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Ambuja Cement: Measuring the Value of Water

Utkarsh Majmudar and Namrata Rana wrote this case solely to provide material for class discussion. The authors do not intend to illustrate either effective or ineffective handling of a managerial situation. The authors may have disguised certain names and other identifying information to protect confidentiality.

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Ambuja Cements Limited (Ambuja Cement) was one of the largest cement companies in India with an annual production capacity of 29.65 million tons of cement in 2016. Across the country, Ambuja Cement had five integrated cement manufacturing plants and eight cement grinding units. The company was the Indian arm of LafargeHolcim, a global cement conglomerate with a presence in over 90 countries. Since its inception, Ambuja Cement had focused on timely, cost-effective, and environmentally clean shipments to its customers. To this end, it was the first Indian cement manufacturer to build a captive port with four terminals along India’s western coastline.

Ambuja Cement was the first cement company in India to be certified as *water positive*, meaning it saved more water than it used. This was achieved through water saving measures such as water harvesting, providing concrete mix designs to masons, and modular concrete curing. In addition to water conservation, the company was involved in the areas of skill-based livelihood generation, health care, education, and women’s empowerment.

A constant question for Ambuja Cement regarded the value it generated. The financial value it generated was well known, but there were also other aspects, namely social and environmental values. Could these values be combined in some way? Social cost–benefit analysis was a popular approach; however, could other approaches be used? These were some of the questions Ambuja Cement’s senior management grappled with.

Valuing natural resources was gaining acceptance, but many aspects of it were proving difficult for the company. Estimating shadow prices was fraught with dangers and difficulties. Also, the company already had a method for assessing its water use (water balance index) that appeared to be informative, and the firm already performed quite well along this metric. Should the company use another measure to assess its water use, or stay with the water balance index?

The company called in a well-known consulting firm to help answer some of these questions. The consulting team, headed by Elena Larsen, began by first understanding the company, its vision, and its business.

Ambuja Cements Limited

Ambuja Cement was set up jointly by Narotam Sekhsaria and his business partner, Vinod Neotia, in 1981. They pulled Gujarat Industrial Investment Corporation Limited, a state government enterprise, into the venture. By 1983, the company had become a public limited company and was renamed Gujarat Ambuja Cements Limited. Subsequently, it was renamed Ambuja Cements Limited. In 2006, the Swiss company Holcim (which became LarfargeHolcim in 2015) acquired a majority stake in Ambuja Cement. The company’s vision was “to be the most sustainable and competitive company in our industry.”

Ambuja Cement mainly manufactured Portland Pozzolana Cement, commonly known as PPC. By 2015, the company was producing about 21.4 million tons of cement and 14.4 million tons of clinker annually. In 2015, the company reported net sales of ₹93.68 billion,[[1]](#footnote-1) EBITDA[[2]](#footnote-2) of ₹15.31 billion, and a net profit of ₹8.08 billion (see Exhibit 1).

The company’s vision guided all of its endeavours: Ambuja Cement believed that sustainability and competitiveness were not mutually exclusive. The company recognized that acting in a sustainable manner was not only a business imperative, but also provided the company with a competitive advantage. To achieve this objective, the company integrated its sustainability key performance indicators (related to energy, water availability, climate change, logistics, mining, and local communities) with its business key performance indicators.

Ambuja Cement’s sustainability efforts were focused on (a) adopting eco-friendly technologies in its plants’ mining operations; (b) ensuring zero harm to employees, visitors, and contractors; (c) minimizing greenhouse gas emissions; and (d) enhancing the quality of life for local communities. The company also established Ambuja Ambition 2030, a plan to focus the company on its sustainability goals (see Exhibit 2).

The company had partnered with many global initiatives, such as Cement Sustainability Initiative of World Business Council for Sustainable Development, to help the company push its agenda forward. Ambuja Cement’s vision to become the most competitive and sustainable company in the industry had also led the company to adopt True Value, the triple bottom-line accounting method that encompassed the three pillars of sustainability: people, planet, and profit.

