



Carbon Outsourcing: A Big Hurdle in Reducing CO2 Emissions

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Abstract

Over the last decade, the United States and many European Union countries like UK, France, and Germany, and some rich Asian countries like Japan and Singapore have reduced their CO2 emissions to a great extent, on the contrary, their consumption of goods that produce large amounts of CO2, (also known as consumption-based emissions) although lower, when compared to the last decade, is still higher than their production of such goods (also known as production-based emissions). Now, this is an interesting paradox that how come they are producing less, but still consuming more CO2.

To get the complete picture, we have to consider another paradox that is closely related to the first one. If we look at the developing countries like China and India, both, their consumption-based and production-based emissions have grown over this period, however, their production-based emissions grew at a much higher pace than their consumption-based emissions.

Now one might wonder why are these countries producing more than they consume, and are the two paradoxes somehow related to each other? The answer is 'Yes', they are related very closely. The reduction in emissions of developed countries is directly related to the increase in the emission of developing countries, as the developed countries have outsourced big quantity of their emissions to developing countries by importing goods from them rather than producing them domestically. This phenomenon of carbon-outsourcing has the caliber of reversing a good deal of progress made in fighting climate change and thus it is crucial to be addressed and tackled properly. In this paper, I discuss in detail the concept of Carbon Outsourcing, its negative impact on the environment and how rich countries exploit this to decrease their overall carbon-footprint.

Key Words: Carbon Outsourcing, CO2 Emissions, Carbon-Footprint, Consumption-Based Emissions, Production-Based Emission.

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1. INTRODUCTION

When nations report their CO₂ emissions to The United Nations Framework Convention on Climate Change (UNFCCC), they consider only their territorial emissions, i.e. emissions that have taken place within their borders, but they do not consider the amount of carbon they've imported with goods, which means that the amount of CO₂ that was emitted in some other country for producing goods for the country importing them. This way the overall carbon footprint of the country exporting the goods increases while that of the country importing them decreases as it is consuming the goods but not producing them.

Now, this supply chain of carbon works on the global level where the developed countries report lower emissions by importing carbon-intensive materials like steel and cement from the developing countries, rather than producing it domestically. Thus, these developed countries outsource a big chunk of their carbon emissions, cutting their territorial emissions while still maintaining or even increasing their consumption emissions. So, this means that if their imports of CO₂ are also considered, their actual carbon-footprint would increase as compared to the amount they report to the UNFCCC. One remarkable case is of Switzerland here whose CO₂ emissions grow 209% higher if its imports of CO₂ are considered.

Although Switzerland is one extreme case, in many European countries' emissions grow more than 30% if CO₂ embodied in imports is added. In the US, this figure stands at about 14%. **Around 25%** of the CO₂ emissions worldwide are outsourced this way and no current inventory of quantifying CO₂ emissions includes them.

On 4 November 2016, the landmark 'Paris Climate Agreement' came into effect to tackle climate change and its devastating impacts on the environment. It was indeed the first step of its kind in the direction of addressing climate change in a unique way. Instead of adding numerous legal prerequisites like in the Kyoto protocol and then in Copenhagen accord the Paris accord encouraged every country to submit its targeted reductions in emission of greenhouse gases, known as '**Nationally determined Contribution or NDC**,' based on its capacity and its degree of commitment to fighting the climate change. Without too many legal requirements the nations were not reluctant to join and it is due to this unique approach of Paris accord, that it was signed by **195 Parties** and as of November 2019 ratified by **187 Parties** representing **97%** of global emissions.

So, it is clear that Paris accord is the first of its kind and it improves upon the downsides of previous agreements dealing with climate change. But there is still a grey area left in Paris that needs to be addressed and improved upon, it was in Kyoto and in every other climate accord that has ever taken place. And that grey area is '**How to calculate a country's emissions?**'.

When a country reports its emissions, it only reports the emissions that have taken place from the manufacture and consumption of goods inside its territory. Now prima facie it seems completely fair and logical, after all, if a country is to report its CO₂ emissions then obviously it will report the emissions that have been emitted from its factories within its borders, and the Paris accord too just like any other climate agreement adopts the same method of defining a country's emissions, and that is where like any other agreement it lacks.

