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Impact of Climate Change Policy on the Cement Industry in India

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Abstract

India intends to reduce the emissions intensity of its GDP by 33 to 35 per cent by 2030 from 2005 level as per the Intended nationally determined contribution submission. To meet these commitments, under the National Mission on Enhanced Energy Efficiency, a scheme called Perform Achieve and Trade in April 2012 for incentivising energy efficiency was announced by Bureau of Energy Efficiency, Ministry of power, Government of India. The specific energy reduction targets have been given to designated consumers in eight energy-intensive sectors that collectively accounted for 25 per cent of country's GDP and 45 per cent of its commercial energy use. Now, being a developing nations question arises that these efficiency standards will impact the development of the nation? To answer that question, a study on the cement sector out of the eight sectors under the scheme was selected because it has a 15% energy saving potential as per the report of the Confederation of Indian Industry. The data, on the variable------ production, energy intensity and CO_2 emissions was collected for the period of five years from 2010 to 2014. Using, a panel data set the relationship between the production with energy intensity and CO_2 emissions was measured. The results show that the energy intensity has an inverse relationship with the production but CO_2 emission has a positive relation with the production. Therefore, the adoption of scheme encourage the industry to effectively produce which further help in achievement of the emission intensity target at the international level.

Keywords: Climate Change Policy, Competitiveness, Cement Industry, India.

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Abbreviations

COP	Conference of Parties
BEE	Bureau of Energy Efficiency
CO_2	Carbon Dioxide
DCs	Designated Consumers
ESCerts	Energy Savings Certificates
EU ETS	European Union Emission Trading Schemes
GDP	Gross Domestic Product
INDCs	Intended Nationally Determined Contributions
NAPCC	Nation Action Plan on Climate Change
NMEEE	National Mission on Enhanced Energy Efficiency
PAT	Perform Achieve and Trade
SEC	Specific Energy Consumption
UNFCCC	United Nations Framework Convention on Climate Change

1. Introduction

The 21st Conference of Parties (COP 21) to the United Nations Framework Convention on Climate Change (UNFCCC), held in Paris in 2015, took the landmark decision where all Parties took emission commitments under the Intended Nationally Determined Contributions (INDCs). Before this, non-Annex I Parties to the Convention took voluntary commitments in 2009 at the Copenhagen Summit, where India committed to reduce by 20-25 per cent the emission intensity of its gross domestic product (GDP) by 2020 compared to its 2005 levels (India, 2010). In the Paris Agreement, India took more commitments through its INDC to reduce the emissions intensity of its GDP by 33 to 35 per cent from 2005 levels by 2030. Additionally, India has set a targets of achieving 40 per cent electric power installed capacity from renewable energy resources, and plant more trees and forests to create carbon sink of 2.5 to 3 billion tonnes of CO_2eq (India, 2015).

The Paris Agreement provides a momentum for a resource-efficient and low-carbon global economy. It encouraged corporate leaders to contribute in the discussions during the COP. Corporations are now pushing the climate agenda instead of blocking the climate action. They are demanding clear and strong policies. Nations now have a new objective which will form the basis for policy instruments for development and investment. The Agreement provides an opportunity to achieve "net zero" climate impact. The key to climate change mitigation depends on the private sector because big multinational corporations (MNC's) are responsible for nearly half of global GHG emissions. Private companies need to initiate investments and innovation essential for a low-carbon economy. The governments also a role to play in bringing regulations, whether market-based or conventional, and facilitate the agenda through public-private partnerships (Stavins et al., 2014).

Just before the Copenhagen Summit in 2009, where India took voluntary emission intensity targets, the then Prime Minister, Dr Manmohan Singh, announced the Nation Action Plan on Climate Change (NAPCC), which has eight missions designed to deal with different aspects of climate change (Prime Minister's Council on Climate Change, 2008). The implementation of this document was predicted to give a directional shift to India's development pathway. One of the eight missions is the National Mission on Enhanced Energy Efficiency (NMEEE). To give effect to this mission, The Energy Conservation Act, 2001, was amended in 2010 which allowed the Central Government to issue energy savings certificates (ESCerts), enhanced the penalty for specified offences under the original Act. Under NMEEE, the Bureau of Energy Efficiency (BEE) announced the Perform Achieve and Trade (PAT) scheme for incentivising energy efficiency. In this scheme, specific energy reduction targets have been given to Designated Consumers (DCs) in eight energy-intensive sectors collectively accounting for 25 per cent of India's GDP and 45 per cent of its commercial energy use. BEE will issue tradable ESCerts to the DCs based on Specific Energy Consumption (SEC). These certificates will be tradable so that the units that outperform will be able to earn money by selling them and those that cannot achieve the desired efficiency will have to buy them to fulfil their obligation.