The Cement industry and its environmental impact

By 2016, India had become the second-largest cement producing country in the world. Almost all states in India produced some quantities of limestone, but about 75 per cent of the total production came from the states of Madhya Pradesh, Chhattisgarh, Andhra Pradesh, Rajasthan, Gujarat, and Karnataka. Cement’s role in India’s economy was critical because it provided employment to more than a million people.

Cement was the major ingredient of concrete, which was the second most consumed material on the planet. It was anticipated that the demand for cement would grow to 550–600 million tons per year by 2025.[[3]](#footnote-3) Cement consumption was dominated by the housing sector, which accounted for roughly two-thirds of the total consumption. The balance of consumption involved infrastructure at 13 per cent, commercial construction at 11 per cent, and industrial construction at 9 per cent.[[4]](#footnote-4)

Cement manufacturing involved four major steps: quarrying, crushing, clinkerization, and grinding. Limestone was quarried at mining sites and the limestone rocks transported to cement plants. At the plant, limestone was crushed and mixed with ingredients such as iron ore, silica, and alumina, and with correctives. This mix was fed into large kilns heated up to 2,700 degrees Fahrenheit. The output of this process was clinker. The clinker was mixed with fly ash and gypsum, and then ground to fine dust, producing cement. Cement was typically packed in 50-kilogram bags and sent to the market by way of trucks, trailers, and trains. Some cement was dispatched in bulk (called bulkers) to ready-mix concrete sites.

Like all industrial activities, cement production could harm the environment if it was not managed properly. Many of the features of cement production made it environmentally unfriendly. Production required land for the plant and infrastructure, which affected the local communities. Limestone, a key raw material, was extracted through mining, and the production caused dust and particulate matter emissions if operations were not managed properly and systems were inadequately designed.

Some mines were located on agricultural land, wasteland, or in forest; therefore, mining changed the land use pattern of an entire region. Land was also associated with livelihoods, generating an emotive issue and issues involving ancestry and tradition.

Cement was an energy intensive industry. It required about 80 kilowatt hours to produce 1 ton of cement, and about 3,000–3,200 millijoules of thermal energy per ton of clinker produced. Because an uninterrupted power supply was not available from the grids, many cement companies had set up captive thermal power plants—plants that generated their own electricity from heat energy to meet the plant’s demands.

Gas emissions were another concern. Limestone, when heated in the cement manufacturing process, was calcined, releasing carbon dioxide (CO2). Each ton of limestone used released 0.44 ton of CO2, or greater than 0.53 ton of CO2 per ton of clinker produced. This led to CO2 emission from the kiln. In addition, because cement production required high temperatures, the emission of nitrogen oxide was another major environmental concern in cement production.

Finally, water was a critical resource for any cement manufacturing company. It was required for cooling, dust suppression, and domestic needs. Thus, water conservation became a significant sustainability opportunity for a cement company.

Ambuja Cement Foundation

Many Indian companies had formed foundations and trusts that undertook social and charitable activities. The companies funded the foundations, and the foundations carried out most of the company’s corporate social responsibility (CSR) activities. Activities that focused on emissions, waste, water, and energy associated with company operations tended to be undertaken by the companies themselves, in-house.

When land was acquired for building the cement plant, it was necessary to bring the local communities along. Ambuja Cement believed that its responsibility to the society went beyond reducing pollution; improving the quality of life in areas near the plant was important too. Gradually, working for communities became part of Ambuja Cement’s culture and the company set up a special cell to undertake rural development activities.

In 1993, the company set up the Ambuja Cement Foundation (ACF) with the mission to “energize, involve, and enable communities to realize their potential.” The foundation’s focus areas were health, agriculture, afforestation, energy conservation, water management, and skill development.