What if when determining a country's emissions, the emissions of other countries would also be added to its emissions? Now it may sound stupid but at first but once we get to know the concept of 'Embodied CO2' and 'Carbon outsourcing', this makes complete sense.

Almost every country on this planet indulges in international trade, they trade goods and services, and with those goods, they trade CO2 as well, so the greenhouse gases emitted during the production of goods that are manufactured for trade across countries and not for domestic consumption are called '**Embodied greenhouse gases**' and this process of importing CO2 embodied in products is called '**Carbon Outsourcing**' because if it wasn't for the embodied CO2 imports, that big amount of CO2 would have been emitted within the country importing the products, during the manufacturing for domestic consumption.

So, what happens in Carbon Outsourcing is that developed countries import goods that are highly carbon-intensive such as steel and cement from developing countries like China and India rather than producing them domestically and thus they report lower emissions, this way they outsource big chunk of their carbon pollution to developing countries, but if their imported carbon emissions are also added to territorial emissions than their total carbon footprint would increase significantly. China is the biggest exporter of embodied carbon with **2.186 Giga Tones** carbon outsourced in 2015.

And this is what the KGM & Associates Pty Ltd, an environmental accounting research firm and Global Efficiency Intelligence, an energy and the environmental consulting firm have referred to as '**Carbon loophole**' in global climate policy in their report .



Figure 1: A steel factory in Wu'an, China. Many countries can report lower carbon emissions because they are increasing imports of materials like steel or cement. Credit...Thomas Peter/Reuters, Nytimes.

2. AS DESCRIBED IN THE REPORT

"The carbon loophole refers to the embodied greenhouse gas emissions associated with the production of goods that are ultimately traded across countries. These emissions are a growing issue for global efforts to de-carbonize the world economy. Embodied emissions in trade are not accounted for in current greenhouse gas accounting systems. If they were, many promising climate trends would be negated or reversed. For example, many achievements of reducing emissions by developed countries under the Kyoto Protocol would appear as emissions outsourced to developing countries."

During the last decade, both the European Union and the U.S. have reduced their carbon emissions significantly adopting the same method, but again these reductions won't seem as intriguing once the amount of CO2 they have outsourced overseas is considered.

Ali Hasanbeigi, CEO of Global Efficiency Intelligence, and Daniel Moran, an economist at KGM & Associates found that claim of many countries of net reductions in CO2 emissions are partly or even fully reversed when this carbon loophole is considered.

If we take Britain for instance, it reduced its emissions by almost 27 % between 1990 and 2014 from 601 Mt in 1990 to 439 Mt in 2014, but once CO2 imports from trade are considered this drop to only 11% reduction.

The same way the reductions in emissions of many European countries will also reduce or completely vanish once the embodied CO2 is considered.

The US is not only the biggest emitter of CO2 in history, but it is also the biggest importer of embodied carbon worldwide. Researchers suggest that if the US were held accountable for all the CO2 embodied worldwide during the manufacturing of products that are ultimately consumed in the US, then its total carbon footprint would be increased by 14 %.

To understand this better, let's have a look at the emissions of the US, UK, and Germany for the year 2018, US- 5416 Mt, UK- 379Mt, Germany-759Mt.

Now 14% of US emissions would be 758.24 Mt. That is almost double the total emissions of the UK and almost equal to the total emissions of Germany. So these facts indicate that this loophole can't go unchecked. Although it is also true that

the emissions differ from country to country depending upon the economy and domestic requirements and Germany and the UK had reduced their domestic emissions using this loophole anyway.

Ali Hasanbeigi said, "It's a huge problem, If a country is meeting its climate goals by outsourcing emissions elsewhere, then we're not making as much progress as we thought."

China is the biggest emitter of CO2 since 2006 when it overtook the US, and as per the figures of the year 2015 from the KGM & Associates report, then we see that the US is the biggest importer of embodied Carbon.

