SNAPFI COUNTRY STUDY

India

Transitioning India's steel and cement industries to low carbon pathways

JULY 2020

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List of acronyms

AFR	Alternative Fuel and Raw Materials
BF	Blast Furnace
BOF	Blast Oxygen Furnace
BoT	Balance of Trade
CAGR	Compound Annual Growth Rate
CO2	Carbon-Dioxide
D/E	Debt to Equity
EAF	Electric Arc Furnace
EBITDA	Earnings Before Interest, Taxes, Depreciation and Amortization
FDI	Foreign Direct Investment
FY	Financial Year
GCal	Gigacalorie
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GJ	Gigajoule
HTA	Hard to abate sectors
ICR	Interest Coverage Ratio
IF	Induction Furnace
ISP	Integrated Steel Producers
JPC	Joint Plant Committee
KWh	Kilowatt-Hour
MMT	Million Metric Tonnes
MnTPA	Million Tonnes Per Annum
MSMEs	Micro, Small & Medium Enterprises
MT	Million Tons (or Tonnes)
NAPCC	National Action Plan on Climate Change
NSE	National Stock Exchange
NSP	National Steel Policy

PAT	Perform Achieve Trade
PSU's	Public Sector Undertakings
RE	Renewable Energy
REC	Renewable Energy Credits
RPO	Renewable Purchase Obligations
SAIL	Steel Authority of India Limited
SEC	Specific energy consumption
YoY	Year over Year

Glossary

Captive power generation	Captive generation is an electricity generation facility generally used by power-intensive industries like steel plants, for their own energy consumption. Captive power generation reduces the dependability on the grid.
Clinker	A material used to manufacture cement.
Debt to Equity Ratio	It calculated by dividing company's total liabilities by its shareholders equity. A low debt to equity ratio is considered to be a positive indicator of the financial health of the companies.
Decarbonisation	Process of reducing GHG emissions
EBITDA	It is a measure of a company's overall financial performance and is used as an alternative to simple earnings or net income.
EBITDA Margin	It is EBITDA to Net Sales ratio, where Net sales are operating revenues earned by a company. A consistently higher value of this ratio indicates the company is keeping its earning at a good level while also minimizing operating expenses, and so it is used for assessing operational performance. It is reflects as a profitability margin.
Energy Efficiency	Method of reducing energy consumption by using less energy to attain the same amount of useful output
Energy Intensity	It is used as a measure of energy used per tonne of output generated. The higher the energy intensity, the higher the cost companies are likely to face over the period of time.
Fuel Supply Agreement	It is a legally enforceable agreement between the seller of coal companies and the consumers as per the new Coal Distribution Policy (NCDP).
Green Cement	A form of cement produced with the help of a carbon-negative manufacturing process
Green Steel	A form of steel which is made by using hydrogen, rather than coal, to lower GHG emissions.
Interest Coverage Ratio	A financial ratio used to determine the ability of a company to pay the interest on its outstanding debt

Power and Fuel to Operating Expenses	It is used to assess the extent of cost which energy intensity can impose on a firm's operating expenses, using the power and fuel expenses as the indicator. However, operating expenses are costs directly attributed to production of goods and services. It is inclusive of power and fuel
Public Sector Undertaking	An Indian company owned by the union government of India or one of the many state or territorial governments or both.
Thermal efficiency	Amount of work output for a given amount of heat
Waste Heat Recovery System	An energy recovery heat exchanger that transfers heat from process outputs at high temperature to another part of the process for some other purpose

Executive summary

While the transitioning of the electricity sector to a lower carbon pathway has been successful to varying degrees across the globe, an area where a green transition is below par, relative to the requirements for combatting climate change, is the heavy industries segment. This creates a major challenge, as these industries which provide some of the most essential goods and are imperative for a country's development, are also amongst the highest emitters of CO2. The technologies required for the effective decarbonisation, is in many cases, not available at feasible terms. Thus, these can also be called the "hard to abate" sectors.

There is a need for a wide range of actions to enable and support this transition, including in-novative implementation models, effective incentives and regulations, access to transformative technologies at a viable price, capacity building, creating an enabling environment through a comprehensive policy framework, etc. For this report, we are focusing on identifying the reg-ulatory, capacity and market gaps existing for transitioning the Indian steel and cement indus-tries to a low carbon pathway, and the impact this has on the availability of green finance for these industries. The aim of the report is to identify areas where international climate finance can step in to address the gaps, working along with the policy interventions, and have a trans-formative impact.

Till now, there has been progress mitigating the impact and emissions from these industries, and these have usually taken place by deploying the technologies which can be considered as 'low-hanging fruits'. However, for truly transformative impact, it is now needed to move to technologies which allow deeper decarbonisation. The challenge with this is, that these technologies are often unproven and haven't been deployed or tested at a commercial scale. Fur-ther, they come at a much higher cost, having longer transition periods and requires enhanced technological capacity. These challenges result in major barriers for commercially available green finance, while the nature of these industries makes them ineligible for most types of public and international climate finance. To address these and initiate an effective transition, the role of policies and international finance in greening India's heavy industries segment, is vital.

Role of the Indian steel and cement industries

Both the Indian steel and cement industries, are fundamental for the country's economic growth and development and are projected to grow significantly in the coming decades. These complex infrastructure sectors have a wide range of actors and strong upward and downward linkages, thus they can deeply impact the country's socio-economic development. Interestingly, these industries' growth will largely be driven by domestic demand, as the demand from most developed countries will slowdown and plateau off, but still they have a robust growth projected due to India's sharply rising infrastructure requirements.

Due to this, the steel and cement industries are going to have a significant role in India's growing emissions in the coming years, as a result of the massive projected scales of demand and production, projected to surpass the climate impact of the electricity sector. This makes it imperative to include these in the country's fight against climate change, with comprehensive sector level planning, supported by a policy framework

Climate actions of the steel and cement industries

The industry leaders have taken proactive measures to mitigate their climate impact, by leveraging a range of climate initiatives, with most of these being voluntary in nature. The leading companies are aware of technologies and solutions available and are deploying many of these already to commit to emission reduction targets. They have also steadily built their internal capacity to identify the climate issues and address these from their own resources.

However, as a next step, it is important to get the wider industry, besides the leading companies, to also commit to lowering their emissions. This may require binding targets for the entire industry access and implementation support for new technologies with higher potential impact, and an enabling environment to scale up the transition. There is a need for a comprehensive roadmap for industry decarbonisation, for which engagement with all the key stakeholders is a must.

Capacity of the steel and cement companies to finance their own transition

The Indian steel and cement industries cannot finance the required transformation to low carbon pathways from their own resources. An analysis showed that the leading companies from these industries have been facing declining profitability over the last few years, which is likely to be made worse due to the impact of the global pandemic, in the short-run. Further, past transitions to energy efficiency have not made a substantial impact on reducing the operating expenses of these companies, so on its own, this is unlikely to be a strong motivator for transitioning to green.

The existing policy framework has initiated energy efficiency measures in these industries, but these are far less than what's required in line with the global climate goals, which transformational changes and deep decarbonisation technologies.

These are cost intensive and requires additional support measures. While some of the industry leaders have the capacity to raise and adequately service external debt, lenders do not prioritise green technologies and transitions, and so these projects have to be undertaken as a part of larger investments. At present, companies themselves need to build a case for green investment by developing a thorough assessment of costs and benefits associated with the transition. In order to overcome this, there is a need for capacity building at both the borrowers and the lenders level.

Gaps in the policy and regulatory framework

India has been consistently committed to its climate goals and has been strengthening its climate policies to achieve this. However, this hasn't always translated to the desired results, due to the lack of a robust climate policy framework for industries and ineffective implementation. The lack of coherence in the existing policy framework has resulted in the creation of critical demand-side, supply-side and finance-side gaps. These gaps, need to be urgently addressed so that they don't have a negative impact on the ongoing voluntary climate actions being taken by the industries.

Since these sectors are demand driven, regulations from the demand side to shift consumer preferences to green, with the help of economic incentives, needs to be developed. Support measure to spur supply of green products is also required. For this, there is a need to provide clear policy signals, indicating sector-wise roadmaps to low carbon transitions and eventual industry decarbonisation. At present, the industry level policies have not been developed with the required stringency for carbon intensive sectors like steel and cement. A comprehensive enabling policy framework would go a long way to enable this transformation.

Barriers for a Low-Carbon Transition of the Steel and Cement Industries

There is an overall weak ecosystem to support the transition towards green products. The barriers identified for a green transition at scale were categorised as demand-side, supply-side and finance-side issues. These are largely inter-linked to each other, which makes addressing these barriers a complex problem.

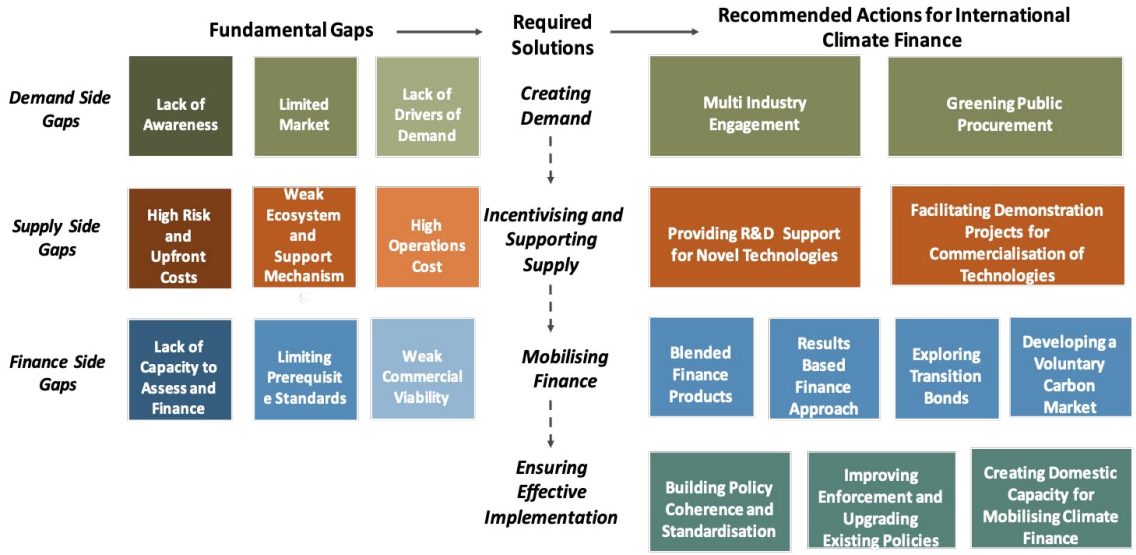
There is minimal demand at present for green products, for consumers being unwilling to pay a premium for these products. Awareness of the benefits of these products and confidence in their technical aspects is also lacking. Further, the market for these products is limited and niche in nature, making it insufficient to meet the large-scale demand which most infrastructure projects generate. But, without means to address the challenges of high upfront costs and high operational costs for manufacturing green products, suppliers from their end cannot scale up the production of the products. These challenges, along with the technological barriers, makes the green transition a very slow process, which is further worsened by weak regulatory drivers, and this impacts the availability of green finance to support the transition. So, policy, targeted incentives and support measures are needed to increase the demand and supply for green alternatives.

Recommendations for International Climate Finance to Enable a Transition

The existing regulatory framework is unsuitable for driving the required rapid transitions at scale by leveraging transformative technologies. However, effectively designed policy measures can be a key driver that can accelerate green transitions in the heavy industry sectors. To address some of these fundamental gaps, the report makes recommendations for addressing these by leveraging international climate finance.

These initial actions would help lay a foundation and build the capacity to facilitate an acceleration of the green transition. The figure below, summarizes the broad categories of solutions and the recommended actions which can bring a significant shift in the current policy framework and strengthen the overall ecosystem enabling the green transition.

GHGs emission per sector, 2012



At present, lack of clarity around the new market mechanisms to be formulated under the Paris Agreement and the impact of the global pandemic on economic growth, seem to have suspended the enhanced ambitions for industrial green transition. To keep the momentum for industrial climate initiatives going and shift towards more transformative actions, there is a need for international climate finance to step in and engage with key national level stakeholders. Addressing gaps in the existing policy framework and taking measures to strengthen these would be an effective approach with wide-reaching impact.

Introduction

Energy transition in emerging and developed countries is largely being driven by policies supporting low-carbon technologies in the power sector, energy efficiency solutions and personal transport. Renewable energy (RE) has now become competitive with some forms of thermal power generation in some regions. However, progress significantly lags in certain industries such as steel and cement, which are also referred to as the 'hard-to-abate' sectors. According to a study done by the Energy Transitions Commission, these hard-to-abate sectors, which comprise of cement, steel, plastics, trucking, shipping and aviation, at present represent around 30% of energy emissions, which could increase to 60% by 2050, making it vital to address the issues of decarbonisation of these sectors.[1]

While there has been success in the transitioning the electricity sector to a lower carbon pathway through innovative implementation models, similar types of climate action in the heavy industry will be more challenging. This creates a major challenge in the context of the global fight against climate change, as these industries are also amongst the highest emitters of CO2, with iron and steel contributing around 6% to 8% and cement and concrete around 6% to global industry emissions.

1 Energy Transitions Commission (2018). Mission Possible: Reaching net-zero carbon emissions from harder-to-abate sectors by mid-century.

These are also growing industries, with global cement demand projected to grow in a range of 12- 23% by 2050 and global steel demand by 15-40% by 2050.[2] Since 2000, global steel production has already more than doubled and is projected to grow further, driven largely by demand from developing nations, including India. Steel on average emits 1.83 tonnes of CO2 for every tonne produced, globally,[3] with each tonne of cement on average emitting 1.25 tonnes of CO2.[4,5]

There have been many technological advancements for reducing the environmental impact and emissions from these industries, usually in terms of deploying the technologies which can be considered as 'low-hanging fruits'. These are relatively inexpensive technology upgrades, which can have a significant impact on emission reductions, when done at scale. These have been successful in terms of their impact and uptake. As a next step, there is now a need to emphasise the adoption of more transformative technologies. However, these have their own set of challenges such as high investment costs, unproven status, lack of access, etc., which are major barriers for their scale–up and replication, making them financially and commercially unviable at present. These have been well assessed in several global studies which focus on technological solutions required and the barriers to implementing these, including TERI's latest report[6] on transitioning to a low carbon Indian steel sector.

In this context, the premise to be assessed in this report is whether there is sufficient support, in the form of finance instruments and policy frameworks, to facilitate the green transition of the Indian steel and cement industries. More specifically, we seek to examine the gaps that international climate finance can fill and the role it can play, through policy interventions and otherwise, to help transition the iron and steel and cement industries to a lower carbon pathway.

The report is divided into three sections:

2 C Bataille, et al. (2019). Low and zero emissions in the steel and cement industries. OECD. Last accessed on May 4th, 2020 at: http://www.oecd.org/greengrowth/GGSD2019_Steel%20and%20Cemement_Final.pdf

3 World Steel Association (2019). World Steel in Figures 2019.

4 The Economic Times (2019). Article: Cement produces more pollution than all the trucks in the world.

5 IPCC (2015).

6 Will Hall, et al (2020). Towards a Low Carbon Steel Sector: Overview of the Changing Market, Technology, and Policy Context for Indian Steel. TERI.

1. In Section 1, we try to develop an overview of the existing context of these industries in India. For this we conducted a landscaping exercise, primarily using a secondary research approach with expert inputs on specific points. The landscaping was done with three broad objectives:
    - To understand the economic role of the steel and cement industries to serve India's developmental needs, and their future growth potential, as well as the climate impact this growth could have.
    - To develop an overview of the types of climate actions being undertaken by these industries.
    - To assess the capacity of these industries to invest in the required transition from their own finances.
2. In Section 2, we focus on identifying the barriers to green transition that these industries face, largely from the finance and policy perspective. For this we primarily use the insights gathered through our consultations with industry practitioners, supplementing them with secondary research on the issue.
3. In Section 3, we highlight the key gaps that exist in the current policy-finance framework and what is required to develop policy and financial instruments to help support the transition to low carbon and climate friendly pathways. On the basis of this, we propose recommended actions to start addressing these issues by leveraging international climate finance to enable private financial flows.

To be noted, while green or low-carbon transitions cover a range of technologies from energy efficiency, to renewable energy use, to waste treatment, in the context of this report, we will be focusing mainly on the solutions and technologies which enable the energy transitions of the steel and cement industries or facilitate the lowering of the carbon content of the products being produced by them, which we term as green products. The terms green transition and transition to a low carbon pathway have been used to denote this

CHAPTER ONE

Context setting

Overview of the Steel and Cement Industries in India from an Economic and Climate Perspective

Infrastructure is the heart of development across the globe, with its key components being the steel and cement industries. These have been the building blocks for many developed countries in the last century and continue to form the base of the developing economies in this one. These industries also have significant forward and backward linkages with a number of industries, including transportation, heavy engineering, energy and construction (see Box 1). To date, a suitable substitute for these products, which is available in the required quantities and affordable prices, has not been developed, which implies that these sectors are most likely remain core to global development in the coming decades.

BOX 1

Global Steel Industry

According to the steel industry association's as-sessment, in 2017, the global steel industry sold USD 2.5 trillion worth of products and created a value add of USD 500 billion, having a 2.5 times multiplier effect on the supporting sectors. Fur-ther, its estimated to employ 6 million people, having a 6.5 times multiplier effect on jobs in the supporting sectors and its supply chain, totaling to about 40 million jobs, which is possibly in the high-end of the range of estimates.

Source: World Steel Association (2019). World Steel in Figures 2019.

In the 2000 to 2018 period, India's annual GDP more than tripled from USD 873 billion to USD 2.84 trillion, with the Indian government now aiming to achieve the highly ambitious target of a USD 5 trillion economy by 2024.[7,8] An economy growing at this rate necessitates a fast growth in all of its key sectors. Both steel and cement, comprise India's core sectors. While steel comprises 2% of India's GDP, cement demand is expected to grow at 1.2 times of the GDP growth rate in the coming years.[9] In this chapter, we try to develop an understanding on the role of the Indian steel and cement industries in the country's growth and development, the growth projections for these industries and their resultant impact on India's climate change initiatives.

7 World Bank data. Last accessed on May 4th, 2020 at: https://data.worldbank.org/indicator/NY.GDP.MKTP.KD?end=2018&locations=IN&start=2000

8 Economic Times article (2020). 'Modi govt's USD 5-trillion GDP target by 2024 looks unimaginably ambitious'.
Last accessed on May 4th, 2020 at:
https://economictimes.indiatimes.com/news/economy/policy/modi-govts-usd-5-trillion-gdp-target-by-2024-looks-unimaginably-ambitious/articleshow/73212751.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst

9 https://www.business-standard.com/article/pti-stories/cement-demand-expected-to-grow-1-2-times-of-gdp-growth-rate-ultratech-119021100761_1.html

1.1

What role do these industries play in India's economy?

1.1.1 Steel Industry

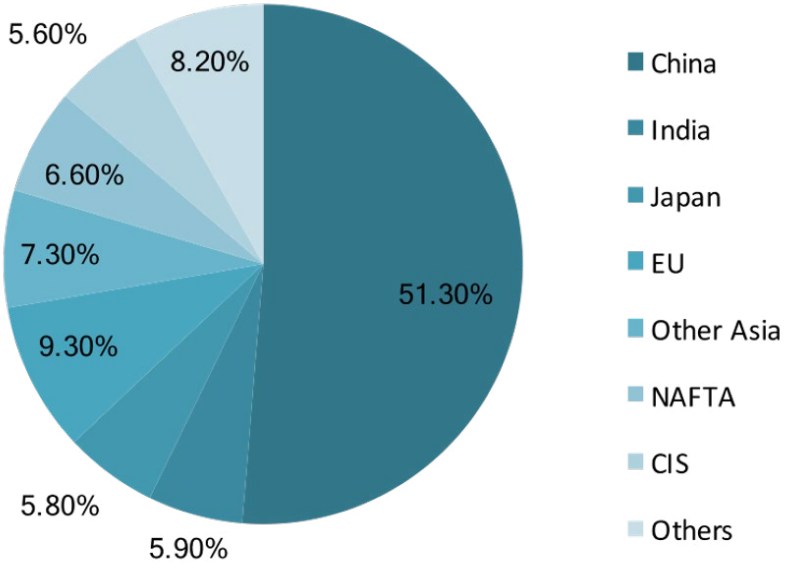
The steel industry is a key pillar of India's growth and industrial development and an integral part of the economy, contributing nearly 2% to its GDP in 2018.[10] The industry has been growing consistently, in terms of production output and capacity, becoming a dominant player in the global scenario. In 2018, the Indian steel industry ranked second globally by overtaking Japan in crude steel production, though being a distant second to China, which produced nearly nine times more than India. In 2018-19, India's steel capacity was 142.236 million tonnes (MT) and production was 110.921 MT, with the country having around 6% share in the total global production.[11] India is also the largest producer of sponge iron in the world, with over three-fourth of the total production in 2018 using the coal-based production route.

10 Ministry of Steel (2019). Last accessed on May 4th 2020 at:https://steel.gov.in/sites/default/files/Framework%20Document%20for%20Safety%20Guidelines.pdf

11 World Steel Association (2019). Statistical Yearbook 2019. Accessible at: https://www.worldsteel.org/en/dam/jcr:7aa2a95d-448d-4c56-b62b-b2457f067cd9/SSY19%2520concise%2520version.pdf

FIGURE 1

Share of Global Crude Steel Production (2018)



Source: World Steel Association's report "World Steel in Figures 2019".

India was the third largest finished steel consumer with the demand for steel projected to increase at a much higher rate than the global average.[12] This is primarily driven by the rapidly increasing demand for high-quality steel in India's growing infrastructure and construction sector, and also by capital goods, consumer durables, automotive and railways sectors, making the industry one of strategic importance to the country.

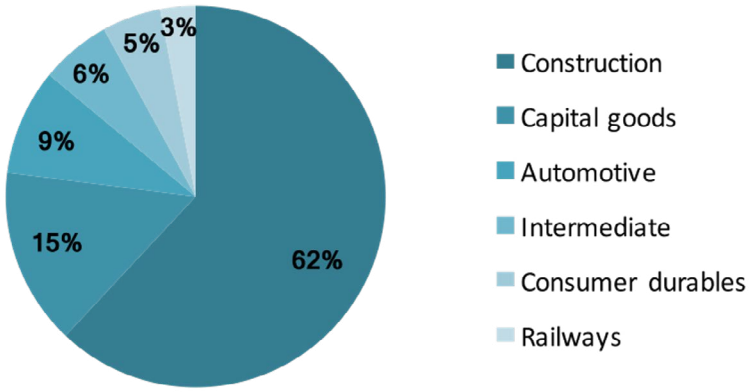
The Indian steel industry has the potential to generate significant export revenue for the economy, thus playing an important role in building the country's positive Balance of Trade (BoT) and enhance its foreign exchange reserves. While the share of steel exports as a proportion of India's total exports has been minimal, less than 1% in the five-year period from financial year (FY) 2013-14 to 2017-18, it was seen to be growing at higher rate (CAGR of 3.4%) than India's total exports (CAGR of 2.5%). This was against an almost global decline in export growth for other major exporters, including China, Japan and Germany.[13]

12 Joint Plant Committee, Government of India (2019). An Overview of Steel Sector. Accessible at:https://steel.gov.in/sites/default/files/An%20_Overview%20_of_Steel_Sector_mar2019.pdf

13 Muthusamy, A.. (2020). Export and Import Performance of Steel in India. 10.35940/ijitee.L2901.129219. Available at: https://www.researchgate.net/publication/338449849_Export_and_Import_Performance_of_Steel_in_India

FIGURE 2

Proportion of sector-wise steel use in India in 2018-19



Source: "The Indian steel industry: Growth, challenges and digital disruption" report by Indian Steel Association and PWC released in November 2019.

India was able to achieve net exporter status for steel in FY 2016-17 and 2017-18. However, this reversed in FY 2018-19 due to the domestic demand being higher than available supply for domestic use. The reason for this was an increase in import of steel from China, which has a relatively lower priced product and was able to take advantage of the lower trade barriers in India, viz. countries like the United States. Further, the demand for steel globally was weak, compared to the robust domestic demand.[14] It should be kept in mind that the steel and cement sectors' growth and profitability is directly linked to the national economic cycles and certain global macroeconomic indicators.

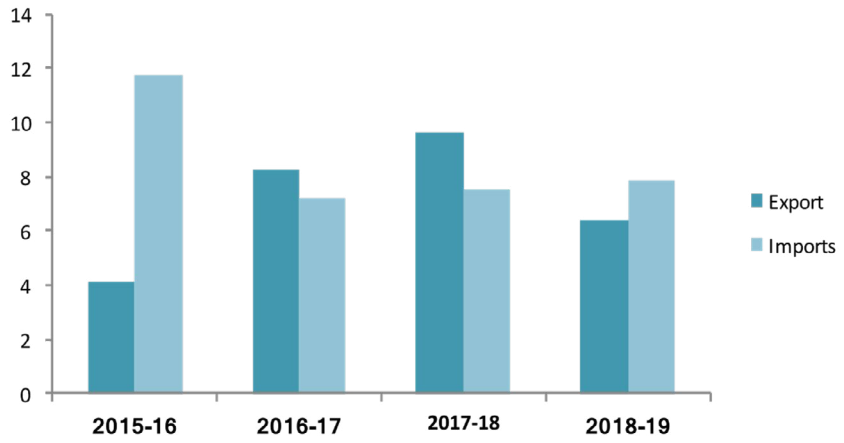
The Indian steel sector is also pivotal for the country as an employer as it engages around 2.5 million people directly and indirectly. Due to its complex and strong backward and forward linkages, in terms of income generation and material flows, steel has an output multiplier effect of 1.4 times on the GDP and an employment multiplier effect of 6.8 times stemming from the associated effects on the supply chain and consumption industries.[15]

14 The Economic Times (2018). Accessible at: https://economictimes.indiatimes.com/markets/expert-view/government-has-to-be-ready-to-step-in-if-steel-imports-surge-sk-roongta/articleshow/65719269.cms?from=mdr

15 Ministry of Steel (2019). Last accessed on May 4th 2020, accessible at:https://steel.gov.in/sites/default/files/Framework%20Document%20for%20Safety%20Guidelines.pdf

FIGURE 3

India's Steel Exports vs. Imports in million tonnes (2015-16 to 2018-19)



Source: Ministry of Steel, Government of India.

The steel industry in India is classified into Integrated Steel Producers (ISP) and Secondary Producers based on the nature of their manufacturing processes. The ISPs, such as Steel Authority of India (SAIL), Tata Steel, Jindal Steel and Power Ltd., JSW Steel, Rashtriya Ispat Nigam Limited and Essar Steel account for around 55% of finished steel production in India. The ISPs are largely homogenous in nature in terms of product range and technology, and have key public sector as well as private sector actors. These companies are present through the steel value chain - starting from the extraction of Iron Ore to the manufacturing and marketing of finished steel. The remaining 45% of steel production, comprises of a range of production units of the mini steel plant or processing unit category, which vary in terms of product range, technology and scale of operation.[16]

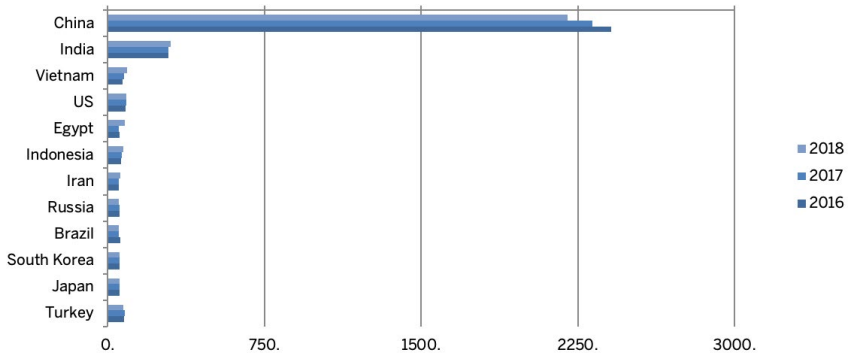
16 Ibid.

1.1.2 Cement Industry

The value proposition of the cement industry in India is immense given the potential infrastructure requirements of the developing and transitioning economy. With a total installed capacity of 545 MT, India's cement industry is the second largest in the world, accounting for over 8% of the total global installed capacity.[17] The Indian Government's infrastructure and developmental schemes such as housing for all, cement concrete highways, dedicated freight corridors, creation of 100 smart cities, ultra-mega power projects, Make in India scheme, etc. will significantly boost the demand for cement.

FIGURE 4

Worldwide cement production in major countries from 2016 to 2018 (in million metric tonnes)



Source: Statista (2020).

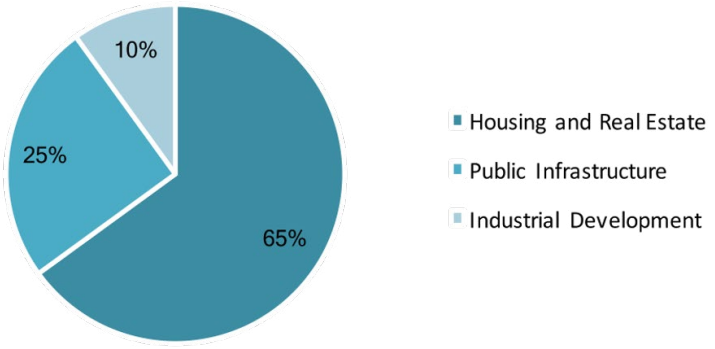
During the financial year 2019, the housing and real estate sector accounted for the highest demand for cement, at 65%, driven by the execution of affordable government housing schemes like Housing for All by 2022 and Pradhan Mantri Awas Yojna. Apart from the housing sector, the public infrastructure segment also accounted for significant demand for cement at 25%.[18]

17 Cement Manufacturers Association website. Last accessed on May 4th 2020, accessible at: https://www.cmaindia.org/about-us/introduction/

18 Cement industry update on India Brand Equity Foundation website. Last accessed on May 4th, 2020 at: https://www.ibef.org/industry/cement-india.aspx

FIGURE 5

Sector-wise cement use in India in 2019



Source: Cement industry update on India Brand Equity Foundation website

Cement is a cyclical commodity with a high correlation with a country's GDP growth. The cement industry provides employment to more than a million people and is the fourth-largest contributor to the national exchequer, through various taxes and levies.[19] India is a net exporter of cement, though due to the nature of the product (having a high weight to value ratio which makes it infeasible to become a major export item), cement is a minimal contributor to the country's total exports.[20] The cement industry in India is supported by high foreign direct investments (FDI), which totaled to about USD 5.3 billion in the April 2000-June 2019 period, in the cement and gypsum products industry.[21]

The Indian cement industry is concentrated in terms of certain key aspects. For instance, it is dominated by domestic players and of the total domestic capacity, 98% lies with the private sector and the rest with the public sector.[22]

19 Research and Markets (2020). Last accessed on May 4th, 2020 at: https://www.globenewswire.com/news-release/2020/02/20/1987610/0/en/Indian-Cement-Industry-Forecasts-2019-2024-Cement-Production-Expected-to-Reach-410-21M-Tons-by-2024-Owing-to-Rising-Demand-from-the-Government-and-Housing-Contractors.html

20 Cement industry update on India Brand Equity Foundation website.

21 Cement Sector Analysis Report (2020). Last accessed on April 29th, 2020 at: https://www.equitymaster.com/research-it/sector-info/cement/Cement-Sector-Analysis-Report.asp

22 Ministry of Commerce & Industry, Government of India (2019). Press release last accessed on April 29th, 2020 at: https://pib.gov.in/Pressreleaseshare.aspx?PRID=1562754

It is important to note that some of the large domestic players have been acquired by large multinational corporations, such as Lafarge Holcim, since the early 2000's, which gives them additional capacity for climate actions. The top 20 companies account for around 70% of the total production.[23] Further, six Indian states account for nearly 60% of India's installed capacity, i.e. Andhra Pradesh, Karnataka, Rajasthan, Tamil Nadu, Punjab and Haryana.[24]

Being a freight intensive industry, India's cement industry is distinctly divided into five regions viz. north, south, west, east and the central region, which has supported the objective of balanced regional development of India. Also, due to low value to weight ratio, cement is not traded easily internationally, and India largely exports to countries which are not too distant, to minimise transport costs, such as Bangladesh, Myanmar, Nepal, Middle East and East Africa.[25]

23 Cement industry update on India Brand Equity Foundation website.

24 Research and Markets (2020).

25 Maritime Gateway. Article last accessed on June 24th, 2020 at: http://www.maritimegateway.com/cement-logistics-costly-affair/

1.2

What is the growth potential for these industries in India?

While demand for steel and cement in most developed economies, including China has peaked or is about to peak, India remains one of the few major economies with robust demand, which is likely to continue remaining at high levels in the coming decades.[26] However, this gives rise to several challenges. Given that both these industries are dependent on natural resources and are highly energy intensive, along with planning for growing production, it is also necessary to ensure adequate supply of the required raw materials at an optimum cost and quality. Further, volatility in the price of coal, which is likely to increase further in response to increasing climate actions, is also an area of concern for the industries.

