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# Carbon Footprint due to Construction Industries

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***Abstract:*** ***This paper focuses on the assessing the impact of construction industry on the carbon footprint and to quantify the existing damage and future plan of action citing reports by various research organizations. Case studies analysis is done to establish the correlation between the economic growth and carbon footprint. It was deduced from the case study that a sustainable construction industry would assure greater GDP growth with less carbon emission.***
***Keywords: Gigaton, Carbon Footprint, GDP (gross domestic product), GHG (greenhouse gas protocol),***

## I. INTRODUCTION

A carbon footprint corresponds to the whole amount of greenhouse gases (GHG), mostly carbon dioxide produced, directly and indirectly, by person's lifestyle and activities. Carbon footprints are usually measured in equivalent tons of CO2 and other gases, during the period of a year, and they can be associated with an individual, an organization, a product or an event too.

The CO2 produced during operations and activities to make a building is defined as that building's carbon footprint. Transporting materials to the job site emits greenhouse gases and the embodied carbon in those materials used to construct the building contributes as a factor to the building's carbon footprint. Carbon footprint is the issue which is found to increase global warming more than the impact of fossil fuel energy.

The carbon footprint and assessment standard is one of the most basic and crucial research in low-carbon research. However, due to this issue consistent results have not been achieved yet, and hence, concerned research was greatly affected. The government needs to make the reduction of carbon footprint their priority because climate change will be slowed down by moving buildings and construction to a low carbon pathway and bring about an economic recovery. Research on the carbon footprint and assessment standards has become a hot topic for governments and researchers.

In a lecture held by Ed Mazria, the founder of Arch2030, he described the impact of embodied carbon on environment. He mentioned that "The upfront carbon emissions associated with just three materials (concrete, steel, and aluminium) used in the construction of new buildings and infrastructure nearly equals annual building sector operational emissions." All the processes involved in extracting, producing, transporting and installing materials for construction accounts for embodied carbon.

## II. BACKGROUND

Carbon footprint is the measure of the mark someone or something leaves on the environment and is measured by the amount of greenhouse gases, including carbon dioxide, produced by a person, an object, an institution or an action, in specific time period. Humans, since the industrial revolutions, are producing carbon dioxide three-times faster than it can be removed from the air by natural cycles. The choices of individual determine their carbon footprint. A greenhouse gas is simply a gas that contributes to the greenhouse effect by depleting the ozone layer, allowing the earth to absorb and trap more infrared radiation. When heat gets trapped in the atmosphere it makes the Earth warmer, leading to climate change, or "global warming".

According to United Nations Environment Program in 2019 — a record 10 gigaton (Gt) carbon dioxide (CO2) was emitted by the construction industry which accounts for more than a third of global energy-related carbon dioxide. According to the 2020 Global Status Report for Buildings and Construction. Building operations accounted for 28% global emissions while construction-related industries (cement, glass, etc.) added another 10%. The CO2 emissions escalated because of high proportion of fossil fuels used for power generation, combined with higher activity levels in regions where electricity remains carbon-intensive.

According to Inger Andersen, executive director, UNEP, the increasing carbon footprint of the construction industry possess a demand for a triple strategy to aggressively decrease energy demand in the sector, decarbonize the power sector and implement materials strategies that reduce lifecycle carbon emissions. To achieve net-zero carbon building stock by 2050, the emission by the sector should fall by around six percent per year up until 2030.

The World Green Building Council (World GBC) on the 10$^{th}$ annual world green building week has issued a bold new vision for how buildings and infrastructure around the world can reach 40% less incorporated carbon emissions by 2030, and achieve 100% net zero emissions buildings by 2050.

The world GBC presents a clear plan of action for all the stakeholders across the value chain to accelerate decarburization, address current market barriers and, develop low carbon alternative solutions for market. For achieving greater awareness, innovation, improved processes to calculate, track and report incorporated carbon, voluntary reduction targets from industry and roll out of new legislation at city, national and regional level, the transition towards mainstream net-zero carbon standards requires immediate action. Approaches like maximizing the use of existing assets, promoting renovation instead of demolition and seeking new circular business models that reduce reliance on carbon intensive raw materials are also needed. To kick-start cross-sector collaboration, World GBC is calling for new national and sectorial roadmaps to be developed, like the ones produced in Finland, Norway and Sweden, with strong support from industry and policymakers.