ACF acted as the implementing agency for all of Ambuja Cement’s CSR activities, but it was an independent agency, separate from the company, with an independent board and registered as not-for-profit. In addition to the initial capital invested, Ambuja Cement gave the foundation an annual grant to undertake its activities. ACF also augmented its resources with grants from other companies. Since Ambuja Cement provided ACF with grants, the company had some influence on the foundation’s activities.

Ambuja Cement's water journey

Ambuja Cement tracked its water consumption and withdrawal. Regular water audits were also conducted to identify measures for increasing water-positive action. A monthly water management report was sent to headquarters for review by top management, and water management became a key performance indicator for every plant. These indicators included items such as water consumption for specific purposes, fresh water withdrawal for specific purposes, the water balance index (water credit/water debit), and the percentage of water recycled. This led to competition among plants for best water conservation.

The company had taken several steps to reduce water consumption at its plants. It used dry process technology for manufacturing cement.[[5]](#footnote-5) The water-cooled condensers in captive thermal power plants were replaced with air-cooled condensers. Water consumption in housing colonies was reduced by way of raising awareness, arresting leaks, and using water-efficient fixtures and fittings. Cooling water and sewage were recycled. Water rejected by the reverse osmosis treatment for purification and treated water from the effluent and sewage treatment plants was used for dust suppression and gardening.

Water harvesting measures were also undertaken in plants and mine pits. The company’s first plant was in Kodinar, in the state of Gujarat, which was where Ambuja Cement’s water journey began. The coastal area of Kodinar suffered from a severe water problem, both in availability and quality. Rainwater ran into the sea during the monsoon and water-intensive crops such as sugar cane, banana, betel leaves, wheat, and coconut were cultivated. Then, as a consequence of groundwater depletion, salt water from the sea flowed into the wells.

While the company had taken steps within the manufacturing plant to optimize water usage, ACF also worked ceaselessly over the years to solve Kodinar’s water woes and transform the small coastal town’s economy. The foundation took several steps to combat the problem. It deepened the ponds to increase their water holding and storage capacity. It constructed structures such as check dams to decrease the velocity of water runoff and percolation tanks to harvest the runoff to increase the recharging capacity of the watershed.

In an innovative experiment, the company used pits created by spent mines for water storage. ACF then connected the water bodies by building link channels and canals from rivers to village ponds and reservoirs of the mined-out pits, and constructed radial canals from the existing tidal regulators and linked them through pipelines.

As Ambuja Cement expanded to other areas within India, ACF did the same, implementing its environmentally supportive functions. The company had other plants in states that already faced water shortages, such as Rajasthan and Gujarat, so many water harvesting and conservation methods were implemented. Check dams, ponds, khadin (long earthen embankments at the low end of a slope to catch runoff), dykes, farm ponds, reservoirs in the mined-out pits, and micro and drip irrigation were all used to help provide water for drinking, irrigation, and domestic needs (see Exhibit 3). Rainwater harvesting was also essential to collect large quantities of water. The company’s efforts were seen positively by the local communities.

Water balance measurement

Achieving positive water impact meant that Ambuja Cement could make more and better water available to the environment and communities where it operated. The company measured its success with a water balance index, defined as the ratio of water credit over water debit at each site. Water debit denoted the volume of total water consumption, and comprised all the water used by the factory and the company’s residential areas. Water debit also included drinking water consumed through purchased water bottles. Water credit was the total amount of water added to the system through recycling and reusing, harvesting rainwater, quarry restoration for reservoirs, recharging ground water, and consumer savings.

If the water balance index was greater than 1, it indicated positive water balance. If the index was less than 1, the water balance was negative. Ambuja Cement’s water balance index doubled from 2.01 in 2011 to 4.02 in 2015 (see Exhibit4). Thus, the company harvested almost four times more water than it took out. The water balance was certified by an independent agency.