TOP EMBODIED CO ₂ IMPORTERS, 2015			TOP EMBODIED CO ₂ EXPORTERS, 2015		
Rank	Country	Embodied CO ₂ in Imports (Gt CO ₂)	Rank	Country	Embodied CO ₂ in Exports (Gt CO ₂)
1	U.S.	1.452	1	China	2.186
2	China	0.706	2	USA	0.734
3	Japan	0.567	3	Russia	0.625
4	Germany	0.395	4	India	0.488
5	UK	0.368	5	Germany	0.355
6	Hong Kong	0.349	6	Japan	0.349
7	France	0.281	7	South Korea	0.271
8	South Korea	0.272	8	Canada	0.186
9	India	0.233	9	Taiwan	0.164
10	Italy	0.233	10	Saudi Arabia	0.154
11	All others	4.007	11	All others	3.267

Figure 2: Source-KGM & Associates- The Carbon Loophole in Climate Policy

We see that the US imported 1.452 Giga Tones of CO₂ in the year 2015, which is even more than the total CO₂ emissions of Japan (1.225 Gt) which bagged the fifth spot in the top five emitters of 2015. Although China is the biggest exporter of embodied CO₂ to the US as well, the US didn't import this huge chunk of CO₂ just from China, but from Canada, Mexico, Japan, India, Russia, Germany, South Korea, and Taiwan as well.

Surprisingly, China is also the second-largest emitter of the embodied CO₂ as China imports mined raw materials, especially petroleum from Africa and iron ores and other metal ores from India as fuel for its factories, but overall it is the net exporter of the embodied CO₂. There is a pattern in which fossil fuels are extracted in a first country, then processed and used as fuel for manufacturing in a second country and then the final product is consumed in a third country, thus the CO₂ originates in a region with low or no carbon regulations and ends up in a region with more strict regulations, evading all current inventories to quantify the emissions. This is a global Chain that engulfs the entire planet. The following image shows the global imports and exports of CO₂.