Demonstrating the feasibility of achieving zero carbon goals, the report is supported by case studies of existing best practice across the whole breadth of the building industry. Businesses involved in design and delivery have already committed to ambitious individual or national decarburization strategies. For example, Skanska, a major development and construction group is making strides in enabling projects to be evaluated for full lifecycle impacts.

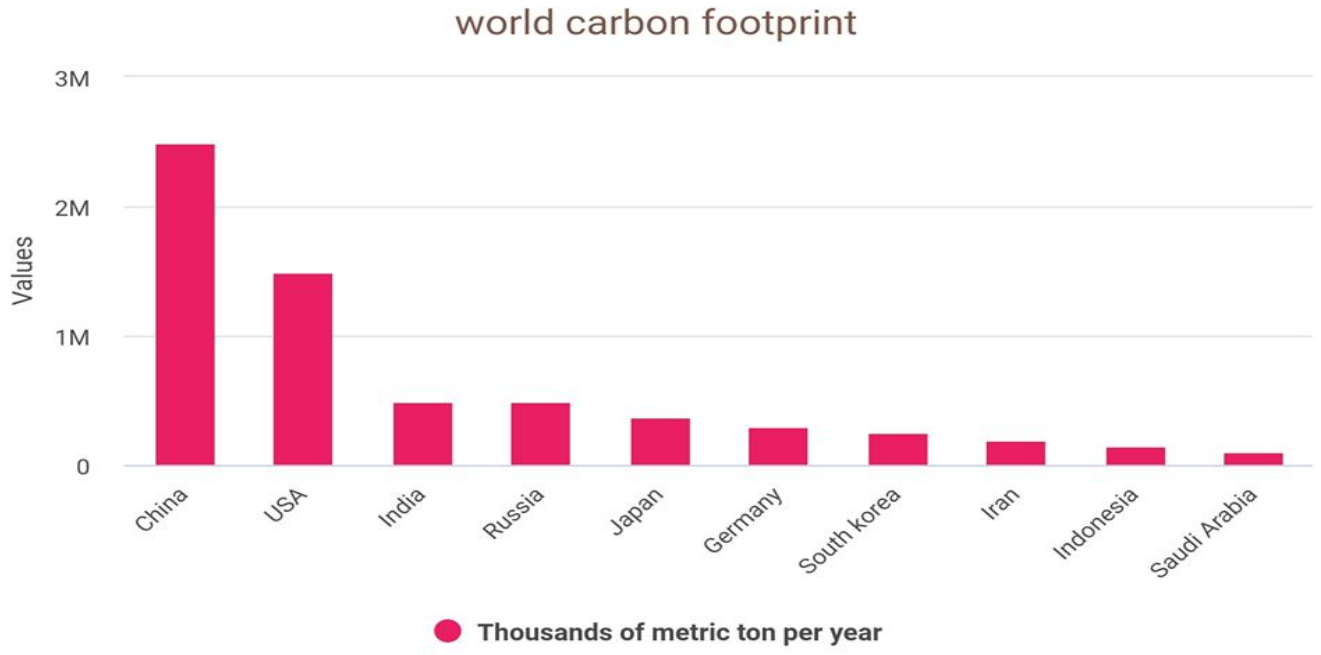
Materials suppliers are also taking a leading role. Heidelberg Cement has committed to developing carbon neutral products by 2050, and Dalmia Bharat Cement, one of India's leading cement manufacturers, is committed to becoming a carbon negative group by 2040.

Cities have also been instrumental in pushing for new innovations and approaches. Oslo, Norway, has a commitment to fossil free construction sites. Vancouver, Canada, has mandated that incorporated carbon be reduced in new buildings by 40% by 2030, as part of its climate emergency response, demonstrating the type of regulatory frameworks that can drive market change.

## III.RESEARCH

One of the most widely used emission reporting standards is the Greenhouse Gas Protocol (GHG Protocol). The emissions are broken down by the companies into three categories, or scopes. The emissions that are produced on a company's site or directly by vehicles: Scope 1. The emissions that are results from electricity purchased by the company: Scope 2. The emissions that occurs as a result of company's activities from sources that it does not own or control: Scope 3.