1.2.1 Current Status- Per Capita Consumption for Steel and Cement

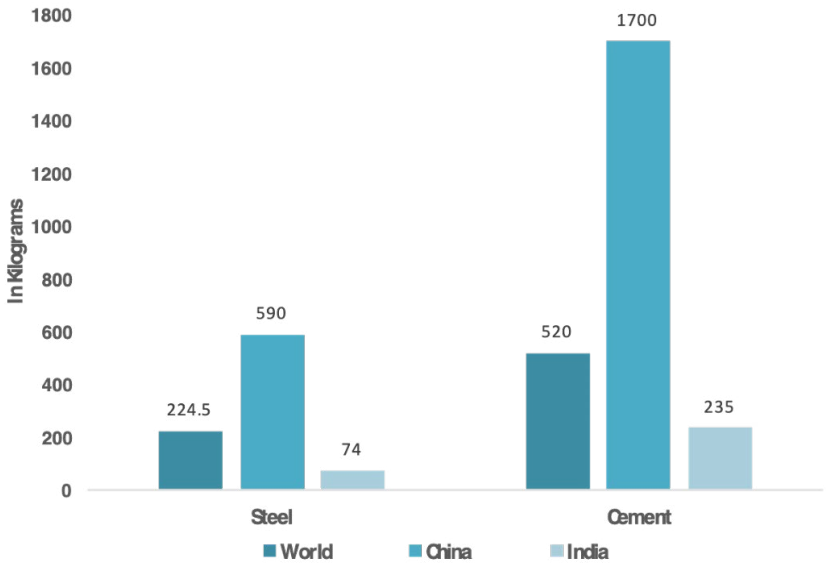
The per capita consumption of steel and cement in India is drastically lower than the world average, signaling massive demand-driven growth opportunities in these industries in the coming years.[27]

26 CW Group (2019). Article last accessed on May 6th 2020 at: https://www.cwgrp.com/cemweek-features/514400-world-cement-demand-to-shrink-to-4-billion-tons-by-2050

27 The Hindu (2019). News article last accessed on May 4th 2020 at: https://www.thehindubusinessline.com/economy/budget/steel-cement-sectors-pin-hopes-on-housing-and-road-spends/article28297591.ece

FIGURE 6

Per capita consumption of Steel and Cement in 2018 (in Kilograms)



Source: World Steel Association (2019). Ministry of Commerce & Industry (2019).

The per capita consumption of steel in India increased significantly from 57.6 kg to around 74 kg during the FY 2014-15 to FY 2018-19 period.[28] However, this is one-third the global average per capita consumption and one-eighth of China's.[29] The Indian average consumption also hides the huge gap between rural and urban consumption rates. Similarly, for the cement industry, compared to the global average, per capita cement consumption in India is less than half, and in comparison to China its around one-eighth.[30,31]

28 Ministry of Steel (2019). Press release last accessed on May 4th, 2020 at: https://pib.gov.in/Pressreleaseshare.aspx?PRID=1595887

29 World Steel Association (2019).

30 Ministry of Commerce & Industry, Government of India (2019). Press release accessible at: https://pib.gov.in/Pressreleaseshare.aspx?PRID=1562754

31 Note: China's steel and cement demand is highly irregular and an anomaly when compared historically and internationally.

It should be noted that the cement industry has been seeing supply exceeding demand in many markets in the last few years, leading to under-utilisation of the installed capacity of cement production.[32,33]

1.2.2 Medium-term Growth Projection (till 2030)

A key indicator of the growth potential for the Indian steel industry can be seen in the form of the National Steel Policy (NSP) which was launched in 2017. The policy aims at achieving 100% indigenous fulfilment of demand for high grade automotive steel, electrical steel, special steels and alloys. For this it encourages capacity additions, development of competitive steel manufacturing capabilities and cost-efficient production through enhancing domestic availability of iron ore, coking coal & natural gas, as well as overseas asset acquisitions for ensuring raw materials. The NSP envisages steel per capita steel consumption in India to increase to 160 kg by FY 2030-31, more than double the current level. While this would still be below the current global average, it implies a major increase in planned steel production in the country in the coming decade, projected to be around 300 MT of crude steel capacity and production of 255 MT by 2030-31.[34] According to a TERI study, total demand for crude steel is projected to be in the range of 131 to 254 Mt by 2030.[35]

Driven by a surge in demand due to the ongoing infrastructure development and various housing schemes being undertaken, demand growth for cement in India ranges from the high estimate of 550-600 MT per annum by 2025,[36] which is approximately 70% higher than the 2018-19 production levels, to 660 MT by 2030.[37]

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32 Cement Manufacturers Association (2018).

33 Business Today (2020). Article last accessed on May 6th 2020 at: https://www.businesstoday.in/opinion/columns/can-cement-industry-be-growth-driver-for-india/story/396951.html

34 Ministry of Steel, Government of India (2019). Press release last accessed on May 4th, 2020 at: https://pib.gov.in/newsite/PrintRelease.aspx?relid=196065

35 Will Hall, et al (2020). Towards a Low Carbon Steel Sector: Overview of the Changing Market, Technology, and Policy Context for Indian Steel. TERI.

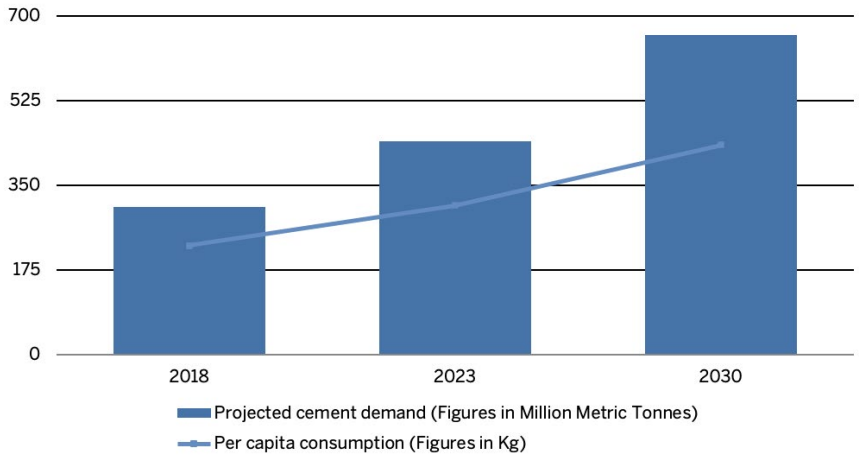
36 Cement Sector Analysis Report (2020). Accessible at:https://www.equitymaster.com/research-it/sector-info/cement/Cement-Sector-Analysis-Report.asp

37 Kanvic Cement Demand Projection Model 2018. Accessible at: https://www.kanvic.com/grey-matter/building-a-new-india#

According to Kanvic's Cement Demand Projection Model, which was specifically developed for Indian Cement Review Vision 2030,[38] the future growth is projected to be driven by increased infrastructure spending, with road construction and the residential sector remaining the biggest contributors for demand. According to the review, to meet this increased demand, the Indian cement industry will need to invest to add 368 MT of additional capacity from the baseline of 2018.

FIGURE 7

Future projected cement demand and per capita consumption



Source: Kanvic Cement demand projection model (2018)

1.2.3 Long-term Growth Projection (till 2050)

As mentioned in the earlier sections, demand for steel is likely to rise in the subsequent decades. The question is, whether this demand will be driven by domestic drivers or international factors. Export demand for Indian Steel has been facing rigorous competition from supply from China. Though the scale of Indian exports has significantly increased between 2015 and 2018, it will continue to face stiff competition from Chinese exports.

38 India Cement Review launched in December 2018. Accessible at: https://indiancementreview.com/events/Cement-Industry--quot-Vision-2030-quot--Launched/114689

In the next few decades, demand for steel will rise significantly for Indian consumption. Currently India's export market for steel is based in Nepal, Vietnam, Italy, Belgium, UAE among others. In 2017-18 itself export to each of these countries, except Nepal, fell by an average of 40%.[39] While it is hard to determine a single reason in decline for steel imports in these countries, in the coming decades demand from developed nations is likely to reduce or stagnate due to a variety of reasons. This could be due to increased environmental standardisation for steel imports, carbon border adjustments, which will make Indian imports in developed countries more expensive, or simply due to reduced consumption and infrastructure demand for steel due to greater material circularity models within these economies. This, therefore, limits the extent of international steel demand in the long-term.

Domestic demand is linked with the growth trajectory of some key sectors which are main drivers of steel demand. These primarily include infrastructure and automobile. As mentioned earlier, existing policy framework offers a significant push for demand up till and beyond 2030. As a result of these policies and the growth trajectory that India is following, it is expected that the investment in Indian infrastructure is likely to rise by 50% till 2024-25.[40]

Similarly, the automobile sector has several subcomponents which are likely to drive demand for steel. Indian demand for 2 and 3 wheelers is expected to rise significantly till 2030, after which it will continue to grow but at a lower rate. This is because as countries become wealthier, demand for 2-wheelers is likely to reduce to translate into increased demand for 4-wheelers. Current demand for 4-wheelers in India is 30 per every 1000 persons. This is expected to more than quadruple to 140 per every 1000 persons.[41] An important point to note here is that it is not only the expected rise in demand for automobile, but also the shift in consumer pattern which is likely to boost the requirement of steel in the automobile industry.

39 Global Steel Monitor 2019, Accessible at : https://legacy.trade.gov/steel/countries/pdfs/exports-India.pdf

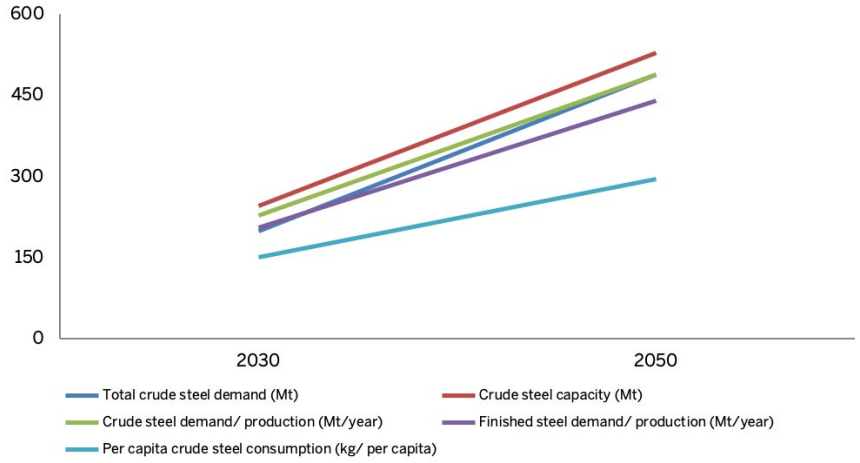
40 The Indian steel industry: Growth, challenges and digital disruption (2019). Accessible at : https://www.pwc.in/assets/pdfs/consulting/technology/the-indian-steel-industry-growth-challenges-and-digital-disruption.pdf

41 'Towards a Low Carbon Steel Sector: Overview of the Changing Market, Technology, and Policy Context for Indian Steel' (2020). Accessible at: https://shaktifoundation.in/wp-content/uploads/2020/01/Towards-a-Low-Carbon-Steel-Sector-Report.pdf

Automobile demand faces considerable uncertainty with regards to the shifts in consumer preferences towards ride-sharing options, as well as access to public transport. In the case of increased uptake of public transport, demand for 4-wheelers may not increase so significantly. However, steel consumption will still increase as part of development of urban infrastructure.

FIGURE 8

Future projections for the Indian steel industry (in million tonnes)



Source: TERI's new report, titled 'Towards a Low Carbon Steel Sector: Overview of the Changing Market, Technology, and Policy Context for Indian Steel' (2020)

According to the Cement Manufacturers Association (CMA), an Indian industry body, has projected India's cement production to reach around 1.36 billion tonnes, annually, by 2050, in a high demand scenario.[42] The Indian cement industry is currently thriving on high domestic demand. As mentioned earlier, construction demand is expected to rise by over 50% by 2025. This will comprise of the construction of road projects, housing and urban infrastructure. The urbanisation rate in India was about around 33% in 2019. This is expected to rise to 40% by 2030–31. As a result, about 90 million people would move from rural to urban areas. The demand for housing and related growth in real estate in urban and semi-urban areas is expected to be a significant driver for both cement and steel demand.

42 WBCSD (2019). Indian Cement Sector SDG Roadmap. Accessible at: https://www.wbcsd.org/Programs/People/Sustainable-Development-Goals/SDG-Sector-Roadmaps/News/Indian-Cement-Sector-SDG-Roadmap

Residential demand is also likely to increase further, as the household occupancy rate, persons per household, declines from almost five to near three. This is a further boost for the cement sector.[43]

43 ibid

1.3

How could the growth of these industries' impact India's climate actions?

As per its commitments to the United Nations Framework Convention on Climate Change, India has pledged to achieve an electricity generation capacity of 40% from non-fossil fuel-based energy resources by 2030, create an additional carbon sink of 2.5 to 3 billion tonnes of carbon-dioxide equivalent by 2030 and reduce the emissions intensity of its GDP by 33 to 35 per cent by 2030 from 2005 levels.[44] While these economy wide targets will cover the Indian steel and cement industries, there are no specific targets committed to for them, with only a brief mention of carbon capture utilisation and storage (CCUS) and one cement related initiative (Fly Ash Utilisation Policy) mentioned under the abatement of pollution measures, and the economy-wide market mechanisms of Perform Achieve and Trade (PAT) and Renewable Energy Certificates (REC) which are applicable to steel and cement industries finding mention.[45] In the context of the massive increase in capacity and consumption for these industries, there is a need to take comprehensive planned action to mitigate their impact on climate.[46]

44 India's NDC. Available at: https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/India%20First/INDIA%20INDC%20TO%20UNFCCC.pdf

45 Note: PAT scheme is a regulatory instrument to reduce specific energy consumption in energy intensive industries, with an associated market based mechanism to enable the trading of certified excess energy saving. REC is a market based mechanism to enable the identified entities and meet their regulatory RE requirements, such as Renewable Purchase Obligations, which are applicable to states, as well as captive power generators and consumers.

46 Bloomberg Green (2020). Article last accessed on May 6th 2020 at: https://www.bloomberg.com/news/articles/2020-02-04/carbon-emissions-by-india-s-steel-sector-to-triple-by-2050

In 2018-19, the steel industry constituted for nearly one-quarter of the energy consumed for industrial use. Thus, at present, CO2 emissions from the steel industry in India are 242 MT, accounting for 12% of the nation's total fossil fuel combustion emissions.[47] According to a recent assessment by TERI, these are projected to jump to 837 MT by 2050, in response to the quadrupling of energy demand for steel, which is projected to result in the industry contributing more than a third of the nation's total fossil fuel combustion emissions.With the Indian Government introducing various policies and programmes for the country's development, for building the required infrastructure and to encourage long term growth for the Indian steel industry, there is a necessity to address the resultant climate change and global warming issues in a structured and comprehensive manner. The CO2 emission intensity (including onsite or captive power plant power generation) of the Indian cement industry was 670 kgCO2 per tonne of cement in 2017.[48] In the cement industry, CO2 is emitted from both the chemical process and energy consumption associated with the manufacturing of cement. Indirect emissions from the burning of fossil fuels used to heat the kiln account for about 40% of emissions from cement. Finally, electricity used to power additional machinery and the transportation of cement account for 5-10% of the industry's emissions.[49] Recognising it emissions and their impact on climate, the cement industry has committed to various emission reduction targets for the near, mid and long term (see chapter 3). While there is vast potential for the industries to mitigate their emissions, these sectors cannot significantly reduce greenhouse gas (GHG) emissions just by improving enhanced energy efficiency and deploying the existing green technologies. There is a need for innovation in technology and a changed product mix to enable the necessary emission reductions and transition to a low carbon pathway of growth.

47 TERI (2020). 'Towards a Low Carbon Steel Sector: Overview of the Changing Market, Technology, and Policy Context for Indian Steel'

48 PowerLine (2019). Article last accessed on April 29, 2020 at: https://powerline.net.in/2019/05/06/setting-benchmarks/

49 Information sourced from: http://cbalance.in/2013/12/carbon-emissions-in-the-cement-sector-in-india/#.XczpbNUzYdV

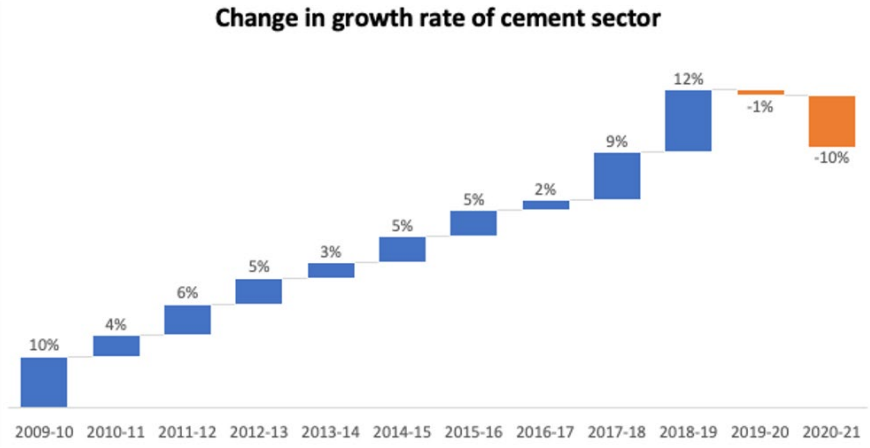
Short note on Impact of COVID-19 on Steel and Cement Sector

Volumes of cement production had been growing at 10-12% YoY in East India and at 4-5% YoY in the West and Central Indian regions over the past two years. However, as a direct response to the COVID-19 pandemic, a national lock down of nearly three months was called for in India. This resulted in construction activities being put on hold, which will have a negative impact on demand for steel and cement.

While production, as well as offtake, was negligible during the lockdown period, the recovery may even be slower in the short run, after the lockdown is lifted. The impact on the overall economy of India, as with other global economies, has been severe leading to acute demand constraints. Factors like reduced income levels, resulting in demand compression is likely to affect steel and cement.[50]

FIGURE 9

Demand Growth in Cement- Post COVID Impact[51]



Source: CRISIL

The problem also persists on the supply side of the issue. Informal labour which comprises the large chunk of workers in construction, cement manufacturing and transport, were hit by the pandemic and the resultant lockdown.

50 Financial Express (2020). 'COVID-19 effect: Cement demand hit, likely to cover in H2 of FY21'. Article last accessed on April 30, 2020 at: https://www.financialexpress.com/industry/covid-19-effect-cement-demand-hit-likely-to-recover-in-h2-of-fy21/1919165/

51 CRISIL (2020). 'Cement cracks: Covid-19 culls demand, crude cushions blow to profit'. Article last accessed on April 29, 2020 at: https://www.crisil.com/en/home/our-analysis/views-and-commentaries/2020/04/cement-cracks.html

This labour migrated back to their homes in the rural areas, from India's metropolitan cities. Movement of migrant labour back into the cities will be a slow process as well, which will likely impact the recovery of supply side processes.

Indian industry experts predict that demand slowdown may persist for a month after the preventive lockdown is lifted. It is estimated that the loss in volume of production would be about 40-60% till the month of April 2020.[52] Further the growth rate of demand for cement is expected to plunge to (-)1% in 2020 and about (-)10% in 2021 (See figure 6).[53]

Much like the cement sector, one of the major stimulus boosters for the steel sectors is construction and infrastructural activity in addition to the automobile sector which is the second largest source of demand for the steel sector. Not only has demand been growing at a relatively slow pace, considering the slowdown in demand from the automobile sector, the lockdown due to the pandemic will only stall activity further. Given the complex nature of manufacturing inside a steel plant, it is not easy to cut down production or 'idle' a blast furnace which can take months to revive.[54] Therefore, the steel industry was exempted from a complete shutdown since it requires 'continuity of process'. Another common issue which is faced by both manufacturers of steel and cement is the limited capacity to store existing inventory and also shortage of working capital.[55] The slowdown in steel sector is expected to be more severe than the one faced by cement (See figure 7).

52 Financial Express (2020). 'Covid-19 to hit cement sector in near term, says experts'. Article last accessed on April 28, 2020 at: https://www.financialexpress.com/industry/covid-19-to-hit-cement-sector-in-near-term-say-experts/1911374/

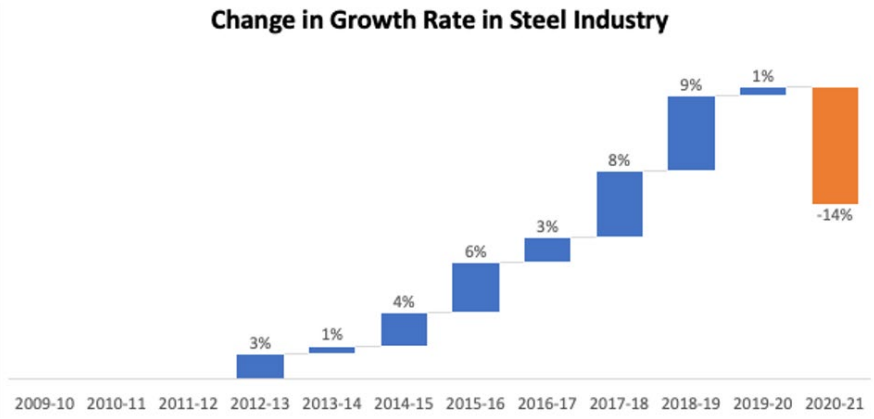
53 CRISIL (2020). 'Cement cracks: Covid-19 culls demand, crude cushions blow to profit'. Article last accessed on April 29, 2020 at: https://www.crisil.com/en/home/our-analysis/views-and-commentaries/2020/04/cement-cracks.html

54 Economic Times (2020). 'Covid-19 impact: Manufacturing grinds to a halt in key sectors'. Article last accessed on April 30, 2020 at: https://economictimes.indiatimes.com/news/company/corporate-trends/manufacturing-grinds-to-a-halt-in-key-sectors/articleshow/74765038.cms?utm_source=contentofintere st&utm_medium=text&utm_campaign=cppst

55 Datta, Aveek (2020). Article last accessed on April 30, 2020 at: https://www.fortuneindia.com/macro/indian-economy-will-be-totally-different-post-covid-19/104355

FIGURE 10

Change in demand in steel post COVID impact[56]



Source: CRISIL

Understandably this unprecedented situation will create financial difficulties for the sector, even more so for undertaking greener transitions, which are associated with higher capital expenditure, in the near term. However, on the path towards recovery post the pandemic, it will be essential that policy makers, industry experts and financiers undertake a series of effective changes to mobilise a greener shift in these sectors. These will not only boost the growth of emission reduction practices in these sectors but will also put the economy on a more sustainable path post recovery. As part of the green recovery pathway, financing greening of heavy industries or incentivising the transition, would go a long way to putting the economy on the path of sustainable development.

Key Takeaway

As a starting point for an assessment of the role of policy and international finance in greening India's heavy industries segment, it becomes crucial to understand the depth of the problem at hand and the externalities it holds for the development process in the national context. This chapter offers a birds-eye view of the cement and steel industries' current and projected roles in the Indian growth story.

56 CRISIL (2020). 'Melting Steel: The Covid-19 pandemic is set to wreck profitability'. Article last accessed on April 28, 2020 at: Source: https://www.crisil.com/en/home/our-analysis/views-and-commentaries/2020/04/melting-steel.html

It also assesses the impact these sectors have in India's emissions inventory and what that means for both the industries and the country.

Both these sectors form the backbone of Indian economic growth in the next few decades. Moreover, steel and cement sectors both have a wide range of scale of producers. These sectors are as significant as key actors amongst the large industries, as they are in the small and medium enterprises level. The role of these sectors therefore transcends beyond economic value but also holds importance in terms of employment and socio-economic development.

Over the medium and long term growth timeframes, Indian steel and cement industries are likely to expand significantly. This is driven by several factors – supportive policies, drivers of domestic demand and drivers of international demand. Even though in the long run international demand would not play as big a role as domestic demand, since these sectors feed into some of the fastest growing sectors of India- infrastructure development both rural and urban, and the automobile industry (for steel), they have a robust growth story ahead.

Needless to say, **these sectors also play a significant role in India's growing emissions**. Indian policymakers have been incentivising energy efficiency and emissions reduction in these hard to abate (HTA) sectors through various policies and market-based mechanisms. While these policies have shown positive results in terms of reducing per unit emissions, in the coming decades, emissions from these sectors are going to keep increasing in absolute terms owing to the massive projected scales of demand and production. Thus, the Indian steel and cement industries can play a critical role in the country's fight against climate change, and this needs to be recognised with comprehensive sector level planning, supported by the right directions from the policy framework.

CHAPTER TWO

Lessons learned: programming

Over the years, the cement and steel industries have recognised the growing climate concerns and realise that increasingly stringent regulations at the international and national level are imminent. In anticipation of stringent regulatory restrictions and negative incentives for carbon emissions which are likely to be introduced in the coming decade, and to mitigate the impact of these, the industry leaders have taken proactive measures to address their climate impact.[57] There are other contributing factors for this shift as well, such as there being a business case for adopting energy efficiency technologies, committing to recycling and reuse of materials, etc.

In this chapter, we look at the kinds of technologies and focus areas of the steel and cement industries. We then look at the kind of commitments being made by the industries, at the industry level and individual companies level. Few specific examples, to get an indication of how companies have been financing their green projects, have been highlighted in case study boxes throughout the chapter.

57 Inputs received through interviews with industry leaders which was conducted by TERI in April 2020.

2.1

What kind of energy transition interventions are being taken by the Indian industries?

Decarbonisation and lessening the impact on the environment is the purported goal for all the industries that are currently undergoing green transitions, with a shift to a lower carbon pathway being the near-term objective. This shift to being green in terms of energy usage is dependent on many factors, key among them being access to viable technologies, adequate affordable finance, increasing demand and regulatory support through policy tools.

Over the last decade, driven by regulatory mechanisms under the Perform, Achieve and Trade (PAT) scheme (further detailed in chapter 4) for improving energy efficiency of the key carbon intensive industries, the steel and cement industries have adopted a range of new technologies. Some key achievements from this are:

1. **Improved energy and thermal efficiency**, i.e. the energy used in generating per tonne of output (steel or cement) has been on a declining trend since 2010. Several factors can be attributed to this, but one of main would be roll out of the PAT scheme, which had both steel and cement sectors as designated entities from the first cycle onwards, and had a speedy impact on the energy and thermal efficiencies of steel and cement industries.

2. **Waste Heat Recovery systems (WHR)** have been installed by cement and steel plants across India and have had an important role to play in reducing energy consumption. The WHR uses the 'waste heat' from the manufacturing process, to be utilised in the generation of steam, process heating and power generation. The waste heat is therefore reused implying a circular use of heat. The Clean Development Mechanism (CDM) under the Kyoto Protocol enabled the installation of WHR plants across steel and cement plants. Though the cost of installation of these plants was very high, the CDM market-based mechanism made it feasible. Further, the high price of Certificates of Emissions Reduction (CERs) under the mechanism provided additional incentive for high emitting industries to undertake capital intensive investments which would continue to reap benefits in the long run.

3. A specific feature to the cement industry has been **clinker factor reduction**. Clinker being the key ingredient in cement, the amount of it used is directly proportional to the CO2 emissions generated in cement manufacturing due to both the combustion of fuels and the decomposition of limestone in the process. The lower the clinker to cement ratio, the lower the emissions. This ratio can, and has, been reduced by partially substituting clinker in the production process with fly ash. Increase in fly ash consumption has been a positive towards reducing emissions.

According to an assessment of the first cycle of the PAT scheme, the following technologies and processes were most effective in helping the industries achieve their energy efficiency targets.[58]

58 BEE (2017). Achievements Under PAT. Available at: https://beeindia.gov.in/sites/default/files/Booklet_Achievements%20under%20PAT_May%202017.pdf

TABLE 1

Best Practices and Technologies Applied for Energy Efficiency under PAT Cycle-1

Iron and Steel Industry	
1	Use of 100% pellets as iron burden to reduce coal consumption.
2	High top pressure blast furnace for recovering energy from the large volumes of pressurised top gas.
3	Waste heat recovery from DRI process to reduce the need for external fuel.
4	Direct Rolling of hot continuous cast billet to produce TMT bars and avoid use of furnace oil in reheating furnace.
5	Coke dry quenching (CDQ) for recovery of waste heat to produce steam & power.
6	Insulation of Hot surface in After Burning Chamber & Dust Settling Chamber in 500TPD kiln.
7	Commissioning of Blast furnace gas line to captive power plant to use surplus Blast furnace gas.
Cement Industry	
1	Installation of Waste Heat Recovery systems
2	Installation of Vertical Grinding Mill
3	Installation of High recuperation efficiency hydraulic cooler
4	Installation of High efficient screw compressor
5	Increasing the usage of AFR in the Kiln
6	Increasing the number of stages of preheater
7	Installation of High Efficiency 3rd Generation Air-Separator

Building on these initiatives and achievements, in a notable move, India announced a National Steel Policy in 2017. This states the goal for the Blast Furnace – Blast Oxygen Furnace (BF-BOF) route to contribute about 60-65% of the crude steel capacity & production, with the remaining 35 – 40% expected to be realised by the Electric Arc Furnace (EAF) and Induction Furnace(IF) route by FY 2030-31.[59]

59 In the Indian Steel Industry, a large number of small steel producers have been sent to utilize sponge iron, melting scrap and non-coking coal for steelmaking through the EAF/IF route. As of March 2016, there were 47 EAFs and 1128 IFs, which use sponge iron or melting scrap for semi-finished steel production. Further The Steel Scrap Recycling Policy, 2019, aims to promote establishment of metal scrapping centres throughout the country, that will facilitate the shift to EAF/IF route.

TABLE 2

Targets for techno-economic performance as per NSP 2017

Parameter	Current Value	Target for 2030-31	International Best
Coke Rate *(in kg/thm)*	400 - 600	300 – 350	275 - 350
Coal Dust Injection Rate *(in kg/thm)*	50 – 200	180 - 200	200 – 225
Blast Furnace Productivity *(in tonnes/m^3/day)*	1.3 – 2.2	2.5 – 3.0	2.5 – 3.5
Specific Energy Consumption *(in Gcal/tcs)*	6.2 – 6.7	5.0 – 5.5	4.5 – 5.0

Source: National Steel Policy. Ministry of Steel.

However, it should be noted, that whilst intended improvements in energy and resource efficiency will result in some reduction in GHG emissions, the impact of the targets set out in the National Steel Policy will be well below what is required to put the industry on a low carbon trajectory.[60]

Some existing measures through which GHG emission reduction within the steel sector can be achieved are improvement in rate of fuel consumption, promotion of renewable energy (RE), increase in recycling and reuse. Going forward, substitution of coal or natural gas as a reducing agent with low carbon hydrogen could be a game-changer as it would allow India to reduce its import dependency while cutting emissions. In the near-term, the aim is to maximise the use of domestic scrap steel, improve energy efficiency and test the effectiveness of emerging low carbon technologies. In the longer run, measures such as introducing a penalty for emissions from the steel industry to push for deeper decarbonisation technologies may be needed.[61,62]

60 National Steel Policy, 2017. Accessible at: https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=2ahUKEwiyl9u0yPboA-hUo83MBHfxTDtMQFjAAegQIARAB&url=https%3A%2F%2Fsteel.gov.in%2Fsites%2Fdefault%2Ffiles%2FNATIONAL_STEEL_POLICY_2017.pdf&usg=AOvVaw11seNtRwypROFqi2y-Aa1B

61 World Steel Association. Accessible at:https://www.worldsteel.org/publications/position-papers/steel-s-contribution-to-a-low-carbon-future.html

62 TERI (2020).

The Indian cement industry is recognised as being amongst the most energy-efficient in the world and for integrating sustainability aspects within their growth aspirations.[63] According to the "Low Carbon Roadmap for Indian Cement Industry: Status Review 2018"[64] report[65], which reviews the achievements of the Indian cement industry based on the milestones set in the International Energy Agency (IEA)'s 2013 low carbon technology roadmap[66], the domestic industry achieved the 2020 performance objective for carbon emissions intensity reduction three years ahead of schedule.

TABLE 3

Specific energy consumption (SEC)

Particulars	Unit of measurement	Global Average	India Average	India Best
Specific Electrical Energy Consumption	*kWh/tonne of cement*	91	80	64
Specific Thermal Energy Consumption	*GJ/tonne of clinker*	3.5	3.1	2.83

Source: Cement Manufacturers Association.

Such performance in achieving sustainable environmental goals was possible due to reduction in energy consumption, increased usage of Alternative Fuel and Raw Materials (AFR), improved heat recovery with the use of cooler hot air recirculation technology, etc.[67]

63 World Business Council for Sustainable Development, 2018. Accessible at: https://www.wbcsd.org/Sector-Projects/Cement-Sustainability-Initiative/News/Indian-cement-industry-on-track-to-meet-2030-carbon-emissions-intensity-reduction-objectives

64 The report can be accessed at: https://www.wbcsd.org/Sector-Projects/Cement-Sustainability-Initiative/Resources/Low-Carbon-Technology-Roadmap-for-the-Indian-Cement-Sector-Status-Review-2018

65 Prepared by CSI and IEA along with nine CSI member companies in India (ACC, Ambuja Cements, CRH, Dalmia Ce-ment (Bharat), HeidelbergCement, Orient Cement, Shree Cement, UltraTech and VotorantimCimentos). The Status Review Report was developed in consultation with Confederation of Indian Industry (CII), with support from Interna-tional Finance Corporation (IFC).

66 The Roadmap calls for a 24% cut in cement emissions globally to achieve the 2 degree celsius target.

67 Cement Manufacturers Association. Accessible at: https://www.cmaindia.org/key-areas/environment/

Since cement emissions depend largely on the proportion of clinker used in each tonne of cement, the type of fuel and the efficiency of equipment used during clinker production,[68] the Indian cement industry is facilitating the growing acceptance of blended cement. Further, it is also building awareness of greener products, along with measures such as using the fly ash from thermal power plants and the experimenting with advanced technologies to reduce their carbon footprint.[69] Continuing on this pathway and putting emphasis on improving energy consumption patterns during the production process and increasing use of alternative fuels through will enable the Indian cement industry to achieve the desired levels of efficiency improvements and emissions reduction set in the roadmap for 2050.[70] However, similar to the steel industry, the cement industry roadmap of achieving 24% reduction in emissions by 2050, sets a trajectory for carbon emissions which is still higher than what's required for the global climate goal limiting temperature increase to less than 2 degree Celsius.

68 Information sourced from: http://cbalance.in/2013/12/carbon-emissions-in-the-cement-sector-in-india/#.XczpbNUzYdV

69 World Business Council for Sustainable Development, 2018. Accessible at: https://www.wbcsd.org/Sector-Projects/Cement-Sustainability-Initiative/News/Indian-cement-industry-on-track-to-meet-2030-carbon-emissions-intensity-reduction-objectives

70 World Business Council for Sustainable Development (2018). Accessible at: https://www.wbcsd.org/Sector-Projects/Cement-Sustainability-Initiative/Resources/Low-Carbon-Technology-Roadmap-for-the-Indian-Cement-Sector-Status-Review-2018

2.2

What kind of emission reduction commitments are the industries making?