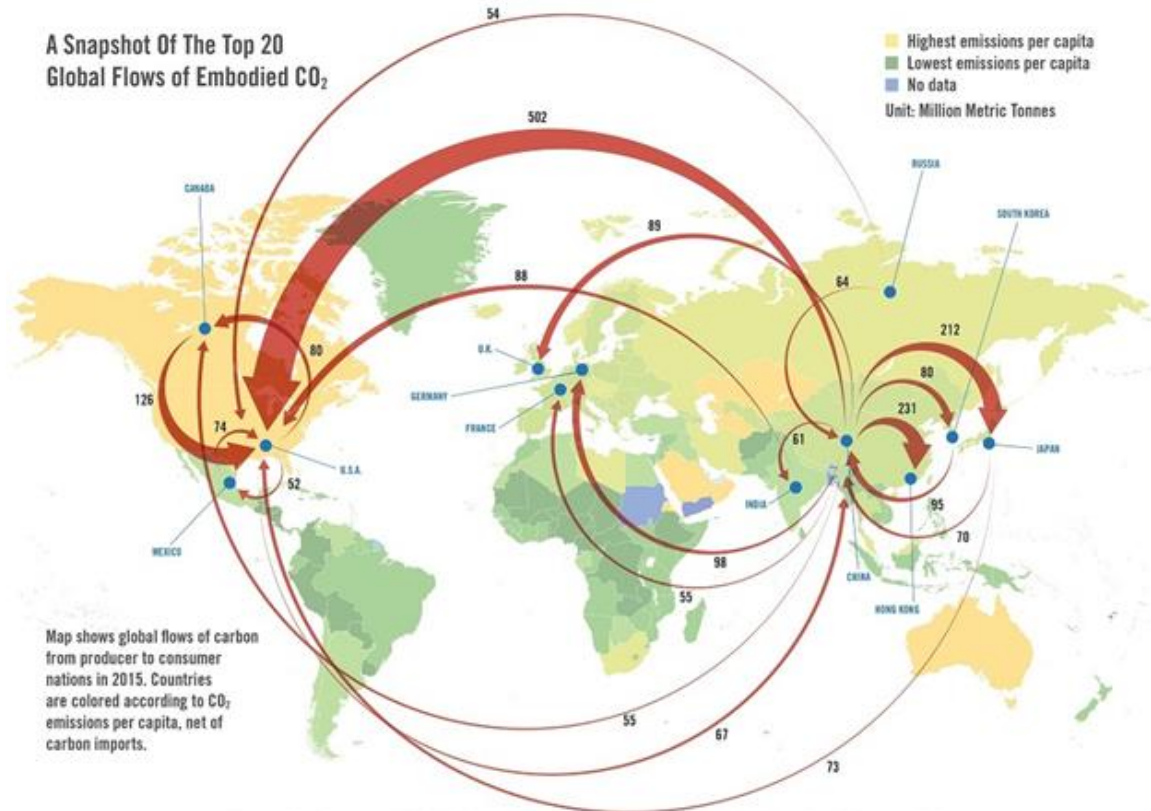


Figure 3: Source-KGM & Associates- *The Carbon Loophole in Climate Policy*

3. SO HOW BIG THIS LOOPHOLE IS?

The answer is 'Very Big', so big that in the year 2015 almost one-fourth of total global emissions passed through this loophole, which is roughly equal to 10 gigatonnes.

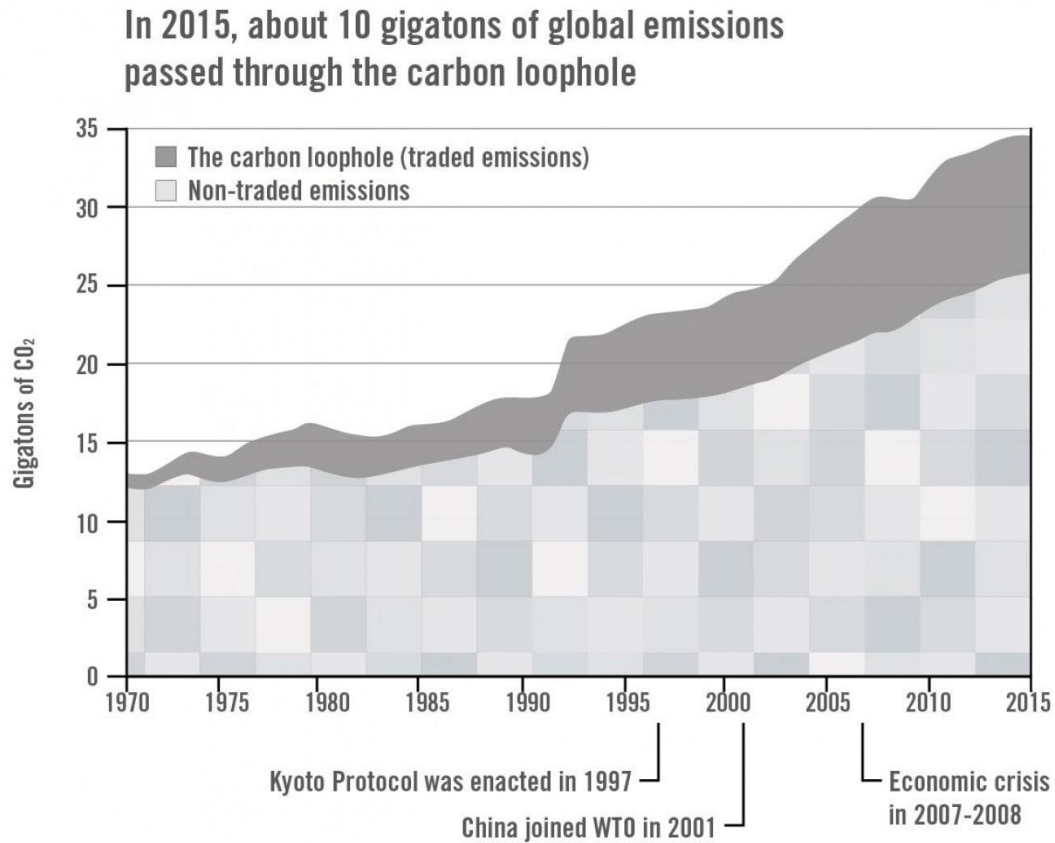


Figure 4: Source-<https://www.washingtonpost.com/news/theworldpost/wp/2018/09/13/carbon-emissions-2/>

And what's even more worrying is the fact that this figure could've been even bigger had it not been for the global financial crisis of 2007-08 since the outsourcing of carbon emissions from developed countries to developing countries has plateaued since the financial crisis. But again, there is no guarantee that this is a permanent slowdown and without proper regulations regarding outsourced carbon, this figure may grow at an even higher pace.