In the company’s plants, water use was reduced by using modular concrete curing systems[[6]](#footnote-6) and concrete mix design services. In 2015, the company introduced a modular concrete curing system that saved 12 litres of water per square foot of poured concrete roof area at customers’ end. This saving led to an additional credit of 57.3 million litres of water in 2015.[[7]](#footnote-7)

Water Movement and Timing

Water measurement was not straightforward; it involved addressing several issues such as rainfall, quality of water, use of water, and complexities around offsetting.[[8]](#footnote-8) Also, water was not a static resource. It was always in motion and water levels changed constantly. Therefore, seasonality and periodicity of claim were significant issues and the time of measurement had a significant effect.

Rainfall, an element of seasonality, was an important factor. Rainfall varied with time, and no two days, months, seasons, or years recorded the same amount of precipitation. How, then, could water positivity be achieved when there was a drought or a flood? Further, how could a water system be replenished or recharged exactly when water was taken out, when the water mighty have been taken out a year earlier? There was also a question regarding when and over what period a company could claim to have a net positive impact.

Another question was related to the source of replenishment of the basin. Would the replenishment occur through rain or through flow from another basin nearby? Should the water levels of the two basins be combined or looked at independently? What should be the baseline? How would one measure success?

Beyond Water Quantity

While net positive impact measured the quantity of water in the system, dealing with the quality of the water was also essential. In many developing countries, a large percentage of untreated industrial waste found its way into the water supply for public distribution.

The intended use of water was also relevant. Saving water by using a method of water intervention such as drip irrigation served one purpose. There needed to be ways to make that saved water available for another use; one of these ways could be redirecting the water into a water body or aquifer.

There was also a problem with localized shortages: Offsetting an amount of scarce water with plentiful water in another area failed to account for local problems with water shortages. Offsets worked only where the entire area was degraded through forest removal, and groundwater levels were decreasing.

The problem of measurement

Larsen was a consultant at the large management consulting firm retained by Ambuja Cement to address the question of how to integrate economic and social values. Many decisions were to be made to perform the calculations.

Framework

Larsen was faced with various measurement systems available to companies. These included standards- and benchmarks-based systems such as *B Impact Assessment*,[[9]](#footnote-9) and strategic frameworks such as Shared Value and True Value (see Exhibit 5).

After due deliberation, Larsen chose the True Valueapproach, which required businesses to estimate the value of their on-going business on an economic basis and add to it the incremental cost or benefit of externalities.

Assessing the Company’s True Earnings

Larsen needed to consider two things for her True Value analysis:

*Economic or accounting earnings*. The appropriate measure had to be chosen; was it earnings (profit after tax), cash flow, or the estimated value of the business? Earnings and cash flow could be simply obtained from the company’s financial statements.

*Social and environmental value*. This involved measuring externalities, and seemed like a more straightforward analysis. A framework for analyzing the externalities was available (see Exhibit 6), but which metric was more appropriate? Larsen had assessed many kinds of externalities that could apply to Ambuja Cement, including harvesting more water than the company used in manufacturing (water positive). Also relevant would be using waste from other industries in the company’s manufacturing process. This would avoid the need for landfill disposal, support income-generating activities for members of the local community, reduce emissions of greenhouse gases and other substances such as fine dust particles, and reduce groundwater extraction.

Water was a strategic focus for Ambuja Cement, and its ambition was to become five times water positive by 2020. The company believed that water was critical for its own purpose and for social impact, and was thus critical in calculating social value. For example, Ambuja Cement had undertaken several efforts, particularly in the areas of Ambujanagar and Rabriyawas, which included pushing salinity toward the coast, and creating check dams, aqueducts, and khadins. These efforts had had a perceptible impact on the water supply—giving people better access to drinking water—and improved the available fertile land, which allowed farmers to harvest multiple crops as opposed to only one crop, as had been the case previously. An ensuing result was an increase in girls’ enrolment in schools.