While Indian industries and companies are not required by regulations to make climate commitments or plan roadmaps for their emission reduction, they have done so at the top level of the steel and cement industries through voluntary actions. Some of these are more far-reaching than the existing industry policy frameworks, and can serve as guidance for Indian industries.

2.2.1 Voluntary Climate Commitments at the Company Level

The industry leaders from the Indian steel and cement industries, have made voluntary climate commitments, some of which are highly ambitious and pioneering at the global level. Besides undertaking an array of social and sustainability projects, such as beach restoration, tree plantation, increasing access to clean energy for communities, working with public schools and healthcare, the companies are increasingly undertaking targeted climate actions. Listed below are some of these key commitments:

Dalmia Cement

The company announced its highly ambitious target of becoming carbon-negative by 2040. To achieve this, the company is taking several measures such as, trying to increase the percentage of renewables in its overall electricity consumption – with a target of 100% RE by 2030, undertaking energy conservation and experimenting with carbon capture and utilisation (CCU) technology at one of its plants in Tamil Nadu (see Box). The company has the lowest carbon emissions per ton of cement produced globally[71]. In 2018, the company had achieved carbon dioxide emissions of 526 kg/t from its cement production as compared to 578kg/t from other Indian members of the Cement Sustainability Initiative (CSI)[72]. Moreover, in April 2018, it achieved the first rank in global cement sector as per the CDP (formerly Carbon Disclosure Project) cement sector report on business readiness for Low Carbon Transition.[73]

To become carbon negative by 2040, in September 2019, Dalmia announced that it will build a large scale carbon capture facility at its cement plant at Tamil Nadu, India. As part of this, the company has entered an agreement with UK based Carbon Clean Solutions Limited (CCSL), a company engaged in the low-cost carbon dioxide separation technology.[74] CCSL will provide technology and operational services for the plant based on its patented CDRMax Technology. To date, there have been a small number of cement plants with carbon capture facilities, mostly in China and Europe. This would be the largest-scale CCU demonstration project in the cement industry. The project will have multiple utilisation streams, has a capacity of 500,000 tonnes, will be critical for the company to achieve its climate goal.[75] In our discussions with Dalmia representatives, they said that they can't disclose the financial details of the project at this stage and they are in the process of raising the required funding.

71 The Hindu (2019). Accessible at: https://www.thehindubusinessline.com/companies/dalmia-cement-announces-to-go-carbon-negative-by-2040/article29458843.ece

72 November 2018 issue of Global Cement Magazine. Accessible at: https://www.cemnet.com/publications/icr-back-issues

73 CDP report (2018). Accessible at: https://www.cdp.net/en/investor/sector-research/cement-report

74 Carbon Clean Solutions Limited (2019). Accessible at: https://carboncleansolutions.com/media-center/news/article/2019/09/dalmia-cement-and-ccsl-sign-mou

75 Dalmia Cement Bharat Limited (2019). Press release accessible at: https://www.dalmiabharat.com/dcbl-carbon-capture-plant.html

UltraTech Cement

The company is the largest Indian cement manufacturer, the only cement company in the world (outside of China) to have more than 100 million tonne capacity in one country. The company has undertaken numerous initiatives to increase the share of renewable energy, switch from fossil fuels to alternative materials, reduce clinker ratio, improve energy efficiency and scale up investments in the development of innovative products and services.[76] In 2019, the company announced its intent to increase contribution of green energy from 10% of its total power consumption in 2019 to 25% of its total power consumption by 2021, to enable it to reduce its carbon emissions by 25% (from 2005-06 level) by 2021. By FY 2108-19, it had already achieved a nearly 19% decline.[77]

ACC Cement

ACC Ltd, is a leading Indian cement company, which was acquired in 2005 by the Swiss Holcim group. Today it's a part of the LafargeHolcim group. According to ACC's 2030 climate targets, the company plans to generate one-third of its turnover from enhanced sustainability measures. This includes, the target of reducing CO2 emissions per tonne of cement by 40% (from 1990 levels) by 2030. This also includes the goal of 10.7 million tonnes of waste-derived resources per year by 2030.[78]

ACC has access to a special climate fund, which was developed from CDM related projects and other measures such as internal carbon pricing, which exists at its parent company level. The fund gives ACC the bandwidth to experiment with and implement innovative green projects. Through this an array of specific projects have been funded, which included seven alternate fuel projects in the previous year and eight waste to heat recovery projects in the current year.[79]

76 Ultratech Cement. Annual Report for FY 2018-19.

77 UltraTech cement. Accessible at: https://www.ultratechcement.com/about-us/media/press-releases/ultratech-cement-to-exceed-25-per-cent-green-energy-contribution-to-total-energy-consumption-by-2021 https://www.ultratechcement.com/about-us/media/press-releases/ultratech-cement-to-exceed-25-per-cent-green-energy-contribution-to-total-energy-consumption-by-2021

78 ACC (2019). Presentation made at CII's National Award ceremony for 'Excellence in Energy Management'.

79 TERI's industry interviews, which were conducted in April 2020.

SAIL

Steel Authority of India Limited (SAIL) is the largest steel producer in India, and is a Public Sector Undertaking (PSU) under the Ministry of Steel. SAIL undertakes climate and environment actions through its Environment Management Division (EMD). SAIL has set a target of achieving specific carbon-dioxide emission of 2.30 tonnes per ton of crude steel production by 2030, amounting to a 23% reduction in emissions from 2007-08 level. In FY 2018-19, it was able to achieve reduction of 11.7% in CO2 emission.[80] SAIL emphasises on afforestation as a major activity under its climate actions and in FY 2018-19, it planted around 0.5 million tree saplings. The company has taken up a project on carbon sequestration through afforestation at Rourkela Steel Plant, located in the state of Odisha.[81]

Tata Steel

Tata Steel group is among the top global steel companies with operations and commercial presence in many regions across the world. It was recognised as the Climate Disclosure Leader in 'Steel category' by CDP in 2017 and as a leader in the Dow Jones Sustainability Indices for three years in a row. Tata Steel has won several awards including the Lighthouse recognition for its Kalinganagar Plant – a first in India (see Box). In 2019, Tata Steel's European business announced its intent to become carbon neutral by 2050 through a range of technological interventions.

In Kalinganagar, Tata Steel launched the Coke Dry Quenching (CDQ) technology process, for which it invested nearly INR 8 billion (~ 100 million Euros at the current exchange rate) over the last three financial years 2016-17 to 2018-19. The company also introduced Top Recovery Turbine (TRT) technology, in which it invested INR 600 million (~ 7.3 million Euros) in FY 2017-18 and FY 2018-19. Further, in FY 2016-17, the company launched a larger heat size convertor in the steel melt shop for enhancing energy efficiency, for which it invested INR 11.4 billion (~ 140 million Euros). Thus overall, the company invested nearly 250 million Euros in one of its plants in the last three years to meet its goal of reducing carbon emissions from operations.

80 Steel Authority of India Limited's Corporate Sustainability Report 2019.

81 Steel Authority of India Limited's annual report 2018-19.

This investment was made from its own internal resources and on the basis of its balance sheet, without using external green finance. As per our assessment of the company's Annual reports for the period FY 2016-17 to 2018-19, the company invested around INR 50 billion (~ 600 million Euros) in energy conservation equipment and technologies across its plants. In our discussion with Tata Steel, they remarked that they are able to take on several smaller projects at different plants, but it is challenging to do transformative actions, such as done at Kalinganagar, throughout its operations within the current regulatory and policy frameworks, where the company largely lacks support from green finance.

JSW Steel

JSW Steel is a leading integrated steel producer of India, with presence across several countries in the world. JSW Steel emphasises resource utilisation for which it has invested in and implemented a range of iron and steel making technologies, including Corex, Blast Furnace, DRI and Twin Shell ConArc2. The company focuses on encouraging internally driven climate initiatives and for this it has established a cross-functional 'climate action group' for project planning, as well as a Board-level Business Responsibility Reporting Committee which regularly reviews the sustainability parameters and impact of the company's CSR spending. The company plans to achieve reduced CO2 emission per ton of crude steel production through use of superior quality of raw materials, improved processes and enhanced energy efficiency.

Internal Carbon Pricing

Internal Carbon Pricing (ICP) is aimed to be developed to incentivise and help organisations make informed assessment in decision making, related to reallocation of resources from high carbon to low-carbon activities through projects in the form of energy efficiency improvements, renewable energy procurement, etc. In private companies, ICP can be developed to support return on investment on cleaner and carbon-efficient technologies, as a mechanism for organisations to internalise carbon risk and prepare for the imminent carbon pricing.

This is being recognised, at the a global level, and an increase of 17% among companies using carbon pricing has been seen in 2019, while in India this increase has been of 43%, from 2018.[82] In 2019, 697 companies around the world were found to be using ICP (as per CDP), and the average global carbon price for 13 industry sectors[83] was found to be US$ 34.15/tCO2e.[84]

In India, 20 companies were reported to have set up the ICP mechanism, with 31 planning to adopt this mechanism. These include, five cement and concrete companies[85] and two steel companies (*see Table*).[86] The overall Indian average ICP was found to be INR 1549.1 per tCO2 (~USD 23)[87], with the cement companies average ICP being INR 2032.2 per tCO2 (~USD 29),[88] and the steep companies, being INR 1172 per tCO2 (~USD 17.7).[89] Amongst all these companies, Ambuja Cement, was found to have the highest ICP of around USD 30 per tCO2.

The primary issue recognised regarding the process of ICP among corporates is the lack of a consistent price setting methodology, as well as regulations to make these credible. It has also been seen that though the larger companies in the steel and cement industries are making an effort to include carbon pricing into their plans to reduce their emissions, however many smaller-scale companies are not yet adopting this practice.

82 Putting a Price on Carbon- Handbook for Indian Companies 2.0. January 2020. TERI; CDP.

83 Manufacturing; Biotech, healthcare & Pharma; Apparel; Infrastructure; Transportation services; Materials; Fossil Fuels; Food, beverages & agriculture; Services; Retail; Power generation; Hospitality; and Minerals extraction.

84 Putting a Price on Carbon- Handbook for Indian Companies 2.0. January 2020. CDP and TERI.

85 ACC, Ambuja, Dalmia Bharat Ltd., Shree Cement and Ultratech Cement.

86 Mahindra Sanyo Special Steel Pvt. Ltd. and Tata Steel

87 Average calculated for the 16 Indian companies that reported their ICP to CDP

88 Average for three cement companies that reported their ICP to CDP

89 Average being calculated for Tata Steel as Rs. 1592.5/tonne of CO2 ($24.5/tonne of CO2)

TABLE 4

Internal Carbon Prices of Indian Steel and Cement Companies (2019)

Company	Price/tonne of CO2 (in INR)	Price/tonne of CO2 (in USD)
Cement		
ACC	3313	47.33
Ambuja Cement	2103.6	30.74
Dalmia Bharat Ltd.	ND**	ND
Shree Cement	ND	ND
*Ultratech Cement**	680	9.93
Steel		
*Mahindra Sanyo Special Steel Pvt. Ltd.**	752.02	10.98
Tata Steel	975-2210	15-34

Source: Climate and Business- Partnership of the Future. CDP India Annual Report 2019. January 2020.

* average exchange rate uses is USD 1 = INR 68.5
**Not publically disclosed

2.2.2 Voluntary Sustainability Measures at the Industry Level

Being recognised globally as one of the highest emitting and polluting industries, the cement industry has been proactively developing industry wide commitments and undertaking a range of sustainability measures. The Indian cement industry is one of the leaders on this aspect. As per a 2018 cement sector report by CDP[90], five out of the top 10 global cement companies ranked in the report's low carbon transition league were from India, with Indian industries out-performing the global average on key parameters.

90 The report can be accessed at: https://www.cdp.net/en/investor/sector-research/cement-report

Some of the key industry associations of the cement industry and their goals are as follows:

Global Cement and Concrete Association (GCCA)[91]

The GCCA is developed as a membership platform for cement and concrete manufacturing industries around the world to help design and come up with solutions on sustainable construction, while demonstrating industrial sustainable leadership in the cement and concrete sector manufacturing sectors. GCCA has a Sustainability Charter that identifies five key pillars in the sustainability spectrum, and sets out requirements for member industries against these pillars.

Cement Sustainability Initiative (CSI)[92]

The GCCA, in collaboration with the World Business Council for Sustainable Development (WBCSD), formed the CSI, to help facilitate sustainable development of the cement and concrete sectors and their value chains. It comprises of 24 major cement producers, with operations in more than 100 countries, having a collective world cement production of around 30%. IEA and CSI developed a roadmap for the industry, with policy as well as technology solutions for a 24% reduction of direct CO2 emissions from cement industry, below current levels, by 2050. This roadmap has been developed through a bottom-up approach, to explore possible transition pathway based on least cost technology for education in CO2 emissions. The roadmap covers regulatory recommendations, policy priorities, as well understands investment and technical challenges in regard to research, and demonstration.

91 Global Cement and Concrete Association. https://gccassociation.org

92 Cement Sustainability Initiative. WBCSD. https://www.wbcsd.org/Sector-Projects/Cement-Sustainability-Initiative/Cement-Sustainability-Initiative-CSI

Cement Manufacturers Association (CMA)[93]

CMA has been developed as an apex organisation of the major cement plants in India, working on issues of environment, waste recycling, taxation, logistics, file supply, etc. CMA's Environment and Sustainability Committee, as well as CMA Committee on Fuels and Energy, facilitates technological innovation, regulation development on emission standards, use of waste and other alternate fuel improvement, by consulting and bringing together cement industry stakeholders.

The global steel industry comprises of some of the largest companies, with sufficient capacity to undertake ambitious measures. The industry, especially in the developed economies, is transitioning to green at an increasing pace.

World Steel Association (WSA)[94]

WSA has been developed as a non-profit industry association, with members representing around 85% of global steel production. Under this, climate change, co-products, product applications, recycling, supply chain and water have been key issues and areas of focus. WSA has a Climate Action Programme under which companies report their site or company level CO2 emissions data, allowing a comparison of the steel industries among themselves, based on average and best performance, to identify scope for improvement. The organisation also supports the transition towards a carbon neutral economy, through a Step Up Programme. This programme showcases a four-stage efficiency methodology (raw material quality, energy efficiency, process yield, process reliability), all together aiming at CO2 reduction.

Indian Steel Association (ISA)[95]

The ISA, works towards its stated objective of "*transforming the Indian Steel Industry as a global leader acclaimed for its Quality, Productivity and Competitiveness, with focus on health, safety and environment, along with growing thrust on innovation through R&D, adopting an inclusive and collective approach*".

93 Cement Manufactures Association (CMA). https://www.cmaindia.org/about-us/introduction/

94 World Steel Association. http://www.worldsteel.org

95 Indian Steel Association. https://indsteel.org/index.php

Under this, the Environment Sub - Committee focuses on matters pertaining to enforcement of energy norms and safety and waste recycling norms, while also working towards strengthening the self-regulatory monitoring mechanism for effective policy compliance.

Key Takeaway

The industry leaders are cognizant of the importance of addressing climate change factors in the coming years and have taken proactive measures to mitigate their climate impact, which in many cases are ahead of the policy mandated requirements.

The **industry leaders have leveraged a range of climate initiatives, with most of these being voluntary in nature**. These include internal carbon pricing, with some of the carbon prices being used being higher than the EU ETS prices at this time. The companies are also participating in the industry level climate commitments for both the steel and cement industries, at the national and global level. These include committing to emission reduction targets for set periods and adhering to certain reporting requirements, and also knowledge sharing to exchange best practices and technical know-how. Further, the leading companies in these industries are well-versed with the technologies and solutions available for lowering carbon emissions and waste generation, and have been proactively deploying these for the last few years, with the impact on their emissions already becoming tangible. **Through these measures, these companies have built their internal capacity to identify the issues and address these from a climate perspective.**

While **there are industry level roadmaps for transitioning to green and enhancing energy efficiency in place**, in the form voluntary commitments by industry associations and plans formulated by the key Ministries, **these are not binding for the entire industry**. In many cases, only the leading large companies have started formulating targets and plans for a lower carbon transition, which is contextual and voluntary in nature. The **inexpensive and accessible technologies have already been well deployed** in both these industries, as seen by the fact that they have achieved and even surpassed their mandatory energy efficiency targets.

However, the technologies with higher potential impact, which are more expensive and yet to be proven, like carbon capture utilisation and storage (CCUS), are still not being leveraged, due to the lack of an enabling environment.

A comprehensive roadmap for decarbonisation, involving all the key stakeholders and addressing the challenges faced by the industry, is needed. This is especially important, given that these two industries are critical for India's development. Further, with industries like the steel industry, where competition is intense at the global level, no single company or even country can commit to decarbonisation without considering the impact on their trade balance and response of other countries.

CHAPTER THREE

Capacity of the Steel and Cement Industries to Finance their Transition

From the earlier chapters, it is clear that the cement and steel industries are and will remain on a growth trajectory, both in terms of demand and supply, with the resultant increase in emissions. However, their climate impact is now better understood and recognised by the regulatory authorities in India and the industries themselves, from an environment and GHG emissions perspective, and they are undertaking a range of initiatives to address these issues. Before proceeding further to understand the barriers to financing green transitions and the policy gaps to facilitate this, in this chapter we look to assess the means and capability of leading companies in these industries to finance green transitions with their own resources.

This chapter attempts to develop a broad understanding on the large companies' capacity of financing long term green initiatives out of their profitability; whether energy intensity imposes a significant cost and its potential as a motivator for undertaking enhanced energy efficiency; and do these companies have the capacity to finance the green transition by raising debt?

We proceed with the understanding that companies, especially larger players in each sector, would undertake green measures not only motivated by policy and regulatory requirements but also to enhance their market standing and safeguard long term growth prospects.

Approach

As part of our assessment of these sectors, we analysed the steel and cement companies which were registered with the National Stock Exchange (NSE) (see Table 5). These companies are the largest ones, based on their market capitalisation and therefore have greater internal resources to undertake transformative action towards lower carbon production. Furthermore, due to their size and larger scale production, they have higher energy usage and emissions in absolute terms, than their smaller and medium-sized counterparts. Since these leading companies from the steel and cement industries are also bound by regulations such as the Perform, Achieve and Trade scheme, PAT, to enhance energy efficiency, we infer that they are more familiar with the need to reduce emissions and the ways to do so.

For our analysis, we look at five companies each, from the cement and steel industries, which hold the largest share of output in their respective sector. These five companies collectively hold about 40% of the total capacity in cement and about 62% capacity in the steel sector (as shown in the table 5).[9697] It should be noted, any industry averages mentioned in this chapter pertain to the averages of these set of companies.

TABLE 5

Top 5 steel and cement companies registered on NSE with total production capacity as in FY19

Steel Industry	Total Capacity of Company (MnTPA)	Share of Total Industry Capacity (%)	Cement Industry	Total Capacity of Company (MnTPA)	Share of Total Industry Capacity (%)
TATA	33	23.91%	**UltraTech**	102.75	20.55%
JSW	18	13.04%	**Ambuja**	29.65	5.93%
SAIL	21	15.22%	**ACC**	27.76	5.55%
Jindal Steel & Power	11.6	8.41%	**Shree**	25.6	5.12%
Jindal Stainless Steel	1.8	1.30%	**J K Cement**	14	2.80%
Total Capacity	**85.4**	**61.88%**		**199.7**	**39.95%**

Source: https://indiancompanies.in/top-companies-in-steel-industry-in-indiaby-capacity-market-share/

For the companies mentioned above, data for different variables was collected to understand the overall financial status and the trend in investment in clean energy over the past 10 years i.e. from 2007-08 to 2017-18. The reason for dating back to 2007-08, is that India's endeavors for addressing the pertinent issues concerning climate change can be said to be kick-started with the constitution of the Prime Minister's Council on Climate Change in 2007.

96 Raveendran R (2020). Top 10 Cement Companies in India 2020. Available at: https://indiancompanies.in/top-10-companies-in-cement-industry-in-india/ (Last accessed on 23rd April 2020).

97 Raveendran R (2020). Steel Companies in India Top 10 Manufacturers. Available at: https://indiancompanies.in/top-companies-in-steel-industry-in-indiaby-capacity-market-share/ (Last accessed on 23rd April 2020).

The National Action Plan on Climate Change (NAPCC) was launched in 2008, followed by the eight National Missions guiding the country's climate actions. Key mechanisms towards enhancing energy efficiency and transitioning to clean energy were initiated soon after, such as Renewable Energy Certificate (REC) mechanism in 2010 and Perform Achieve and Trade (PAT) scheme in 2012. Both steel and cement companies were included as the Designated Entities since the first cycle of PAT. The analysis is carried out using publicly available financial information. We use simple financial ratios to get an indicative picture of the trend these sectors are following in terms of green initiatives, impact on emissions, and impact on financials, to provide context to the possible barriers to green finance these sectors face. The metrics analysed are discussed in the following sections.

Building Capacity for Conducting a Needs Assessment

One of the prerequisites while inferring the internal capacity that companies have for financing green transitions, is the assessment of technologies and their viability and the quantum and duration of finance required for implementing these.

Needs assessment of the scale and duration of finance, internal or borrowed, is determined by various factors. The kind of decisions guiding this assessment will be first, how much emission reduction is required and in how much time, for example, by forming roadmaps for becoming carbon neutral in a span of 30 years. Next, determining the ways in which emission reduction can be achieved via changes in sub-processes of the manufacturing cycle. Further, identifying available and accessible means and technologies to achieve the required modification in the production process, and a related decision is whether this will be via brownfield or greenfield investment. (Companies have the option of undertaking brownfield or greenfield investments to improve efficiencies and enhance low-carbon production to existing or new capacities.) It is after this step that companies can assess the scale and amount of finance required, the means of financing it, and the additional financial costs associated with different means of financing. This process also involves estimating the additional cost incurred in greening the production process when compared with BAU upgradation of technologies.

The discussion around the available technologies and cost differential is out of the scope of this report. There have however been several studies assessing the technological and related financial costs.[98] This chapter discusses the cases of some of the best steel and cement manufacturing companies and implicitly assumes that these companies are thorough with their technological and financial needs assessment. We now discuss the next step- their ability to finance the transitions out of their own earnings.

98 See for example: 1. TERI (2020), " Towards a Low-Carbon Steel Sector". Available at: https://shaktifoundation.in/wp-content/uploads/2020/01/Towards-a-Low-Carbon-Steel-Sector-Report.pdf ; 2. CEEW (2019), "Sustainable Manufac-turing for India's Low-Carbon Transition". Accessible at: https://www.ceew.in/sites/default/files/CEEW%20-%20Sustainable%20manufacturing%20in%20a%20low-carbon%20economy%2024Sep19.pdf#overlay-context= ; 3. IFC (2013) "Existing and Potential Technologies for Carbon Emissions Reductions in the Indian Cement Industry". Accessible at: https://www.ifc.org/wps/wcm/connect/0bd665ef-4497-4d6d-9809-9724888585d2/india-cement-carbon-emissions-reduction.pdf?MOD=AJPERES&CVID=jWEGLpL

3.1

Are firms capable of financing green investments from their own resources?

Transitioning towards a greener process of production, could necessitate high upfront investments in different parts of the production process. While profitability levels may not necessarily ensure that a company will be able to invest in green technologies/processes, it's a good starting step. For understanding this, we assessed the EBITDA[99] to Net Sales ratio i.e. the EBITDA margin, to compare the profitability margins. A consistently higher value of this ratio indicates the company is keeping its earning at a good level while also minimizing operating expenses, and so it is used for assessing operational performance. By inference, such companies should also potentially have a higher capacity to invest in green technologies.

3.1.1 Cement Industry

Using data from the selected cement companies, we observe a downward operating profitability trajectory for the cement industry companies, which signifies that operating expenses borne by these companies in this sector are increasing as a proportion of their total sales.

Rising operating expenses across cement companies has been observed due to a variety of reasons (See Table 2).

99 Earnings Before Interest, Taxes, Depreciation and Amortization

FIGURE 11

Future projections for the Indian steel industry (in million tonnes)

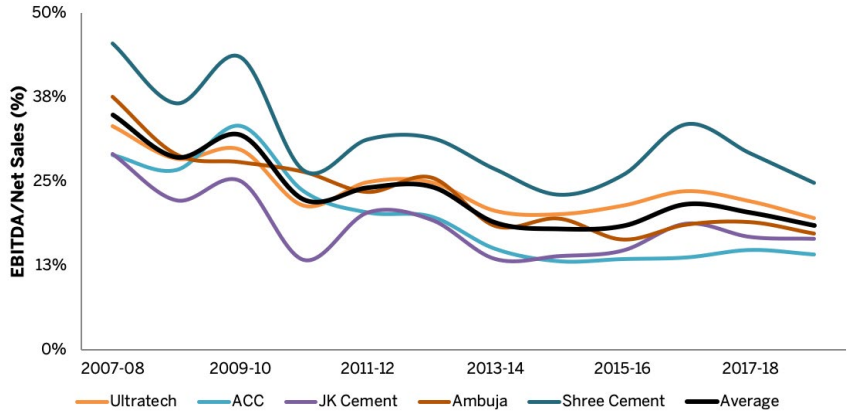


TABLE 6

Operational Cost Breakdown for an Average Cement Plant

Type of Manufacturing cost	Proportion
Energy Costs	46%
Raw Materials	25%
Man Power	12%
Factory Overheads	4%
Others	13%

Source: CII, Shakti Foundation 2015, Case Study Booklet on Energy efficient technologies in Cement Industry.

On average, cement plants spend about 35-50% of the total manufacturing cost of cement to meet their energy demands, which is primarily from thermal power.[100]

100 Accessible at: https://gita.org.in/Attachments/Reports/Case%20Study%20Booklet%20on%20Energy%20Efficient%20Technologiesin%20Cement%20Industry.pdf

Coal prices have a direct impact on the operating expenses of the plant and are a prime contributor in certain years to the volatility in the operating expenses. Supplies from domestic suppliers of coal had been inadequate, and in 2008-09 only 48% of the total coal requirement came from Coal India Ltd. (CIL) and Singareni Colleries Co. Ltd. (SCCL), the two indigenous coal suppliers for the cement industry.[101] The additional requirement of coal had to then be procured at a higher cost from various other sources like purchase from open market and imports (with added import duties), which led to an increase in input costs. Between 2007 and 2017, the cement sector's dependence on imported coal had increased from 12% to 31% (Spencer et al. 2018)[102]. One of the primary reasons for this has been the limited supply of high quality coal (low-ash coal) in the country. The gradual shift towards increasing imported coal consumption over indigenous coal has also had an impact in increasing the cost of raw material for production for cement companied in this time period. Further, overall input costs for the sector are rising, due to increase in basic prices and transportation cost, which add to operational expenses. For example, Ultratech reported an increase in costs by 5% per tonne of cement produced during 2012-16[103].

EBITDA margin showing a declining trend highlights the difficulty faced, even by the large cement companies, in financing green initiatives. The cement sector, faces further constraints due to fluctuating capacity utilisation which indirectly adds to the operational cost.[104] While demand for cement is rising and will continue to, shocks to the economy lead to short term decline in capacity utilisation. For instance, the capacity utilisation was at a six year high at 76% in 2018, but fell to 67% in 2019, due to the slowdown in the manufacturing sectors.[105]

101 Long term agreements between companies across predetermined sectors and coal suppliers on minimum coal supply to the assigned plant

102 Spencer, Thomas et al. (2018), "Coal Transition in India", TERI Discussion Paper (New Delhi: The Energy and Re-sources Institute). Accessible at: https://www.teriin.org/sites/default/files/2018-12/Coal-Transition-in-India.pdf

103 https://www.televisory.com/blogs/-/blogs/benchmarking-the-cement-industry-in-india-and-chi-2

104 https://www.business-standard.com/article/economy-policy/india-s-manufacturing-capacity-utilisation-declines-to-the-lowest-ever-119120600055_1.html

105 https://www.globalcement.com/news/item/9503-indian-cement-sector-operating-at-67-capacity-utilisation-rate

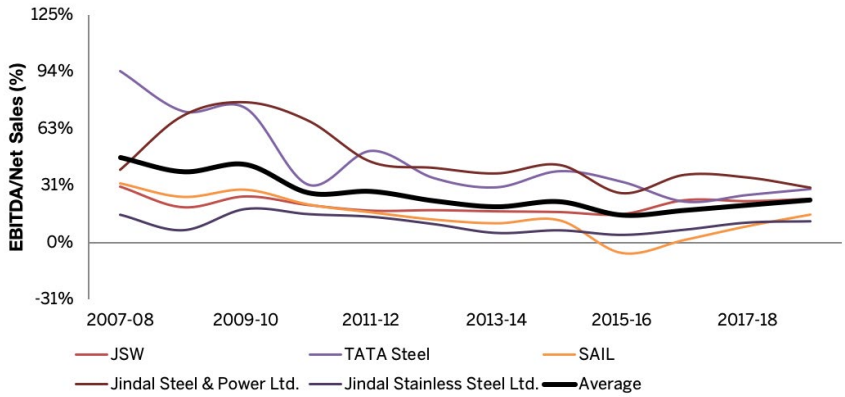
As seen, even the largest firms in the cement sector are struggling to maintain a consistent EBITDA to Net Sales ratio. Thus, to be able to finance green investments, which come at a high cost for such a hard to abate sector, is challenging and unlikely to be at the scale required, by using just the firm's own earnings.

3.1.2 Steel Industry

Assessing the profitability and net sales of five major steel producers of India, we see that there is a steep decline in the EBITDA Margin for steel, being significantly more pronounced as compared to the cement industry. There are multiple reasons for this decline. Firstly, historical growth in EBITDA in the steel sector has not been as steep as that in the cement sector. Steel industry, which is a major consumer of coal, also faced the high costs of coal, between 2012 and 2016, which resulted in the steep decline in EBITDA margin ratio (See Figure 12). However, the period from 2009 onwards till 2011, is a steeper decline than that between 2012-16. In order to understand this, it is essential that one be reminded of the long boom period in the steel industry between 2003-08.

FIGURE 12

EBITDA Margin for Steel



Between 2003-08 the Indian economy soared, as did the global economy, and so did income and investment. This translated into high domestic demand for steel (growing at the rate of ~11%)[106] which was matched by production expansion by both big and small steel industries. During this period of growth, the structure of the Indian steel industry underwent rapid change in terms of scale of operation, integration levels, and levels of technological sophistication. The advent of new production technologies brought about a significant change in the capacity of the Indian steel industry.

The steep decline from 2009 onwards was a result of the economic slowdown arising from international markets. Between 2010 and 2013, larger steel companies faced a loss of 46%, in nominal terms and the impact was much more for MSMEs. There are few reasons to explain this downturn. First, global economic slowdown beginning since 2008-09, hit demand for steel across the world. India, being the fourth largest producer of steel at that time, took a severe hit in its exports to rest of the world. Second, India saw an increase in imports largely from China. In 2014-15, a staggering 71% increase in imports of steel, had a massive adverse impact on the Indian steel industry[107]. In 2015-16, about 11.71 million tonnes were imported, the maximum that had been since 1991, implying a further increase of imports by 26% over 2014-15 levels. This led to a steep decline in domestic steel prices which meant less net realisation for steel companies and a squeeze in their profit margins; something that we observe in the declining EBITDA margin.

Table 7, shows a brief account of total iron and steel imports from rest of the world, between 2007 and 2017, with a large majority of this being from China.

Third, India experienced an excess supply of steel and dumping of steel from china at very low prices further created financial difficulties for the sector. Cheap imports from china not only caused demand substitution away from Indian manufactured steel but also drastic decline in domestic steel products. As steel prices declined, steel producing companies' EBITDA margins eroded[108]. In addition to this, capacity utilisation of steel has remained around 75-80% over the past year[109].

106 http://ficci.in/spdocument/20888/Steel-Report-2017.pdf

107 https://www.businesstoday.in/magazine/special-reports/steel/l-recession-global-steel-industry-steel-companies-import-steep-decline-domestic-steel-prices/story/273843.html

108 http://ficci.in/spdocument/20888/Steel-Report-2017.pdf

109 Ministry of Steel

TABLE 7

India's Iron and Steel Imports

Year	Imports ('000 tonnes)
2007-08	7029
2008-09	5841
2009-10	7382
2010-11	6664
2011-12	6863
2012-13	7925
2013-14	5450
2014-15	9320
2015-16	11711
2016-17	723
2017-18	1062

Source: https://steel.gov.in/sites/default/files/DEVELOPMENT.pdf

This under-utilisation of capacity implicitly adds to the costs of operation, thereby tightening available margins. The subdued demand for steel from key consumers such as the automobile sector and infrastructure sector, is a key reason for the moderate capacity utilisations.

This eventually led to a larger difficulty of bad debts by the Indian steel industry, as lending to the steel industry accounts for around one-tenth of the bad loans of the Indian banking system.[110] Therefore, as a result of shocks- international (leading to excess supply) and domestic (high prices of coal), the profitability of the Indian steel industry remained very low, as depicted by the declining EBITDA margin.

As in the case of cement, the ability of steel firms to be able to finance green initiatives on their own is highly limited. The steel sector, in fact, has been relatively more strained for resources than the cement sector.

110 https://www.livemint.com/Opinion/J17b2iGXgFGdkT0C0bkwgJ/A-troubled-time-for-Indias-steel-industry.html

The advantage of note is that, the larger steel companies are technologically sound in their means of production, largely due to the prior investments made. However, the challenge this throws is that to bring about further efficiency improvements in an already technologically sound system, will require heavy investments in cutting-edge technologies, which the industry is not capable to make from its declining profits.

Thus, it is clear that both cement and steel companies lack resources to finance initiatives towards a green transition on their own.

3.2

Is energy efficiency a strong motivator for decarbonisation?