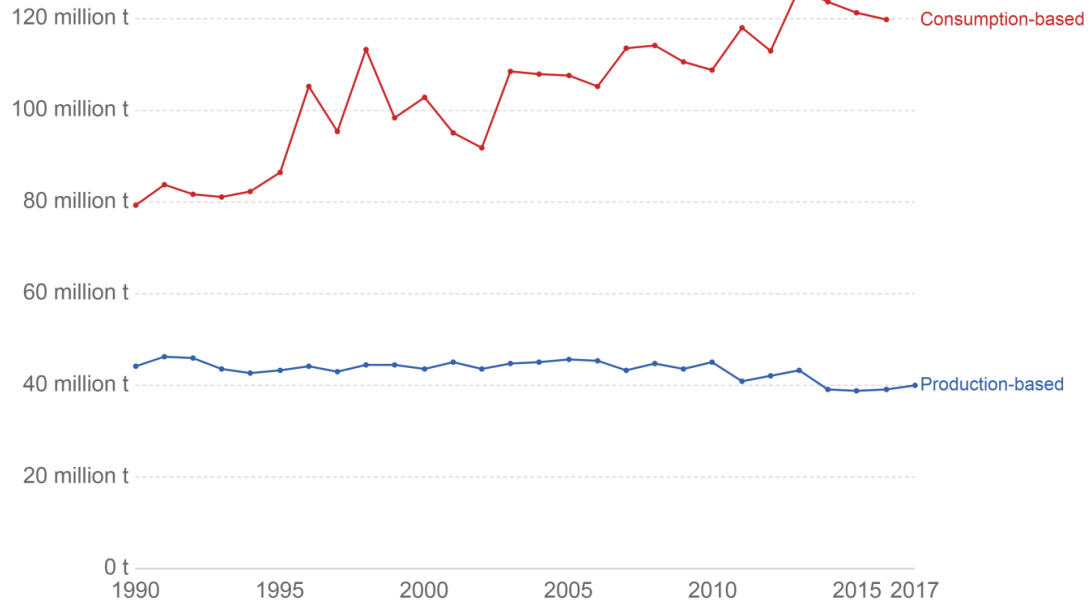
4. SWITZERLAND: ONE EXTREME CASE

According to Carbon brief, a UK-based website covering the latest developments in climate science, climate policy, and energy policy, in many European countries carbon embodied in imports amounts to more than 30% of territorial emissions but Switzerland is an extreme case with emissions getting 209% higher (more than three times as large) once CO2 imports are taken into account.

Production vs. consumption-based CO₂ emissions, Switzerland



Annual consumption-based emissions are domestic emissions adjusted for trade. If a country imports goods the CO₂ emissions needed to produce such goods are added to its domestic emissions; if it exports goods then this is subtracted.



Source: Le Quéré et al. (2018). Global Carbon Project.

OurWorldInData.org/co2-and-other-greenhouse-gas-emissions/ • CC BY

Figure 5: Source- Le Quere et al. (2018) Global Carbon Project. <https://www.ourworldindata.org/co2-and-other-greenhouse-gas-emission/>

The graph shows that Switzerland's production emissions fell by 11% while its consumption emissions grew by 44% since 1990, it is such a huge disparity between its production and consumption-based emissions again emphasizing the importance of dealing with the outsourced carbon.

5. CHINA: THE WORLD'S FACTORY

China is, by a huge margin, Asia's and the world's largest emitter: it emits about 10 billion tonnes CO₂ each year, almost 30% of global emissions.