Estimating the value of water

Water availability was affected when the demand for water exceeded the water available in a given period. This situation usually occurred in locations where there was a combination of low rainfall and high population density, or in locations with strong agricultural and industrial operations. Unsustainable water abstraction could adversely affect the local population’s access to water, provoke the intrusion of salt water into groundwater sources in coastal areas, and, in more extreme situations, led to the disappearance of water bodies and wetlands. Thus valuing water was critical.

Larsen’s search for the appropriate metric for evaluating the social cost of water led her to a metric propagated by Trucost, a company that assessed climate risks.[[10]](#footnote-10) Trucost estimated that the true cost of one cubic metre of water ranged between US$0.10 where water was plentiful and US$15 in areas where it was extremely scarce (see Exhibit 7). The total economic value was determined based on direct and indirect costs of water.

Estimating the social cost of water from the beginning would entail a significant cost in conducting several studies. The Trucost estimates might involve a few errors, but would be cheaper to use and take less time. The question for Larsen, however, was whether Trucost’s numbers made sense for India.

Larsen gathered the monthly US$/INR exchange rates (see Exhibit 8). She also collected the details for the water scarcity levels,[[11]](#footnote-11) and the water credits and debits in different parts of the country where Ambuja Cement had operations (see Exhibit 9).

The decision

Larsen stretched and yawned. It was two in the morning, and her business school training had not prepared her for anything like this. There were many decisions to be made. She had time to spare; however, she also knew that if she took any longer to arrive at a decision, the decision-making process could go into an endless loop. The time was now.

The authors would like to thank the representatives of Ambuja Cement Limited who made this case possible.

Exhibit 1: Ambuja Cements Limited, Financial highlights (in ₹ million)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Income Statement** | | | | | |
| Year ended December 31st | | | | | |
|  | **2011** | **2012** | **2013** | **2014** | **2015** |
| Net sales | 85,040 | 96,750 | 90,790 | 99,110 | 93,680 |
| Operating profit EBITDA | 19,770 | 24,730 | 16,670 | 19,280 | 15,310 |
| Profit before tax | 17,030 | 19,020 | 15,140 | 17,830 | 11,720 |
| Profit after tax | 12,290 | 12,970 | 12,950 | 14,960 | 8,080 |
|  | | | | | |
| **Balance** **Sheet** | | | | | |
| As of December 31st | | | | | |
|  | **2011** | **2012** | **2013** | **2014** | **2015** |
| Net worth | 80,690 | 88,050 | 94,860 | 101,030 | 103,070 |
| Borrowings | 430 | 350 | 290 | 290 | 330 |
| Capital employed | 87,780 | 94,140 | 101,210 | 107,630 | 109,460 |
| Fixed assets: gross block | 97,020 | 101,840 | 108,260 | 114,290 | 120,130 |
| Fixed assets: net block | 61,860 | 58,620 | 60,630 | 62,270 | 60,920 |
| Current assets | 42,640 | 52,760 | 55,370 | 59,950 | 65,490 |
| Current liabilities | 27,640 | 28,990 | 28,430 | 31,380 | 32,260 |

Note: ₹ = INR = Indian rupee; ₹1 = US$0.02 on December 31, 2015; EBITDA = earnings before interest, tax, depreciation, and amortization.

Source: Company documents.

EXHIBIT 2: AMBUJA AMBITIONS 2030

|  |  |
| --- | --- |
| **Year 2020** | **Year 2030** |
| **People and Communities** | |
| * Have no site fatalities (zero) | * Have no site fatalities (zero) |
| * Reduce LTI FR to <0.70 | * Reduce LTI FR to <0.20 |
| * Reduce TIFR by 30% | * Reduce TIFR by 50% |
| * Implement India Road Safety Vision 2020 * Develop social programmes to benefit 1.5 million people * Complete human rights assessment | * Assess 100% of high risk active suppliers and implement consequence management |
| **Water and Nature** | |
| * Reduce fresh water withdrawal in cement operation by 10% | * Reduce fresh water withdrawal in cement operation by 15% |
| * Implement WASH pledge at all sites | * Improve water balance index to 6 |
| * Improve water balance index to 5 | * Show positive change for biodiversity |
| * Implement biodiversity indicator and reporting system at all quarries |  |
| **Climate** | |
| * Reduce net specific CO2 emission by 5% versus 2015 | * Reduce net specific CO2 emission by 12% versus 2015 |
| **Circular Economy** | |
| * Use 9 million tonnes of waste resources per year | * Use 13 million tonnes of waste resources per year |