The higher the energy intensity, the higher the cost companies are likely to face over the period of time. In the previous section, we saw that declining EBITDA margins for both steel and cement imply high operating expenses. Here we assess the degree to which energy intensity can impact a firm's operating expenses, using the power and fuel expenses as the indicator for doing so.

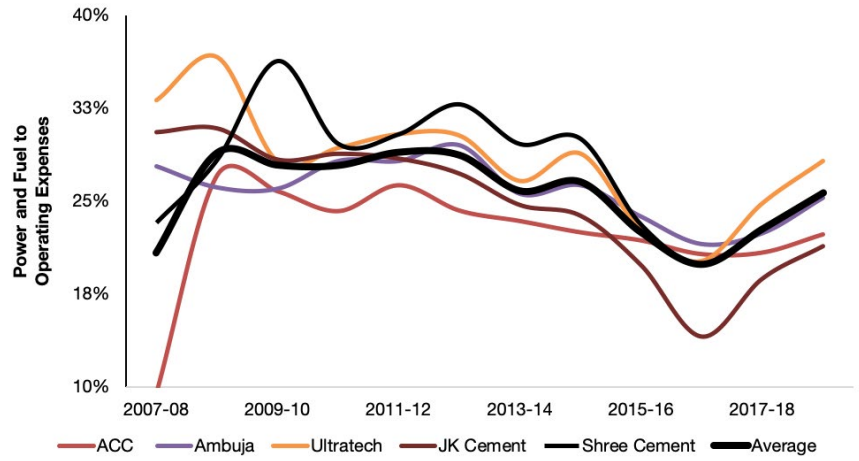
3.2.1 Cement Industry

In the cement sector, power and fuel costs comprise largely of coal usage- imported and domestic, and pet coke. Inevitably, prices of these are on an upward trajectory due to inflation and global changes in demand and supply. The other expense includes the cost of electricity that is incurred in the manufacturing process. This includes the cost of power purchased and also, in the case of some larger manufacturers (such as ACC), power generated.

Over the time period that is considered for this analysis, the larger companies of the cement sector do not show any trend in the power and fuel to operating expenses ratio. This may be because of various reasons. First, fluctuation in fuel prices, primarily coal. When import duties on coal had risen between 2012 and 2016, many of these companies had increased the uptake of domestic coal in these periods substituting coal which was imported.

FIGURE 13

Power and Fuel to Operating Expenses in Cement



The result is overall expenditure remaining relatively consistent. Further, some companies reported efficiency in power consumption such as improving kiln thermal efficiency, installing waste heat recovery systems and improving electrical efficiency in manufacturing processes such as cement grinding[111]. Companies such as ACC even entered solar power purchase agreements under the Renewable Purchase Obligations (RPO; further detailed in chapter 4) to cut purchased power costs while also meeting renewable energy obligations.

While there is a lack of clear trajectory there are two key observations that provide useful inferences. First, between 2008 and 2015, the range of fluctuation of proportion of power and fuel as part of operating expenses, remains within 25-30%. This relative consistency in the expenditure is likely to be the result of short-term cost reduction measures such as shifting to domestic coal when imports became costly. However, they do not necessarily ensure any significant uptake of long-term clean energy transition. So, the enhancement in efficiency may be attributed to a short-term improvement.

Second, the maximum and minimum variation in this ratio, throughout the observation period ranges for about 30% in 2008 to 20% in 2016.

111 https://www.acclimited.com/newsite/annualreport2018/ACC_Annual_Report_2018.pdf

Even this variation is not extreme in nature, even though there had been some significant price shocks for coal in this period. It can thus be inferred that power and fuel expenses on their own, with the currently available feasible technologies for improving efficiency, may not be a significant motivator for shifting to low carbon pathways. The technologies required for making a significant improvement and thus prove beneficial for the operating expenses, are probably not viable for commercial use at this stage.

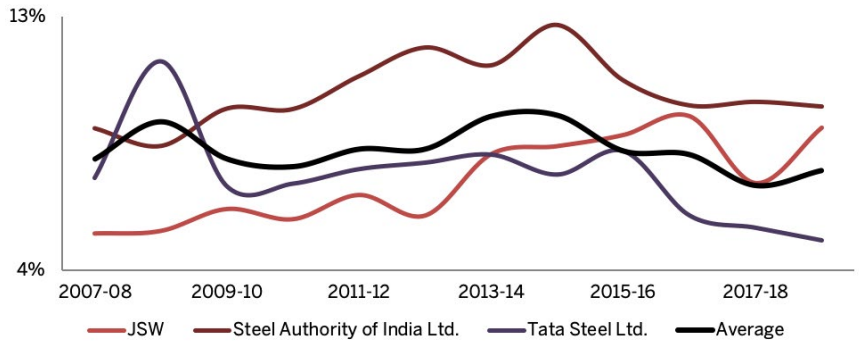
3.2.2 Steel Industry

Power and fuel expenses, as a part of overall operational expenses in the steel industry, are less than that in the cement. For the given set of companies these expenses range between 7-9% of the total operating expenses incurred by this sector. This ratio has stayed consistent, making it difficult to arrive at inferences on the extent of cost energy intensity imposes on operating expenses of a company.

For the financial ratios estimated in this subsection, we have eliminated two companies- Jindal Steel and Power Limited and Jindal Stainless Steel Limited. During the period chosen of analysis, both these companies have had cases which have led to them being outliers to the industry trends and averages.[112]

FIGURE 14

Power and Fuel to Operating Expenses Steel



112 Jindal Steel and Power Limited, was involved in an ongoing case on pertaining to irregularities in allocation of a coal block in Jharkhand, since 2016 till 2018. Jindal Stainless Steel Limited, was already under a corporate debt recovery starting 2009. This continued till 2019. As a result of this, the company's debt remained very high, during several years of the study.

As with the cement sector, this does not offer clear inferences on the impact of energy efficiency investments on the forms' finances, and thus, for the steel sector too, this energy expenses on their own are not a major driver for transitioning to low carbon pathways.

3.3

What is the existing capacity to raise debt for green transition?

This section explores the ability of cement and steel companies to raise debt to facilitate a green transition. There are several ratios to assess the borrowing capacity of a company. Of these, some of the most crucial ones are the Debt to Equity Ratio (DER) and the interest coverage ratio (ICR). We assess the same for the five companies considered in this chapter for both the industries. These two ratios are useful indicators of the structure of capital employed by the firm and the extent of borrowing capacity they have. This ratio varies from sector to sector however, in general, a low debt to equity ratio is considered to be a positive indicator of the financial health of the companies.

Figure 12 depicts the sectoral debt to equity trajectory of the steel industry in general.

In general, a company with a high DER is viewed as a higher risk to lenders and investors because it suggests that the company has financed a larger amount of its growth through borrowing.[113] For general purposes, a DER of 1 or below is a strong indicator of a company's ability to raise additional debt. Tata Steel, has consistently maintained a favourable debt to equity ratio, even though it has been on an increasing trend over the years observed. Debt to equity ratio SAIL and JSW have consistently been at or more than 1 for all the years during the study period, except for two years.

113 https://www.investopedia.com/ask/answers/063014/what-considered-high-debttoequity-ratio-and-what-does-it-say-about-company.asp

FIGURE 15

Debt to Equity Ratio for the largest players in the Indian Steel Sector

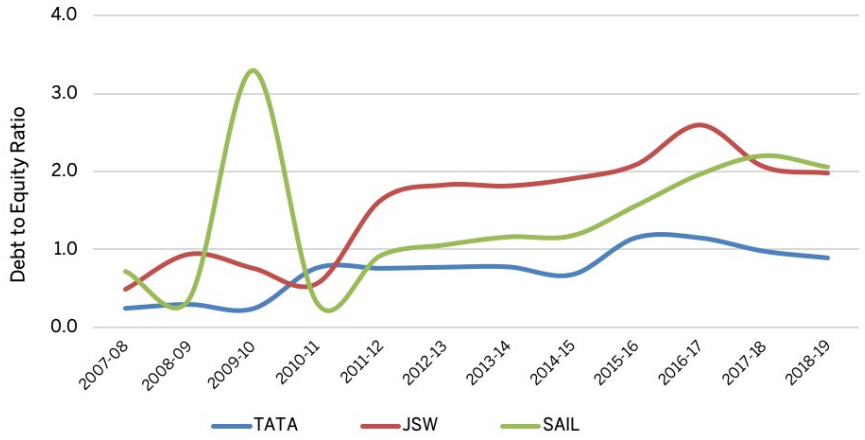
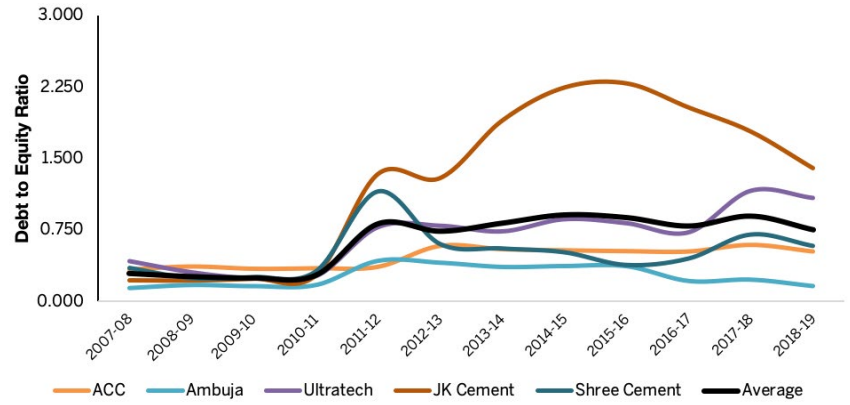


FIGURE 16

Debt to Equity Ratio for Cement



As is evident from the graph, DER of steel sector companies is higher than that of cement. Cement companies considered in this chapter, have a much more balanced DER (with the exception of JK Cements) which depict a lower risk perception. While the borrowing capacity of any company depends on several factors, a low debt to equity ratio, such as that in the cement sector, enhances the borrowing capacity.

Another indictor, the interest coverage ratio is a sign of the ability of the company to cover its debt servicing from its earnings (EBITDA). The higher the ICR, the more favourable the borrowing capacity becomes.

On assessing the interest coverage ratio of both steel and cement companies, as a sign of the ability of the company to cover its debt servicing from its earnings (EBITDA), this ratio is found to be favourable for both sectors (see table below).

TABLE 8

Interest Coverage Ratio of steel and cement companies

Company	Average ICR
Cement companies	
ACC	31.7
Ambuja	57.2
Ultratech	11.4
JK Cement	3.7
Shree Cement	13.3
Steel companies	
TATA	8.8
JSW	4.8
SAIL	13.8
Jindal Stainless Ltd	6.9
Jindal and Power Ltd	6.9

Source: Respective Annual Reports of all companies for the years 2007-2018

The higher the ICR, the more favourable the borrowing capacity becomes. The interest coverage ratio of the steel sector in average has remained around 6.8, signifying good financial health to cover debt servicing. While that for the cement sector is higher than steel at 15. The borrowing capacity of cement therefore is well placed in the industry, especially for the top five companies discussed in this section.

As would logically comply, companies which have high debt to equity ratio will have lower interest coverage ratio and vice versa. Therefore companies like TATA steel and Ambuja cements, which are the front runners in their respective sectors have favourable DER and ICR ratios.

The above analysis is indicative of the ability of large companies in both these sectors to raise debt. However, this ability does not necessarily translate into feasibility of raising finance for green transitions. This is likely to be made more challenging due to the constrained finances due to the pandemic induced global slowdown.

As of date, as a result of existing policies (further discussed in chapter 4), cost effective energy efficiency measures have been undertaken. The next steps are to undertake larger changes at a technological and procedural level. This involves high costs. If long term finance for greening the production process was readily available for green projects, these companies would have greater ease in accessing it. However, according to financing institutes, there is a lack of bankable projects for green transitions. Since such options are limited from both the supply and demand side, in the subsequent sections we explore barriers such as this- the supply of green finance.

Key Takeaway

The Indian steel and cement industries do not have the capacity to finance the required transition to low carbon pathways from their own resources, especially given the current status of available, viable technologies.

The **leading companies from these industries have been facing a consistent decline in profitability over the last few years, which is likely to be made worse due to the impact of the global pandemic**, at least in the short-run. Further, companies are unlikely to gain significant cost reductions by enhancing their energy efficiency, making this factor not strong enough to be the driving force for green transitions. **Despite the energy efficiency measures undertaken in the last few years, the impact is not evident on the profitability of these companies**, with the power and fuel expenses ratio remaining in a more or less consistent range.

This could indicate that either the investments have not been enough and that there is a need for clearer perceived and real benefits for transitioning, which can be facilitated by suitable incentives and policy levers.

While these select companies, covered in this chapter, have the potential to raise external debt, a few caveats need to be kept in mind. **A few of the key larger players in both industries have the capacity to borrow and adequately service their debt, however lenders consider financing green transitions riskier, and give it lower priority**, than other investments (as will be discussed in more detail in chapter 5). In order to overcome this, there is a need for capacity building at both the borrowers and the lenders level. It is necessary that the companies themselves develop a thorough assessment of costs and benefits associated with the green investment, building a business case for this, which could be used by the banks and lenders to develop feasible lending models for green or climate initiatives.

This also indicates the **need to build a more enabling environment overall, which can support such sectors in transitioning to lower carbon pathways**. A key driver for this, from across various perspectives, is the policy framework. The existing policy framework has initiated energy efficiency measures in these industries and certain regulatory controls, which are discussed in the next chapter. However, the extent of transition which is further required necessitates bigger transformational changes, which are cost intensive and beyond the capacity that the companies' own resources permit. Thus, this requires additional support measures and addressing gaps from the policy, capacity and finance side. These are further detailed in the next sections.

CHAPTER FOUR

Gaps in the Policy and Regulatory Framework, as a Driver for Low-Carbon Transition

India started to address the climate change issues through its comprehensive National Action Plan for Climate Change (NAPCC), which was launched in 2008. Since then, the climate perspective has been included in several industry specific and sector specific policies, as well as regulatory measures, at different levels. In many cases, this is at a rudimentary level at present and there are gaps in the regulatory and policy framework which are creating barriers for effective transition to green. In this chapter, we will be identifying a few of these in some key areas.

The NAPCC has been further developed with eight specific National Missions, addressing various specific climate issues, from an adaptation as well as mitigation perspective. The eight missions developed are, 1. National Solar Missions, 2. National Mission for Enhanced Energy Efficiency, 3. National Mission on Sustainable Habitat, 4. National Water Mission, 5. National Mission for Sustaining the Himalayan Ecosystem, 6. National Mission for a Green India, 7. National Mission for Sustainable Agriculture, 8. National Mission on Strategic Knowledge for Climate Change.

Further, State Action Climate Plans on Climate Change (SAPCC), have been developed by all states and Union Territories of India, which are consistent with objectives and strategy of the NAPCC . With regional vulnerability specificity, these plans aim to cover the exact sectoral implications, and help in framing actionable strategies to the states.

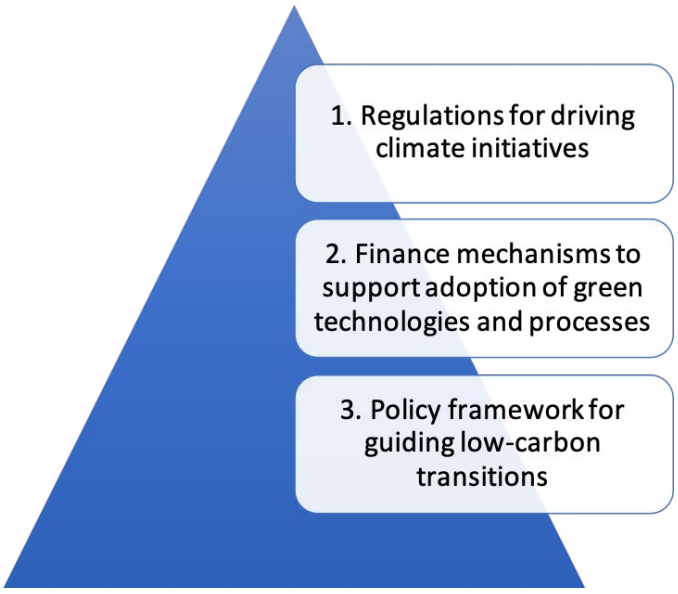
India has committed to the global fight against climate change and after the Paris Agreement, it submitted climate targets, to be achieved by 2030. Broadly, as mentioned earlier in the report, India has made three commitments. Firstly, the aim is to reduce 33-35% of greenhouse gas emissions intensity of GDP, below 2005 levels, secondly, the target is to shift 40% of India's power generation capacity to be based on non-fossil full sources, and finally to create an additional carbon sink of 2.5 to 3 billion tonnes of CO2 equivalent through additional forest and tree cover. Since then, India has consistently reiterated its commitment to addressing climate change on various international forums and has been adding ambitious plans and initiatives to its NDCs. For instance, during the United Nations Climate Action Summit 2019, India made the commitment of increasing the renewable energy capacity to 450 GW.

India has also launched two global coalitions to achieve climate objectives, the International Solar Alliance in 2015 and Coalition for Disaster Resilient Infrastructure in 2019. These go to emphasise India's long-term commitment to addressing climate change.

In the context of this report, we considered the key relevant policies and regulations for the steel and cement industries under three broad categories, to understand the existing drivers of green initiatives and also the supporting measures available for these industries to enable their green transition.

FIGURE 17

Requirements for enabling green transitions



4.1

What regulations exist for addressing environment protection and climate change issues?

Over the last few decades, India has developed an extensive environmental management system that implements and enforces environmental policy objectives, focusing mainly on pollution. This is done through a comprehensive set of environmental laws, regulatory instruments, statutory mandates, and institutional frameworks, which broadly come under the Environmental Protection Act. Specific environmental standards and requirements are also set, based on the current scenario of the industry under consideration, and its assessed impact on the environment.[114]

From the climate perspective, a group of regulations that is central for the steel and cement industries are energy conservation and efficiency measures, as these are amongst the most energy- intensive sectors in the country. Accounting for 15.05% of industrial energy use, the iron and steel sector is the largest energy consuming industrial sector in India.[115] Energy use at the plant level in the Indian steel industry is significantly higher than the global average.[116] Cement is the third largest industrial energy consumer in the world, and second largest CO2 emitting industry, following the energy sector.[117]

114 ASCI and UNDP India. 2009. Analysis of Existing Environmental Instruments in India.

115 Energy Statistics 2019. Central Statistics Office, Ministry of Statistics and Programme Implementation. Government of India. http://www.mospi.gov.in/sites/default/files/publication_reports/Energy%20Statistics%202019-finall.pdf

116 Samajdar, C. 2012. Reduction in Specific Energy Consumption in Steel Industry - with special reference to Indian steel industry. Energy and Environmental Engineering Journal.

117 IEA. Cement technology roadmap plots path to cutting CO2 emissions 24% by 2050. April, 2018. https://www.iea.org/news/cement-technology-roadmap-plots-path-to-cutting-co2-emissions-24-by-2050

Emissions from the burning of fossil fuels account for about 40% of emissions from cement.

Thus, the steel and cement industries are under the purview of a range of rules and regulations aiming at reduction of environmental pollution, water consumption, energy consumption, as well as solid waste & hazardous waste management, adoption of clean technologies etc.

4.1.1 Environmental Protection Act

KEY AUTHORITY

Ministry of Environment, Forests and Climate Change (MOEFCC)

The Environmental Protection Act, 1986 (EPA), under MoEFCC, has been developed as an umbrella legislation under the purview of the central government. Through this national ambient and emissions standards are set, the establishment of new industrial units are regulated from the environment perspective, processes for management of hazardous substances are mandated, research related to pollution issues is conducted, and collection and dissemination of information is done.[118] The management instruments, formulated under EPA, which broadly oversee steel and cement industries, are as follows:

1. Environmental Impact Assessment (EIA)

The EIA process was developed as a tool in 1994, used to identify and estimate the environmental, social and economic impacts, prior to the commencement of the proposed project or development. Its aim is to understand and predict the impact a project may have on the environment, and hence shape the project to suit the environment.[119] The EIA cycle comprises of four cycles- Screening, Scoping, Public Hearing, and Appraisal and seeks to regulate aspects such as the land use, water usage and pollution, waste generation, air pollution and emissions. It also checks if the projects are meeting requirements of other relevant legislations, such as Forest Act, Wildlife Protection Act, Fisheries Act, etc. This significantly impacts the development of new projects, and expansion of old ones in the cement and steel industries, which are amongst the high emitters and polluters.

118 Environmental Compliance and Enforcement in India: Rapid Assessment. 2006. OECD. http://www.oecd.org/dataoecd/39/27/37838061.pdf

119 https://www.cseindia.org/understanding-eia-383

2. Environment Clearance

As per the 2006 Amendment to the EIA Notification, the development of a new project or expansion of any existing project, needs Environmental Clearance. The amendments sought to structure the clearance process, which varies across a range of sectors. The four cycles under the EIA tool form the basis of the environmental clearance process. Decentralisation of environmental clearance for projects was issued, under the 2006 EIA Amendment, categorising the projects into Category A, National Level Appraisal, done by Impact Assessment Agency (IAA) and the Expert Appraisal Committee (EAC) and Category B, State Level Appraisal, carried out by State Level Environment Impact Assessment Authority (SEIAA) and State Level Expert Appraisal Committee (SEAC).[120] Category A projects need environmental clearance and hence do not undergo a screening process. The Category B project undergo screening to be further divided into Category B1 (mandatorily need EIA) and Category B2 (do not require EIA).[121]

In 2018, Standardisation of Environmental Clearance Conditions was issued for 25 industrial sectors, of which steel and cement industries were included. These conditions cover statutory compliance measures in form of requiring forestry, wildlife clearance, air, water and noise pollution monitoring and prevention, energy conservation measures, waste management, and provisions under Corporate Environment Responsibility.[122]

BOX

Forest (Conservation) Act, 1980

This act was constituted by MoEFCC, to help conserve forests by controlling deforestation and to restrict indiscriminate diversion of forest land to non-forest purposes. Under this act, gov-ernment's prior approval is required before reserved forest is declared as de-reserved or di-verted for non-forest purposes. Diversion of forest lands is completed by compensatory foresta-tion and other suitable conditions are also imposed where non-forest lands are not available. Diversion of forest area for any steel or cement unit has to be complemented by afforestation.

120 http://moef.gov.in/wp-content/uploads/2018/04/so1533_2.pdf
121 http://moef.gov.in/wp-content/uploads/2018/07/SO1533E-14092006_0.pdf
122 http://environmentclearance.nic.in/View.aspx?rid=30

3. Environment Statement

MoEFCC has made it mandatory to all industries which require authorisation under this act to submit an Environment Statement (ES), for each financial year to the concerned State Pollution Control Board (SPCB). ES can be understood in terms of the last step of EIA. As per the, International Chamber of Commerce, ES can be defined as a management tool that's comprises of an evaluation of management of an industry with respect to safeguarding the environment. The ES mostly contains a description of the environment and description of the proposed project in detail, and explaining the expected environmental impacts. Further it is expected to identify and analyse alternatives, mitigation action/mitigation management plans, environmental management plans, and develop monitoring program/ plans.[123]

Another key focus of the EPA, especially regarding industries such as steel and cement, is on the aspect of waste management. These industries have the potential to produce large quantities of hazardous waste, and the situation is likely to become even more critical as the production increases in response to the growing demand for the materials.

4. Hazardous & Other Waste (Management and Handling and Transboundary Movement) Rules (2016) (Amended 2019)

Under the EPA, Hazardous Waste (Management and Handling) Rules, 1989, were formed. They were further amended in 2008, as the Hazardous Waste (Management, Handling and Transboundary Movement) Rules. The rules have been further amended in 2016, and further in 2019 to form the Hazardous & Other Waste (Management and Handling and Transboundary Movement) Rules (2016) (Amended 2019).[124]

123 Kalita, J. D. January, 2016. Environmental Impact Assessment in India (EIA): An Appraisal. Dimorian Review, Vol.3, Issue 1. https://www.researchgate.net/publication/311351409_ENVIRONMENTAL_IMPACT_ASSESSMENT_IN_INDIA_EIA_AN_APPRAISAL

124 https://www.npcindia.gov.in/NPC/Files/delhiOFC/EM/Hazardous-waste-management-rules-2016.pdf

As per these rules, hazardous waste can be defined as "any substance, excluding domestic and radioactive wastes, which because of its quantity and/or corrosive, reactive, ignitable, toxic and infectious characteristics causes significant hazards to human health or environment when improperly treated, stored, transported and disposed."[125] These rules helped make the distinction between hazardous waste and other waste, to allow proper disposal of waste, as well as promote reuse and recycle wherever possible. Further, they lay out a guide for hazardous wastes from generation to disposal. The production of steel and cement are both classified as processes generating hazardous wastes.[126]

Cement industry has also been understood to be best suited for utilisation of hazardous waste. Co-processing using hazardous waste in cement industries has been encouraged, under right environmentally safe manner. Similarly, waste recycling/reuse opportunities have been seen to be possible in the steel industry.

4.1.2 Pollution Laws

KEY AUTHORITY

MOEFCC, Centre Pollution Control Board (CPCB), States Pollution Control Boards (SPCBs)

The industrial units are categorised into four categories (Red, Orange, Green, and White), based on their pollution load and potential or pollution index, where the Red category units have maximum pollution potential, and the Green units have the least pollution potential.[127] The pollution index is formed as a function of the emissions (air pollutants), effluents (water pollutants), hazardous wastes generated and consumption of resources. Both steel and cement industry fall under the red category.

This categorisation of industries, on the basis of pollution index, forms the basis of rules under which these industries are formed and operated on. The two major pollution legislations, that apply to cement and steel industries, are Water Pollution Act and Air Pollution Act. Both these acts come under the purview of MoEFCC, with mandates shared between the Central Pollution Control Board (CPCB) and the SPCBs as well.

125 http://iwma.in/HWM%20Rules.pdf
126 http://iwma.in/HWM%20Rules.pdf
127 https://pib.gov.in/newsite/printrelease.aspx?relid=137373

- **Water (Prevention and Control of Pollution) Act, 1974, amended in 1988:** The Water Act aims to prevent and control the pollution of water. It outlines the powers and duties of regulatory bodies, constituted under this act, in ensuring preservation and control of water pollution. It gives regulatory authority to SPCBs to establish and enforce effluent standards for facilities/industries discharging pollutants into water bodies.[128] Under this act every cement and steel plant has to secure Consent to Establish (CTE) and Consent to Operate (CTO) from the required SPCB. Under section 25 and 26 of the Act, industries have to secure these CTE and CTO at commissioning stage as well as during subsequent years production for its plant and mine operations. The consent is granted for a specific period only and has to be renewed before its lapse by showing compliance under the Act.[129]
- **Air (Prevention and Control of Pollution) Act, 1981, amended in 1987:** The Air Act, provides for the prevention, control and abatement of air pollution. Regulatory bodies constituted under this act, provide prevention, control and abatement of air pollution. States also prescribe emission standards for stationary and mobile sources.[130] Complimentary to the Water Act, under this act also, CTE and CTO, is required by every steel and cement plant, from the respective SPCB. Under section 21 of the Act, every industry under these sectors require CTE and CTO at the commissioning stage and during succeeding years of production, for plant and quarry operations.[131]

128 http://www.oecd.org/environment/outreach/37838061.pdf

129 https://www.worldcement.com/asia-pacific-rim/09102013/environmental_regulations_in_indian_cement_industry2_274/

130 http://www.oecd.org/environment/outreach/37838061.pdf

131 https://www.worldcement.com/asia-pacific-rim/09102013/environmental_regulations_in_indian_cement_industry2_274/

4.1.3 Energy Conservation Act, 2001

The Energy Conservation Act, under the Ministry of Power (MoP), has been developed as the legal framework which lays out rules for energy conservation in the country. This act provides the basis for energy conservation in the country through regulatory mechanism, institutional arrangement, and a legal framework.

KEY AUTHORITY

Ministry of Power (MoP), Central Government, State Government, Bureau of Energy Efficiency

The Bureau of Energy Efficiency (BEE) was created under the provisions of this act. National Mission for Enhanced Energy Efficiency (NMEEE) is one of the key missions under National Action Plan for Climate Change (NAPCC), which aims at promoting a marketer energy efficiency though policies and market based instruments. These initiatives are aimed to facilitate the shift of energy intensive industries towards efficiency standards, by reducing energy footprints and catalysing efficient energy investments.[132] The Ministry of Power (MoP), through the BEE, is the authority of the NMEEE.

The act has been developed, specifically for industries like steel and cement, as a command and control regulation framework. The Act specifies a precise compliance method rather than an absolute emissions level.[133] Important features of this Act and the NMEEE, that apply to steel and cement industries, include the following:[134]

- Energy Conservation Building Code (ECBC)
- Standards and Labelling (S&L)
- Demand Side Management (DSM)
- Designated Consumers for the Perform Achieve and Trade scheme (PAT)
- Certified energy audits

132 https://beeindia.gov.in/content/nmeee-1

133 D. M. Driesen. (1998). Is emissions trading an economic incentive program?: Replacing the command and con-trol/economic incentive dichotomy. Wash. Lee Law Rev. [Online]. 55(2). pp. 289-350. Available: http://scholarlycommons.law.wlu.edu/wlulr/vol55/iss2/2

134 The Energy Conservation Act, 2001. Ministry of Law, Justice and Company Affairs. The Gazette of India. Government of India. https://powermin.nic.in/sites/default/files/uploads/ecact2001.pdf

Steel and cement industries have been classified as designated consumers (energy intensive industries), which have been prescribed energy consumption norms and standards and are to participate under the PAT scheme.[135]

Perform, Achieve and Trade (PAT) Scheme

The PAT scheme has been developed as a Market-based Instrument under the NMEEE,[136] for creating a market for energy efficiency. The Energy Conservation Act, 2001 was a precursor to the PAT scheme and acts the genesis to the mechanism thus formulated. The provisions of energy efficiency improvement targets under this act reflect the economic/market dimension of the PAT scheme. This Act recognised Designated Consumers, and highlighted their legal obligations on achieving energy efficiency. Building on this, the PAT scheme was developed as a market based mechanism, providing incentives to overachieve the energy targets set for the DC companies.[137]

PAT is a regulatory instrument that focuses on reducing Specific Energy Consumption (SEC) in energy- intensive industries. Iron and steel and the cement industries have been included in the first three PAT cycles and are amongst the out-performers and main contributors to the energy savings achieved under the scheme.

The first PAT Cycle (PAT Cycle-I) was from 2012 to 2015. Under this, 478 industrial units from eight industries were notified as Designated Consumers (DCs), and these included both the steel and cement industries. These DCs were assessed at the industry level and given SEC targets. The below Table provides a snapshot of the targets and achievement.

135 The Energy Conservation Act, 2001. Ministry of Law, Justice and Company Affairs. The Gazette of India. Government of India. https://powermin.nic.in/sites/default/files/uploads/ecact2001.pdf

136 Potdar, A., Unnikrishnan, S., & Singh, A. 2016. Study of Energy Regulations in India. International Journal of Envi-ronmental Science and Development, Vol. 7, No. 11.

137 Shakti Sustainable Energy Foundation & PwC. November, 2014. "The PAT Scheme: Analysis, Insights and Way For-ward". (Report). (https://shaktifoundation.in/wp-content/uploads/2014/02/The-PAT-scheme-Analysis-Insights-and-Way-Forward1.pdf)

TABLE 9

Key Numbers from PAT Cycle I (Steel and Cement industries)

PAT Cycle I (2012-13 to 2014–15)	No. of Designated Consumers	Annual Energy Consumption (in mtoe)	Energy Reduction Target (in mtoe)	Achievement (saving in mtoe)
Iron and Steel industry	67	25.32	1.486	2.1
Cement industry	85	15.01w	0.815	1.48

The DCs under the Steel Sector PAT Cycle I, saw energy savings which were around 41% higher than the targets set. For cement sector the achieved saving was found to around 81.6% higher than the saving targets for the notified DCs. The price of an energy saving certificate (ESCert) for PAT Cycle I, was in the range of INR 200 (less than USD 3) to INR 1200 (less than USD 17), with supply being significantly higher than the demand for the certificates.

> *Almost all industry practitioners interviewed by TERI found the price of the ESCerts arrived at for the PAT cycle I, to be too low and ineffectual in incentivizing the steel and cement industries to undertake activities more than the minimum mandatory requirements. Some also remarked that it would be significantly more economical to buy the ESCerts to make up for not achieving the energy saving targets, instead of investing in the green technologies and processes. However, it was understood that the first cycle was more of a pilot and going forward, with the targets being more stringent in each subsequent PAT cycle, the price of ESCerts too is likely to increase.*

For PAT Cycle II (2016-17 to 2018-19), the aim was to broaden the scope by including new sectors and increasing the identified DCs from the existing sectors. In this cycle, 71 DCs were identified from the iron and steel industry, comprising of 72% of total energy consumption of the steel industry.[138] As for the cement industry, 26 additional DCs were included, to take the total to 111.

138 (https://steel.gov.in/energy-environment-management-steel-sector)

In PAT Cycle III (2017-18 to 2019-20) too, the iron and steel and cement industries have been included, with the aim to achieve overall energy consumption reduction of 1.06 MTOE from 116 DCs from six sectors.[139]

4.1.4 Electricity Act 2003

KEY AUTHORITY

Ministry of Power (MoP), State Elec-tricity Regulatory Commission (SERC), Central Electricity Authority (CEA)

The Electricity Act, 2003, has been developed to consolidate issues and laws relating to generation, distribution, transmission and trading of power. The generation of power (except nuclear and certain sized hydro-power projects), has been delicensed, and captive generation[140] is freely permitted, under this Act. Further, suppliers and distributors are required to generate 10% of power supplied to the consumers, through renewable and non-conventional sources of energy. Also, Power Trading has also been recognised by this Act, which is critical to enable a market mechanism for RE. This is being overseen by Regulatory Commissions, which issue licenses and fix ceilings on trading margins.[141] The Central Electricity Authority (CEA), Central Electricity Regulatory Body (CERC), and State Electricity Regulatory Commission (SERC), are the major regulatory bodies.