In the PAT Cycle I, operational from 2012 to 2015, 478 DCs in eight energy-intensive sectors — Aluminium, Chlor-Alkali, Textile, Pulp paper, Fertilizer, Cement, Thermal Power plants, Iron & steel, accounting for 36 per cent share in total energy consumption, were identified. Cement sector had 85 DCs having an energy consumption share of 9.10 per cent. At the end of the PAT cycle I, 41 DCs achieved targets, 15 outperform and 27 underperform in cement sector (Ranjan, 2015). Being a developing nations question arises that these efficiency standards will impact the development of the nation? To answer that question, a study on the cement sector out of the eight sectors under the scheme was selected because it has a 15 per cent energy saving potential as per the report of the Confederation of Indian Industry (CII) and accounted for 6.8 per cent of India's direct CO_2

emissions(INCCA, 2010). It is an attempt to find out the impact of climate change policy on the productivity of the Indian cement industry. It will also assess whether the industry is in a position to meet these commitments.

2. Literature Review

Cement Industry in India

Industry's contribution to the economic growth in India is considerable and coal accounted for over half of primary energy consumption. Energy intensity in the industry declined gradually from 1990 to 2000. This can be attributed to adoption of new technologies and expansion of non-energy-intensive industries (MoEF, 2004). Electricity generation and industry are the largest CO_2 emitting sectors in India and together account for 54.31 per cent of emissions (MoEF, 2015). Top energy consuming industries in India are iron & steel, cement, aluminium, fertilizer, paper & pulp, and glass, which consume around 40 per cent of total industrial fuel(Bhattacharya and Cropper, 2010). The top two emitting industries are cement and iron & steel, which accounted for 41.44 per cent and 31.93 per cent of industry sector emissions of 300.62 Mt of CO_2eq in 2012 (MoEF, 2015). Electricity generation, and energy consumption in six Energy Intensive industries— iron & steel, aluminium, cement, fertilizer, refining, and pulp and paper — and fuel used in road transport covered 75 percent of emissions from energy use in India (Gaba et al., 2011). Globally, aluminium, cement, and iron and steel contribute more than 10 per cent to global GHG load and are growing rapidly in China, India and other emerging economies.

Indian cement industry is estimated to consume at 2 per cent of global primary energy, or almost 5 per cent of the global industrial energy consumption (Worrell et al., 2001). TERI Director General Ajay Mathur has noted that developing countries have a huge advantage in energy efficiency since late development of infrastructure means it used latest technology (TERI, 2016). It accounts for around 10 per cent of the coal and 6 per cent of the electricity consumed by the Indian industrial sector. On an average, cement plants are spending about 35-50 per cent of the total manufacturing cost of cement to meet their energy demands. In fact, energy cost contributes 46 per cent of the total manufacturing cost (SSEF et al., 2013).

Role of Climate Change Policy in Cement Sector

Climate policy has imposed an indirect cost on the energy-intensive sectors, for which energy forms a significant share of production costs, which could have a negative impact on its competitiveness vis-s-vis foreign and home producers. Energy intensive Industries are exposed to impacts of emissions pricing policies, and the constraints arising from national climate policies are a double-edged sword. Steel, cement, aluminium, basic chemicals and pulp & paper represent the classic sectors of industrialisation and rising living standards. But they also represent the largest sources of energy consumptions and GHG (Droege, 2013). Globally, aluminium, cement and iron & steel related companies face a risk due to the climate change policy (Baron et al., 2007).