Note: CO2 = carbon dioxide; LTI FR = Loss Time Injury Frequency Rate; TIFR = Total Injury Frequency Rate ; WASH = Water, Sanitation, and Hygiene

Source: Ambuja Cements Limited, *Sustainable Development 2015*, accessed June 29, 2017, www.ambujacement.com/Upload/PDF/Ambuja-Cement-Sustainable-Development-Report-2015.pdf.

Exhibit 3: community sustainable water management projects executed in the Previous 27 years (As of June 30, 2016)

|  |  |
| --- | --- |
| **Water Harvesting Structures/Project Types** | **Total Number** |
| Check dams constructed/renovated | 387 |
| Dykes constructed | 22 |
| Well recharging and percolation wells | 1,356 |
| Ponds constructed/renovated | 612 |
| Link channels/canals constructed | 78.5 km |
| Water storage tanks and farm ponds | 1,394 |
| RRWHS constructed | 5,872 |

Note: km = kilometres; RRWHS = roof rainwater harvesting structures.

Source: Company documents.

Exhibit 4: Water Balance Index (As of December 31st)

|  |  |  |  |
| --- | --- | --- | --- |
| **Year** | **Debit (consumption) (m3)** | **Credit (addition) (m3)** | **Water Positive Index** |
| 2011 | 8,388,790 | 16,859,500 | 2.01 |
| 2012 | 7,950,066 | 19,888,455 | 2.50 |
| 2013 | 7,350,604 | 19,199,310 | 2.61 |
| 2014 | 7,734,486 | 31,192,523 | 4.03 |
| 2015 | 7,254,630 | 29,198,450 | 4.02 |

Note: m3 = cubic metres.

Source: Company documents.

Exhibit 5: measurement systems

|  |  |
| --- | --- |
| **Measures** | **Details** |
| B Impact Assessment | Standards, benchmarks, and tools enabling companies to assess, compare, and improve their social and environmental impacts over time. |
| Environmental Profit and Loss  Statement | Pioneering development of a means of placing a monetary value on the environmental impacts along the supply chain of a business. |
| KPMG True Value | A three-step methodology that enables companies to (i) assess their “true” earnings including externalities; (ii) understand future earnings at risk; and (iii) develop business cases that create both corporate and social value. |
| Natural Capital Protocol | A harmonized framework for valuing natural capital in investor decision-making. |
| Redefining Value | A work program that aims to help WBCSD member firms standardize tools to measure and manage the firm’s impact on society and the environment. |
| Shared Value | A management strategy focused on creating business value by identifying and addressing social problems. |
| Social Return on Investment | A framework based on generally accepted accounting principles used to help manage and understand an organization’s social, economic, and environmental outcomes. |
| Total Impact Measurement and Management | New language to assist companies in understanding the overall impact of their activities. |
| True Price | A social enterprise that helps organizations—multinationals, SMEs, NGOs, and governments—quantify and evaluate their economic, environmental, and social impacts, particularly on a product level. |

Note: SME = small and medium enterprises; NGO = non-governmental organization; WBCSD = World Business Council for Sustainable Development

Source: KPMG International, *A New Vision of Value: Connecting Corporate and Societal Value Creation* (2014), accessed June 29, 2017, https://assets.kpmg.com/content/dam/kpmg/pdf/2014/10/a-new-vision-of-value-v1.pdf.