Renewable Purchase Obligation is a mechanism developed under this Act, in co-ordination with National Tariff Policy 2006, where obligated entities are required to purchase certain percentage of electricity, of their total consumption, from renewable energy sources, or buy **Renewable Energy Certificates (REC)**.[142] RECs have been developed as market tradable certificates issued as a substitute to RPO, traded on the Indian Energy exchange (IEX), and Power Exchange of India (PXIL). Electricity distribution companies, and large power consumers, like steel and cement industries, have been mostly recognised as obligated entities. The entities under RPO, are expected to procure 10.5% of their total electricity from solar sources, and another 10.5% of their power from other non-solar

139 https://beeindia.gov.in/content/pat-read-more

140 Captive generation is an electricity generation facility generally used by power-intensive industries like steel plants, for their own energy consumption. Captive power generation reduces the dependability on the grid.

141 https://powermin.nic.in/sites/default/files/uploads/The%20Electricity%20Act_2003.pdf

142 https://rpo.gov.in/Home/Objective

renewable sources, making the RPO target set by MoP to 21% by 2022.[143]

The RPO policy measure has been effective in increasing the uptake of solar power, and has even encouraged the setting up of wind and solar power plants by many large companies. Some of the steel and cement companies interacted with for this report, have informed TERI that the RPO scheme was a driving factor for increasing the share of power generation through wind or solar by these companies. Such a transition from coal may not have happened otherwise. Further, the policy mandates increasing targets every cycle, which ensures that companies increase their capacity to buy more power or compensate by purchasing REC. As of August 2019, about 4,400 MW of wind and solar plants are under REC mechanism.[144] However, despite the push, the necessary grid infrastructure does not permit companies to fully rely on RE power. This limits the uptake only to the necessary and minimal mandates and obligations.

> *A cement company practitioner interviewed by TERI highlighted the need to bring certain changes in the non-solar RPO obligations. Current policy does not incentivise the co-generation of power from waste heat, something that could be attained via waste heat recovery (WHR) plants. Setting up a WHR plant could cost more than double, on average, of what it would cost to set up a wind or solar power plant. However unlike solar or wind power, it is not possible to use WHR to meet compliance requirements. A policy initiative to consider WHR under the RPO could significantly scale up these capacities. This is motivated for two purposes. First, WHR plants are capital intensive and a long-term investment which can help in significantly reducing GHG emissions and increasing energy efficiency. Second, the CDM had made installation of WHR systems financially viable, however, that is no longer the case. Setting up of WHR can be made financially viable again if it is regulated by policy when WHR can be included to meet compliance for non-RPO requirements.*

143 https://government.economictimes.indiatimes.com/news/policy/the-rpo-conundrum-a-myopic-policy-wreaks-havoc-on-indias-energy-intensive-sectors/70696603

144 https://government.economictimes.indiatimes.com/news/policy/the-rpo-conundrum-a-myopic-policy-wreaks-havoc-on-indias-energy-intensive-sectors/70696603

4.2

What policy support measures are available for mobilising climate finance?

Steel and cement are capital intensive industries, with the technologies required for green transition in many cases being costly to implement versus the incumbent technologies. The cost of financing expansion or new development, especially from a green perspective is usually expected through borrowed capital. The cost of finance in India is high compared to other economies like China, Japan and Korea, as well as the western developed economies.[145] Thus, there is a need for policy instruments to be developed to impact the financial or investment landscape in these industries. These policy instruments can also be developed to directly influence the flow of finance towards climate friendly technologies, and help make sectors like cement and steel less carbon intensive. An overview of some mechanisms which are available and on which India is already focusing, though not in particular for the steel and cement industries, are given below.[146]

145 https://www.pwc.in/assets/pdfs/consulting/technology/the-indian-steel-industry-growth-challenges-and-digital-disruption.pdf

146 Climate Finance Policy in Practice (2019). Center for International Environment and Resource Policy and The Fletcher School, Tufts University.

4.2.1 Targeted Lending

This policy instrument is developed to promote access to finance among select stakeholders and specific sectors, on the basis of their special developmental needs, in the form of Priority Sector Lending. These sectors face the problem of lack of access to adequate finance, high risk, information asymmetries, or long gestation periods, resulting in under-supply of credit.[147] Sectors like agriculture, micro-enterprises, renewable energy, are among those which form the priority lending sectors in India. However, the steel and cement industries do not have advantage in form of priority lending, largely due to their overall heavy industry status which has historically enjoyed relatively better access to finance. It is important to understand the special needs of the green initiatives of these industries, and have a special categorisation for such projects, giving them preferential treatment for targeted lending.

4.2.2 Green Bonds

Green Bonds are developed with the aim to reduce cost of capital for green initiatives, by promoting access to finance and providing long-term finance. With a focus to finance climate change mitigation and adaptation, green bonds are earmarked for projects with environmental benefits.[148] The first Indian green bond to be issued was in 2015 and over two dozen other green bonds have been issued through September 2019.[149] However, to date most Indian green bonds have focused on renewable/ green energy projects, and only a few for green infrastructure like housing and transport. A lack of sector diversification has been observed as a lag in the development of green bonds. Government regulation is under-developed for such bonds, and are mostly at status quo with the international standards.

147 Vittas, Dimitri, and Yoon Je Cho.1996. "Credit Policies: Lessons from Japan and Korea." The World Bank Research Observer 11 (2): 277–98.

148 Meng, Alan Xiangrui, Ivy Lau, and Bridget Boulle. 2018. "China Green Bond Market 2017." Cliamte Bonds Initiative and China Central Depository and Clearing Company. https://www.climatebonds.net/files/reports/china_annual_report_2017_en_final_14_02_2018.pdf.

149 TERI Research

The specific context and needs of Indian companies looking to transition to green have not been fully considered in the national green bond guidelines, which results in the steel and cement industries largely falling out of their purview.[150]

4.2.3 Tax Incentives

Tax credits or incentives are leveraged in some countries as a fiscal policy tool to compensate investors/consumers for production/use of green technologies. These can be in the form of tax holiday periods or reduced tax rates. In India, tax incentives are there for certain activities, such as research and development for eligible manufacturers and industries, for spurring manufacturing under the Make in India scheme, and for infrastructure development. The current system also provides investment-based tax incentives to promote capital expenditure in certain sectors and region-based tax incentives for promoting investments in specific marginalised states. However, while the government has been exploring tax cuts for the steel and cement industries, there isn't an applicable tax incentive for encouraging these industries to invest in or deploy green technologies.

4.2.4 National Development Bank (NDBs)

NDBs are government-backed, sponsored, or supported financial institutions developed with a public policy mandate.[151] NDBs have been seen to be important policy coordinators for finance mobilisation in the context of green projects deployment.[152] In the past in India, the Industrial Development Bank of India (IDBI), was also developed to provide financial facilities and credit for development of the Indian industries, and the Industrial Finance Corporation of India (IFCI), Unit Trust of India (UTI) and Small Industries Development Bank of India (SIDBI) have been developed as its subsidiaries.

150 TERI (2018). Unlocking the Green Bond Potential in India." Available at: https://www.teriin.org/projects/nfa/files/Green-Bond-Working-Paper.pdf.

151 Smallridge, Diana, and Fernando de Olloqui. 2011. "A Health Diagnostic Tool for Public Development Banks." Tech-nical Notes IDB-TN-225. Inter-American Development Bank. https://publications.iadb.org/en/health-diagnostic-tool-public-development-banks.

152 Zhang, Fang. 2019. "How Do Governments Mobilize Finance for Innovation: The Case of Domestic Clean Energy." PhD, Tufts University.

The IDBI is the apex institution of development banking for industries in India. Further, State Financial Corporations were developed as the state-level NDBs for the development of small and medium scale industries in Indian states. Their aim is to bring about balanced regional development by encouraging wider dispersal of industries, as well as promoting greater investment and generating larger employment opportunities. While these institutes, to different extents, have started developing focused green finance products and portfolios, this at present is at a relatively minimal level and through a prima-facie research, haven't been found to support the hard to abate industries with their transition to green.

BOX

Foreign Direct Investments for the Steel and Cement Industries

In India, 100% FDI through the automatic route is allowed for both steel and cement indus-tries as another form of financial incentive for these industries. Steel industry, and associ-ated mining and metallurgy sectors, as well as the cement sector have seen an increasing investment and development in the recent past. The Indian metallurgical industries attract-ed FDI of USD 11.45 billion in the period April 2000–December 2019, according to Depart-ment for Promotion of Industry and Internal Trade (DPIIT). It was also found that cement and gypsum products attracted FDI worth USD 5.28 billion between April 2000 and Decem-ber 2019, according to DPIIT. While this has the potential to promote green transition of the domestic actors, it isn't clear if this is indeed taking place and to what extent.

Source: IBEF industry profiles

4.2.5 National Climate Funds

These have been developed by various governments across the world as funding vehicles designed to mobilise, access, and channel climate finance. In India too, climate change funds have been developed to focus on specific climate issues, at the national, state or sectoral levels.

The most substantial of these funds is the National Clean Energy and Environment Fund (NCEEF), which was developed in FY 2010-11 with the aim to finance research and promote clean energy technologies and environment initiatives through a range of projects. The coal cess levied on domestic and imported coal, was used to finance NCEEF. While the fund could be a source to support and finance the green transition of the steel and cement industries in their transition, based on its objective, however, it was not found to have done so in the past.[153] Further, at present, this fund has been diverted for compensating the States on the losses they bear due to India's new Goods and Services Tax system.

153 Department of Environment note. Last accessed on May 8th 2020 at : https://doe.gov.in/sites/default/files/NCEF%20Brief_post_BE_2017-18.pdf

4.3

What key industry specific policies are there to drive low-carbon transitions?

4.3.1 Companies Act, 2013 (Corporate Social Responsibility)

KEY AUTHORITY

Ministry of Corporate Af-fairs; Central Public Enter-prises (CPSEs)

The Ministry of Corporate Affairs, formulated the Companies Act to regulate incorporation of a company, and oversee the responsibilities of a company, directors, as well as dissolution of a company.[154] Under the Companies Act, 2013, every company with a net worth of INR 500 crore or more, or with a turnover of INR 1000 crore or more, or having made a net profit of INR 5 crore or more during any financial year shall constitute a Corporate Social Responsibility Committee of the Board. In common parlance, Corporate Social Responsibility and Corporate Environmental Responsibility mean the same thing and thus, companies are obliged to conform to certain environmental standards.[155] These mandatory requirements can be built on by industries to undertake climate initiatives, besides other types of social causes.

Disclosure policies: Also, many disclosure measures have been made mandatory, which help in assessing compliance regulations such as those for waste generation, energy usage, environmental impacts, etc.

154 http://www.mca.gov.in/MinistryV2/companiesact2013.html
155 http://www.ficci.in/spdocument/20782/ficci-steel-report.pdf

Corporate periodical disclosure of information through annual reports to stakeholders is important to oversee efficient allocation of limited resources as well as to governments to oversee the regulatory aspects. Policy-makers and regulators aim to develop sustainability sided-disclosure to induce the industrial and corporate sector to manage the environmental externalities of their business operations. The Companies Act, 2013 and amended Clause 49 SEBI (Listing Obligations and Disclosure Requirements) Regulations 2015 have been developed to encourage more voluntary disclosure standards.

BOX

Corporate Environment Responsibility

In 2003, MoEFCC instated the Charter on Corporate Responsibility for Environment Protec-tion (CREP), which was formulated to regulate 17 most polluting sectors in India, of which Cement and Integrated Iron and Steel Industry were a part. The Central Pollution Control Board in association with Ministry of Steel (MoS), and MoEFCC set up a National Task Force to monitor the industries' compliance of regulatory norms. As per CREP norms, 100% utili-sation of solid wastes generated from the steel production process is mandatory (FICCI, 2015).

4.3.2 Steel Sector Policies

The Indian steel industry has a special place in the Indian economy and its developmental goals and this is reflected in the fact that it is one of the few industries having its own focused ministry, the Ministry of Steel (MoS). The objective of the MoS is to enhance India's steel industry, by coordinating and planning its growth through various policy and support measures. Another key body for the industry is the Joint Plant Committee (JPC), which was constituted in 1964, to set guidelines for production, allocation, pricing and distribution of iron and steel products in the country.

After the de-regulation of the iron and steel industry in 1992, the role of JPC shifted to become a facilitator for the steel industry and a data and knowledge bank on iron and steel sector.[156] The most significant policy development in the industry has been through the launch of the National Steel Policy in 2017, with key objective looking to ramp up steel production and also enhance its domestic consumption for developmental purposes.

National Steel Policy (2017)

The policy aims to ensure that the Indian steel industry is prepared to facilitate the growing infrastructure demand, achieve this in a sustainable manner and create a self-sufficient steel industry that is technologically advanced and globally competitive.[157] The main objectives of this policy are that by 2030-31: (a) build globally competitive industry with a crude steel capacity of 300 MT; (b) increase per capita steel consumption to 160 Kgs; (c) domestically meet entire demand of high grade automotive steel, electrical steel, special steels and alloys for strategic applications; and (d) encourage industry to be a world leader on energy and raw material efficient steel production, in a safe and sustainable manner.

BOX

Relevance to Climate Change objectives

- Aims to make steel production energy and raw material efficient by 2030-31.
- Necessary policy environment will also be provided to promote gas based steel plants, elec-tric/ induction furnaces and other technologies which will bring down usage of coking coal in blast furnaces.
- Steel is a water intensive industry, thus the aim is to recycle treated waste water and re-duce specific water consumption per tonne of steel produced
- Mechanism of Special Purpose Vehicles (SPVs) for Greenfield capacity additions

156 http://jpcindiansteel.nic.in/writereaddata/files/JPC%20PROFILE%202018_1.pdf

157 https://www.investindia.gov.in/team-india-blogs/indias-road-towards-being-economic-powerhouse-paved-steel; https://steel.gov.in/sites/default/files/draft-national-steel-policy-2017.pdf;

- To reduce carbon footprint
- Energy efficient steel production in an environmentally friendly manner
- Waste management plan- impetus for zero waste or complete waste recycling
- Formulation and adoption of standards at par with global best practices with regard to par-ticulate matter emissions, SOx, NOx, water consumption and zero or near zero liquid dis-charge.

India aims to be a net exporter of steel by FY 2025-26, and develop and implement quality standards for domestic steel products. To facilitate this 100% FDI is allowed in the steel sector through the automatic route. Further, to promote domestic manufacturing, the government has hiked export duty on iron ore to 30%. Also, the Nation Steel Policy states that preference would be given to domestically manufactured iron and steel products in government procurement.

The broad policy framework under the National Steel Policy, encompasses some key prioritised initiatives for the industry, through policy and institutional measures, which include:[158]

- **Set-up value addition focused steel clusters:** Indian steel industry has a competitive advantage at the global because of availability of high grade iron ore, robust domestic demand and existence of availability labor force. However, the goals set for the steel industry require further development in form of raw material linkage, suitable logistics connectivity and lower project risk. Therefore, a mechanism to facilitate capacity increase is required to be developed. To supplement this aim, a draft **Framework Policy on Steel Clusters** is being developed. The main aim of this is to "create a model ecosystem for steel manufacturing through world class steel clusters to promote self-sufficiency, drive cost competitiveness and generate employment opportunities."[159]

158 https://pib.gov.in/newsite/PrintRelease.aspx?relid=196065
159 https://steel.gov.in/sites/default/files/Draft%20Policy%20for%20Steel%20Cluster_vf15.pdf

This policy targets to provide growth of steel sector, especially SMEs, help drive investments and help job creation by helping resolve the challenges that exist for the ancillary, downstream and value-added steel units. A creation of two archetypes of clusters, the Ancillary and Downstream cluster and Value-Added Steel Cluster, will allow development, based on 'plug-and-play' model, where cost competitiveness is improved through strategic interventions. This policy aims to (a) facilitate import substitution, by promoting domestic manufacturing through initiatives like Make in India; (b) generate employment across value chains and hence contributing to GDP growth; and (c) aid the growth of steel players in the SME sector by improving their cost competitiveness and quality of their finished products.[160]

- **Increase raw material production:** From a sustainability and a circular economy perspective, steel material can be developed to be reused and recycled. Re-used steel, in the form of scrap, is a secondary raw material used in the steel industry. A large number of small steel producers use scarp inputs in Electric Arc Furnace/IF (EAF/IF) for production of steel. With the aim to develop the Indian steel industry at a globally competitive rate, by creating 300 MT, with a contribution of 35-40% from EAF/IF route.[161] Thus there is the importance to ensure adequate availability of scarp, to reduce import and improve competitiveness of the India Steel Industry. Hence the **Steel Scrap Recycling Policy, 2019**, has been developed to provide framework to promote and facilitate the establishment of metal scrapping units, for scientific processing and recycling of ferrous scape generated at various sources and through a variety of products. The main aims of this policy is to (a) promote circular economy in steel sector; (b) minimise dependency on imports by producing high quality ferrous scrap for quality steel production; and (c) ensure proper and scientific handling, processing and disposal of all types of recyclable scraps, and hence promoting 6Rs principles of Reduce, Reuse, Recycle, Recover, Redesign and Remanufacture.[162]

160 https://steel.gov.in/sites/default/files/Draft%20Policy%20for%20Steel%20Cluster_vf15.pdf
161 https://steel.gov.in/sites/default/files/213770.pdf
162 https://pib.gov.in/newsite/PrintRelease.aspx?relid=194359

- **Improve Trade balance for Steel Industry:** To improve the trade balance in the sector, the government has introduced a licensing system to maintain a statistical database for all steel imports entering the country.[163] The Steel Import Monitoring System has been instituted by the Ministry of Commerce and Industry, to ensure that the government as well as relevant stakeholders have the necessary information about steel imports into the country.

- **Promote Research and Development in the steel industry:** With the aim of making the sector globally competitive, R&D related efforts are being made by national research laboratories as well as a few steel companies, like Tata Steel, SAIL, RINL, JSW, ESSAR and JSPL. The MOS to promote R&D, skill development, and technological research and development, has created the **Steel Research & Technology Mission of India (SRTMI)**. The aim is to develop the steel sector by utilising expertise available in various academic and research institutes of national repute as well as by collaborating with international organisations in the field to meet National Steel Policy objectives through cost effective, environment friendly, state of art technologies for optimum utilisation of natural resources and strengthening design and equipment manufacturing capability in the country.[164] SRTMI aims to support programmes and national steel sector objectives, to make this sector sustainable and globally competitive. One of the main aim under the steel sector roadmap that SRTMI aims to support is to promote "Zero discharge, zero waste and zero harm" by:[165]

1. Achieving CO_2 emission of 2T/ Tcs in existing facilities.
2. Minimising CO_2 emission through CO_2 sequestration and methanisation.
3. Develop ultra low CO_2 steel through non-coking coal based technology.
4. 100% utilisation of waste through existing and new applications.

163 https://steel.gov.in/sites/default/files/FAQ%20list-%20SIMS%20Website_vf.pdf
164 Steel Research and Technology Mission of India-SRTMI.
165 https://www.srtmi.com/uploads/SRTMI.pdf

5. Establish alternative routes of power generation through dry quenching of coke, dry slag granulation, heat recovery from concast slabs, hot charging etc. to minimise external power requirement.

6. Zero discharge through 100% recycling of waste water by effective waste water treatment solutions.

R&D in Iron and Steel sector has been developed to provide financial assistance for the R&D projects identified for funding by MoS. The budget allocated for the R&D scheme in India is around INR 15 crore per year. R&D Project Proposals are invited from reputed Academic Institutions/ Research Laboratories and Indian Steel Companies for pursuing R&D projects for the benefit of the Iron & Steel Sector in the country. Till February 2020, 37 R&D projects have been approved by the Project Approval and Monitoring Committee (PAMC), in which Rs 142.26 crore has been released from Ministry of Steel's budget.[166] Further, the Union Cabinet had approved in 1997-98 to fund upto Rs. 150 crore per year for R&D projects in iron & steel sector, from the interest proceeds of Steel Development Fund (SDF), 1978.[167] Under this scheme, upto March 2019, 91 R&D projects have been approved in which Rs 252.89 crore has been released from SDF.[168]

4.3.3 Cement Sector Policies

From a sustainability perspective, Indian cement industry has shown a progression, because of proactive participation and policy push. To promote Management of Municipal Solid Waste (MSW), under Solid Waste Management (SWM) Rules, 2016, the potential of usage of refuse derived fuels (RDF) in cement industry has been realised. Development of a viable business model for RDF and biomass and its use in the cement sector, however, requires a wider look at the waste management plan.[169]

166 https://steel.gov.in/sites/default/files/R%26D%20Chapter%20for%20MoS%20Website%20Feb%202020%20update.pdf

167 https://pib.gov.in/newsite/PrintRelease.aspx?relid=107948

168 https://steel.gov.in/sites/default/files/R%26D%20Chapter%20for%20MoS%20Website%20July%202019%20updated_0.pdf

169 https://www.worldcement.com/indian-subcontinent/13012020/india-cements-its-future/

Similarly, Waste Heat Recovery System (WHRS) in the cement industry has been seen those great potential but requires a regulatory push to streamline it.

Policy on use of Alternate Fuels and Raw (AFR) materials is a good step towards reducing the consumption of fossil fuel and thereby reducing GHG emissions from the production process. It also serves the purpose of managing the solid waste problem of urban areas of India. The barrier posed here is in the implementation.

First, waste is not segregated at the household and municipality level. This means that the dry waste with high calorific value which could be made available to replace coal in cement and steel plants, comes with high moisture content and thereby lowers the calorific value. Second, even if it the waste is segregated, the dry waste with high calorific value such as plastic waste often goes to informal recyclers.
Though existing policy (PWM Rules 2016) mandates that cement manufacturers must replace at least 5% of total fuel using refuse derived fuel (RFD) from solid waste, the costs increase significantly for cement manufacturers if the waste is unsegregated. As an indicative example, the cost of setting up the plant to treat unsegregated waste and make it fit for use in the manufacturing process would be high with a payback period of about 10 years. However, if plant was set up for segregated waste then costs could be reduced bringing payback period down to 4 years.

Here too, the policy is directed at solving two problems – that of solid waste management and that of reducing emissions by replacing fossil fuel use in the production process. However, challenges at the ground level on implementation of the policy increase the cost of complying to the policy. As in the case of RPO, though the policy holds significant potential, it is unlikely to be scaled up beyond the minimum mandates because of high costs imposed due to poor implementation at the ground level.

4.3.4 Mines and Minerals (Development & Regulation) Act, 2015; Coal Mines (Special Provisions) Act, 2015 – Supply-side Policies

The act forms the basis of mining regulations in India. Iron ore and Limestone, have been specified as a notified mineral, with end use specified by the central government and reserved for integrated steel plants and cement plants. The Act was amended in 2015, to allow allocation of mining licenses through auction,[170] and further in 2016, to allows the transfer of captive mine leases which have not been granted through auction. Through these amendments, a two-stage auction model (with technical bid and financial bid) was introduced for mining and it allowed extension of extension of leases for captive mining as well as transferring all statutory clearances, including environment and forest, of the outgoing leaseholder to new leaseholders, for a period of two years. The resulted in policy certainty, regarding the renewal of leases, which was a challenge for the industries, and is likely to lead to a decrease in imports, especially of minerals like iron ore.[171]

The Coal Mines (Special Provisions) Act (CMSP) provides for the auction and allocation of mines, with the main of this act through auction or allotment coal mines, being to minimise impact on core sectors such as steel, cement and power.[172] The aim of this act is also to attract large investment in coal mining sector, as restrictions of end use for coal has been dropped, with an aim of reducing dependence on coal imports, the fluctuating price have of which have been an area of concern for the operational expenses of steel and cement industries.[173]

170 https://www.mines.gov.in/writereaddata/UploadFile/The_Mines-and-Minerals_Amendment_Act,2015.pdf

171 http://www.swaniti.com/wp-content/uploads/2015/06/Analysis-of-MMDR-Amendment-Act-.pdf

172 http://legislative.gov.in/sites/default/files/A2015-11.pdf

173 https://pib.gov.in/newsite/PrintRelease.aspx?relid=197375

4.3.5 Policies as Demand Drivers

Many policies, acts, rules, and government initiatives that have been developed that directly bolster up the demand for steel and cement. Policies for infrastructure and real estate (Housing for All, *Swachh Bharat, Pradhan Mantri Awaas Yojana*), automotive policies, industrial policy to support Make in India and Urban Rejuvenation Mission, are responsible for increasing the demand for steel and cement. The demand for cement is driven by all interventions aimed at enhancing housing and real estate, building public infrastructure and industrial development, which have been key issues for the Government of India in the past and will continue to be in the coming decade.[174] Similarly, demand for steel is driven by the construction sector, and manufacturing of automobiles, capital goods and consumer durables which are also being boosted through several ongoing government policies.[175] Such policies are likely to keep being formulated and implemented in the coming decades for India's growth and development.

BOX

Government Procurement

Government procurement norms can act as a major demand driver for steel and cement prod-ucts in India, which is currently focusing on its infrastructure development. Introduction of Cen-tral Public Procurement Portal (CPPP), Government e-Marketplace (GeM), preferential market access for micro and small enterprises, preference for domestic manufacturers have been some recent and welcome steps taken in the public procurement domain.

Make in India, has also been some positive developments to encourage and promote manufac-turing and production of goods and services in India. This is complemented by the Policy for Providing Preference to Domestically Manufactured Iron and Steel Products in Government Pro-curement, 2019.

174 Indian Cement Industry Analysis. December, 2019. IBEF.

175 The Indian Steel industry: Growth, challenges and digital disruption. November, 2019. PwC & Indian Steel Associa-tion.

This policy seeks to accomplish Make in India vision with objective of nation building and encourage domestic manufacturing. This policy provides a minimum value addition of 15% in notified steel products which are covered under preferential procurement. However, based on TERI's discussions with industry practitioners, green products from the steel and ce-ment industry are not highlighted or given any form of preference in government procurement in the recent past.

Source: Ministry of Steel; TERI interviews conducted in April 2020.

BOX

Policy Measures Impacting the Import and Export in the Steel Industry

- Steel Scrap Recycling Policy, and National Steel Policy have been developed, aimed at reducing steel imports
- Anti-dumping and safeguard duties on iron and steel items, have also been introduced
- Customs duty on imported flat-rolled stainless steel products has been increased to 15 per cent from 7.5 per cent.
- Customs duty on steel grade dolomite and steel grade limestone is being reduced from 5 per cent to 2.5 per cent
- Levy of 50% export duty on iron ore (lumps and fines) to encourage supply to domestic steel industry

4.4

Issues arising from India's federal system of governance

India has a federal structure of governance, with the legislative powers between the state governments and the central government being divided on the basis of items falling under the Union List (critical industries, mining, commerce and trading among a list of 100 items), the State list (includes water and land issues) and the Concurrent List (includes a range of issues like forest and factories). However, in many cases, especially those related to industries, environment and pollution control, the state bodies authorise their respective central bodies to form uniform regulations and laws.

What this generally translates to, in terms of the cement and steel industries, is that most rules and laws pertaining to these sectors are formulated at the central level – the Ministry of Environment, Forests and Climate Change (MoEFCC), the Central Pollution Control Board (CPCB), and Ministry of Commerce and Industry – but the enforcement of these falls heavily on the state bodies, such as the State Departments of Environment, State Pollution Control Boards (SPCBs), State Forest Authorities and Municipal Corporations. This at times results in an overlapping of authorities and regulatory requirements.

Regulatory risk could be viewed as the risk associated with uncertain shifts in policy, and inconsistent enforcement of policies between federal and state level governments. Constantly shifting policies that affect India's economic and financial framework, especially those in the domain of green initiatives, cause uncertainty and wariness among green investors and the

industries.

One could look at the case of deciding of tariffs for renewable energy producers. Some states have a fixed feed-in-tariff,[176] while other states have implemented a bid auction system. Even such difference in procurement systems proves to be a hurdle in the form of red tape for investors. Furthermore, there has been uncertainty about the enforcement of existing policies. As recently as 2019, there have been cases of state governments considering reopening power purchase agreements in the case of renewable power.[177] Instances such as these deteriorate investor sentiments and hamper the flow of international finance for green initiatives.

This uncertainty around policy at the central and state level, must be resolved through engagement models between both levels of governments. Agreement and consensus, on policy enforcement is imperative to make the overall policy framework effective. This requires a multi-ministry engagement, as well multi-level engagement at the governance levels.

Key Takeaway

India has been consistently moving towards more ambitious climate policies, through including critical climate issues as a part of its sector specific or industry specific policies. Yet, **while there have been a range of climate commitments and action plans announced in the last few years, in many cases these haven't always been translated into a robust policy and regulatory framework, to enable their effective implementation.** An area where this is most evident is regarding the greening of the heavy industries, like steel and cement.

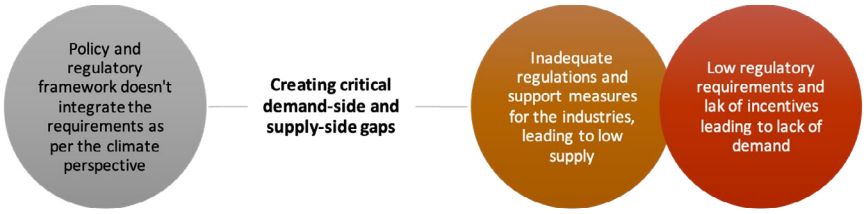
The **lack of coherence, from the climate perspective, in the existing policy and regulatory framework, has resulted in the creation of critical demand-side and supply-side gaps for the hard to abate industries. Further, there are also lack of supportive measures, which translate to finance-side gaps.**

176 i.e. it amounts to a guarantee by the state government to pay a rate based on operating costs plus an additional agreed upon profit margin percentage.

177 https://www.financialexpress.com/industry/power-purchase-agreement-honour-contracts-dont-halt-growth-centre-tells-andhra/1643387/

FIGURE 18

Policy and Regulatory Gaps



These gaps, if unaddressed could have a counter-productive impact on the voluntary climate actions being taken by the industries as well as the national level climate actions.

Since these sectors are demand driven, demand side regulations for enabling the greening of the product range have to be more strongly developed. Government regulations can enforce different standards, such as creating a distinction between steel or cement production of different emission intensities. At present, the demand side regulations in form of economic incentives are not complementary to achieving sustainability. **Another gap that exists is in the form of ministry specific regulations not being developed to their complete ability, which is a supply side gap.** These barriers are further enhanced with a lack of financial and economic incentives. Another critical gap is the lack of clear carbon pricing signals at the national level, which can go a long way in providing security to companies and encourage them to undertake new greening projects. And finally, in many cases, these industry level policies have not been developed with the required stringency for carbon intensive sectors like steel and cement.

Thus, a comprehensive enabling policy framework specifically covering the demand side as well as the supply side of these industries needs to be developed. In addition, **there is a need at the national level, to provide clear policy signals, indicating the roadmap to low carbon transitions** and eventual decarbonisation of these industries. This also needs support from international trade requirements and other support measures, to mitigate the risk of shifting carbon emissions to the developing countries and avoiding carbon leakages from market mechanisms.

CHAPTER FIVE

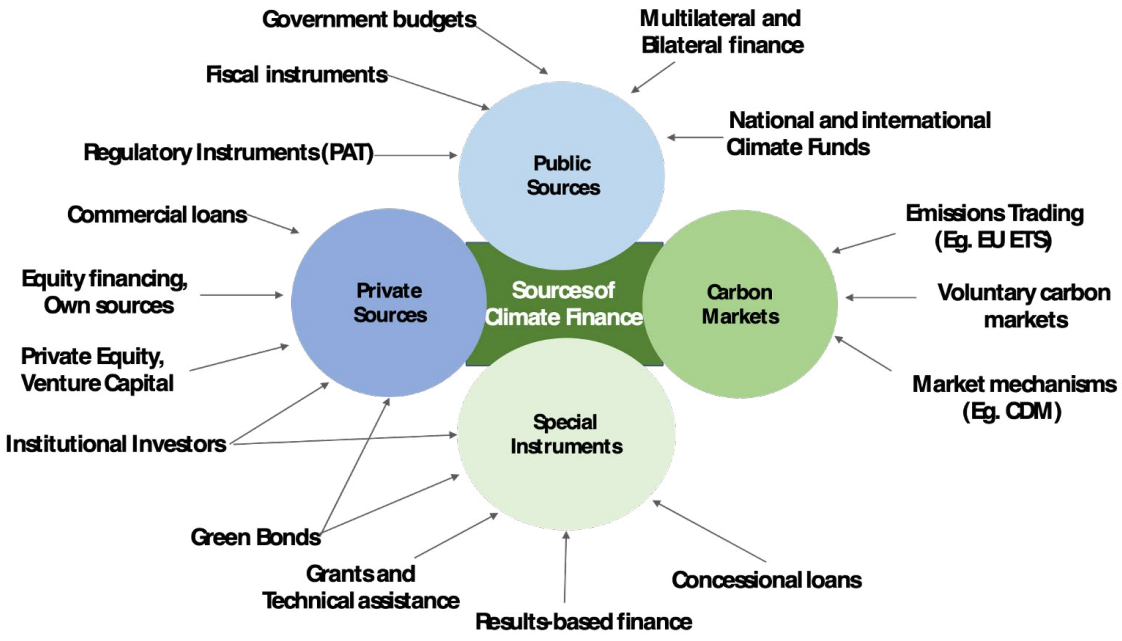
Barriers for a Low-Carbon Transition of the Steel and Cement Industries

The barriers to financing the low-carbon or green transition[178] of the steel and cement industries are not stand-alone problems with single solutions. As will unfold in this chapter, these problems are closely intertwined with the state of consumer preferences, behavioural choices, available technologies, commercial viabilities and existing regulatory mechanisms. As a next step, we assess if the existing policy framework is acting as a barrier to finance being directed towards greening the manufacturing processes of India's hard to abate sectors. This will provide an understanding of what's required to address these gaps and the role international climate finance can play in this.

