

A REVIEW OF INDUSTRY CARBON FOOTPRINTS

Mr. Talha Munshi

Department of Mechanical Engineering
Saraswati College of Engineering
Kharghar, Navi Mumbai
munshitalha@gmail.com

Prof. T.Z Quazi

HOD Department of Automobile
Engineering
Saraswati College of Engineering
Kharghar, Navi Mumbai
taqui.quazi@gmail.com

Abstract— The climate change and global warming is no more academicians pass time and it is a real threat which is going to affect each and every living being on the planet. Since the Industrial Revolution, human sources of carbon dioxide emissions have been growing. Human activities such as the burning of oil, coal and gas, as well as deforestation are the primary cause of the increased carbon dioxide concentrations in the atmosphere. In 2010, emissions from electricity and heat production reached 12.5 billion tons, and emissions from transport totalled 6.7 billion tons and the agricultural sector totalled 4.7 billion tons of carbon dioxide (CO₂) equivalent. While the main purpose of the technology is to augment power, it does reduce carbon footprint. This paper reviews various studies on industry carbon footprint.

Keywords— Carbon footprint; environmental policies; greenhouse gases emission; life cycle assessment; Low-carbon production characteristics; Ferrous metal industry China

I. INTRODUCTION

A. Carbon Footprints

The amount of carbon dioxide released into the atmosphere as a result of the anthropogenic activities of a particular individual, organization, or community. It relates to the amount of greenhouse gases produced in our day-to-day lives. Greenhouse gases are those which contribute to the greenhouse effect. The six regulated gases are: Carbon dioxide (CO₂), Methane (CH₄), Nitrous oxide (N₂O), Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs), Sulphur hexafluoride (SF₆). The most influential greenhouse gas for climate change is carbon dioxide (CO₂). Manufactured goods, materials, wood, roads, buildings, and services are the sources of Green house gas emissions. For simplicity of reporting, it is often expressed in terms of the amount of carbon dioxide, or its equivalent of other GHGs, emitted.

The concept name of the carbon footprint originates from ecological footprint discussion. The carbon footprint is a subset of the ecological footprint and of the more comprehensive Life Cycle Assessment (LCA). An individual's, nation's, or organization's carbon footprint can be measured by undertaking a GHG emissions assessment. Once the size of a carbon footprint is known, a strategy can be devised to reduce it, e.g. by Technological developments, better process and product management, changed Green Public or Private Procurement (GPP), carbon capture, consumption strategies, and others. The mitigation of carbon footprints through the development of alternative projects, such as solar or wind energy or reforestation, represents one way of reducing a carbon footprint and is often known as Carbon offsetting. The main influences on carbon footprints include

population, economic output, and energy and carbon intensity of the economy.

These factors are the main targets of individuals and businesses in order to decrease carbon footprints. Scholars suggest the most effective way to decrease a carbon footprint is to either decrease the amount of energy needed for production or to decrease the dependence on carbon emitting fuels.

B. Effects of Green house gases

- Since From 1880 to 2012, average global temperature increased by 0.85°C.
- Oceans temperature is rising, the amounts of snow and ice have diminished and sea level has risen.
- Given current concern and on-going emissions of greenhouse gases, it is likely that by the end of this century, the rise in global temperature will exceed 1.5°C compared to 1850 to 1900 for all but one scenario.
- It is observed that Global emissions of carbon dioxide (CO₂) have increased by almost 50 per cent since 1990.
- Emissions grew more quickly between 2000 and 2010 than in each of the three previous decades.
- But it is still possible, using a wide array of technological measures and changes in behavior, to limit the increase in global mean temperature to two degrees Celsius above pre-industrial levels.
- Leading institutional and technological change will give a better than even chance that global warming will not exceed this threshold limit.

C. The Paris Agreement on climate change within the United Nations Framework Convention on Climate Change (UNFCCC)

- The historic Paris Agreement gives an opportunity for countries to strengthen the global response to the threat of climate change by keeping a global temperature rise this century well below 2 degrees Celsius and to pursue efforts to limit the temperature increase even further to 1.5 degrees Celsius. It entered into force on 4 November 2016.
- As of April 2018, 175 parties had ratified the Paris Agreement and 168 parties had communicated their first nationally determined contributions to the UN framework convention on Climate Change Secretariat.

- As of April 2018, 10 developing countries had successfully completed and submitted their first iteration of their national adaptation plans for responding to climate change.
- Developed country parties continue to make progress towards the goal of jointly mobilizing \$100 billion annually by 2020 for mitigation actions.

HFC-134a	1300
HFC-152a	140
PFCs	7850
Sulfur Hexafluoride	23900

D. From UN's Sustainable Development Goals (SDGs) - Goal 13 Climate Actions

- To Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries.
- To Integrate climate change measures into national policies, strategies and planning.
- To Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning.
- To Implement the commitment undertaken by developed-country parties to the United Nations Framework Convention on Climate Change to a goal of mobilising jointly USD 100 billion annually by 2020 from all sources to address the needs of developing countries in the context of meaningful mitigation actions and transparency on implementation and fully operationalise the Green Climate Fund through its capitalisation as soon as possible.
- To Promote mechanisms for raising capacity for effective climate change related planning and management in least developed countries and small island developing states, including focusing on women, youth and local and marginalised communities.
- To Acknowledge that the United Nations Framework Convention on Climate Change is the primary international, intergovernmental forum for negotiating the global response to climate change.