The quantity of greenhouse gas (GHG) emissions that are produced as a result of a company's operations is classified as its carbon footprint. Carbon footprints are usually measured in terms of an annual footprint. The impact of all of the company's key activities over the course of a calendar year is taken into account as annual footprint. It is more commonly seen that manufacturing companies communicate their footprint on a per- product basis.




China is the top country to emit the most amount of carbon, followed by the US, India, Russia, Japan, Germany, South Korea, Iran, Indonesia, and lastly Saudi Arabia completing the top 10.

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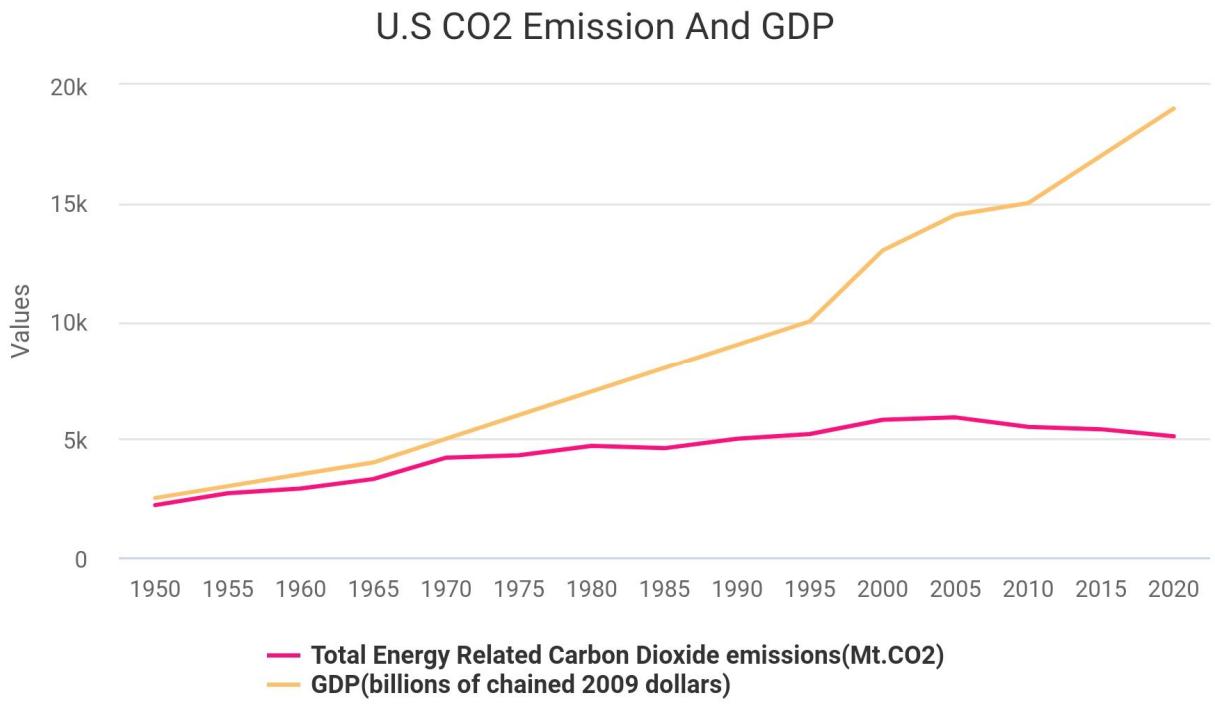
The United States is the largest country where the growth in carbon dioxide emissions has "decoupled" the economic growth in multiple consecutive years. GDP grew by 4 percent (from $14.8 to $15.4 trillion), while the energy-related carbon dioxide emissions declined by 6 % (from 5.58 to 5.23 billion metric tons), from year 2010 to year 2012. The U.S. Energy Information Administration, in its analysis of the Clean Power Plan (CPP) forecasted that a sustained period of GDP-GHG decoupling will be brought about if we move to a cleaner electricity system after 2020. The CPP implementation is expected to reduce total U.S. energy-related carbon dioxide emissions between 2020 and 2025 by a further 6%, while GDP increases by 13% in real terms over the same period as illustrated in the figure below.