Green finance can broadly be understood as a financial instrument or investment which is given in exchange for the delivery of positive environmental externalities, which are additional to the business as usual scenario. Climate finance is a form of green finance, which in the context of these industries, will be aimed at helping them reduce their emissions.

FIGURE 19

Key ESIF-related reporting of the European Commission and EU Member States



178 Note: For the purpose of this report, green or low-carbon transitions are largely focused on the technologies and pro-cesses which enable energy transition to non-fossil fuel sources.

There have been many studies and assessments done on the sources of climate finance and the uses to which they are directed. However, while according to some reports, "*money is gushing into any kind of asset labeled green or sustainable*",[179] from our discussions with these industries and understanding of these sectors in India, it is clear that these investments are largely side-stepping the green initiatives of the heavy industries, due to the basic nature of their operations.

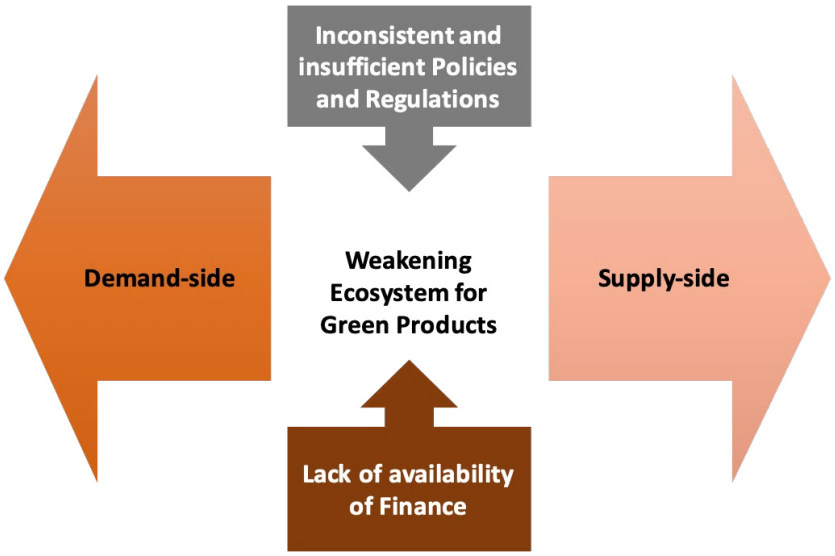
Currently the Indian steel and cement industries are not able to access most of these sources of climate finance due to the nature of their business, which falls out of the ambit of most of these finance mechanisms and instruments under the public and private sectors, as well as the special instruments. This is exacerbated by the high perceived risks of the newer green technologies for these industries and lack of clarity on how these projects will transpire. Further, carbon market mechanisms like the CDM are largely not operational for projects in India and there isn't an existing emissions trading system (ETS) in India. A close substitute is the operational regulatory instrument, the PAT scheme, which is one of the few sources of finance for such projects. But as mentioned previously, the price discovered under this was too low, ranging from around USD 3 to USD 17 per tonne of CO2 emission reduction in the first cycle. This leaves these industries having to depend on their own finances or their ability to raise commercial debt to finance their green transition.

In this chapter, we will dive more into some of these issues to understand the specific barriers to financing. The inputs in this chapter are from interactions with key industry experts, from the leading Indian steel and cement companies, as well as the finance institutions which are key sources of climate finance (the direct inputs are highlighted in boxes through the chapter). The chapter is structured on the basis of the regulatory gaps identified in the previous chapter – demand-side gaps, supply-side gaps and finance-side gaps.

179 Bloomberg (2019). Article: Green Finance is now $31 Trillion and Growing. Last accessed on May 10th, 2020 at: https://www.bloomberg.com/graphics/2019-green-finance/

FIGURE 20

Key Factors for Weak Ecosystem for Green Products in Steel and Cement Industries



5.1

Demand-side gaps

The primary demand-side issue is that there is no actual prevailing demand for green steel and cement products in the market. The demand for green products remains a niche market segment, where users are buying green products as either a part of their brand value (in the case of companies) or environmental concerns (in the case of individual consumers). This leaves the vast majority of the market still preferring conventional products. The weak demand can broadly be attributed to two factors: lack of drivers to change consumer preferences and lack of awareness. This situation is made worse due to the structural gaps in the market for these nascent-stage green products, which further limits the existing demand.

5.1.1 Lack of Drivers for Demand

Since steel and cement are used in large quantities in infrastructure and construction projects, their **cost is a critical factor** for overall project costs. Unlike energy efficiency or captive renewable energy generation, there is no business case from the consumer side for buying green steel or cement. At present, consumers ranging from the individual to infrastructure development companies, are largely driven by the cost factor and are choosing the better-known and lower priced product.

A major source of demand for green materials arises from the point of view of **compliance requirements** for buildings or other infrastructure to attain green certification. However, these **are not mandatory** for large and public infrastructure projects, and instead we only see a few developers and builders commit to them voluntarily for select projects.

> *Most construction contracts are purely commercial in nature, with the emphasis being on meeting the minimal regulatory and compliance requirements as per the agreement.*

In India, there are three primary certifications that buildings can attain: Green Rating for Integrated Habitat Assessment (GRIHA), LEED – India's approach for green rating (Leadership in Energy & Environmental Design), and BEE Green Buildings Rating System. One of the criteria for green ratings is that a certain amount of input products used must be green, but as gathered from our discussions, this can usually be fulfilled without having to use green cement or steel in significant quantities.

On top of the existing minimal regulatory and compliance requirements to influence consumer preferences, there are also **no financial and fiscal incentives**, in the form of tax rebates for developers or subsidies for buyers to motivate consumers and help to develop and grow this market segment. This makes for a **weak value proposition for green steel and cement**, from the consumer perspective.

> *Based on inputs gathered from stakeholders, it was found that some green cement and steel products were perceived to be "higher priced but lower quality" products and for some specific product categories, were also considered to be "unproven." Further, it was felt that the technical requirements of the project developers were not met by the available green products.*

5.1.2 Lack of Awareness

A key issue emerging from the demand side was regarding the **lack of clarity on what is a green product** amongst the users from the construction and infrastructure development sectors.

The definition of a green product (that is, what makes it green), especially from the steel and cement industries, is not regulated and standardised. The certification parameters/ endorsement labels of green steel and cement, and the aspects which make these inputs green, are lacking. Even the green housing rating systems do not clearly specify what qualifies cement or steel inputs as green.

> *Since there is no comprehensive framework for green cement and steel in India, developers like Mahindra Lifespaces, are proactively trying to create their own framework for evaluating the inputs they use in their buildings on green parameters. They also mentioned that they face challenges even for products branded as green, as it is often not clear what proportion of their content is recycled material.*

Another aspect of the lack of awareness issue is from the side of the end-user. As gathered from industry experts, in India, there is very limited demand for and awareness on the need for greening infrastructure. In many developed countries, it was this bottom-up driven demand which led to policy changes and the introduction of clear standards and labels for green products. However, with the huge prevailing gap in critical infrastructure in India, and this being the focal point for demand, the general public is not likely to prioritise green infrastructure if it comes at an added cost, which could result in slowing down infrastructure development.

5.1.3 Limited Market for Green Products

A critical challenge highlighted was that the market for green cement and steel was too narrow and under-developed. While this can be said to be because of the circular issue of lack of demand leading to lack of supply and vice versa, it is resulting in a structural market gap which makes a significant increase in demand for these products unviable from the consumer perspective.

The large-scaled developers require their steel and cement inputs in a consistent and regular manner. However, it was felt that with green steel and cement there was a lack of availability, especially in the large quantities required of these products.

The market was felt to be limited in terms of number of suppliers as well as the available products range, both of which constrains consumer choice. It was also perceived that the availability of the green substitutes was limited to certain regions in the country and not easily accessible throughout the country, making it unviable for a wide range of projects due to the resultant high transportation costs. These factors act as a massive barrier for demand making it a challenge to scale up the market from the demand-side.

5.2

Supply-side gaps

As detailed earlier, the demand for green cement and steel is limited, and because of this, companies do not undertake green transitions as a priority. In the absence of mandated use of green products and incentives for driving demand, the process for building this market segment is likely to be a slow one. Low hanging fruit for improving energy efficiency have already been undertaken to meet compliance under PAT. However, the other types of green actions are not as easily achievable or viable. Since the demand for these products is extremely price sensitive, it is important to produce them at low costs.

5.2.1 High Risk and Upfront Cost for Green Technologies

The cement and steel companies in India face a unique challenge. Both industries' leaders are operating near their maximum operating efficiencies by deploying best available and viable technologies. Yet, due to the kind of manufacturing processes, they remain highly GHG intensive. Low carbon technologies, over and above the low hanging fruit already deployed, are capital intensive and hence require large investment volumes.

This would require a shift towards low-carbon manufacturing processes which would involve high capital expenditure and have long gestation periods to break-even, making these technologies, which often are yet to be proven and reach the commercialisation stage, extremely high-risk in nature. Thus, any further reduction in emissions would require significant breakthrough in existing technologies or complete overhaul of their processes. This would come at a prohibitive cost, which is not practical for a developing country like India. In addition, if firms decide to fund the high capital expenditure fully or partially via debt, it only further raises the cost as the cost of borrowing capital is very high for these sectors in India. As an illustration, the rate of lending for the steel projects in India is about 12% on average. However, the rate in China is as low as 6%, 1.5% in Japan and 4% in South Korea.[180]

Research and development (R&D) has to be funded entirely from a company's internal resources as there is no commercial financing available for this in the market. As will be discussed in subsequent sections, financiers are reluctant to lend for R&D considering the economic viability of R&D projects not measurable. The scale required for R&D purposes is large but lack of certain outcomes makes it difficult for financiers to develop a clear business case for such lending.

R&D has seen a development within the steel sector at a country level. Cost saving and improving efficiency measures have been adopted by many steel companies. The first R&D Laboratory was set up in 1936, by Tata Iron & Steel Company (TISCO). Various steel companies like SAIL, Tata Steel, JSW Steel and Essar Steel have also set up their R&D corpus, looking at raw material beneficiation, agglomeration and product development.[181] However, the contributions of these companies have not been sufficient. Only about 0.05-0.5% of their sales turnover, is invested in R&D by these steel companies. The secondary steel sector has the added disadvantage of limited capacity for undertaking R&D. The Ministry of Steel has thus been developing R&D projects, especially for the benefit of these secondary sector units.

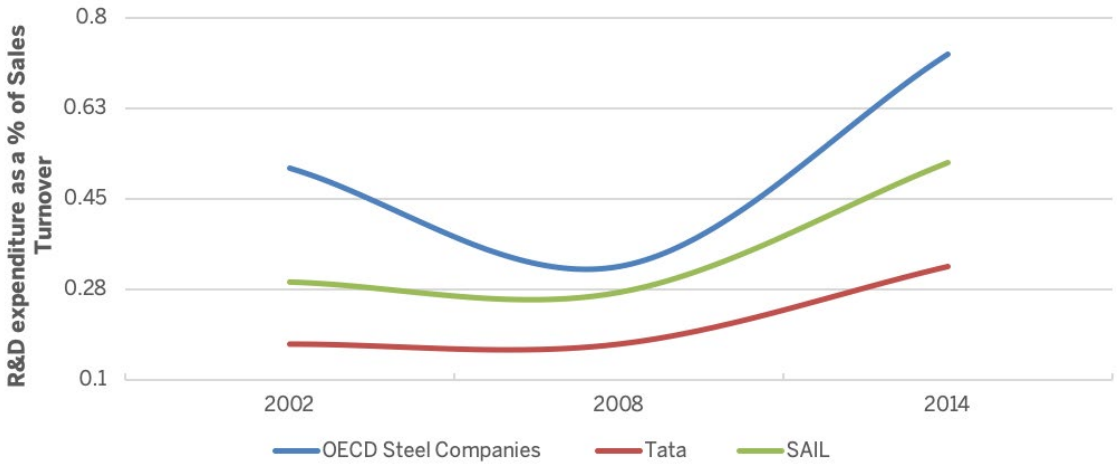
180 https://niti.gov.in/sites/default/files/2019-07/Need%20for%20a%20new%20Steel%20Policy_NITI%20Website%20Final.pdf

181 https://steel.gov.in/sites/default/files/research_main_0.pdf

Further, while there are some tax benefits for R&D expenditures, these were not sufficient to enable the scale of investment required in this sphere. This is also visible in the trends of spending on R&D in India's most advanced and large scaled steel companies vis-à-vis steel companies in the OECD countries.

FIGURE 21

Expenditure in R&D in Indian Steel companies vis-a-vis OECD



Source: http://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=DSTI/SU/SC(2015)5/FINAL&docLanguage=En, and Annual Reports of TATA Steel and SAIL

Companies said that while they are willing to experiment with the new technologies being developed, there is a need for support in the period before a technology reaches commercialisation stage. A crucial driver for this will be the synchronised movement of policy and finance. One of the notable illustrations to be considered here is developed countries' venture to advance technology and uptake for hydrogen to be used in industry. The companies carried this out by implementing strong supply and demand side policy pushes backed by adequate finance.

The supply side was ensured in part by ensuring adequate and appropriate financing across the innovation chain, largely through R&D financing, with both public and private funding playing an important role. In parallel, demand-side policies to pull technologies towards deployment and diffusion were rolled out, also including subsidies for novel technologies.[182]

182 Mazzucato, M., & Semieniuk, G. (2017). Public financing of innovation: new questions. Oxford Review of Economic Policy, 24-48.

At present, this enabling environment is not there and companies end up having to bear the entire risk and the significant incremental costs of implementing the technological solutions for greening. For instance, almost all companies mentioned that while the use of carbon capture utilisation and storage (CCUS) technology could be a game-changer, due to the high cost of the technology at present it is not feasible to implement or financially viable till at least 2040.

> *Tata Steel which is one of India's most reputed and financially sound company, explained that it is not feasible for it to finance a CCUS plant at present. While the company has been financing various green initiatives out of its earnings and internal carbon price, the high cost of a CCUS unit per tonne of CO2 abated, which is estimated to be about USD 80-120 on average, significantly exceeds the margins available to the company and also the prevailing carbon prices in India and most international markets.*

The complete lack of subsidies and fiscal incentives to encourage and support companies in their endeavors to transition to a lower carbon pathway is a major prevailing barrier in making these industries a key actor in the upcoming low carbon economies.

5.2.2 Higher Cost of Operations for Green Processes

Green processes, which focus on recycling and reuse of materials, can be inferred to be more economical than the regular processes due to the lower usage of primary materials. But we found that on the ground, the case is often the opposite.

For instance, cement manufacturers are easily able to use waste instead of coal in their manufacturing processes. This would have the added advantage of also getting rid of waste instead of piling it in landfills. However, in many cases the waste made available to the manufacturers is unsegregated and not fit for use. The manufacturers then end up having to add another stage to their processes where they have to sort the waste. Another issue is that the waste is not usually made available at the manufacturing plant's location, but instead the manufacturers

have to transport it for 100's of kilometers, which adds to their carbon footprint and the cost of operations.

> *A cement manufacturer with plants in central India told us that this process resulted in the overall operational cost being higher by around 50%, in comparison to the process of using coal. Due to this, the company had to minimise their use of waste in their processes and revert to the conventional use of coal.*

In the steel industry, the issue of lack of available scrap steel for recycling has been recently addressed through the Steel Scrap Recycling Policy which was issued in November 2019. To ensure that quality scrap is available for the steel industry, the policy aims to set up about 70 scrap processing centres. However, until this is achieved and running effectively, through trade agreements to import scrap metal, there is a significant deficit of scrap metal, which has high global demand, which impacts the cost of operations.[183]

Another operational issue that arises is due to the lack of adequate grid infrastructure for RE. Even though using RE offers a price advantage, not many companies have increased its uptake beyond what is required as per compliance. This is because, cement and steel are heavy users of power, therefore need a consistent power supply. Some of the issues faced by these plants are one of these issues include poor transmission and distribution infrastructure, inadequate load and generation forecasting, lack of grid flexibility and unavailability of grid till the tail end. Inadequacy of grid infrastructure creates concerns among manufacturers to scale up the level of RE used in the production process, with RE installed requiring back-up and storage solutions, which add to costs.

183 S&P Global Article (2019). Analysis: India's new steel scrap policy raises concerns on higher unprocessed imports. Last accessed on May 10th 2020 at: https://www.spglobal.com/platts/en/market-insights/latest-news/metals/110819-analysis-indias-new-steel-scrap-policy-raises-concerns-on-higher-unprocessed-imports

5.2.3 Weak Ecosystem for Green Products

A critical issue which was highlighted was the lack of a comprehensive ecosystem to promote green products in India. This ecosystem requires engagement from a range of stakeholders, such as cross-industry technology developers, buyers, including automobile manufacturers, infrastructure and housing companies, etc., finance institutions, governments at all levels – central, states and local, and industry associations.

For instance, it is essential to engage with the buyers from the different industries, to understand their needs and technical requirements and assure them of the quality of the products. This could include buyers which would have high demand requirement, like infrastructure companies, and builders, who face regulations on input materials. There is also a need to engage with state governments and local governments at the municipality level, as in many cases there are different rules and regulations prevailing across states with varying levels of enforcement. It is important to get the sub-national actors to engage with these industries so that they are able to get the raw materials required for manufacturing greener products, such as segregated waste for the cement manufacturers and scrap steel.

> *Tata Steel reported that it is receiving an increasing number of requests from certain consumer segments, such as the automobile manufacturers and builders, regarding the carbon footprint of their products and related data. However, this wasn't seen to be accompanied by an equal increase in demand or willingness to pay for the greener products. This could indicate an upcoming shift in preferences, probably in the next three to five years, and producers should start preparing for it.*

Finally, there is also a need to engage other Ministries of the government, such as the Ministry of Power, Ministry of Road Transport and Highways, Ministry of Housing and Urban Affairs, Ministry of Rural Development, etc. These ministries are in charge of undertaking a range of infrastructure development across the country for which they undertake vast public procurement of materials. However, there is no demand for green products generated from these.

Almost all companies emphasised that a change in public procurement rules, with green products being given a preference, could be an effective way to build confidence in these products and help generate the demand which can support the companies to ramp up their production and product range for these. Instead at present, in many cases green products like blended cement are not permitted, even if they are technically suitable for the needs of the projects.

5.2.4 Weak Support Mechanisms for Climate Initiatives

Volatile carbon prices, over the last few years, has weakened investor sentiment for climate initiatives. The Clean Development Mechanism (CDM) was the first to drive companies to undertake emission reduction with the promise of compensation through the carbon price for their investments. Under it, several industry leaders started projects and were able to realise payments for their efforts. However, once CDM stalled, these projects were unable to get any additional returns leading to many industry players becoming skeptical of the national and global markets.

While the Indian PAT scheme was important to kick-start the process for making companies across both industries adopt energy efficiency measures as per the mandated requirements, it is not felt to be enough for the kind of deep decarbonisation that is desired and might be required in the coming decades. It was found in the first cycle of PAT, which traded between September 2017 to January 2018, that the sellers were almost three times the number of buyers, as the relatively low targets resulted in almost all designated consumers being able to achieve their targets. Thus, the price of an energy saving certificate (ESCert) was in the range of INR 200 (less than USD 3) to INR 1200 (less than USD 17) through the trading period. While the targets have been made more stringent in the subsequent PAT cycles, the confidence in the likely price to emerge from the coming rounds of trading is low, as there is no floor price prescribed. Further, PAT trading isn't annual in nature, with each cycle lasting three years, so the sellers are left with their ESCerts and the uncertainty of the likely price they will get for them, for long periods of time. This makes PAT ineffective in driving green transitions, and instead results in it becoming a regulatory barrier.

BOX

Proxy Carbon Price in India – Coal Cess

Coal cess, India's first carbon tax equivalent, moved from INR 50 (USD 0.8) in 2010 to INR 400 (USD 3.2) in 2016, per tonne of coal.[184] This cess, also known as the Clean Energy Cess and Clean Environment Cess, was an attempt to disincentivise the amount of coal domestically produced and imported. In effect, by taxing the source of fossil fuel, it would further increase the cost of operation of some of the heavy users of coal- especially steel and cement companies- thereby initiating a chain of energy efficiency or green reforms. This however, didn't materialize, because the amount of cess remained well within the capacity of most coal users to absorb. At the same time, the political difficulty of imposing a coal cess in a growing economy like India, should be recognised, making this a creditable initiative.

Any certainty around the carbon markets and carbon price investors are likely to get, will go a long way in spurring green initiatives, as this would give more clarity to project planning and lower the perceived risk of such investments.

> *When asked about the carbon price at which most technologies for the cement industry could become financially viable, the companies suggested a carbon price in the USD 30 to USD 50 range. Some also suggested sector level carbon markets instead of a uniform one, as the cost of achieving emissions varies significantly across the industries, leading to over-supply from some which puts the entire market in imbalance.*

184 IISD, The evolution of coal cess in India, Accessible at: https://www.iisd.org/sites/default/files/publications/stories-g20-india-en.pdf

5.3

Finance-side gaps

Almost all companies interviewed agreed that they did not have access to green finance, especially in the quantities required for businesses of their nature and production scale. As seen in chapter three, the green projects undertaken in the recent years were from the companies' own resources, with very little, if any, support coming from public or developmental sources of finance.

5.3.1 Lack of Capacity to Finance Green Transition of HTA sectors

A key challenge identified for domestic commercial financing is that low carbon technologies are capital intensive and hence require large investment volumes. However, most green finance institutions in India operate at much smaller levels where they are more keen on investing in projects for renewable energy, energy efficiency or support growth stage companies in their commercialisation. For instance, green financiers are able to fund those activities of steel and cement industries which can operate as smaller and individual projects- such as solar power projects as a standalone activity that a business undertakes. But, in the kind of projects which require improvement in energy efficiency by changing the technology or a part of technology which will modify the production process, such an activity is part of a much larger and complex project, which is often beyond the scope and capacity of the commercial finance institutions.

Often, financial support for improved technology and upgradation is offered by existing lenders of the company. If an external financier, focusing on green finance, was to lend for such projects, it would require cooperation from the existing financiers, which due to the complexity of agreements is usually infeasible. Thus, in most cases, companies finance such transitions via internal financing or through their existing mezzanine finance agreements.[185] The green aspects of these projects are then not emphasised as much, as they become a small part of a much larger conventional funding.

5.3.2 Weak Commercial Viability of Green Projects in the HTA sectors

The first criteria for banks and financiers is the commercial viability of a project. Usually, commercial financing is an efficient and cost-effective method, but is commercially viable only when the payback period of the projects is small, in the one to three years range. However, certain transformative green technologies, such as CCUS, have long payback periods (about 15-20 years), which makes regular commercial financing unviable for these projects.

This long tenure also leads to there being a high-risk perception from the lenders side, especially since these technologies and their impact are at times unproven. Further, financiers are not keen on lending for R&D practice because economic viability of R&D projects are not measurable. Thus, in areas where finance is most needed to enable a low carbon transition, the regular commercial finance products are unviable, necessitating specially tailored finance products.

185 Financing Instruments with features of both debt and equity financing, which provides lenders provides lenders the right to convert the loan into equity in case of a default, after the private equity companies and other senior debts are paid off.

5.3.3 Limiting Prerequisite Standards from Financiers

The global steel and cement sectors have seen difficulty in accessing climate finance to transition towards the low carbon pathway, as some of the larger international climate financiers such as International Finance Corporation (IFC) or Green Climate Fund (GCF), have a stringent protocol to be followed, including minimal technology standards before financing green transitions. As an illustration, TERI's interaction with senior members at the IFC highlighted that one of the pre-requisites for IFC to lend for green transitions, is that the plants install a WHR system. This is a standard protocol to ensure that companies have undertaken some extent of action towards greening their manufacturing processes. Such standardisation, while doable for the leading companies who are already undertaking climate initiatives, results in side-lining several medium to large manufacturers in these sectors who are in the early stages of their green transition.

Further, international financiers are difficult to approach for most manufacturers in the hard to abate sectors, with the exception of those which are at the top. International green financiers, like domestic financiers are wary of the credibility of the borrower and their reputational and financial reputation regarding the environmental, social and welfare practices, thus preferring to not direct green finance to the sector as a whole.
Finally, companies can't directly access international climate funds, without involving the nodal government bodies. For instance, in the GCF model of funding, approval from the nodal climate change bodies is required for an application, and the nodal bodies have their own set of national priorities which they seek funding for.

Development of a risk sharing mechanism between public and private institutions in hard-to-abate sectors like steel and cement, can help bridge the financial gap. For example, the Green Climate Fund (GCF) Private Sector Facility has been developed with the aim to help fund and mobilise institutional investors. The GCF's goal is to use its funds as a lever to encourage corporates to co-invest alongside the it. This is done through financial instruments including debt and guarantees, equity, concessional loans and grants.

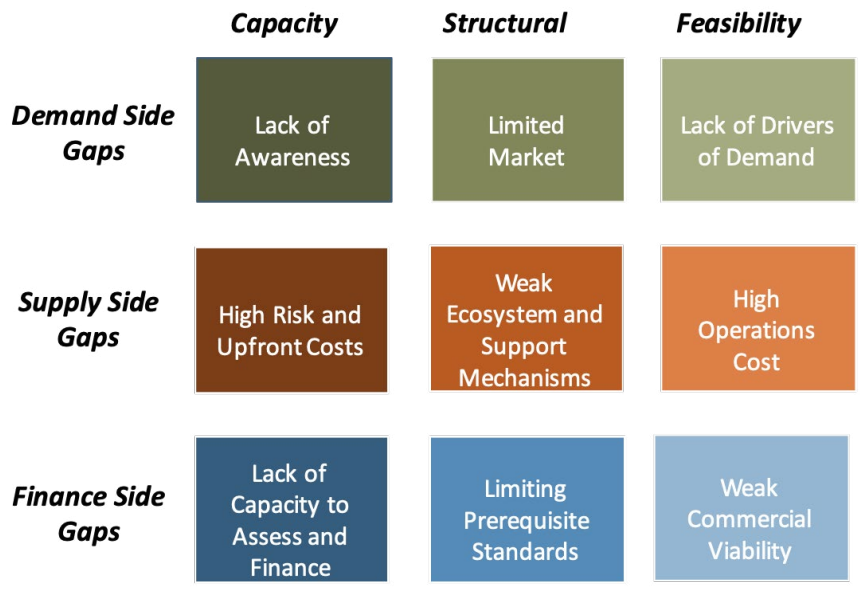
Key Takeaway

For hard to abate sectors like steel and cement specifically, **decarbonisation is a difficult, costly and slow process, with several technological barriers making this even more challenging**. This slow transformation is **further worsened by weak regulatory drivers, which impact the availability of green finance to support the transition**. Policies to date, have largely targeted incremental energy efficiency improvements viz. the large-scale transition away from fossil fuel technologies that is now required. This is weakening the nascent-stage ecosystem for green products, arising from lack of confidence in this segment, which could have an adverse impact on long-term transition of the industries.

The barriers identified, through a series of discussions with industry practitioners, are in many cases inter-linked to each other, often leading to **a "chicken or the egg" causality situation with one type of an issue making the other type wors**e. This makes addressing these barriers a complex problem, requiring a range of simultaneous actions. The barriers were categorised as demand-side, supply-side and finance-side issues.

FIGURE 22

Overview of Key Gaps in the Ecosystem, Resulting in Barriers for Green Finance



There is an **overall weak ecosystem to support the transition towards green products**. From the demand side, there is a need for generating demand for green steel and cement, which at present is minimal. This is due to lack of regulatory drivers for green products and lack of clear incentives or benefits for changing consumer preferences to green. Awareness on the technical aspects, across consumer segments as well as the producers themselves is also lacking, indicating the need for cross engagement across the industries. Policy and targeted incentives are needed to increase the demand for green alternatives, which in turn can boost production. Similarly, policies fully implemented and with structured support measures for the industries can make production of green alternatives commercially feasible. All this collectively will help increase scale and will also ease the perceived risk burden that financiers face at present.

This vicious cycle of demand, supply and finance related barriers, can only be broken through a comprehensively designed policy framework with effective implementation and enforcement. In an attempt to move towards this, in the next chapter, suggestions are proposed for addressing some fundamental critical gaps by leveraging international climate finance.

CHAPTER SIX

Recommendations for International Climate Finance to Enable a Transition to Low-Carbon Pathways through the Policy Framework

Decarbonising heavy industries, like steel and cement, require a much faster transition to lower carbon growth pathways if global climate targets are to be met. These are referred to as hard to abate sectors because their transition to low carbon production involves expensive and difficult to implement solutions, in the current policy and technology context. This is a global phenomenon, but it is even more critical for growing industrial economies like India.

Modifications in the existing policy framework, such as widening the scope, introducing effective regulations and ensuing their enforcement at national and state level, are required. Increasing focus on selecting the best available technology, facilitating the adoption of new technologies which require high investments, reducing the use of natural resources by shifting to circular economy models and increasing the use of cleaner and renewable sources of energy, are effective steps. Also improving and upgrading the existing policies to fit the climate commitments, can enable a smoother green transition.

This needs to be supported by adequate and viable finance. Looking specifically at the large players in these industries, they have the capacity and credibility to raise external debt to finance investments in general. However, in the case of green investments the perceived risk is very high which makes it difficult to raise debt from commercial sources specifically to finance green transitions. There is a need for significant scaling-up and replicating of green solutions and technologies, which is challenging due to their capital-intensive nature, necessitating large investment volumes at the industry level. The medium and smaller players however, need more assistance to help their transition to green, including support for capacity development, improved availability to finance and technology, as well as policy certainty.

International climate finance can play a critical role, by supporting and strengthening the existing policy framework and by addressing the gaps identified. Recommendations to enable this transition, by leveraging international climate finance, have been developed across the different aspects.

6.1

Creating demand

Since the steel and cement industries are demand driven, their growth is inter-linked with other growing sectors like construction, infrastructure, aviation, railways, roads, transport and automobiles to name a few. Since there is significant expected demand growth for these sectors which will result in large emission increases if current technologies continue to be deployed, it is important to urgently start addressing these gaps.

The first step, is to drive demand for greener products from the consumer side. A weak ecosystem around green products has been recognised as a barrier, leading to low demand for green products. This vital aspect, which can lead to regular finance mobilisation from the private sector in terms of investments and consumption, is often ignored in policy interventions and international finance models. But, to ensure a sustainable and long-term transition, it could probably be the most critical requirement, enabled by a sharp focus on strategic incentives for to change behaviour and drive demand for green products.

International climate finance can engage with key Ministries or industry associations to help set engagement platforms, which can be a pre-cursor for policy changes. This can be done through existing projects from the demand-side, such as infrastructure or housing projects, where there is an opportunity to mandate the use of green products, requiring focused cross-sector engagement. In order to meet this demand, a simultaneous policy support must also be initiated on the supply side.

International climate finance can also play a role by mandating or incentivizing the use of green public procurement criteria for the development and infrastructure projects being supported by it. For instance, development organisations like the World Bank and Asian Development Bank, as well as several bilateral funds have several large-scale investments in infrastructure development in India. These can be used to explore leveraging and creating a demand for green products and also to initiate discussions with the Ministries involved, on the importance of leveraging green procurement. It is important to highlight the need for an inclusive approach for demand creation, where the Indian industries are able to highlight their challenges, and co-develop workable solutions, which may be transitional in nature at the start, and not comprehensively green.

6.1.1 Enabling Multi-Industry Engagement

Steel and cement sees demand from a range of industries – infrastructure, automobile, construction, etc. However, these industries may not have yet fully understood the role of green products in their operations or been able to communicate their technical requirements for these products. The hard-to-abate sectors enable a shift towards a carbon-neutral economy, and hence should be developed not only individually, but also in co-ordination with each other to help scale up use of transformative technologies. This can be done by building platforms for collaboration and co-ordination between different sectors.

Sector-wise engagement or cross-sector coalitions for cooperation should be formed. An example of such a cross sectoral approach can be seen in the form of Sustainable Process Industry through Resource and Energy Efficiency (SPIRE), which was launched in 2013. This contractual public-private partnership (PPP) was launched to enable sharing of technologies and best practices for ensuring competitive, resource efficient and energy efficient process industry in Europe, at all stages of existing value chains. This involved the cement, ceramics, chemicals, engineering, minerals, non-ferrous metals, steel and water sectors.[186] Similarly, cross-sectoral implications in India can be understood from a sustainable production perspective.

186 https://www.spire2030.eu/sites/default/files/users/user85/Vision_Document_V5_Pages_Online_0.pdf

Cement industry is for example paving the way for sustainable growth, by implementing cross sector processes. Using fly ash from thermal power plants or 100% utilisation of slag from steel industry, shows a shift to an alternative fuel usage and increasing energy efficiency, which is possible through cross-industry operational models.

There are many other areas where there are opportunities for scaling up such an approach can be used, requiring cross-Ministry engagement as well as engagement with different levels of governments. For instance, Waste Heat Recovery (WHR) for example has been developed as an alternate source of captive power generation in the cement sector. High investment cost for WHR has been seen as a roadblock, especially for small scale industries. However, if WHR is recognised as renewable energy source, then overall cost of adoption of these technologies will reduce. This can be done by applying a cross-ministerial approach, where Ministry of New and Renewable Energy (MNRE), will allow fiscal advantages in form of accelerated depreciation benefits, tax benefits, generation-based incentives and capital subsidies. Further, financial Renewable Energy Certificates can be developed to support this shift, and will enhance financial gains through this.[187]

Developing cross-sectoral co-ordination will also further enable a shift to green products. Over the past years, a push for affordable housing and road has been acting as a boost for domestic consumption. This can act as a perfect opportunity to allow cross co-ordination between different ministries to understand the technical requirements of products for these projects and develop an understanding on whether the existing green products are suitable or need a change in their composition. This can be driven by setting up and clarifying standards for the green products. Green standards can be set in for example steel or cement demand centric industries, like construction, infrastructure, roads, railways etc. A shift from prescriptive to performance-based design standards in such cases would allow a faster shift to carbon efficiency at the demand level. For example, implementation of building codes to ensure utilisation of low-carbon blended cements would stimulate a shift to cleaner technology.[188]

187 Waste Heat Recovery for the Cement Sector: Market and Supplier Analysis. 2014. Institute for Industrial Productivi-ty; International Finance Corporation.

