business move towards greener processes, they will become scarce. While this scenario is expected to play out in rich economies over the next five years, it would not have an immediate impact on cement output in developing countries like India.

Over the past decade, the industry has experimented with various options globally to identify alternative low-clinker cement on a large scale, thereby not negating the industry's carbon journey. The industry sees great possibilities in limestone calcined clay cement (LC3) as a viable option. Multiple LC3 experiments are currently underway around the world, notably in India.

LC3 comprises clinker (50%), raw limestone (15%), calcined clay (30%), and gypsum (5%). As it uses much lower clinker, CO_2 emissions are also ~40% lower than OPC. Low-grade limestone (containing dolomite) can be used in LC3. Even the clay used can be waste from ceramics or cosmetics industries, and it is abundantly available globally. Further, clay calcination occurs at ~750-900^{o}C vs 1400-1500^{o}C for clinkerisation, thus conserving fuel. So, similar to PPC or PSC cement, LC3 employs a large amount of waste materials. However, compared to PPC and OPC, it has very low clinker factor and requires much less thermal and electrical energy. All of these imply a lower CO_2 footprint. Thus, as and when LC3 gains commercial acceptance, the industry's blended cement portfolio will expand. And, a decade from now, when slag/ fly-ash availability begins to reduce, LC3 can support the industry's net-zero journey.

LC3 production – schematic flow

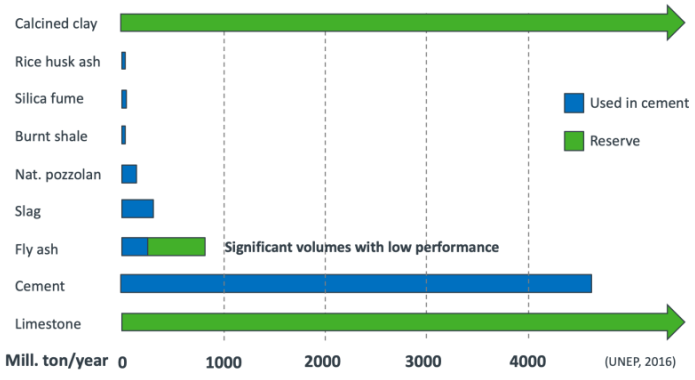


Source: LC3.ch, HSIE Research

In India, its BIS standards for LC3 are expected to be announced soon. As LC3 relies on the calcination of clay and raw limestone to be fed into the grinding unit, it will require retrofitting and upgrade of equipment. According to our discussions with various industry experts, LC3 has a good future, but not in near future.

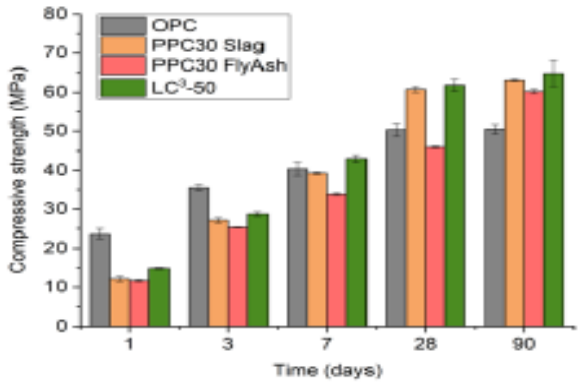
As LC3's initial compressive strength (1day/ 3day) lags that of OPC, it will be difficult to market it on large scale (at least initially). Additionally, because of the huge amount of clay being present, it has a brownish colour, which is very different from the grey/black colour cement that people are used to. It is also believed that this may delay its market acceptance.

LC3 components are widely available in abundance



Source: LC3.ch, HSIE Research

Compressive strength: While LC3 has lower early strength, it supersedes others on its long term strength



Source: Industry, HSIE Research

Water – a scarce resource: sector refills more than it uses

The world over, water management is becoming more important as part of global sustainability development. As per industry estimates, if it is not used and managed judiciously, the world would face a 40% deficit of usable water by 2030! Further, only 2.5% of total water is available as fresh water, emphasising the significance of proactive water management.

Cement is a major water consumer, both during its production and, later, when it is used to make concrete or plaster. In plant, water is majorly required for power plants (thermal and waste heat recovery), cooling, and dust suppression. The Indian cement industry has taken a proactive approach to multidimensional water management. The GCCA member companies in India are addressing water resource management both within and outside their operating boundaries.