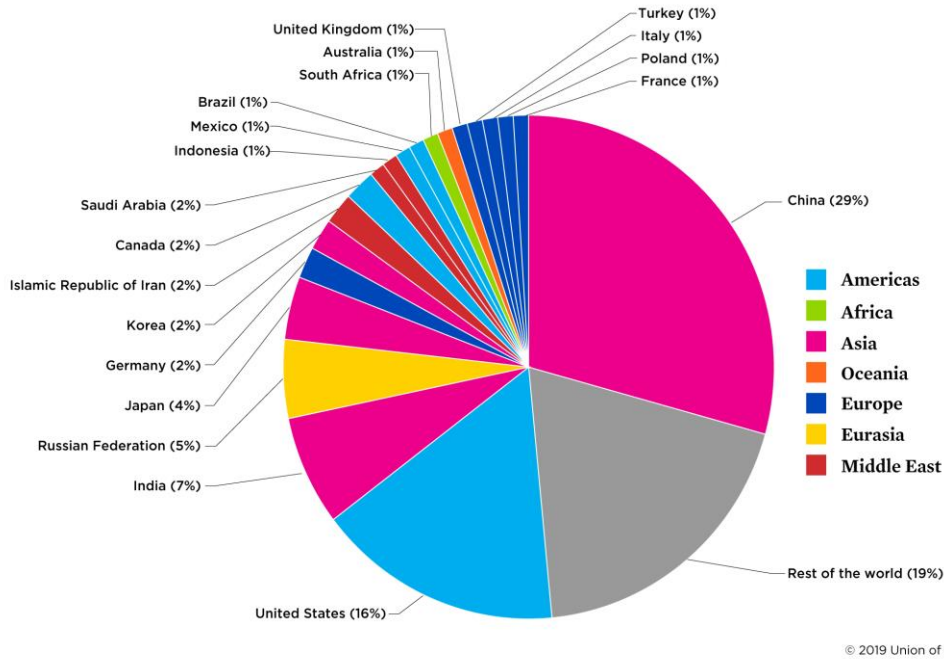


Figure 5: Source-ucsusa.org-Each Country's Share of CO2 Emissions

A significant portion of this emission is meant for export. In 2015 alone, China exported 2.186 Gt CO₂ i.e. about 13% of its emissions, which exceeds the total import tally of US of 1.452 Gt. (As shown in Figure 2).

Steel and Cement are highly CO₂ sensitive, cement production releases about 1.25 tons of CO₂ per ton of cement created and each ton of steel produces about two tons of CO₂. Also, both of these products are traded between different regions of the world on a large scale. According to 'The Carbon loophole in Climate policy', China exported 115 million tons of steel in 2015, which is equal to 140 % of steel production in the US. As per the data of the 'World Steel Association', China produced 928.3 Mt of steel in 2018, which is more than 50% of the world total i.e. 1808 Mt. As per the report of U.S. Geological Survey (2016), China exported about 15 million tons of cement in 2015, i.e.18% of the total cement production in the U.S. in that year. China produces more cement than the entire world.