The CO_2 issue for cement companies is mainly focused on the production process. The issue has not resulted in the companies' global strategy being called into question for the time being. Most energy efficient units are being installed in almost every sector and seven Indian cement plants are at the frontier of energy efficiency (Eberlein and Matten, 2009). Mandal & Madheswaran (2009) measured the environmental efficiency of both desirable and undesirable output on a state- level data of the Indian cement industry for the years 2001 to 2005. By taking capital, energy, labour, materials as input and production as output variable. It showed that average environmental efficiency measured in 2005 was declined in comparison to 2001 and larger the availability of coal resulted towards lower environmental efficiency. Arjaliès et al. (2016) conducted a comparative study of CO_2 reduction strategies in the cement and chemical industries to find i) the dependence of the production process on natural resources, ii) the ability to leverage the business portfolio, and the resulting role of R&D, and iii) the structure of the downstream sector. And clearly stated that it was depends features of companies to adopt an approach of to sustainable development. Another study by Sheinbaum, C., & Ozawa, L. (1998) on energy use and emissions trends in the Mexican cement industry between 1982 and 1994, showed that energy use increased by 10.8 per cent and CO_2 emissions increased by 40 per cent but energy intensity dropped due to modernization, increased production of blended cements, and use of Alternatives Fuels. Neuhoff et al. (2014) examined the influence of the EU ETS and other policy instruments on the investment and operational choices at the company level in the cement sector through interviews of the executives about the influence of the EU ETS system, energy & CO_2 intensity, trade flows, competitiveness, investments and innovation on short, medium and long term. Results showed that EU ETS was considered the main driver in the CO_2 emission from 7 per cent to 5.6 per cent between 2008 and 2012. In this study to fulfil the objective to measure the impacts of climate change policy on the productivity of the Indian cement industry null hypothesis was framed i.e., H_0: there is an influence of climate policy on the productivity of cement industry.

3. Methodology

This section introduces the methodological approach adopted for the empirical analysis, used to test the hypothesis stated. The research design consist the three steps i.e., selection of sample size and variables for the study, processing of variables and the statistical analysis approaches or econometric specifications used in the empirical testing of the hypothesis formulated in Section 2.

Selection of Sample Size and Variable

Sample size: Out of the eight most energy intensive sectors of PAT cycle I, cement sector was chosen because it contributes 9.10 per cent of annual energy consumption during PAT cycle I. In the PAT cycle I, 85 cement plants were listed. These 85 plants were further segregated into 46 companies and due to unavailability of the data 24 companies were taken for the study. These 24 companies approximately cover the 80 percent of the Indian cement industry. The study period is five years from Financial Year 2010, to FY 2014. The data used in the study was generated from the Annual Reports of the Companies.

Variables: For the present study dependent variable is production and independent variables are energy intensity and CO_2 emissions. And control variables are firm size, firm age, growth rate, leverage.

Table 1: The Measure of construct of dependent and explanatory variables

Sr No	Variable	Authors
1	Production	Bassi et al., 2009; Clarkson et al., 2008; Reinaud, 2005; Wagner, 2005
2	Energy Intensity	Arens et al., 2012; Bernard and Côté, 2002; Bhattacharya and Cropper, 2010; Kitson et al., 2013; Mandal and Madheswaran, 2009; Wagner, 2005; Wang et al., 2016
3	CO_2 emission	Kim and Worrell, 2002; Mandal and Madheswaran, 2009; Sheinbaum and Ozawa, 1998)

4	Company Size	Clarkson et al., 2008; Russo and Fouts, 1997; Wagner and Schaltegger, 2004
5	Age of Company	Russo and Fouts, 1997; Wagner and Schaltegger, 2004
6	Growth Rate	Russo and Fouts, 1997; Wagner and Schaltegger, 2004
7	Leverage	Russo and Fouts, 1997; Wagner and Schaltegger, 2004

Calculation of variables

Production

Production is used as an output variable to measure productivity in terms of Million tonnes.

Energy Intensity

For this study, energy consumption was measured by taking power consumption as an input variable in cement sector. The power consumption for cement sector was calculated by adding the electricity purchased, electricity through diesel generators, and electricity through steam turbine generator. A power form WHR plant was not taken. The following steps have been performed to calculate the energy consumption intensity:

(a) First, that data for electricity purchased, electricity through DG, and electricity through steam turbine generator was taken from annual reports. All values were added to calculate the energy consumption.
(b) Electricity consumption in kwh was converted to tonnes of oil equivalent (toe) for calculation of energy consumption for comparison among different industrial units as per PAT guidelines. The conversion factor for converting kwh to toe is 0.0000859845228.
(c) Coal consumption in terrajoules (TJ) was converted into toe by multiplying it with 23.8845897.
(d) toe from electricity consumption and coal consumption was added and divided by production to calculate specific energy intensity.