188 https://www.iea.org/reports/tracking-industry/cement

6.1.2 Driving direct demand via green public procurement

Green public procurement is an important potential demand side stimulus for green products, as about 30% of India's GDP is spent on public procurement, a large part of this going for infrastructure products.[189] Public sector procurement can hence be developed towards sustainable production and consumption. For this, Government can collaborate with the industries to formulate green product criteria, based on their product requirements. This will also allow the government to leverage its large-scale, aggregated power as a consumer.

Green Public Procurement (GPP) or green purchasing can act as a stimulus for eco-innovations. This will also serve other purposes such as instilling public confidence in green materials, and influence consumer preferences, which can further increase demand. Continued green procurement can also help provide the initial scale to green materials, thereby reducing cost. GPP has been mostly developed as a voluntary instrument, and in 2012, Confederation of Indian Industry (CII) came up with GPP Guidelines to initiate the uptake of green materials. The Green Products or GreenPro certification scheme launched by CII aims to promote green products, especially in the construction sector. It follows the life cycle approach, to ensure and encourage green measures from product design, to usage of raw materials, as well as ensuring a green manufacturing process, and product performance during use and finally recycling/disposal.[190]

Public sector intervention is especially required to develop verifiable sustainable criteria for products. In case of cement for example, public procurement criteria to enable the uptake of blended cement can be a useful initiator for this range of products. This may also help ensure a behavioural change among consumers, to increase acceptance of green/recycled products. Regulatory drivers may also help the industry to undergo much needed structural production changes.

189 https://www.cci.gov.in/sites/default/files/presentation_document/p4.pdf?download=1
190 http://www.greenbusinesscentre.com/site/ciigbc/greenpro.jsp?greennode=475864

6.2

Supporting the Development and Implementation of Technologies

Researching, developing and demonstrating (RD&D) climate technologies[191] is an integral part of solutions for enabling shift to low-carbon pathways. This was a critical factor for driving the renewable energy sector to its current status of becoming a competitive and viable solution for energy production. There is a need to adopt a similar approach for heavy industries. The approach also has the added benefit of enhancing capacities at the local level, and facilitating modification of existing technologies to local contexts.

Novel climate technologies, especially for the heavy industries, face the challenge of being high-cost investments with unproven results and the full operational cost also being unknown in many cases. Thus, international climate finance can play a role by reducing the perceived risk of these by supporting RD&D projects and helping to prove their positive impacts, post this, these technologies can be scaled up with suitable policy mechanisms.

191 Climate technologies are those used to address climate change by reducing greenhouse gas emissions.

6.2.1 Providing Research and Development Support for Novel Technologies

An increased need for R&D investments and funding support, from government as well as development agencies, is a priority according to industry leaders. This is mainly because R&D, and further commercialisation through large scale demonstration and technology deployment allows the scale-up of the carbon-efficient technologies. R&D support, and related demonstration projects are essential to build confidence in feasibility and viability, while supporting the commercialisation stage of these technologies, where the scaling up of R&D so as to reduce costs and increase uptake, is also critical. In both of these stages the role of government is crucial.

Since finance from commercial sources for R&D is not possible, due to the high-risk nature of these projects, developing an integrated risk sharing model for R&D investments, between government and private sector, can act as a support measure for the deployment of new technologies. This can further be evolved at an international scale, with countries entering coalitions of the willing to enhance R&D in these areas. The first step to accelerate R&D is by enhancing the research budgets.[192] This can be done by developing a risk guarantee fund or directing concessional loans for R&D related climate relevant projects in these sectors. An assessment of R&D programmes for renewable energy, energy efficiency and agriculture showed annual rate of returns of more than 20% for research expenditures.[193] This needs to be demonstrated in the national and industry context, to inspire confidence in these kinds of investments, which will then enable a wider-range of investors to enter.

International climate finance can lead the way in designing such financial support measures and demonstrating their impact, which can then be scaled up through policy mechanisms. These projects can be at an aggregate industry level too, under the aegis of the relevant Ministries, with appropriate risk-sharing.

192 https://www.usea.org/sites/default/files/ccc17012011_Carbon%20capture%20and%20storage%20-%20legal%20and%20regulatory%20framework_ccc179.pdf

193 Technology Working Committee- Working paper (2017). Enhancing finance for the research, development and demonstration of climate technologies. UNFCCC.

Such projects also help build network of researchers, including academia and research organisations on similar areas of concerns, which can accelerate the outcomes of R&D. This can then be scaled-up through a policy measure, on lines of a fund like the EU Innovation Fund (see *box*).

BOX

EU Innovation Fund

To help secure finance to scale up and support demonstration projects of high risk renewable energy technology, as well as CCS and CCU.

The funding is from the 450 million auctioned emission allowances from ETS, as well as funds from NER 300 Programme.

6.2.2 Facilitating Demonstration Projects for Commercialisation of Technologies

Demonstration projects should be developed with the aim to promote innovation, by capturing and disseminating information. Industries have shown willingness to shift to nascent technologies like carbon capture and storage, however the lack of commercial finance for these is an issue. High risks, high upfront cost, and high cost of operations for green products, for low carbon technologies, has been seen as a major gap by companies in the steel and cement industries. Demonstration project will hence show the viability as well as provide real-world examples for the scale of the financial requirements and the overall costs of such technological changes, while also proving their impact on operational efficiency as well as climate goals. An example of this approach, in the steel and cement industries, is the EU led STEPWISE project (Sorption-Enhanced Water-Gas Shift Technology to Reduce Carbon Footprint in the Iron and Steel Industry) and the OGCI's Kickstarter for CCUS (see *box*).

BOX

Demonstration Projects for the Steel and Cement Industries

1. The STEPWISE programme aims at reducing the carbon footprint of steel production through demonstration projects of advanced pre-combustion CO2 removal technology. It is funded by European Union's Horizon 2020 research and innovation programme.[194]
2. Oil and Gas Initiative (OGCI) launched KickStarter in 2019, as a Carbon Capture Utilisation and Storage (CCUS) initiative, starting in US, UK, Norway, the Netherlands and China. The aim is to upscale CCUS technologies through collaboration between industry and government.[195]

Demonstration projects help in four major ways:

1. Help understand the risks involved and the financial feasibility of the project, which will also help in upscaling commercial financing if other sources of financial aid isn't provided;
2. By incentivising governments to change policy and regulate in the direction of the positive result of the demonstration project;
3. Demonstrate the technical viability of technologies which are yet to reach commercial scale, encouraging competitors to implement change; and
4. Increase participation willingness of other companies in the sector to uptake these technologies.

A gap in adoption of technologies can be explained by lack of a supportive policy and regulatory framework. The policies need to be developed to incentivise adoption of these technologies, by demonstrating or helping companies demonstrate the financial viability of the technologies.

194 https://www.stepwise.eu/

195 https://www.gasworld.com/exclusive-kickstarter-ccus-initiative-launches/2018046.article

Further, adapting to results from demonstrations, will help avoid unnecessary costs at larger scale of deployment.

Lack of financing and access to capital acts as a roadblock for many demonstration projects. Hence, fiscal help as a regulatory mechanism can be developed to allow smooth transition. There is a need to incentivise demonstration projects through grants, tax incentives, credit support, liability relief etc. An international climate finance led model for this, in collaboration with a few select key Ministries and industry leaders, can pave the way for critical upcoming technologies, making this model workable for the Ministries to take forward through policy framework in the future

BOX

The NEDO Model projects for Energy Efficiency Improvement

The projects for Energy Efficiency Improvement, developed for steel sector, with Ministry of Steel overseeing the necessary projects, is an example of demonstration projects with, financial assis-tance from an international bilateral agency. Government of Japan has provided funds, under its Green Aid Plan (GAP), to sectors (including steel) for setting up of energy efficient, environment friendly projects. These projects are routed through and managed by NEDO (New Energy & Indus-trial Technology Development Organisation), Japan. Ministry of Steel is coordinating the projects undertaken. So far the following three projects have been commissioned

1. BF Stove Waste Heat Recovery: Completed at Tata Steel
2. Coke Dry Quenching: Completed at Tata Steel
3. Sinter Cooler Waste Heat Recovery: Completed at Rastriya Ispat Nigam Limited.

Further, two more Model Projects (i) Regenerative Burner System for reheating furnaces at Rourke-la, SAIL and (ii) Energy Monitoring and Management System at ISP Burnpur, SAIL have been signed for implementation.

6.3

Mobilising Finance

Greening the hard to abate sectors cannot be fully undertaken through conventional financial products. This is because, private equity is largely not applicable for such projects in these industries, commercial loans are difficult to get due to the high risk and unproven operational impacts, with loan tenures offered and prevailing interest rates in India being relatively high. Further, other channels such as green bonds and green loans are ineligible to be issued for high emitting industries in the transitional phase. Institutional investors, looking to green their portfolios, are also unlikely to invest in these industries, as they are perceived to be fossil-fuel powered industries. Amidst this lack of viable financing options, there is a need for special mechanisms to bridge this gap, which can be undertaken by international climate finance, with the help of developmental funding from national budgets.

6.3.1 Designing Blended Finance products that Support Green Transitions

Blended finance is strategically designed funding, usually led by development finance and public funds, with the aim of mobilising private capital flows to new market segments, such as the green sector or climate technologies.

Blended finance encapsulates a large combination of financial sources and instruments, and can be a combination of risk mitigation or guarantees, concessional debt and equity, performance based incentives and co-financing with public resources.[196] Especially in the face of high-risk perception, blended finance can serve the necessary purpose of hedging risk, offering guarantee and increasing the supply of private capital. In sectors such as steel and cement, where the costs and risks for greening are high and large scale is required, using blended finance could be useful to overcome the initial investment barriers, and enable private finance mobilisation.

Blended finance can be customised in several ways to serve the needs of the sectors.

- The lack of a national or even sectoral carbon price has proved to be a disincentive for private investors to put money in cost intensive green products/ processes. In order to, to counter some of this perception, the public finance institutes such as IDBI or State Finance Corporations, can collaborate with international climate finance to support the more ambitious low carbon transitions. Here blended finance can play a significant role in reducing the cost of private capital and increase the volume of lending, while also providing more feasible terms such as longer tenure, etc.

  Private capital from commercial banks can be used to further enhance this lending. Multi-lateral development banks (MDBs) are increasingly using their resources for credit enhancement of private sector loans through blended finance products. Between 2012 and 2015, MDBs through a combination of guarantees, syndicated loans and credit lines mobilised USD 81 billion of private finance.[197] For instance, IFC's blended climate finance products uses a mixture of concessional finance instruments (i.e. soft loans, equity, guarantees) to undertake pioneering projects that directly combat climate change and have a strong potential to transform markets.[198]

196 https://www.ifc.org/wps/wcm/connect/b775aee2-dd16-4903-89bc-17876825bad8/IFC+Blended+Finance+Fact+Sheet+%28July+2019%29.pdf?MOD=AJPERES&CVID=mUEEV3E

197 https://www.orfonline.org/wp-content/uploads/2019/01/GP-ORF-Financing-Green-Transitions.pdf

198 ibid

› Blended finance can make projects more 'bankable' from a commercial viability perspective, as it can offer a risk safeguard against defaults. As an illustration, IFC rolled out a Co-Lending Program for infrastructure where three third party institutional investors together invested USD 1.5 billion. The 10% first-loss tranche is supported by guarantees by the Swedish International Development Cooperation Agency.[199] 'First-loss' guarantees are a guarantee instrument which states that the development or public funder will absorb the initial losses associated with an investment. Funders have found these to be powerful tools to enable enhanced investments.[200]

Blended finance can also be used to mitigate some of the financial risks associated with green lending, such as risk of currency fluctuation. Any kind of finance- green or conventional enjoy certain advantages with guarantee and insurance products vis-à-vis direct funding. Blended climate finance can be used to offer risk underwriting, insurance and guarantee mechanisms built in its very form. This is seen to be highly effective in bringing out the necessary social and environmental benefits, as a result of developmental financing which would not have been possible in case of direct funding.[201]

Thus, international climate finance led projects in these industries, can be formed in collaboration with national development banks as well as commercial banks, to take a longer –term view in transitioning these industries, as is the case in the Terra Approach (*see box*).

BOX

Terra Approach

ING, BBVA, BNP Paribas, Société Générale, and Standard Chartered, in association with 2° Invest-ing Initiative, have developed the Terra Approach, to help steer €600 billion lending portfolio toward Paris alignment by 2025. The aim is to specifically target sectors like steel and cement, and help them to decarbonize.

199 ibid

200 https://www.idfc.org/wp-content/uploads/2019/10/blended-finance-a-brief-overview-october-2019_final.pdf

201 https://ieg.worldbankgroup.org/blog/what-blended-finance-and-how-can-it-help-deliver-successful-high-impact-high-risk-projects

6.3.2 Leveraging Results Based Finance Approach to Incentivise Climate Initiatives

Results based financing (RBF) is a programme where incentives are provided for the delivery of predefined outputs or outcomes, upon verification. RBF has been well explored as a finance instrument that is effective in delivering the required impact. It has largely been focused for developmental indicators, such as those under the SDGs so far, but there is vast potential of using this mechanism for the hard to abate sectors, to ensure comprehensive impact, as these industries have impact on water resources, waste generation, poverty and livelihoods, working environment, as well as the climate aspect of emission reduction. This approach can expand the co-benefits of decarbonisation, while also be used to mobilise additional sources of developmental and climate financing, which are not in general available to these industries.

A specially designed programme, led by international climate finance, which incentivises the participants, in this case the companies, to undertake investments in new technologies and processes, while also delivering on other positive social and environmental aspects, could help in establishing a demonstrating a best-case model scenario for the transitioning of these industries. This would be a useful platform to engage with a range of domestic funder too, from the national development banks to the state governments as well as philanthropies, and start a multi-ministry dialogue which can develop comprehensive policy support measures for future decarbonisation. The World Bank's Program-for-Results is a performance based loan, a form of RBF, which can be built on for designing such projects.

6.3.3 Exploring Transition Bonds for Indian Steel and Cement Industries

A form of direct financing support which can be provided through international climate finance sources is through the emerging instrument of transition bonds. Since green bonds fall out of the scope of these industries, the transition bonds are specifically meant for carbon-intensive industries, to incentivise and drive them towards decarbonisation, through practicable phases, understanding that it is not feasible for these industries to completely transition to green in the near-term.

Considering the urgency of transitioning the steel and cement industries to low-carbon pathways in India, this measure may have the most direct impact. The bond can either be issued for a single company, or to provide a larger message, be at an industry level and be issued by the relevant ministry, in collaboration with a national public finance institute, as well as the international climate finance partners. It can be tailored to promote a set of priority technologies for reducing emissions and having a long-lasting impact on the operations of the companies.
There have been no transition bonds issued in India yet. This is an opportunity for international climate finance vehicles to set benchmarks for such bonds in India, ensuring that a stringent criteria is in place, to push for the best possible and achievable emissions reduction.

6.3.4 Developing a Voluntary Carbon Market for Hard to Abate Sectors

Voluntary carbon markets enable the trading of carbon credits outside of the existing regulatory environment. They are useful for supporting voluntary actions of companies and other private entities. Since it is still unclear to what level the HTA sectors will be able to participate in the market mechanisms being developed under the Paris Agreement's Article 6, in the short-run there may be a need for establishing alternate mechanisms and channels for these industries.

There isn't a structured voluntary carbon market operating at the national level in India. Further, the Indian HTA sectors, including steel and cement, find limited to no opportunities for trading their carbon assets at the global level. To provide encouragement to these industries and incentivise their emission reductions, international climate finance can be used to establish a pilot of such a market mechanism for the steel and cement industries. Methodologies and criteria for creating robust carbon assets can be set and used to improve the quality of the carbon credits being generated.

6.4

Ensuring Effective Policy Implementation

6.4.1 Building Policy Coherence and Standardisation

A common barrier which has been highlighted through interaction with green financers, is the inability of these industries to adhere to the minimum standards for eligibility for green finance. Very often, this problem is exacerbated by the conflict with or lack of support from existing policy and regulatory norms. As mentioned in Section 5.3, often, one of the minimum requisites for extending finance in steel companies is that a minimum energy efficient technology, such as WHR, is installed in place. Not many steel companies have this due to the high cost incurred in setting up, and little to no compliance benefit is reaped to justify the cost of installation. One can revisit the case of existing policy, such as earlier mentioned policy on RPO, which does not include the energy use from WHR to be met as compliance under the non-solar obligation of RPO. In other words, necessary requisites for international finance are either not encouraged or do not serve necessary requirements under the domestic policy and regulatory framework.

Needless to say, for sectors such as steel and cement, which are subject to various policy and regulatory compliances, these policies must be coherent with the global industry standards. This is especially in case the criteria of green finance depends on such practices.

Considering India is on a developing trajectory, meeting global standards will be highly challenging, however, a policy framework must be designed to nudge industries to move further in the desired direction. Policy frameworks should thus, target global best practices and should be framed so as to incentivise Indian industries to meet the international benchmarks.

At the same time, international finance is difficult to access for Indian companies in these industries, because the minimum required standards for making international finance available are very high for Indian manufacturers. This is a major barrier, which prevents even those companies that are committed to low-carbon pathway of growth, to be able to get the required support.
This calls for action on the part of financiers, and international financing bodies to develop a different set of protocols/ standards for financing hard to abate industries in developing countries. If standards of the global north are applied universally as a metric for extending finance, then the amount of finance available to developing countries will always remain a minute proportion of the finance lent to industries in developed countries.

In this regard, Indian industries must support advocacy to put forth developing countries' issues in transitioning to green processes. The industry standards for finance must be broad-based, and developed in thorough consultation with developing countries. International climate finance can support these endeavours in an inclusive manner, facilitating interactions with key stakeholders from the global sphere for industry level.

6.4.2 Improving Enforcement and Upgrading Existing Policies

The previous point discusses the inadequate policy enforcement at the central and state levels. However, further concern arises on inadequate implementation of existing policies. One of the barriers that was raised by several respondents was that policy mandating uptake of solid waste, which could be used to meet the compliance in AFR policy, is unfeasible because of lack of segregated waste. That is, at the ground level, policy on solid waste management lacked implementation, which further hurdled the compliance on AFR.

Lack of policy enforcement creates a domino effect, which creates uncertainty which in turn is not favourable for accessing international finance. Like mentioned in the earlier chapters, the cost of waste to energy processes incorporated in the production process varies depending on availability of segregated or unsegregated waste, and the cost difference from this alone can make the activity either viable, or not.

This calls for better enforcement of policy at the ground level through innovative engagement models. For instance, policy-makers could work on improving centre and state engagement in such cases by developing mechanisms linking segregated urban waste to steel and cement plants, with possible sharing of offsets between companies and the municipalities. This could be started through a pilot project or a market-based mechanism, which can be developed and led by an international climate finance project.

Further, policy-makers should look into existing frameworks and mechanisms to modify them to include aspects which better align them with climate objectives, while making them more practicable in view of the challenges. The PAT scheme, one of the principal drivers of energy efficiency enhancement in the cement and steel sectors, has faced the problem of low and volatile prices for its Energy Saving Certificates (ESCerts). As a short-term remedy to this situation, policy makers should consider means to correct is market mechanism by buying excessive ESCerts or 'warehousing' them for later use. Warehousing or banking ESCerts when not required, can control the excess supply and allow prices to rise. The warehousing of excess ESCerts, could be led though an international climate finance project.

Streamlining policy, strengthening enforcement and taking corrective measures in existing market-based mechanisms serve a vital purpose from the lens of international green finance. Strong policy backing offers a strong market signal for international financiers. The risk associated with uncertainty is removed and coherence of domestic policies with global bets practices, will make it easier to flow finance towards these sectors. Streamlined and well enforced policy will also serve its purpose of mobilising demand. Increased market demand serves additional stimulus for undertaking green transitions, drive investment and also invite finance.

6.4.3 Creating Domestic Capacity for Mobilising Climate Finance

International climate finance support and technical assistance can also be directed towards helping India to systematically develop its capacity to mobilise national financial resources for climate initiatives. In India, National Climate Funds and the National Development Banks, have to be developed as financial catalysts towards green transition. National Development Banks for climate can be seen as policy facilitators, mobilising finance towards green projects and being the first-movers in terms of the support provided for new clean and green technologies.

The government-owned Indian Renewable Energy Development Agency (IREDA), is at present the only non-banking finance company dedicated to clean energy funding in India. There have been talks of it becoming a commercial 'green bank', but these are yet to fructify. International climate finance can support advocacy and engagement with India's nodal climate change bodies and existing green finance organisations, to implement the establishment of such a finance institute.

Development banks are especially advantageous for heavy industries like steel and cement because they provide long term credit for capital intensive investments. There is a growing precedent for this across the world, where National Development Banks are assisting a green industry growth, as done by China's Export-Import Bank of China, or Germany's KfW. Similarly, State Investment Banks like Australia's Clean Energy Finance Corporation or UK's Green Investment Bank have also made a substantial impact in de-risking and mobilising finance for certain industries.

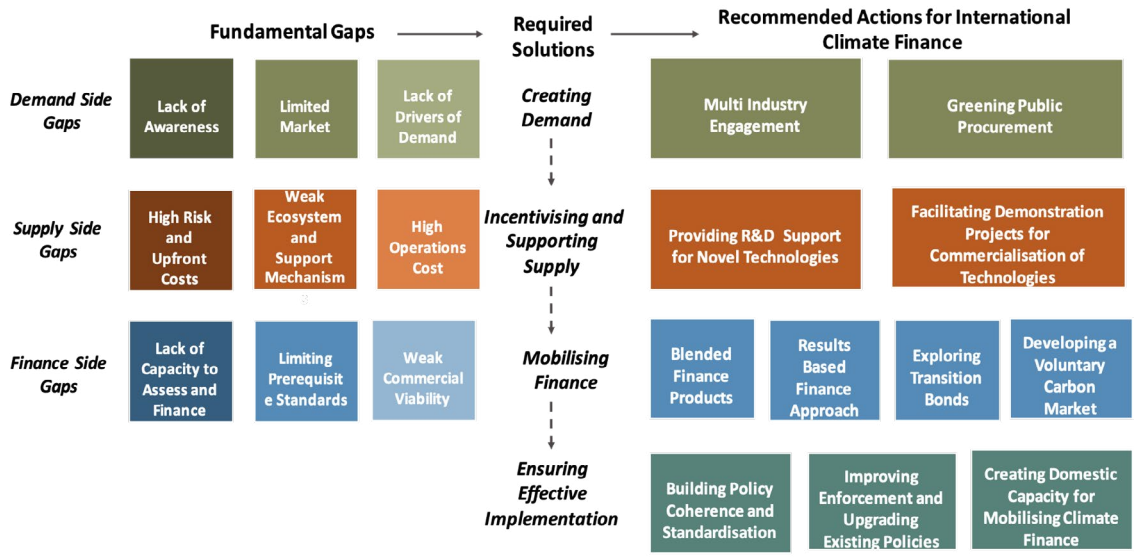
Key Takeaway

Policy is a key driver that can accelerate green transitions in the heavy industry sectors. A conducive policy framework helps attract finance, however, implementation gaps for the same policies act as hurdles for mobilizing the required green finance. As seen, transition to a low emissions steel and cement sector is technically possible, and the willingness to reduce their emissions, and adopt green technologies exists among the industry leaders. However, **the existing regulatory framework is unsuitable for driving the rapid transitions at scale by leveraging transformative technologies**, which is the requirement.

As a first step towards this, there **needs to be clear policy signals, which push for a transition to low carbon pathways for these industries**. The identified fundamental gaps need to be addressed and leveraging international climate finance can play a key role in transforming the current situation with greening the steel and cement industries. The figure below, summarizes the broad categories of solutions and the recommended actions which can bring a significant shift in the current policy framework and strengthen the overall ecosystem enabling the green transition.

FIGURE 23

Recommendations for Addressing Key Gaps by Leveraging International Climate Finance



While there are a range of additional actions required to fully address the existing gaps and enable a low carbon transition of the steel and cement sectors, **the above-mentioned actions would help lay a firm foundation which would build the capacity and facilitate an acceleration of the transition. Emphasis should be put on collaborative design and implementation** of these activities, where key stakeholders from the national side are closely engaged with, to create a truly transformative impact.

In the current times, the enhanced ambitions for industrial green transition seem to be in suspension due to various factors, including lack of clarity around the new market mechanisms to be formulated under the Paris Agreement and the impact of the global pandemic on economic growth. In this context, the role of international climate finance in continuing the momentum of climate actions and building on it becomes critical.

Conclusion

In most analyses of heavy industry decarbonisation, two of the key factors which serve as both hurdles and mobilisers, are access to technology and finance. These two facilitators of green action, do not however, operate in isolation. The synergy between technology and financial flows is determined and influenced to a great extent by the underlying policy framework. This dimension adds to the existing intricate relationship between these three determinants of green initiatives.

Under this project, our focus has been on understanding the role played by policy and the potential for international finance to facilitate green transitions. However, on delving deeper into this area, one finds that these factors not only that determine the rate and extent of green transitions, but also have a great influence on each other. Financial prospects, guidelines, standards often play a role in framing a policy structure or developing a market-based mechanism for carbon emissions. At the same time, policy frameworks, its effectiveness and enforcement play a crucial role effective in determining the ease of finance. This dynamic is further highlighted by the role policy, regulation and finance has on influencing demand for green products and the ability to ensure its supply.

As India moves into the implementation phase of its NDCs, it is critical to understand the role industries, especially the hard to abate ones, play in India's overall GHG emissions and the actions that are required to support them to transition to lower carbon pathways. Despite its large emissions footprint, the heavy industries have largely been exempt from stringent climate policy measures, globally, due to their critical role in the economy. For instance, under the EU ETS, compensations were paid to some high-emitting key industries which minimised the impact of the carbon penalty.[202] It is essential for the policy framework to address this incongruity from the lens of 'just transition', which allows for a shift to a regenerative economy, while securing livelihoods.

202 Carbon Market Watch (2017). A Fair EU ETS Revision. Last accessed on May 10th at https://carbonmarketwatch.org/wp-content/uploads/2017/06/A-Fair-EU-ETS-Revision_policy_brief_June2017_websingle_final.pdf

It is imperative that while countries across the world look at rebuilding their economies after the global pandemic, international climate finance is able to step in and advocate for a green comprehensive transition. Addressing the hard to abate sector at this time with targeted initiatives would bean effective way to build on the past momentum and drive towards more transformative changes.

References

Chapter 1

Afonso, Swansy. 2020. "Carbon emissions by India's Steel Sector to Triple by 2050" (Article). Bloomberg Green https://www.bloomberg.com/news/articles/2020-02-04/carbon-emissions-by-india-s-steel-sector-to-triple-by-2050 (Last accessed on 6th May 2020).

Business Standard. 2019. "Cement demand expected to grow 1.2 times of GDP growth rate: UltraTech" (Article). https://www.business-standard.com/article/pti-stories/cement-demand-expected-to-grow-1-2-times-of-gdp-growth-rate-ultratech-119021100761_1.html (Last accessed on 6th May 2020).

Cement Manufacturers Association. https://www.cmaindia.org/about-us/introduction/ (Last accessed on 4th May 2020).

CRISIL (2020). 'Cement cracks: Covid-19 culls demand, crude cushions blow to profit'. Article last accessed on April 29, 2020 at: https://www.crisil.com/en/home/our-analysis/views-and-commentaries/2020/04/cement-cracks.html

CRISIL (2020). 'Melting Steel: The Covid-19 pandemic is set to wreck profitability'. Article last accessed on April 28, 2020 at: Source: https://www.crisil.com/en/home/our-analysis/views-and-commentaries/2020/04/melting-steel.html

CW Group. 2019. "World Cement Demand to Shrink to 4 Billion Tonnes by 2050" (Article) https://www.cwgrp.com/cemweek-features/514400-world-cement-demand-to-shrink-to-4-billion-tons-by-2050 (Last accessed on 6th May 2020).

Datta, Aveek (2020). Article last accessed on April 30, 2020 at: https://www.fortuneindia.com/macro/indian-economy-will-be-totally-different-post-covid-19/104355

Equitymaster. 2020. "Cement Sector Analysis Report" (Article). https://www.equitymaster.com/research-it/sector-info/cement/Cement-Sector-Analysis-Report.asp (Last accessed on 29th April 2020).

Financial Express (2020). 'Covid-19 to hit cement sector in near term, says experts'. Article last accessed on April 28, 2020 at: https://www.financialexpress.com/industry/covid-19-to-hit-cement-sector-in-near-term-say-experts/1911374/

Financial Express (2020). 'COVID-19 effect: Cement demand hit, likely to cover in H2 of FY21'. Article last accessed on April 30, 2020 at: https://www.financialexpress.com/industry/covid-19-effect-cement-demand-hit-likely-to-recover-in-h2-of-fy21/1919165/

Gilani, Vivek. "Carbon Emissions in the Cement Sector in India" (Article). http://cbalance.in/2013/12/carbon-emissions-in-the-cement-sector-in-india/#.XczpbNUzYdV (Last accessed on 29th April 2020).

Global Cement. 2018. "Dalmia Cement sets carbon negative target of 2040" (Article). https://www.globalcement.com/news/item/8073-dalmia-cement-sets-carbon-negative-target-of-2040 (Last accessed on 6th May 2020).

Global Cement Magazine. 2018. "International Cement Review, November 2018 issue" (Journal). https://www.cemnet.com/publications/icr-back-issues (Last accessed on 6th May 2020).

Hall, Will, Thomas Spencer and Sachin Kumar. 2020. "'Towards a Low Carbon Steel Sector: Overview of the Changing Market, Technology, and Policy Context for Indian Steel' (Report). Shakti Foundation, The Energy and Resources Institute and Energy Transitions Commission. https://shaktifoundation.in/wp-content/uploads/2020/01/Towards-a-Low-Carbon-Steel-Sector-Report.pdf (Last accessed on 29th April 2020).

India Brand Equity Foundation. 2020. "India Cement Industry Report" (Report). https://www.ibef.org/industry/cement-india.aspx (Last accessed on 4th May 2020).

India Cement Review. 2019. "Cement industry 'Vision 30' launched" (Article). https://indiancementreview.com/events/Cement-Industry--quot-Vision-2030-quot--Launched/114689 (Last accessed on 6th May 2020).

International Trade Administration. 2019. "Steel Exports report: India" (Report). Department of Commerce, USA. https://legacy.trade.gov/steel/countries/pdfs/exports-India.pdf (Last accessed on 29th April 2020).

Joint Plant Committee, Government of India. 2019. "An Overview of Steel Sector" (Report). https://steel.gov.in/sites/default/files/An%20_Overview%20_of_Steel_Sector_mar2019.pdf. (Last accessed on 30th April 2020).

Joshi, Sanjay. 2020. "Can cement industry be the growth driver for India?" (Article). Business Today. https://www.businesstoday.in/opinion/columns/can-cement-industry-be-growth-driver-for-india/story/396951.html (Last accessed on 6th May 2020).

Kanvic. 2018. "Building a New India" (Article). https://www.kanvic.com/grey-matter/building-a-new-india# (Last accessed on 30th April 2020).

Khan, Mirza. 2019. "Steel, cement sectors pin hopes on housing and road spends" (Article). The Hindu. https://www.thehindubusinessline.com/economy/budget/steel-cement-sectors-pin-hopes-on-housing-and-road-spends/article28297591.ece (Last accessed on 4th May 2020).

Khuller, Anita. 2019. "Setting Benchmarks: Indian Cement Industry Emerges as a Global leader in Energy efficiency" (Article). PowerLine. https://powerline.net.in/2019/05/06/setting-benchmarks/ (Last accessed on 29th April 2020).

Maritime Gateway. Cement Logistics a Costly Affair. http://www.maritimegateway.com/cement-logistics-costly-affair/ (Last accessed on June 24th 2020)

Ministry of Commerce & Industry, Government of India. 2019. "Commerce & Industry Minister Releases Compendium of Cement Industry" (Press Release). https://pib.gov.in/Pressreleaseshare.aspx?PRID=1562754 (Last accessed on 29th April 2020).

Ministry of Steel, Government of India. 2017. "National Steel Policy, 2017". https://steel.gov.in/sites/default/files/NATIONAL_STEEL_POLICY_2017_0.pdf (Last accessed on 29th April 2020).

Ministry of Steel, Government of India. 2019. "25 Safety guidelines for Iron and Steel Sector" (Report). https://steel.gov.in/sites/default/files/Framework%20Document%20for%20Safety%20Guidelines.pdf (Last accessed on 4th May 2020).

Ministry of Steel, Government of India. 2019. "Per Capita Steel Consumption in the Country" (Press Release). https://pib.gov.in/Pressreleaseshare.aspx?PRID=1562754 (Last accessed on 29th April 2020).

Ministry of Steel, Government of India. 2019. "Several initiatives taken by the Ministry of Steel to support a competitive, efficient, environment friendly steel industry, adhering to global safety and quality standards" (Press Release). https://pib.gov.in/newsite/PrintRelease.aspx?relid=196065 (Last accessed on 4th May 2020).

Muthusamy, A.. 2020. "Export and Import Performance of Steel in India" (Paper). https://www.researchgate.net/publication/338449849_Export_and_Import_Performance_of_Steel_in_India (Last accessed on 4th May 2020).

PricewaterhouseCoopers (PWC) and Indian Steel Association. 2019. "The Indian steel industry: Growth, challenges and digital disruption" (Report). https://www.pwc.in/assets/pdfs/consulting/technology/the-indian-steel-industry-growth-challenges-and-digital-disruption.pdf (Last accessed on 29th April 2020).

Research and Markets. 2020. "Indian Cement Industry Forecasts 2019-2024" (Article). https://www.globenewswire.com/news-release/2020/02/20/1987610/0/en/Indian-Cement-Industry-Forecasts-2019-2024-Cement-Production-Expected-to-Reach-410-21M-Tons-by-2024-Owing-to-Rising-Demand-from-the-Government-and-Housing-Contractors.html (Last accessed on 4th May 2020).