Exhibit 6: Framework to identify and quantify material externalities

|  |  |  |
| --- | --- | --- |
| **Externality Type** | **Externality** | **Example** |
| Positive Economic | Taxes | Contribution to the economy via taxes of all kinds |
| Shareholder Dividends | Contribution to societal wealth via returns to shareholders |
| Interest on Loans | Contribution to health of the financial services sector via loan interest |
| Wages | Provision of sustainable incomes and quality of life for workers |
| Negative Economic | Avoided Taxes | Loss to the economy by not paying fair share of taxes |
| Corruption | Contribution to inefficiency in economies |
| Positive Social | Infrastructure | Provision of infrastructure (such as roads and energy generation) that deliver improved quality of life and economic opportunity |
| Health Care | Provision of health care to workers or communities, or via health and fitness products and services; creates value for society through improved health and life quality |
| Education | Provision of education to workers or communities, or via educational products and services; creates value for society through improved earning capacity and life quality |
| Negative Social | Low Wages | Failure to provide workers with a sustainable livelihood and good quality of life through underinvestment in living wages or through poor working conditions; use of child labour |
| Health and Safety | Damage to health, injury, or death caused by underinvestment in health and safety safeguards |
| Pollution | Damage to the health of workers and communities through air, water, or noise pollution |
| Positive Environmental | Renewable Energy | Displacement of carbon-intensive energy and GHG savings by generating renewable energy (for company operations and/or supplying the grid) |
| Land Stewardship | Reforestation and other regenerative practices that improve ecosystems and habitats |
| Recycling | Avoidance of waste to landfill or incineration by reusing waste materials (whether produced by the company or sourced from elsewhere) |
| Negative Environmental | Waste | Environmental damage caused by gaseous, liquid, or solid waste (includes GHG emissions resulting from landfill and incineration of waste) |
| Ecosystems | Degradation of ecosystem services |
| GHG and Energy | Contribution to climate change and the resulting costs for society and the environment through energy use and GHG emissions |
| Water | Damage to ecosystems and communities by withdrawing water in areas of water shortage |
| Raw Materials | Use of raw materials for production process resulting in environmental damage and resource scarcity |

Note: GHG = greenhouse gas.

Source: KPMG International, *A New Vision of Value: Connecting Corporate and Societal Value Creation (2014)*, accessed June 29, 2017, https://assets.kpmg.com/content/dam/kpmg/pdf/2014/10/a-new-vision-of-value-v1.pdf.

Exhibit 7: Relationship between the components of social cost and water scarcity

|  |  |  |
| --- | --- | --- |
| **Water Scarcity Level (%)** | **Total (US$/m3)** | **Ground Water Recharge (US$/m3)** |
| 1 | 0.10 | 0.05 |
| 5 | 0.15 | 0.10 |
| 10 | 0.25 | 0.20 |
| 20 | 0.80 | 0.65 |
| 30 | 1.35 | 1.05 |
| 40 | 2.25 | 2.00 |
| 50 | 4.50 | 3.35 |
| 60 | 6.25 | 4.50 |
| 70 | 8.25 | 6.25 |
| 80 | 9.85 | 7.35 |
| 90 | 11.25 | 9.45 |
| 100 | 15.35 | 11.45 |

Note: m3 = cubic metre.

Source: Liesel van Ast, Rebecca Maclean, and Alice Sireyjol, “White Paper: Valuing Water to Drive More Effective Decisions,” April 3, 2013, accessed October 16, 2016, www.trucost.com/publication/white-paper-valuing-water-drive-effective-decisions.

Exhibit 8: Monthly exchange rates (US$1.00 to INR), 2015

|  |  |
| --- | --- |
| **Month** | **Average** |
| January | 62.22 |
| February | 62.07 |
| March | 62.47 |
| April | 62.61 |
| May | 63.73 |
| June | 63.81 |
| July | 63.51 |
| August | 65.01 |
| September | 66.27 |
| October | 65.02 |
| November | 66.07 |
| December | 66.47 |

Source: “Historical Rates,” OANDA Corporation, accessed August 21, 2017.