Carbon emissions

Carbon emission is an indicator often taken to track emission intensity of industrial units and the entire economy. They are estimated from the consumption of electricity, coal and other fuels since they comprise a major share of raw materials and energy inputs or both. In cement industry, coal is used as a major raw material as well as source of energy. Emission from coal are calculated taking into account the energy content of the fuel and multiplying that by country-specific and sector-specific emission factors. For cement industry the India-specific emission factor, as given by IPCC guidelines of 1995 and 2006 and India's Second National Communication to the UNFCC (IPCC, 1995, 2006; MoEF, 2012), is estimated by taking the Net Calorific Value (NCV) and Carbon Emission Factor (CEF). This is multiplied by the molecular weight ratio of carbon dioxide to carbon (44/12). Following the method of the (IPCC, 1995) the sectoral CO_2 emission of the i^{th} fuel is obtained from the following relationship

$$EC_i(t) = C_i\,(t) \times O_i \times N_i \times M$$

where $EC_i(t)$ is the CO_2 emission of the i^{th} fuel at time t; $C_i\,(t)$ is the consumption of i^{th} fuel at time t; $O_i$is the carbon emission factor of the ith fuel; N_i is the fraction of carbon oxidized of the i^{th} fuel and M is the molecular weight ratio of CO_2 to carbon (44/12). The fraction of carbon oxidise is taken as one. The following steps were performed to calculate CO_2 emissions from the consumption of a particular fuel.

1. CO_2 emissions from grid electricity were directly obtained multiplying the electricity consumed in Mwh with the weighted average emission rate for grid electricity of 0.80 tCO_2/Mwh.
2. CO_2 emissions depend on the calorific value of coal consumed. Due to the different nature of coal used in different industries, it was obtained by multiplying the amount of coal used with the NCV for that industry. This gave the calorific value in TJ.
3. Carbon emissions were estimated by multiplying the TJ value with CEF for the industry.
4. The carbon emissions thus obtained were multiplied by the molecular weight ratio of CO_2 and C to arrive at CO_2 emissions.

Company size

Size of the company is measured by its total assets. In this study, the natural logarithm of book value of total assets has been considered to control for the size effect.

Age of company

Age of the company is measured by taking the natural logarithm of the number of years for which the company has been in existence since the incorporation.

Growth rate

Growth opportunities are measured as the ratio of R&D expenditure to total sales.

Leverage

Leverage affects access to credit its cost. It considered in terms of debt equity ratio. It is calculated by the formula i.e., short-term debt + long-term debt divided by total shareholders' equity.

Research Tools

To study the impact of climate policy on the cement industry the relationship between the independent and dependent variables, by correlation and regression analyses were checked. Pearson's correlation coefficient test was applied to measure the strength of a linear association between the key variables. In most of the studies, to check the association between the dependent and independent variables panel data regression was applied to take the advantage of both the time series and cross sections.

The regression model equations:

$$PROD_{it} = \beta_0 + \beta_1 SEC_{it} + \beta_2 COE_{it} + \beta_3 SIZE_{it} + \beta_4 AGE_{it} + \beta_5 GROWTH_{it} + \beta_6 LEV_{it} + \varepsilon_{it}$$

Where, i represents company and t represents the time

$PROD_{it}$ = Production of the company

SEC_{it} = Energy Intensity

COE_{it} = CO_2 emissions

$SIZE_{it}$ = Size of the Company

AGE_{it} = Age of the Company/plant

$GROWTH_{it}$= Growth rate of the Company

LEV_{it} =Leverage of the company

4. Results and Analysis

To measure the strength of a linear association between the key variables Pearson's correlation coefficient test was applied. The correlation matrix shows that production has a significant correlation with the all variables except the energy intensity. It shows positive and strong correlation with the CO_2 emissions (r=0.968, p>0.01), and Size (r=0.576, p<0.01).But negative and weak correlation with the growth, leverage, and size of the company. Size of the company shows a shows significant correlation with energy intensity (r=-0.156, p>0.10), and CO_2 emissions (r=0.556, p>0.01) But both the variables have an inverse relationship with the size of the firm. CO_2 emissions was strongly correlated with the size of the firm means increase in the size will lead to the increase in the CO_2 emissions but with energy intensity it will decrease. Age of the company shows a negative and significant relationship with the Energy intensity (r=-0.375, p>0.01), and CO_2 emissions (r=-0.339, p>0.01). Besides that energy intensity and CO_2 emission were decline from 2010 to 2014. The average energy intensity in 2010 was 7 per cent and in 2014 it was 5.7 per cent. The CO_2 consumption in the sector was 1.69 mt in 2010 and in 2014 it was 1.533 mt.