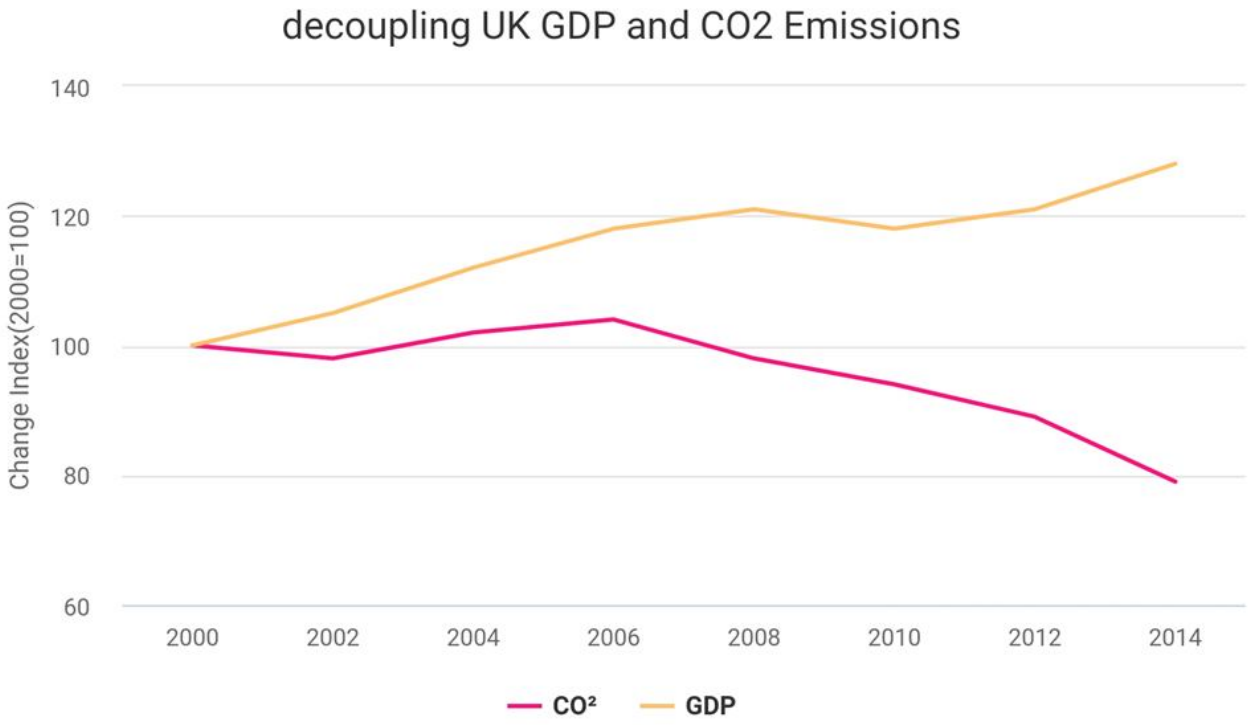



A big chunk of carbon footprint comes from the Construction Industries, and earlier when the infrastructure development was going on in the America, the carbon emissions increased tremendously. The concern for global warming enabled various carbon footprint decreasing techniques and tools to get developed which led to strengthen its economy as well as decrease the carbon footprint caused due to construction.

If the Clean Power Plan is implemented and sustained decoupling is achieved in the United States implements, it will be in well balance. Over the period from 2000 to 2014, decoupling of GDP and energy-related carbon dioxide emissions is achieved in twenty other countries.

An example of a country where economic growth and CO2 emissions have increasingly diverged is UK. The UK achieved six years of absolute decoupling where real GDP grew at the same time that carbon dioxide emissions declined between 2000 and 2014. The GDP grew from $2.1 to $2.7 trillion (constant 2005 U.S. dollars), while emissions dropped from 591 to 470 million metric tons of energy-related CO2, over the 14-year period. As industrialization began in Europe, a tremendous increase in carbon footprint was observed. Huge scale Construction Industries were set up and carbon emissions shot up exponentially, which led to a rising of earth temperature by 1.5°c which earlier was just a maximum of 0.2°c.

After the development of several environment favoring concepts, UK started to empower its industries and reduce its carbon emissions. A high growth in technology was seen during this time which was majorly used for Construction Industries.UK transformed its Conventional Construction Industries into Sustainable Development Construction which led to declination of carbon footprint, with still a rise in economy.




## IV. CONCLUSIONS

Sustained period of GDP-GHG could be brought if we move to a cleaner electricity system after 2020 as forecasted by CPP. If this is implemented then it is expected that total U.S. energy related CO2 emissions in coming 5 years would be decreased by additional 6% whereas GDP would be increased by 13%. In UK, GDP and CO2 emissions have divergingly increased.