Exhibit 9: Computation of value of water credited (As of December 31, 2015)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Region** | **Place** | **Total Water Credits (1,000 m3)** | **Total Water Debits (1,000 m3)** | **Water Scarcity Level (%)** |
| East | Bhatpara | 3,045 | 138 | 14 |
|  | Farakaa | 37 | 2 | 37 |
|  | Sankrail | 230 | 15 | 37 |
| West and South | Ambujanagar | 12,175 | 5,039 | 71 |
|  | Maratha | 3,328 | 123 | 14 |
|  | Panvel | 0 | 0 | 49 |
|  | Surat | 0 | 0 | 57 |
|  | Cochin | 0 | 0 | 9 |
|  | Mangalore | 0 | 0 | 9 |
| North | Rabriyawas | 8,089 | 1,324 | 39 |
|  | Darlighat | 458 | 120 | 37 |
|  | Marwar | 1,664 | 467 | 71 |
|  | Ropar | 6 | 0 | 71 |
|  | Bhatinda | 63 | 12 | 71 |
|  | Dadri | 1 | 0 | 71 |
|  | Nalagarh | 84 | 11 | 37 |
|  | Roorkee | 18 | 3 | 71 |
|  | **Total** | **29,198** | **7,254** |  |

Note: m3 = cubic metres.

Source: Company documents.

1. ₹ = INR = Indian rupee; ₹1 = US$0.02 on December 31, 2015. [↑](#footnote-ref-1)
2. EBITDA = earnings before interest, tax, depreciation, and amortization. [↑](#footnote-ref-2)
3. “Cement Industry in India,” India Brand Equity Foundation (IBEF), accessed October 16, 2016, www.ibef.org/industry/cement-india.aspx. [↑](#footnote-ref-3)
4. “Cement Industry in India,” India Brand Equity Foundation (IBEF), accessed October 16, 2016, www.ibef.org/industry/cement-india.aspx. [↑](#footnote-ref-4)
5. Cement could be produced by dry-grinding the minerals to form a powder or by wet-grinding the minerals with water to produce a fine slurry. Wet processing had its advantages, but used more water and more processing energy. [↑](#footnote-ref-5)
6. Traditionally, curing was done by pouring or spraying water on concrete or mortar surfaces for an adequate period. Water had to be continuously replenished as and when it evaporated because of high temperature and low humidity. If the water dried off, the strength of the concrete structure or surface would be affected. In modular concrete curing systems, surfaces that were concreted or cemented were covered with plastic sheets, primarily to prevent loss of humidity. [↑](#footnote-ref-6)
7. The company accounted for only the portion of water credit that accrued to the extent of Ambuja Cement’s investment in ACF. Thus, if Ambuja Cement invested 20 per cent in ACF, it took credit for only 20 per cent of the water credits. [↑](#footnote-ref-7)
8. James Dalton, “Is Net Positive Feasible When it Comes to Water?,” *The Guardian*, September 6, 2013, accessed October 16, 2016, www.theguardian.com/sustainable-business/net-positive-feasible-water. [↑](#footnote-ref-8)
9. “Measure What Matters,” B Impact Assessment, accessed October 16, 2016, www.bimpactassessment.net. [↑](#footnote-ref-9)
10. Liesel van Ast, Rebecca Maclean, and Alice Sireyjol, “White Paper: Valuing Water to Drive More Effective Decisions,” Trucost and Yarra Valley Water, April 3, 2013, accessed October 16, 2016, www.trucost.com/publication/white-paper-valuing-water-drive-effective-decisions. [↑](#footnote-ref-10)
11. Water scarcity levels were measured based on rainfall, structure capacity, and the groundwater situation. The World Resource Institute provided measures of water scarcity in a region; “Aqueduct Water Risk Atlas,” World Resources Institute, accessed June 29, 2017, www.wri.org/resources/maps/aqueduct-water-risk-atlas. [↑](#footnote-ref-11)