Table 2: Correlation matrix of the variables form the year 2010 to 2014

	Prod	SEC	COE	SIZE	GRWTH	LEV	AGE
Production	1	-0.056	0.968*	0.576*	-0.148***	-0.172**	-0.237*
SEC	-0.056	1	0.085	-0.156***	-0.057	-0.043	-0.375*
COE	0.968*	0.085	1	0.556*	-0.129	-0.139	-0.339*
SIZE	0.576*	-0.156***	0.556*	1	-0.002	0.163**	-0.303*
GRWOTH	-0.148***	-0.057	-0.129	-0.002	1	-0.033	-0.237*
LEV	-0.172**	-0.043	-0.139	0.163**	-0.033	1	-0.071
AGE	-0.237*	-0.375*	-0.339*	-0.303*	-0.237*	-0.071	1

*Notes: *, **, *** indicates level of significance at 0.01, 0.05, 0.10 level.*

Panel data analysis

To test hypotheses: there is an influence of climate policy on the productivity of cement industry, panel data analysis was used. This is meant to find the relationships of variables production with, energy intensity, CO_2 emission, and other control variables. Such analysis has been used by García-Sánchez & Prado-Lorenzo (2012), Wagner & Schaltegger (2004), Wagner (2005), and Wang, Li, Fang, & Zhou (2016). Before running the regression equation, normality assumption has to be met, which measured the theoretical residuals is independent and normally distributed. In this study as per Wooldrige (2003), that's says "normality is insignificant for a large sample size, and if the sample size is large then regression results are considered robust and valid " was applied. After that autocorrelation and serial correlation was tested by using the Durbin-Watson test. Multicollinearity was checked by variance inflation factor (VIF). VIF shows how the variance of an estimator is inflated by the presence of multicollinearity. The collinearity tolerance is the inverse of VIF. Larger the value of VIF, the more collinear the variable, whereas smaller the value of tolerance, the more collinear the variable(Gujarati and Porter, 2009). In this study, the values of VIF are lies between 1.14 to 1.78 which is smaller and shows that no collinearaity exist between the variables.

To decide between the pooled OLS regression compared to panel regression, the redundant FEs test-likelihood ratio (TOBIT estimation) test was applied. It shows that panel regression was appropriate for the present study. And for the random effect model (REM) and fixed effect model (FEM) in panel data Wu-Hausman test is used. The results for the REM and FEM are presented in **Error! Reference source not found.**3. REM is the best suited since the Wu-Hausman test shows insignificance. The linear term of climate policy variables are significant at the one per cent level except the growth and leverage. Energy intensity was negatively & CO_2 emission was positively, related with production. Size and age were positively related with the production function. The intercept (β =-5.25; p>0.05) was found to be significant at five percent level. Significant coefficients are reported for energy intensity (β =-32.65; p<0.01), CO_2 emission (β =2.845 p<0.01), size (β =0.284; p<0.10), and age (β =1.59; p<0.01). The overall r-square is 0.95 as per the REM; the Wald statistics for the regression model is significant at one percent level of significance for both the models, indicating the model fitness. From the table, it is clear that climate policy there has an influence on the productivity of cement industry. This leads to the rejection of Null Hypothesis H_0. In other words there was a significant influence of climate policy on the productivity of cement industry.

Table 3: Regression results of climate policy variables on cement companies (FY 2010-2014)

Variables	Production	
	FEM	**REM**
Intercept	**-15.69***	**-5.25****
SEC	**-31.44***	**-32.65***
CO2	**2.790***	**2.845***
SIZE	**0.126**	**0.284*****
AGE	**4.756***	**1.59***
GROWTH	**0.243**	**0.047**
LEV	**0.009**	**0.003**
N †	**120**	**120**
Overall R2	**0.87**	**0.95**
f ‡	**0.000***	**0.000***
Hausman	**0.0906**	

*Notes: Independent variables: energy intensity (SEC), CO_2 emission (COE). *, **, *** indicates level of significance at 0.01, 0.05, 0.10 level. † Number of observations. ‡ Wald Statistic.*

5. Discussion and Findings

In the present study, under the correlation matrix of cement sector, production function was influenced by the CO_2 emissions. More production leads to the more CO_2 emissions. But energy intensity was negatively related with the production function. This means that producing one more unit the SEC is reduced, which also helps in decoupling the pressure of reduction of energy intensity from development as development was the overriding priority for India. In other words, raising the production in the industry will reduce energy intensity but CO_2 emission will increase. Due to the increase in production, overall emission increased but emissions per unit of output decreased.