The Economic Times. 2018. "Government has to be ready to step in if steel imports surge: SK Roongta" (Article). https://economictimes.indiatimes.com/markets/expert-view/government-has-to-be-ready-to-step-in-if-steel-imports-surge-sk-roongta/articleshow/65719269.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst (Last accessed on 4th May 2020).

The Economic Times (2020). 'Covid-19 impact: Manufacturing grinds to a halt in key sectors'. Article last accessed on April 30, 2020 at: https://economictimes.indiatimes.com/news/company/corporate-trends/manufacturing-grinds-to-a-halt-in-key-sectors/articleshow/74765038.cms?utm_source=contentofintere st&utm_medium=text&utm_campaign=cppst

The Economic Times. 2020. "Modi govt's USD 5-trillion GDP target by 2024 looks unimaginably ambitious" (Article).

https://economictimes.indiatimes.com/news/economy/policy/modi-govts-usd-5-trillion-gdp-target-by-2024-looks-unimaginably-ambitious/articleshow/73212751.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst (Last accessed on 4th May 2020).

UNFCCC. "India's Intended Nationally Determined Contribution: Working Towards Climate Justice" (Article). https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/India%20First/INDIA%20INDC%20TO%20UNFCCC.pdf

World Bank. "World Bank national accounts data, and OECD National Accounts data files". https://data.worldbank.org/indicator/NY.GDP.MKTP.KD?end=2018&locations=IN&start=2000 (Last accessed on 4th May 2020).

World Business Council for Sustainable Development. 2019. "Indian Cement Sector SDG Roadmap" (Report). https://www.wbcsd.org/Programs/People/Sustainable-Development-Goals/SDG-Sector-Roadmaps/News/Indian-Cement-Sector-SDG-Roadmap

World Steel Association. 2019. "Steel Statistical Yearbook 2019" (Report). https://www.worldsteel.org/en/dam/jcr:7aa2a95d-448d-4c56-b62b-b2457f067cd9/SSY19%2520concise%2520version.pdf (Last accessed on 10th May 2020).

Chapter 2

BEE (2017). Achievements Under PAT. Available at: https://beeindia.gov.in/sites/default/files/Booklet_Achievements%20under%20PAT_May%202017.pdf

Carbon Clean Solutions Limited. 2019. "Dalmia Cement and CCSL sign MOU" (Article) https://carboncleansolutions.com/media-center/news/article/2019/09/dalmia-cement-and-ccsl-sign-mou (Last accessed on 6th April 2020).

CDP and TERI. 2020. "Putting a Price on Carbon- Handbook for Indian Companies 2.0" (Report). https://www.cdp.net/en/reports/downloads/4918 (Last accessed on 4th May 2020).

Cement Manufacturers Association. 2020. "Environment Overview" (Article) https://www.cmaindia.org/key-areas/environment/ (Last accessed on 4th May 2020).

Cement Manufacturers Association. https://www.cmaindia.org/about-us/introduction/ (Last accessed on May 4th 2020).

Dalmia Bharat Group. 2019. "Dalmia Cement (Bharat) Limited and Carbon Clean Solutions team up to build cement industry's largest Carbon Capture plant" (Press Release). https://www.dalmiabharat.com/dcbl-carbon-capture-plant.html (Last accessed on 6th May 2020).

Gilani, Vivek. "Carbon Emissions in the Cement Sector in India" (Article). http://cbalance.in/2013/12/carbon-emissions-in-the-cement-sector-in-india/#.XczpbNUzYdV (Last accessed on 29th April 2020).

Global Cement and Concrete Association. https://gccassociation.org (Last accessed on 4th May 2020).

Global Cement Magazine. 2018. "International Cement Review, November 2018 issue" (Journal). https://www.cemnet.com/publications/icr-back-issues (Last accessed on 6th May 2020).

Hall, Will, Thomas Spencer and Sachin Kumar. 2020. "'Towards a Low Carbon Steel Sector: Overview of the Changing Market, Technology, and Policy Context for Indian Steel' (Report). Shakti Foundation, The Energy and Resources Institute and Energy Transitions Commission. https://shaktifoundation.in/wp-content/uploads/2020/01/Towards-a-Low-Carbon-Steel-Sector-Report.pdf (Last accessed on 29th April 2020).

Indian Steel Association. https://indsteel.org/index.php (Last accessed on 4th May 2020).

Kisic, Marco, Carole Ferguson, Christie Clarke, and James Smyth. 2018. "Which Cement Companies will be left Behind in the Low-carbon Transition" (Report). CDP Disclosure Insight Action. https://www.cdp.net/en/investor/sector-research/cement-report (Last accessed on 6th May 2020).

Ministry of Steel, Government of India. 2017. "National Steel Policy, 2017". https://www.google.com/

Chapter 3

ACC Limited, 2018. "ACC Limited 83rd Annual Report 2018" (Report). https://www.acclimited.com/newsite/annualreport2018/ACC_Annual_Report_2018.pdf

ACC Limited, 2019. "Integrated Annual Reports" (Report). https://www.acclimited.com/investor-relations/financial-annual-results (Last accessed on 20th April 2020).

ACC Limited, 2019. "Sustainable Development Reports" (Report). https://www.acclimited.com/sustainable/sustainable-development-reports (Last accessed on 29th April 2020).

Ambuja Cements Limited, 2019. "The Annual Reports" (Report). https://www.ambujacement.com/investors/annual-reports (Last accessed on 20th April 2020).

Banerji, S., 2018. "Out of the Woods", Business Today, 22nd April (Article). https://www.businesstoday.in/magazine/special-reports/steel/l-recession-global-steel-industry-steel-companies-import-steep-decline-domestic-steel-prices/story/273843.html(Last accessed on 30th April 2020).

CEEW (2019), *"Sustainable Manufacturing for India's Low-Carbon Transition"*. Accessible at: https://www.ceew.in/sites/default/files/CEEW%20-%20Sustainable%20manufacturing%20in%20a%20low-carbon%20economy%2024Sep19.pdf#overlay-context=

Chandaran, J., 2015. "A Troubled Time for India's Steel Industry" (Article). https://www.livemint.com/Opinion/J17b2iGXgFGdkT0C0bkwgJ/A-troubled-time-for-Indias-steel-industry.html (Last accessed on 2nd May 2020).

Confederation of Indian Industry, 2019. "Case Study Booklet on Energy Efficient Technologies in Cement Industry" (Report).

Domain-b.com, 2007. "ACC Commissions Wind Energy Farm in Tamil Nadu to Supplement Power for Cement Plant", Domain-b.com, 6th October" (Article). https://www.domain-b.com/companies/companies_a/acc/20071006_commissions.htm (Last accessed on 4th May 4th, 2020)

Folger, J., 2020. "What Is Considered a High Debt-To-Equity Ratio?" [Article].https://www.investopedia.com/ask/answers/063014/what-considered-high-debttoequity-ratio-and-what-does-it-say-about-company.asp (Last accessed on 29th April 2020).

Global Cement, 2019. "Indian cement sector operating at 67%capacity utilization rate" (News Article). https://www.globalcement.com/news/item/9503-indian-cement-sector-operating-at-67-capacity-utilisation-rate

IFC (2013) *"Existing and Potential Technologies for Carbon Emissions Reductions in the Indian Cement Industry"*. Accessible at: https://www.ifc.org/wps/wcm/connect/0bd665ef-4497-4d6d-9809-9724888585d2/india-cement-carbon-emissions-reduction.pdf?MOD=AJPERES&CVID=jWEGLpL

India Steel, 2017. "Global and Domestic Steel: Pressing Issues and Way Ahead" (Report). India: Federation of Indian Chambers of Commerce & Industry. http://ficci.in/spdocument/20888/Steel-Report-2017.pdf (Last accessed on 7th May 2020).

Jindal Stainless Limited, 2019. "JSL Annual Reports" (Report). https://www.jslstainless.com/annualreports.html(Last accessed on 28th April 2020).

Jindal Steel & Power Limited, 2019. "Annual report 2007-08 to 2018-19" (Report). https://www.jindalsteelpower.com/investors/annual-report.html (Last accessed on 29th April 2020).

JK Cement Limited, 2019. "The Annual Reports" (Report). https://www.jkcement.com/financial_reports (Last accessed on 25th April 2020).

JSW Steel Limited, 2019. "The Annual Reports" (Report). https://www.jsw.in/investors/steel/investor-relations-steel(Last accessed on 25th April 2020).

Mishra, T., 2019. "Free from CDR Process now, Jindal Stainless Eyes Easier Access to Capital" (Article). Business Line, 22nd July. https://www.thehindubusinessline.com/markets/free-from-cdr-process-now-jindal-stainless-eyes-easier-access-to-capital/article28648567.ece (Last accessed on 6th May 2020).

National Council of Applied Economic Research, 2015. "The Indian Steel Industry: Key Reforms for a Brighter Future" (Report). http://www.ncaer.org/free-download.php?pID=257 (Last accessed on 4th May 2020).

National Stock Exchange, 2019. "NIFTY Broad Market Indices - Methodology Document" (Website). https://www.moneyworks4me.com/best-index/nse-stocks/top-nse500-companies-list/ (Last accessed on 4th Feb 2020).

Raveendran R., 2020. "Steel Companies in India Top 10 Manufacturers" (Article)https://indiancompanies.in/top-companies-in-steel-industry-in-indiaby-capacity-market-share/ (Last accessed on 23rd April 2020).

Raveendran R., 2020. "Top 10 Cement Companies in India 2020" (Article). https://indiancompanies.in/top-10-companies-in-cement-industry-in-india/ (Last accessed on 23rd April 2020).

SAIL, 2019. "The Annual Reports" (Report). https://www.sail.co.in/financial-list/103 (Last accessed on 26th April 2020).

Shree Cement Limited, 2019. "The Annual Reports" (Report).https://www.shreecement.com/pages/annual_reports_archive.php (Last accessed on 29th April 2020).

Spencer, Thomas, Raghav Pachouri, G Renjith, Sachi Vohra, 2018. "Coal Transition in India" (Discussion Paper). The Energy and Resources Institute. https://www.teriin.org/sites/default/files/2018-12/Coal-Transition-in-India.pdf

TATA Steel, 2019. "Sustainable Development Reports" (Report). https://www.tatasteel.com/sustainability/ (Last accessed on 18th May 2020).

TATA Steel, 2019. The Annual Reports" (Report). https://www.tatamotors.com/investors/annual-reports/ (Last accessed on 29th April 2020).

Televisiory, 2020. "Benchmarking the cement industry in India and China" (Article). https://www.televisory.com/blogs/-/blogs/benchmarking-the-cement-industry-in-india-and-chi-2 (Last accessed on 28th April 2020).

The Joint Parliamentary Committee, 2017. "Development of Indian Steel Sector Since1991" (Report) https://steel.gov.in/sites/default/files/DEVELOPMENT.pdf(Last accessed on 8th May 2020)

TERI (2020), *"Towards a Low-Carbon Steel Sector"*. Available at: https://shaktifoundation.in/wp-content/uploads/2020/01/Towards-a-Low-Carbon-Steel-Sector-Report.pdf ;

UltraTech Cement Limited, 2019. "The Annual Reports" (Report). https://www.ultratechcement.com/investors/financials (Last accessed on 28th March 2020).

Waghmare, Abhishek, Amritha Pillay, 2019. "India's manufacturing capacity utilization declines to the lowest ever" (Article). Business Standard https://www.business-standard.com/article/economy-policy/india-s-manufacturing-capacity-utilisation-declines-to-the-lowest-ever-119120600055_1.html

Chapter 4

Agarwal, Swati., & Singh, Tamiksha. . 2018. "Unlocking the Green Bond Potential in India" (Report). TERI. *https://www.teriin.org/sites/default/files/2018-05/Report%20under%20NFA%20grant_2018.pdf* (Last accessed on 6th May 2020).

ASCI and UNDP India. 2009. "Analysis of Existing Environmental Instruments in India" (Report).

Bureau of Energy Efficiency. "National Mission for Enhanced Energy Efficiency". Ministry of Power, Government of India. https://beeindia.gov.in/content/nmeee-1 (Last accessed on 18th April 2020).

Bureau of Energy Efficiency. "PAT-Read more". Ministry of Power, Government of India. https://beeindia.gov.in/content/pat-read-more (Last accessed on 14th April 2020).

Carbon Market Watch. 2017. "A Fair EU ETS Revision: Removing Favouritism and Discrimination from the EU's Cabon Market" (Policy Brief). https://carbonmarketwatch.org/wp-content/uploads/2017/06/A-Fair-EU-ETS-Revision_policy_brief_June2017_websingle_final.pdf. (Last accessed on May 10th, 2020).

Central Pollution Control Board, & National Productivity Control.

2016. "Hazardous Waste Management Rules-2016" (Presentation). Capacity Building Programme on Implementation of waste Management Rules, 2016. Ministry of Housing & Urban Affairs, Ministry of Environment, Forest & Climate Change, Government of India. https://www.npcindia.gov.in/NPC/Files/delhiOFC/EM/Hazardous-waste-management-rules-2016.pdf (Last accessed on 14th April 2020).

Central Statistics Office. 2019. "Energy Statistics 2019" (Report). Ministry of Statistics and Programme Implementation. Government of India. *http://www.indiaenvironmentportal.org.in/files/file/Energy%20Statistics%202019.pdf* (Last accessed on 4th May 2020).

Center for International Environment and Resource Policy. 2019. "Climate Finance Policy in Practice: A Review of the Evidence" (Report). Climate Policy lab, The Fletcher School, Tufts University, Number 017. (https://sites.tufts.edu/cierp/files/2019/11/CPL_ClimateFinancePolicyinPractice.pdf)

Centre for Science and Environment. "Understanding EIA" (Blog). https://www.cseindia.org/understanding-eia-383 (Last accessed on 4th May 2020).

Chatterjee, Anupam. July, 2019. "Power purchase agreement: Honour contracts, don't halt growth, Centre tells Andhra Pradesh" (News Article). Financial Express. https://www.financialexpress.com/industry/power-purchase-agreement-honour-contracts-dont-halt-growth-centre-tells-andhra/1643387/ (Last accessed on 18th April 2020).

Deo, Pradomd. August, 2019. "The RPO conundrum: How a myopic policy wreaks havoc on India's energy intensive sectors" (News Article). ETGovernment. https://government.economictimes.indiatimes.com/news/policy/the-rpo-conundrum-a-myopic-policy-wreaks-havoc-on-indias-energy-intensive-sectors/70696603 (Last accessed on 14th April 2020).

Deo, Pradomd. August, 2019. "The RPO conundrum: How a myopic policy wreaks havoc on India's energy intensive sectors" (News Article). ETGovernment. https://government.economictimes.indiatimes.com/news/policy/the-rpo-conundrum-a-myopic-policy-wreaks-havoc-on-indias-energy-intensive-sectors/70696603 (Last accessed on 4th May 2020).

Driesen, M.D. 1998. "Is Emissions Trading an Economic Incentive Program?: Replacing the Command and Control/Economic Incentive Dichotomy" (Article). Washington and Lee Law Review, Vol. 55, Issue 2, pp. 289-350. http://scholarlycommons.law.wlu.edu/wlulr/vol55/iss2/2 (Last accessed on 4th May 2020).

FICCI. 2015. "Indian Secondary Steel Industry- Opportunities & Challenges" (Report). *http://www.ficci.in/spdocument/20782/ficci-steel-report.pdf* (Last accessed on 16th April 2020).

Impact Assessment Division. 2018. "Standardisation of Environment Clearance conditions- reg" (Office Memorandum). Ministry of Environment, Forest and Climate Change, Government of India. http://environmentclearance.nic.in/View.aspx?rid=30 (Last accessed on 14th April 2020).

International Energy Agency. April, 2018. "Cement technology roadmap plots path to cutting CO2 emissions 24% by 2050"(News Article). https://www.iea.org/news/cement-technology-roadmap-plots-path-to-cutting-co2-emissions-24-by-2050 (Last accessed on 4th May 2020).

India Brand Equity Foundation (IBEF). December, 2019. "Indian Cement Industry Analysis" (Report Analysis). *https://www.ibef.org/archives/industry/cement-reports/indian-cement-industry-analysis-january-2020* (Last accessed on 14th April 2020).

Invest India. 2019. "India's Road Towards Being an Economic Powerhouse is Paved on Steel" (News Article). https://www.investindia.gov.in/team-india-blogs/indias-road-towards-being-economic-powerhouse-paved-steel (Last accessed on 4th May 2020).

Joint Plant Committee. *http://www.jpcindiansteel.nic.in/writereaddata/files/JPC%20PROFILE%202018_1.pdf* (Last accessed on 6th May 2020).

Kalita, J. D. 2016. "Environmental Impact Assessment in India (EIA): An Appraisal" (Article). Dimorian Review, Vol. 3, Issue 1. *https://www.researchgate.net/publication/311351409* (Last accessed on 4th May 2020).

Meng, Alan Xiangrui, Ivy Lau, & Bridget Boulle. 2018. "China Green Bond Market 2017" (Report). Climate Bonds Initiative and China Central Depository and Clearing Company. https://www.climatebonds.net/files/reports/china_annual_report_2017_en_final_14_02_2018.pdf (Last accessed on 8th May 2020).

Ministry of Coal. 2015. "The Coal Mines (Special Provisions) Act, 2015". http://legislative.gov.in/sites/default/files/A2015-11.pdf (Last accessed on 8th May 2020).

Ministry of Corporate Affairs. 2013. "The Companies Act, 2013". Government of India.

Ministry of Department of Environment note. https://doe.gov.in/sites/default/files/NCEF%20Brief_post_BE_2017-18.pdf (Last accessed on 8th May 2020).

Ministry of Environment and Forests. 2006. "Environmental (Protection) Rules" (Notification). The Gazette of India, Government of India http://moef.gov.in/wp-content/uploads/2018/04/so1533_2.pdf (Last accessed on 27th April 2020).

Ministry of Mines. 2015. "The Mines and Minerals (Development and Regulation) Amendment Act, 2015". The Gazette of India, Government of India. https://www.mines.gov.in/writereaddata/UploadFile/The_Mines-and-Minerals_Amendment_Act,2015.pdf (Last accessed on 7th May 2020).

Ministry of New and Renewable Energy. "National Portal for RPO". Government of India. https://rpo.gov.in/Home/Objective (Last accessed on 17th April 2020).

Ministry of Power. 2001. "The Energy Conservation Act, 2001" (Act of Parliament). The Gazette of India, Ministry of Law and Justice, Government of India. https://powermin.nic.in/sites/default/files/uploads/ecact2001.pdf (Last accessed on 17th April 2020).

Ministry of Power. 2001. "The Energy Conservation Act, 2001" (Act of Parliament). The Gazette of India, Ministry of Law and Justice, Government of India. https://powermin.nic.in/sites/default/files/uploads/ecact2001.pdf (Last accessed on 27th April 2020).

Ministry of Power. 2003. "The Electricity Act, 2003". The Gazette of India, Ministry of Law and Justice, Government of India. https://powermin.nic.in/sites/default/files/uploads/The%20Electricity%20Act_2003.pdf (Last accessed on 24th April 2020).

Ministry of Steel. 2017. "National Steel Policy". https://steel.gov.in/sites/default/files/draft-national-steel-policy-2017.pdf (Last accessed on 27th April 2020).

Ministry of Steel. 2019. "Steel Scrap Recycling Policy". Government of India. https://steel.gov.in/sites/default/files/Steel%20Scrap%20Recycling%20Policy%2006.11.2019.pdf (Last accessed on 27th April 2020).

Ministry of Steel. "Energy & Environment Management in Steel Sector". Government of India. https://steel.gov.in/energy-environment-management-steel-sector (Last accessed on 24th April 2020).

Ministry of Steel. October, 2019. "Draft Framework Policy-Development of Steel Clusters in India". Government of India. https://steel.gov.in/sites/default/files/Draft%20Policy%20for%20Steel%20Cluster_vf15.pdf (Last accessed on 7th May 2020).

Ministry of Steel. October, 2019. "Steel Import Monitoring System (SIMS): Sample form and Frequently Asked Questions (FAQs)". https://steel.gov.in/sites/default/files/FAQ%20list-%20SIMS%20Website_vf.pdf (Last accessed on 27th April 2020).

Ministry of Steel. November, 2019. "Steel Scrap Recycling Policy" (Notification). Government of India. https://steel.gov.in/sites/default/files/213770.pdf (Last accessed on 12th April 2020).

Ministry of Steel. February, 2020. "Research and Development in Iron and Steel Sector". https://steel.gov.in/sites/default/files/R%26D%20Chapter%20for%20MoS%20Website%20Feb%202020%20update.pdf (Last accessed on 17th April 2020).

Ministry of Steel. "Steel Research and Technology Mission of India-SRTMI". https://www.srtmi.com/uploads/SRTMI.pdf (Last accessed on 27th April 2020).

OECD. 2006. "Environmental Compliance and Enforcement in India: Rapid Assessment" (Report). http://www.oecd.org/dataoecd/39/27/37838061.pdf (Last accessed on 17th April 2020).

Potdar, A., Unnikrishnan, S., & Singh, A. 2016. "Study of Energy Regulations in India" (Article). International Journal of Environmental Science and Development, Vol. 7, No. 11. (DOI: 10.18178/ijesd.2016.7.11.891).

Press Information Bureau. March, 2016. "Environment Ministry releases new categorisation of industries- 'Re-Categorisation of Industries a landmark decision, new category of white industries will not require environmental clearance': Javadekar" (News Article). Ministry of Environment, Forest and Climate Change, Government of India. https://pib.gov.in/newsite/printrelease.aspx?relid=137373 (Last accessed on 17th April 2020).

Press Information Bureau. December 2019. "Several initiatives taken by Ministry of Steel to support a competitive, efficient, environment friendly steel industry". Ministry of Steel. *https://pib.gov.in/newsite/PrintRelease.aspx?relid=196065* (Last accessed on 27th April 2020).

PwC, Indian Steel Association. November, 2019. The Indian steel industry: Growth, challenges and digital disruption" (Report). https://www.pwc.in/assets/pdfs/consulting/technology/the-indian-steel-industry-growth-challenges-and-digital-disruption.pdf (Last accessed on 14th April 2020).

Samajdar, C. 2012. "Reduction in Specific Energy Consumption in Steel Industry - with special reference to Indian steel industry" (Article). Energy and Environmental Engineering Journal, Volume 1, Issue 3. http://citeseerx.ist.psu.edu/viewdoc/

Smallridge, Diana., &de Olloqui, Fernando. 2011. "A Health Diagnostic Tool for Public Development Banks" (Article). Technical Notes IDB-TN-225. Inter-American Development Bank. https:// publications.iadb.org/en/health-diagnostic-tool-public-development-banks (Last accessed on 12th April 2020).

Steel Research & Technology Mission of India. "Government Initiative in Steel Sector- SDF Projects". https://www.srtmi.com/index.php/site/governmentinitiatives (Last accessed on 27th April 2020).

Steel Research & Technology Mission of India. "Government Initiative in Steel Sector- SDF Projects." (https://www.srtmi.com/index.php/site/governmentinitiatives)

Swaniti Initiative. "Mines and Mineral Development and Regulation (MMDR) Amendment Act, 2015" (Article). http://www.swaniti.com/wp-content/uploads/2015/06/Analysis-of-MMDR-Amendment-Act-.pdf (Last accessed on 27th April 2020).

The Gazette of India. Ministry of Environment and Forests. 2006. (Notification). Government of India. http://moef.gov.in/wp-content/uploads/2018/07/SO1533E-14092006_0.pdf (Last accessed on 24th April 2020).

The Gazette of India. Ministry of Environment, Forest and Climate Change. 2016. (Notification). http://iwma.in/HWM%20Rules.pdf (Last accessed on 7th April 2020).

The Gazette of India. Ministry of Environment, Forest and Climate Change. 2016. (Notification). http://iwma.in/HWM%20Rules.pdf (Last accessed on 27th April 2020).

Vittas, Dimitri, and Yoon Je Cho.1996. "Credit Policies: Lessons from Japan and Korea" (Article). The World Bank Research Observer, Vol. 11, No. 2, pp. 277–98. *http://documents.worldbank.org/curated/en/499221468261345046/pdf/765570JRN0WBRO00Box374378B00PUBLIC0.pdf* (Last accessed on 6th April 2020).

World Cement. October, 2013. "Environmental Acts affecting the Indian cement industry" (News Article). https://www.worldcement.com/asia-pacific-rim/09102013/environmental_regulations_in_indian_cement_industry2_274/ (Last accessed on 4th April 2020).

World Cement. October, 2013. "Environmental Acts affecting the Indian cement industry" (News Article). https://www.worldcement.com/asia-pacific-rim/09102013/environmental_regulations_in_indian_cement_industry2_274/ (Last accessed on 24th April 2020).

World Cement. 2020. "India Cements its Future" (News Article). https://www.worldcement.com/indian-subcontinent/13012020/india-cements-its-future/ (Last accessed on 27th April 2020).

Zhang, Fang. 2019. "How Do Governments Mobilize Finance for Innovation: The Case of Domestic Clean Energy". PhD, Tufts University.

Chapter 5

Choo, Clement., Chin, Samuel., & Ong, Marcus. November, 2019. "Analysis: India's new steel scrap policy raises concerns on higher unprocessed imports" (Article). S&P Global. https://www.spglobal.com/platts/en/market-insights/latest-news/metals/110819-analysis-indias-new-steel-scrap-policy-raises-concerns-on-higher-unprocessed-imports (Last accessed on May 10th 2020).

Green Climate Fund. 2019. "Green Climate Fund's Private Sector Facility" (Report). https://www.greenclimate.fund/sites/default/files/document/green-climate-fund-s-private-sector-facility_0.pdf (Last accessed on 27th April 2020).

IISD. "The evolution of coal cess in India". https://www.iisd.org/sites/default/files/publications/stories-g20-india-en.pdf (Last accessed on 25th April 2020).

Landberg, R., Massa, A., & Pogkas, D. 2019. "Green Finance is now $31 Trillion and Growing" (News Article). https://www.bloomberg.com/graphics/2019-green-finance/ (Last accessed on May 10th, 2020).

Mazzucato, M., & Semieniuk, G. 2017. "Public financing of innovation: new questions". Oxford Review of Economic Policy, 24-48.

Ministry of Steel. "Research & Development in Iron & Steel Sector". Government of India. https://steel.gov.in/sites/default/files/research_main_0.pdf (Last accessed on 6th April 2020).

Steel Authority of India Limited. 2019. "Annual Report 2018-19" (Report). https://www.sail.co.in/financial-list/103 (Last accessed

on 6th May 2020).

Saraswat, K.V., & Bansal, Ripunjaya. 2019. "Need for a New Steel Policy" (Article). NITI Ayog. https://niti.gov.in/sites/default/files/2019-07/Need%20for%20a%20new%20Steel%20Policy_NITI%20Website%20Final.pdf (Last accessed on 24th April 2020).

Silva, F. 2016. "Research and Development, Innovation and Productivity Growth in the Steel Sector" (Article). OECD. http://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=DSTI/SU/SC(2015)5/FINAL&docLanguage=En (Last accessed on 25th April 2020).

TATA Steel, 2019. The Annual Reports" (Report). https://www.tatamotors.com/investors/annual-reports/ (Last accessed on 29th April 2020).

Chapter 5

Burgess, Molly. November, 2019. "Exclusive: KickStarter CCUS initiative launches" (Article). GasWorld. https://www.gasworld.com/exclusive-kickstarter-ccus-initiative-launches/2018046.article (Last accessed on 29th April 2020).

Competition Commission of India. "Public Procurement and Competition Law". https://www.cci.gov.in/sites/default/files/presentation_document/p4.pdf?download=1 (Last accessed on 25th April 2020).

Confederation of Indian Industry. "Green Product Certification". http://www.greenbusinesscentre.com/site/ciigbc/greenpro.jsp?greennode=475864 (Last accessed on 30th April 2020).

Hatashima, Hiroyuki., &Demberel, Unurjargal. January, 2020. "What is blended finance, and how can it help deliver successful high-impact, high risk projects?" (Blog). Investment Executive Group, World Bank Group. https://ieg.worldbankgroup.org/blog/what-blended-finance-and-how-can-it-help-deliver-successful-high-impact-high-risk-projects (Last accessed on 4th May 2020).

Institute for Industrial Productivity& International Finance Corporation. 2014. "Waste Heat Recovery for the Cement Sector: Market and Supplier Analysis". https://www.ifc.org/wps/wcm/connect/f0394a25-3645-4765-8291-ea33d9f09594/IFC+Waste+Heat+Recovery+Report.pdf?MOD=AJPERES&CVID=kqgTRfZ (Last accessed on 30th April 2020).

International Development Finance Club. 2019. "Blended Finance: A Brief Overview" (Article). https://www.idfc.org/wp-content/uploads/2019/10/blended-finance-a-brief-overview-october-2019_final.pdf (Last accessed on 26th April 2020).

International Energy Agency. May, 2019. "Tracking Industry- Cement". https://www.iea.org/reports/tracking-industry/cement (Last accessed on 30th April 2020).

Russial, Thomas. 2011. "Carbon capture and storage- legal and regulatory framework" (Article). US Carbon Sequestration Council. https://www.usea.org/sites/default/files/ccc17012011_Carbon%20capture%20and%20storage%20-%20legal%20and%20regulatory%20framework_ccc179.pdf (Last accessed on 24th April 2020).

Saran, Samir. 2018. "Financing Green Transitions"(Report). ORF. https://www.orfonline.org/wp-content/uploads/2019/01/GP-ORF-Financing-Green-Transitions.pdf (Last accessed on 6th May 2020).

Saran, Samir. 2018. "Financing Green Transitions"(Report). ORF. https://www.orfonline.org/wp-content/uploads/2019/01/GP-ORF-Financing-Green-Transitions.pdf (Last accessed on 30th April 2020).

Saran, Samir. 2018. "Financing Green Transitions"(Report). ORF. https://www.orfonline.org/wp-content/uploads/2019/01/GP-ORF-Financing-Green-Transitions.pdf (Last accessed on 30th April 2020).

SPIRE. 2018. "SPIRE 2015 Vision: Towards the Next Generation of European Process Industries" (Working Document). https://www.spire2030.eu/sites/default/files/users/user85/Vision_Document_V5_Pages_Online_0.pdf (Last accessed on 30th April 2020).

STEPWISE a H2020 Project. "The stepwise project". https://www.stepwise.eu/ (Last accessed on 30th April 2020).

Technology Working Committee. 2017. "Enhancing finance for the research, development and demonstration of climate technologies". (Working paper). UNFCCC.

Chapter 6

Bu Burgess, Molly. November, 2019. "Exclusive: KickStarter CCUS initiative launches" (Article). GasWorld. https://www.gasworld.com/exclusive-kickstarter-ccus-initiative-launches/2018046.article (Last accessed on 29th April 2020).

Competition Commission of India. "Public Procurement and Competition Law". https://www.cci.gov.in/sites/default/files/presentation_document/p4.pdf?download=1 (Last accessed on 25th April 2020).

Confederation of Indian Industry. "Green Product Certification". http://www.greenbusinesscentre.com/site/ciigbc/greenpro.jsp?greennode=475864 (Last accessed on 30th April 2020).

Hatashima, Hiroyuki., &Demberel, Unurjargal. January, 2020. "What is blended finance, and how can it help deliver successful high-impact, high risk projects?" (Blog). Investment Executive Group, World Bank Group. https://ieg.worldbankgroup.org/blog/what-blended-finance-and-how-can-it-help-deliver-successful-high-impact-high-risk-projects (Last accessed on 4th May 2020).

Institute for Industrial Productivity& International Finance Corporation. 2014. "Waste Heat Recovery for the Cement Sector: Market and Supplier Analysis". https://www.ifc.org/wps/wcm/connect/f0394a25-3645-4765-8291-ea33d9f09594/IFC+Waste+Heat+Recovery+Report.pdf?MOD=AJPERES&CVID=kqgTRfZ (Last accessed on 30th April 2020).

International Development Finance Club. 2019. "Blended Finance: A Brief Overview" (Article). https://www.idfc.org/wp-content/uploads/2019/10/blended-finance-a-brief-overview-october-2019_final.pdf (Last accessed on 26th April 2020).

International Energy Agency. May, 2019. "Tracking Industry- Cement". https://www.iea.org/reports/tracking-industry/cement (Last accessed on 30th April 2020).

Russial, Thomas. 2011. "Carbon capture and storage- legal and regulatory framework" (Article). US Carbon Sequestration Council. https://www.usea.org/sites/default/files/ccc17012011_Carbon%20capture%20and%20storage%20-%20legal%20and%20regulatory%20framework_ccc179.pdf (Last accessed on 24th April 2020).

Saran, Samir. 2018. "Financing Green Transitions"(Report). ORF. https://www.orfonline.org/wp-content/uploads/2019/01/GP-ORF-Financing-Green-Transitions.pdf (Last accessed on 6th May 2020).

Saran, Samir. 2018. "Financing Green Transitions"(Report). ORF. https://www.orfonline.org/wp-content/uploads/2019/01/GP-ORF-Financing-Green-Transitions.pdf (Last accessed on 30th April 2020).

Saran, Samir. 2018. "Financing Green Transitions"(Report). ORF.

https://www.orfonline.org/wp-content/uploads/2019/01/GP-ORF-Financing-Green-Transitions.pdf (Last accessed on 30th April 2020).

SPIRE. 2018. "SPIRE 2015 Vision: Towards the Next Generation of European Process Industries" (Working Document). https://www.spire2030.eu/sites/default/files/users/user85/Vision_Document_V5_Pages_Online_0.pdf (Last accessed on 30th April 2020).

STEPWISE a H2020 Project. "The stepwise project". https://www.stepwise.eu/ (Last accessed on 30th April 2020).

Technology Working Committee. 2017. "Enhancing finance for the research, development and demonstration of climate technologies". (Working paper). UNFCCC.