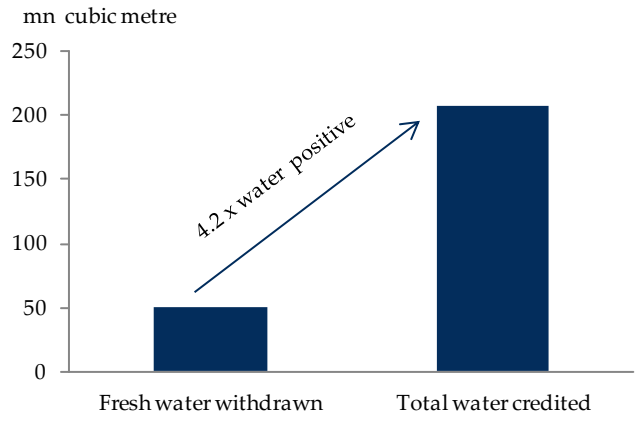
The core principles guiding/ driving water management are – conservation (reduce, recycle, and reuse) and harvesting. Reduce: as a first stage to water sustainability, the industry identifies judicious usage, with a greater emphasis on reducing fresh groundwater consumption. Process optimisation and incorporating water-efficient technologies, water metering, and monitoring are helping the industry reduce its water consumption per MT of cement produced. Recycle & reuse: Recycling waste water and reusing it lowers the need for fresh water consumption and, through zero liquid discharge, affluent discharge impact on the environment is contained.

In FY20, all 129 cement plants of GCCA member cement companies were zero liquid discharge. Harvesting: Companies have been installing rainwater harvesting structures both inside and outside plant boundaries, assisting in groundwater recharge as well as meeting peak demand during summer season.

As per GCCA data, its Indian member companies collectively achieved >4x water positivity in FY20 through minimal freshwater withdrawal, zero liquid discharge, rainwater harvesting, and ground water recharge.

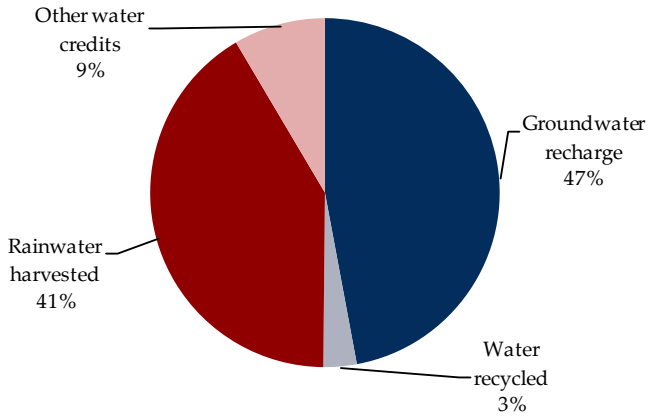
As against, collective net freshwater withdrawal (debit) of 50mn cbm by these 129 plants, a total of 208mn cbm got credited through rainwater harvesting, groundwater recharge, recycled water usage and other credits, thus leading to water positivity factor of ~4.2x. As per the data shared by various cement companies in India, Dalmia and Ambuja lead with a large water positivity factor of 12.4x and 8x respectively.

GCCA Indian members are >4x water positive



Source: GGCA India, HSIE Research

Sources of water credit created by the cement companies



Source: GCCA India, HSIE Research

Cement companies have been recharging more water than they are withdrawing

Water positivity factor (x)	FY21 (x)	Target (x)
UltraTech Cement	3.9	5 (FY23)
Shree Cement	3	NA
Dalmia Bharat	12.4	20 (Yr 2050)
ACC	1.1	5 (Yr 2030)
Ambuja Cements	8	NA
JK Cement	3	5 (Yr 2030)
Orient Cement	3.3	NA
Heidelberg Cement	4.4	NA