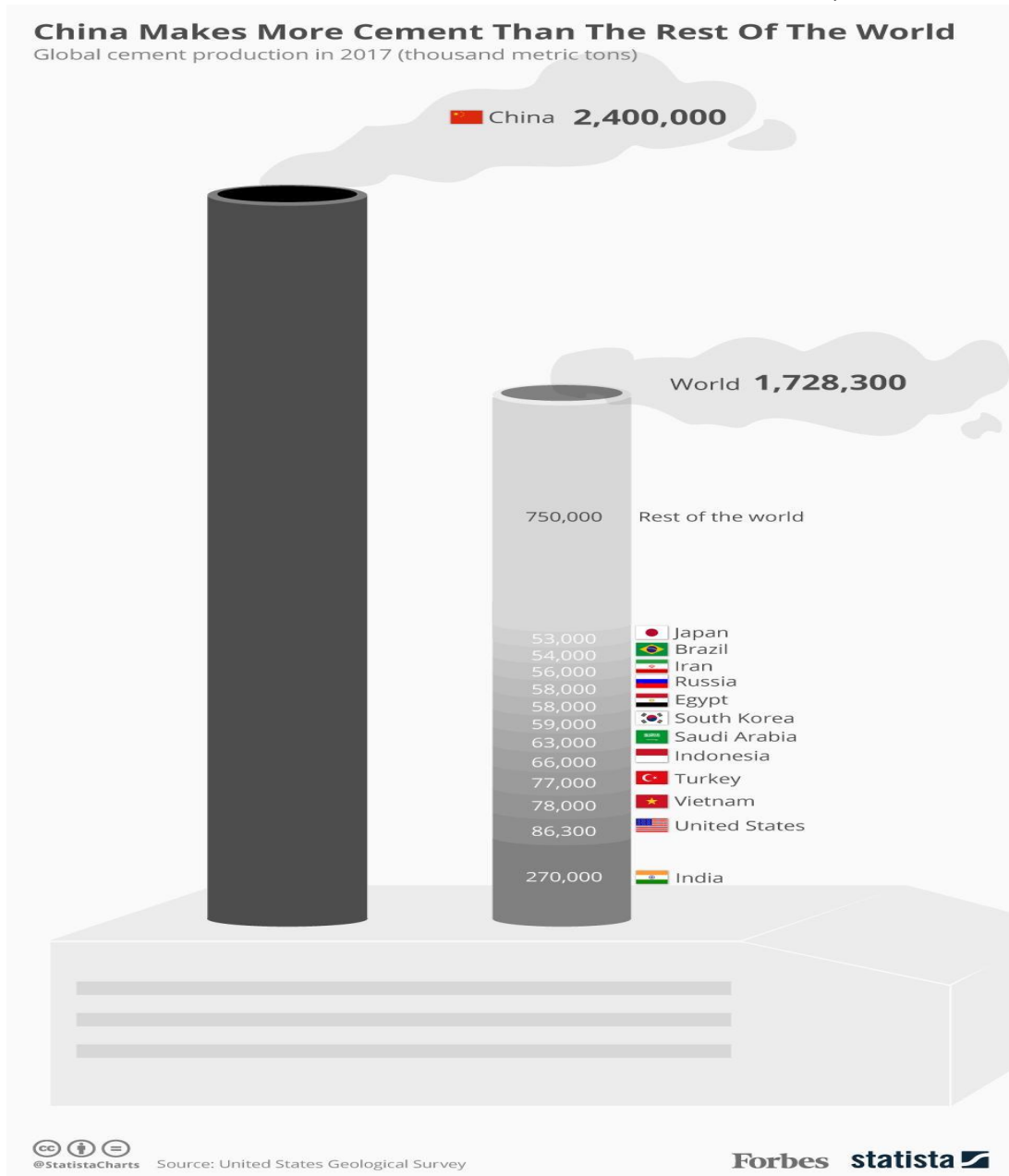


Figure 6: Source- United States Geological Survey.

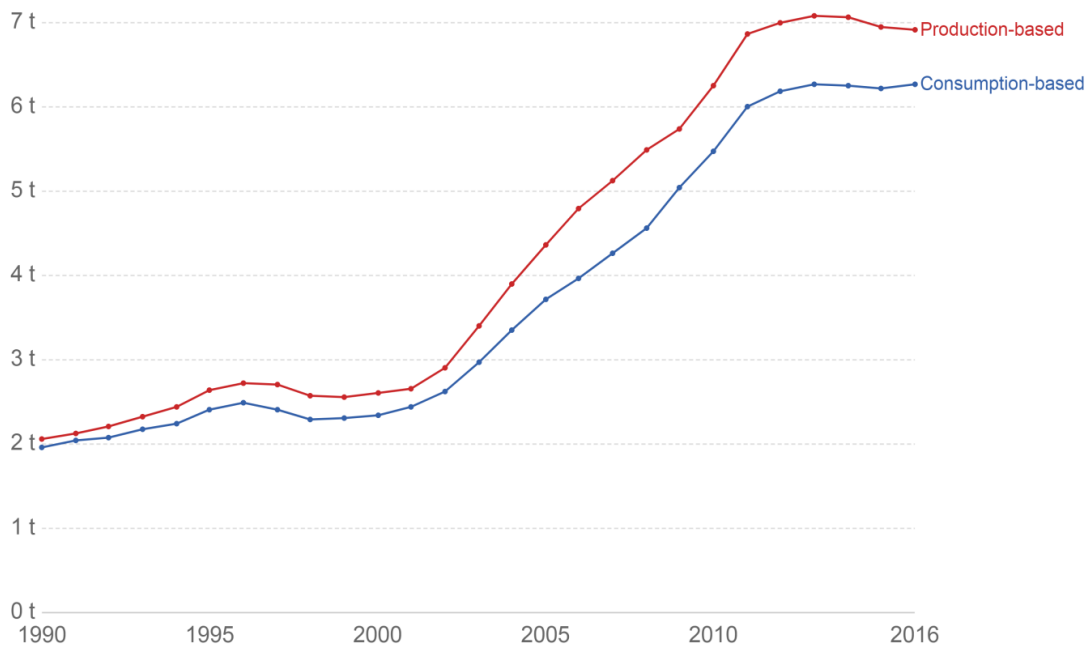
China produced around a whopping 139% of the total cement production of the whole world in 2017.