Besides that, company size and age also matter in the reduction of energy intensity and CO_2 emissions. Large-scale firms emit more CO_2 because of the huge production. But efficient utilisation of technology and by-products helps in eliminating the barriers. Old companies also leads to reduction of CO_2 emission by proper utilisation of resources, reduction of wastage, appropriate technology, advancement in technology, investment in cleaner processing, participating in the international negotiations and efficient managerial practices. REM indicates that climate policy has an impact on the overall productivity of the cement industry. Energy intensity was inversely and CO_2 emission was positively related to the production function. The results also show that the PAT scheme is having a positive impact on the overall efficiency of the sector in general and companies in particular.The results support the existing literature in which the climate policy has impact on the industry. A study by Schultz and Williamson (2005) noted that European businesses exposed to climate change and generate new strategic challenges and opportunities for both public and private sector organisations. Smale et al (2006) said UK energy-intensive sectors and companies are facing the greatest international competition and have a significant impact on policies. In the cement and steel sector, the cost of EU ETS system passes to consumers which lead to loss of production by 1 per cent across all sectors, but in cement and steel sectors it ranges between 5 and 10 per cent.

In the cement sector, UltraTech, ACC limited and Ambuja maintained its best-in-class position in terms of its carbon footprint. By using alternative fuels like rice husk, rubber tyre chips, mustard waste, saw dust, municipal solid waste and invested in innovative cement products like ACC-Gold, ACCF2R, ACC Plus, ACC and process like CALERA, Calix and CCS to reduce energy intensity and CO_2 emissions. It also adopt renewable energy sources like ACC Limited has 19 MW wind farms, Ambuja Cements has 7.5 MW wind and 330 KV Solar Power project. All these practices help in reducing the energy intensity and carbon emission which will lead to successfully implementation of the PAT scheme.

6. Conclusion

The focus of the present study is on finding the impact of climate policy on the cement industry in India. By using the quantitative measures it was found that the policy has an impact on the performance in terms of their production. Maximum companies accounting for a large share in production showed improvement in efficiency during the study period. It also became clear that the energy intensity has an inverse and CO_2 emission has positive relationship with the production. So, before framing the strategic decisions, businesses must understand the impact of climate policy on the internal activities and how the changing climate may affect the business environment. The idea behind framing a climate policy for businesses and industry was that it would help in reducing energy costs and thereby carbon emissions while at the same time reduce operating costs, and motivate the industry for socially responsible investment to raise production. Because of the changing environment, companies started substituting coal by natural gas & diesel oil, implanting WHR plants, more energy production through the renewable sources and strategic integration within the organization. Earlier businesses took climate polices as a threat to their operations and, therefore, kept away from national and international agreements. They believed that the new policy will impact on the cost of their operations and the market will shifts towards low-emission products and new technologies that could hit their core competencies. But the perceptions of business house regarding the threats & opportunities over the time period are changing because of lucrative returns and new business prospective. Development of emissions trading markets will also stimulate the reduction of carbon emissions in India. Therefore, the adoption of scheme encourage the industry to effectively produce which further help in achievement of the emission intensity target at the international level.

7. Policy recommendations

1. Production plays an essential role because production and energy intensity have an inverse relationship. So, industry must focus on the increase in the production or build expansion strategy for the business.
2. The industry took initiative in energy saving activities by employing innovative technologies and fuel-switching initiatives. There is a need for cross-sector collaboration to capture and identify the best and worst practices related to managing change associated with carbon emissions reduction initiatives.
3. Government must build policies to support the expansion of the industry.
4. Industry must adopt multiple channels like WHR, solar and wind energy to fulfil the growing demand for electricity. This also helps in generating more revenues in term of CERs or EScerts.
5. By utilising the AF like fly-ash, slag, steel slag, and bio-waste, companies reduce their risk associated with shortage of raw materials.

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