Source: Companies, HSIE Research, NA – data not available

Peer set valuations and TP revisions

Rating and target price revision summary

Company	Mcap (INR bn)	CMP (INR/sh)	Reco	TP	EV/EBITDA			EV/MT (INR bn)			RoE (%)		
					FY22E	FY23E	FY24E	FY22E	FY23E	FY24E	FY22E	FY23E	FY24E
UltraTech Cem	2,111.5	7,315	BUY	8,490	17.5	15.1	12.7	17.64	16.46	14.70	12.8	13.9	16.1
Shree Cem	934.3	25,894	REDUCE	28,700	19.3	16.6	14.4	19.69	17.72	15.97	16.2	15.9	15.6
Ambuja Cem	716.8	361	ADD	390	17.3	14.9	13.1	18.65	16.68	16.24	10.8	10.4	10.8
ACC	400.4	2,132	BUY	2,670	10.5	11.2	9.5	9.85	9.30	9.20	15.1	13.9	14.1
Dalmia Bharat	343.6	1,842	ADD	2,240	12.2	11.8	11.2	10.46	11.20	9.03	8.5	8.3	7.5
Nuvoco Vistas	159.8	507	BUY	827	9.3	7.4	7.1	9.03	8.30	8.05	6.7	10.0	10.0
Ramco Cem	228.6	969	BUY	1,096	15.7	12.7	11.5	13.40	12.37	12.20	13.5	15.1	14.9
JK Cement	265.0	3,430	REDUCE	3,210	16.9	13.5	11.6	14.61	14.61	12.17	20.2	22.8	21.0
Birla Corp	105.8	1,374	BUY	1,634	9.9	8.3	7.0	7.44	7.10	6.83	9.2	9.5	11.6
Heidelberg Cem	48.5	214	ADD	250	8.9	8.1	7.5	7.33	7.59	7.90	17.4	18.3	20.6
Star Cement	38.8	94	BUY	130	8.4	6.5	5.6	7.56	6.73	5.62	12.9	16.8	18.0
JK Lakshmi Cem	63.3	538	BUY	780	7.6	6.2	5.9	5.17	5.12	4.57	18.5	20.1	19.1
Orient Cem	32.6	159	BUY	185	6.3	7.1	7.4	4.32	4.82	5.37	17.5	15.7	15.7
Sagar Cem	29.5	251	ADD	295	9.3	7.2	6.7	4.39	4.38	4.38	11.3	13.2	13.0
Deccan Cem	7.7	550	ADD	785	3.5	5.4	5.4	2.64	4.01	2.82	17.8	15.0	15.5

Source: Company, HSIE Research

Thematic reports by HSIE

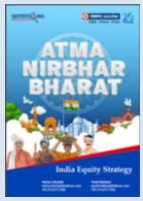
Cement: WHRS – A key cog in the flywheel

Autos: Where are we on "S" curve?

FMCG: Defensive businesses but not valuations

Autos: A changed landscape

Banks: Double whammy for some



India Equity Strategy: Atma Nirbhar Bharat

Indian IT: Demand recovery in sight

Life Insurance: Recovery may be swift with protection driving margins

Retail: Whole flywheel is broken?

Appliances: Looing beyond near-term disruption

Pharma: Chronic therapy – A portfolio prescription

Indian Gas: Looking beyond the pandemic

India Equity Strategy: Quarterly flipbook

Real Estate: Ripe for consumption

Indian IT: expanding centre of gravity

Indian Chemical: Evolution to revolution!

Life Insurance: ULIP vs. MF

Infrastructure: On the road to rerating

Cement: Spotting the sweet spot

Pharma: Cardiac: the heartbeat of domestic market

Life Insurance: Comparative annual report analysis

Indian microfinance: Should you look micro as macros disappoint?

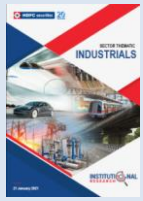
India Equity Strategy: Quarterly flipbook

Autos: Divergent trends in PVs and 2Ws

India Internet: the stage is set

FMCG: Opportunity in adversity - A comparative scorecard

Logistics: Indian Railways - getting aggressive



Industrials: Triggering a new cycle

Indian IT: raising the bar

India Equity Strategy: Quarterly flipbook

FinTech Playbook: P2M Payments | Surging pool, dwindling yields

India Hospitals: capital discipline improving, sustenance is key

Autos: Will EVs impact the 'EV'?

Cement: Riding High

Power: Reforms essential for rennaissance

Fashion & Lifestyle: From a disruptor's lens II

India Equity Strategy: Quarterly flipbook

Indian Gas Sector: Resilience in the eye of the storm

Consumer Durables: Fans - a compounding story but underrated

Quarterly flipbook: Q2FY22– Demand environment improves but input cost inflation dents profitability

FinTech Playbook: Discount Brokers

Footwear: No bargains here!

Holdcos for portfolio diversification

Disclosure:

We, **Rajesh Ravi, MBA & Keshav Lahoti, CA** authors and the names subscribed to this report, hereby certify that all of the views expressed in this research report accurately reflect our views about the subject issuer(s) or securities. HSL has no material adverse disciplinary history as on the date of publication of this report. We also certify that no part of our compensation was, is, or will be directly or indirectly related to the specific recommendation(s) or view(s) in this report.

Research Analyst or his/her relative or HDFC Securities Ltd. **does not have** any financial interest in the subject company. Also Research Analyst or his relative or HDFC Securities Ltd. or its Associate may have beneficial ownership of 1% or more in the subject company at the end of the month immediately preceding the date of publication of the Research Report. Further Research Analyst or his relative or HDFC Securities Ltd. or its associate **does not have** any material conflict of interest.

Any holding in stock – NO

HDFC Securities Limited (HSL) is a SEBI Registered Research Analyst having registration no. INH000002475.