E. Key information to calculate carbon footprint

The carbon footprint is a measurement of all greenhouse gases we individually produce and has units of tonnes (or kg) of carbon dioxide equivalent (CO₂e).

Table I. Global Warming Potential of different gases

Gas	GWP
CO ₂	1
CH ₄	25
N ₂ O	298
HFC-23	1170
HFC-125	2800

II. LITERATURE REVIEW

Sr. No	Title	Research Methodologies Used	Results	Outcomes
1	Carbon footprint analysis in plastics manufacturing	Data from a plastics manufacturer was used, a cradle-to-grave study was conducted for trays produced from recycled polyethylene terephthalate, calculating their product carbon footprint and analyzing to know how various parameters affect the carbon footprint.	A spreadsheet analysis based model was developed, which allows the product carbon footprint to be determined using production batch data. It was observed that, 24% decrease in tray carbon footprint could be obtained by manufacturing trays from 100% recycled content.	High recycling rates of the raw materials should be targeted. Tray light weighting should be encouraged without compromising tray structural integrity.
2	CO ₂ Emission Calculation and Reduction Options in Ceramic Tile Manufacture-The Foshan Case	A carbon measuring model is established and used to calculate carbon dioxide emissions from key processes and carbon footprint of products.	CO ₂ emission reduction from firing process: Using diesel oil or natural gas instead of coal. Energy efficiency improvement. Adopted several new technology to reduce CO ₂ emission.	Spray drying and firing process process emits 26% and 57% of total emission, therefore special attention has to be given to these processes. The big potential reduction lies in using microwave drying technology, recycling of hot air from Natural gas.
3.	Estimates of Emissions from Coal Fired Thermal Power Plants in India	In this paper emissions of carbon dioxide (CO ₂), sulfur dioxide (SO ₂), and nitric oxide (NO) from thermal power plants in India for a period of nine	The analysis shows region wise differences in total emissions as well as differences in emissions per unit of electricity. Computed estimates thermal power	This study gives plant wise methodology for the development of emission inventory of various trace atmospheric species from coal combustion in

		years from 2001-02 to 2009-10 were calculated. A model was prepared in which the mass emission factors are theoretically calculated using the basic principles of combustion and operating conditions.	plants show the total CO2 emissions, SO2 emissions and NO emissions increased during 2009-10.	indian thermal power plants for which measured emission factors are still sparse. This is the first study which provides the emissions from 86 operational thermal power plants with future trends nationally.
4	Impact of Heavy Industrialization on the Carbon Emissions : An Empirical Study of China	In this paper the error correction model of china's CO2 emissions under the condition of the heavy industrial structure (HIS) was established.	In this paper 31 group data about heavy industry output value and carbon emissions in china were selected from 1978 to 2008 with dynamic equilibrium analysis method on time series, and error correction model was developed, which is based on the unit root test, and co-integration relationship test, attempts to solve the mentioned problems.	It is found that behind the rise in china's carbon emissions to further more extent, the concrete realization lies: with a growth of 1 percent in heavy industrial output, the long term effects show a increase of 0.278141 percent in china's carbon emissions, and immediate effect shows an increase of 0.146636 percent in carbon emissions.
5	The low-carbon technology characteristics of China's ferrous metal industry	This paper examines the low carbon production characteristics of ferrous metal industry in china during the period 1980 to 2013 by Using the Weighted Russell Directional Distance Function model.	The Environmental regulation costs and carbon-adjusted technical efficiency of the China's ferrous metal industry have significantly increased in recent decades, especially when China joined the WTO.	In china the largest energy consuming industrial sector is the ferrous metal industry. This paper analyses the low-carbon production characteristics of this industry during the period 1980 to 2013.
6	Integrating waste and renewable energy to reduce the carbon footprint of locally	The method shows that Total Site targeting methodology can be successfully applied to integrate renewable	Total Site targeting methodology is able to provide the basis for an overall design of a Locally Integrated Energy Sector (LIES) that	This paper demonstrate the use of Total Site targeting methodology on the concept of a LIES for the distribution of heat involving small-scale

integrate d energy sectors	sources into the energy source mix and consequently reduce the carbon footprint of locally integrated energy sectors.	involves both heat and power.	industrial plants and domestic, business, and social premises, and integrating renewable energy sources
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III. SUMMARIZATION OF REVIEW

In this paper the literature reviews are discussed about various studies on carbon footprint taking into consideration aspects related to plastic manufacturing industries, textile industries, ferrous metal industry, coal Fired thermal Power Plants, Heavy Industrialization, Ceramic Tile Manufacture and locally integrated energy sectors. This paper highlights the effects of carbon footprints and the measures taken to curb them.

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