Carbon footprint in construction industry can be reduced significantly by implementing low carbon strategies in the design process, decreasing construction waste and lowering water and energy consumption. Using Revit as a tool to calculate carbon footprint of building materials early in the designing process will allow us to work in a way to reduce embodied carbon of buildings. Low embodied carbon material choices like dense timber, cork flooring and wood insulation in place of steel, concrete, and foam insulation can also contribute to decrease a building's carbon footprint.

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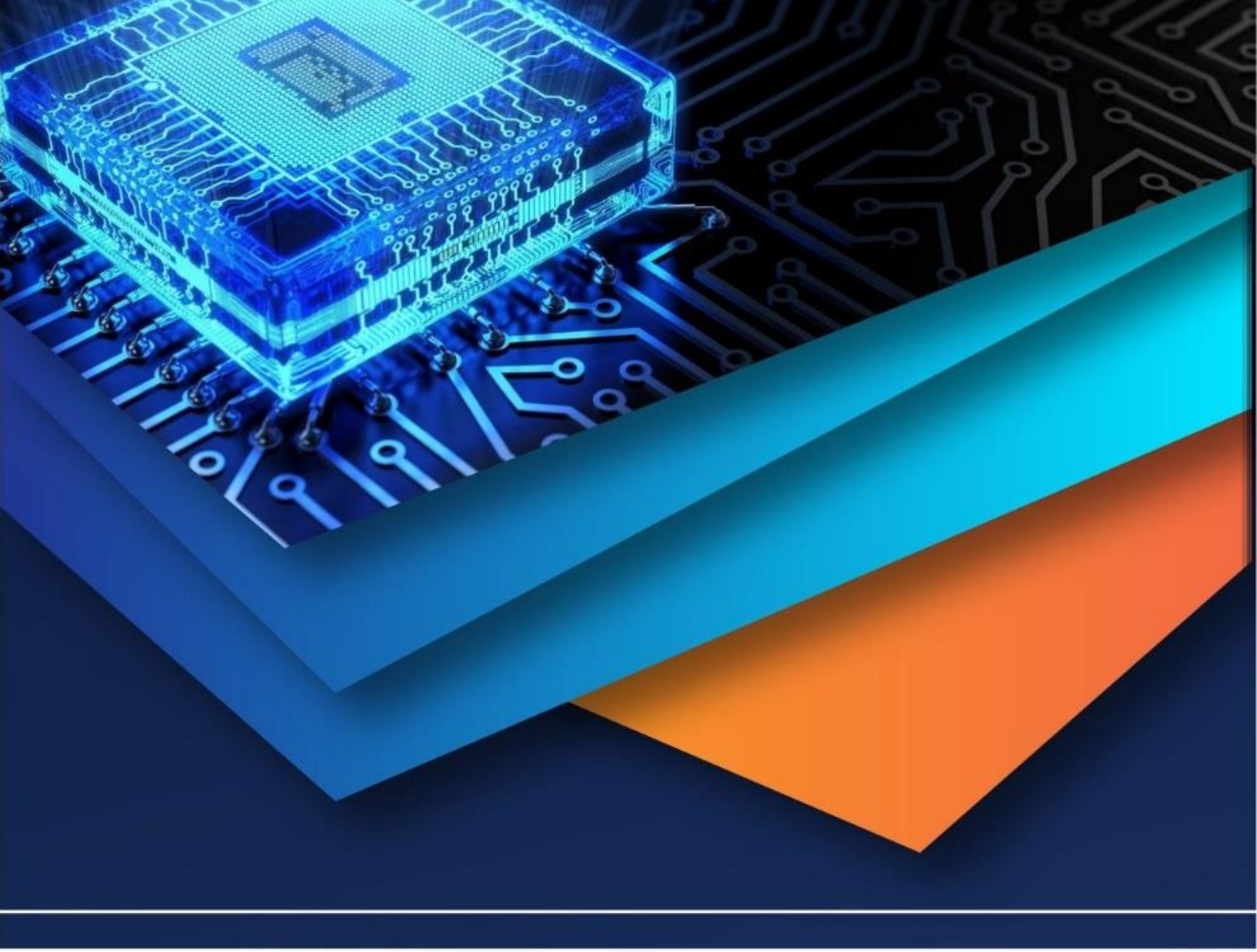

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