Disclaimer:

This report has been prepared by HDFC Securities Ltd and is solely for information of the recipient only. The report must not be used as a singular basis of any investment decision. The views herein are of a general nature and do not consider the risk appetite or the particular circumstances of an individual investor; readers are requested to take professional advice before investing. Nothing in this document should be construed as investment advice. Each recipient of this document should make such investigations as they deem necessary to arrive at an independent evaluation of an investment in securities of the companies referred to in this document (including merits and risks) and should consult their own advisors to determine merits and risks of such investment. The information and opinions contained herein have been compiled or arrived at, based upon information obtained in good faith from sources believed to be reliable. Such information has not been independently verified and no guaranty, representation of warranty, express or implied, is made as to its accuracy, completeness or correctness. All such information and opinions are subject to change without notice. Descriptions of any company or companies or their securities mentioned herein are not intended to be complete. HSL is not obliged to update this report for such changes. HSL has the right to make changes and modifications at any time.

This report is not directed to, or intended for display, downloading, printing, reproducing or for distribution to or use by, any person or entity who is a citizen or resident or located in any locality, state, country or other jurisdiction where such distribution, publication, reproduction, availability or use would be contrary to law or regulation or what would subject HSL or its affiliates to any registration or licensing requirement within such jurisdiction.

If this report is inadvertently sent or has reached any person in such country, especially, United States of America, the same should be ignored and brought to the attention of the sender. This document may not be reproduced, distributed or published in whole or in part, directly or indirectly, for any purposes or in any manner.

Foreign currencies denominated securities, wherever mentioned, are subject to exchange rate fluctuations, which could have an adverse effect on their value or price, or the income derived from them. In addition, investors in securities such as ADRs, the values of which are influenced by foreign currencies effectively assume currency risk. It should not be considered to be taken as an offer to sell or a solicitation to buy any security.

This document is not, and should not, be construed as an offer or solicitation of an offer, to buy or sell any securities or other financial instruments. This report should not be construed as an invitation or solicitation to do business with HSL. HSL may from time to time solicit from, or perform broking, or other services for, any company mentioned in this mail and/or its attachments.

HSL and its affiliated company(ies), their directors and employees may; (a) from time to time, have a long or short position in, and buy or sell the securities of the company(ies) mentioned herein or (b) be engaged in any other transaction involving such securities and earn brokerage or other compensation or act as a market maker in the financial instruments of the company(ies) discussed herein or act as an advisor or lender/borrower to such company(ies) or may have any other potential conflict of interests with respect to any recommendation and other related information and opinions.

HSL, its directors, analysts or employees do not take any responsibility, financial or otherwise, of the losses or the damages sustained due to the investments made or any action taken on basis of this report, including but not restricted to, fluctuation in the prices of shares and bonds, changes in the currency rates, diminution in the NAVs, reduction in the dividend or income, etc.

HSL and other group companies, its directors, associates, employees may have various positions in any of the stocks, securities and financial instruments dealt in the report, or may make sell or purchase or other deals in these securities from time to time or may deal in other securities of the companies / organizations described in this report.

HSL or its associates might have managed or co-managed public offering of securities for the subject company or might have been mandated by the subject company for any other assignment in the past twelve months.

HSL or its associates might have received any compensation from the companies mentioned in the report during the period preceding twelve months from the date of this report for services in respect of managing or co-managing public offerings, corporate finance, investment banking or merchant banking, brokerage services or other advisory service in a merger or specific transaction in the normal course of business.

HSL or its analysts did not receive any compensation or other benefits from the companies mentioned in the report or third party in connection with preparation of the research report. Accordingly, neither HSL nor Research Analysts have any material conflict of interest at the time of publication of this report. Compensation of our Research Analysts is not based on any specific merchant banking, investment banking or brokerage service transactions. HSL may have issued other reports that are inconsistent with and reach different conclusion from the information presented in this report.

Research entity has not been engaged in market making activity for the subject company. Research analyst has not served as an officer, director or employee of the subject company. We have not received any compensation/benefits from the subject company or third party in connection with the Research Report.

HDFC securities Limited, I Think Techno Campus, Building - B, "Alpha", Office Floor 8, Near Kanjurmarg Station, Opp. Crompton Greaves, Kanjurmarg (East), Mumbai 400 042 Phone: (022) 3075 3400 Fax: (022) 2496 5066 Compliance Officer: Binkle R. Oza Email: complianceofficer@hdfcsec.com Phone: (022) 3045 3600

HDFC Securities Limited, SEBI Reg. No.: NSE, BSE, MSEI, MCX: INZ000186937; AMFI Reg. No. ARN: 13549; PFRDA Reg. No. POP: 11092018; IRDA Corporate Agent License No.: CA0062; SEBI Research Analyst Reg. No.: INH000002475; SEBI Investment Adviser Reg. No.: INA000011538; CIN - U67120MH2000PLC152193