We see that China produces such gargantuan amount of Steel and Cement, although around 87% of this steel and 99% of this cement is consumed domestically, the remaining tally of 13% and 1% exports may not seem too big, but when we see the fact that this is a country which produces more than half of the world's steel and around 1.4 times the cement production of the world alone, these numbers don't look that small anymore. If we compare the growth in China's production and consumption-based emissions since 1990, it is clear that China's production emissions have grown significantly higher than its consumption-based emissions.

Production vs. consumption-based CO₂ emissions per capita, China



Annual consumption-based emissions are domestic emissions adjusted for trade. If a country imports goods the CO₂ emissions needed to produce such goods are added to its domestic emissions; if it exports goods then this is subtracted.



Source: Global Carbon Project; Carbon Dioxide Information Analysis Centre; UN Population Division

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Figure 7: Source- Global Carbon Project; Carbon Dioxide Analysis Centre; UN Population Division

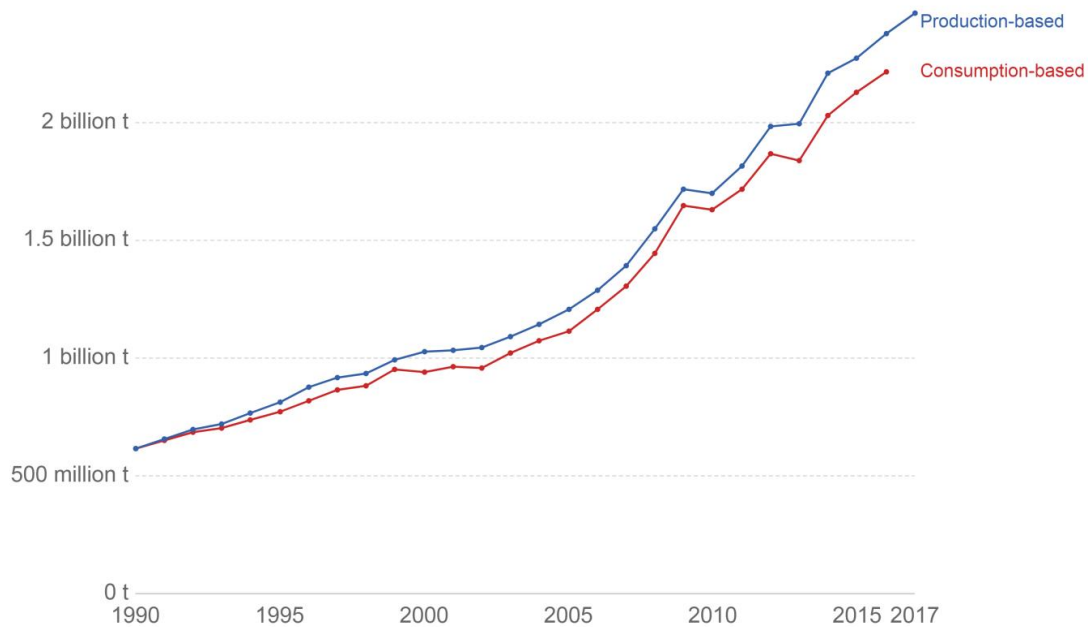
6. INDIA: THE GROWING MARKET

India's CO₂ emissions have grown two-fold between 2002 and 2015. While in 2015, the world factory China exported around 13% of its production, for India, another big export destination, the figure is 20%. Overall the country has been a net exporter of embodied CO₂ since 1990, its exports have grown rapidly since the beginning of this decade.



Production vs. consumption-based CO₂ emissions, India

Annual consumption-based emissions are domestic emissions adjusted for trade. If a country imports goods the CO₂ emissions needed to produce such goods are added to its domestic emissions; if it exports goods then this is subtracted.



Source: Le Quéré et al. (2018). Global Carbon Project.

OurWorldInData.org/co2-and-other-greenhouse-gas-emissions/ • CC BY

Figure 8: Source- Le Quere et al. (2018) Global Carbon Project. <https://www.ourworldindata.org/co2-and-other-greenhouse-gas-emission/>

The graph shows that since the beginning of the nineties, territorial emissions started to outgrow consumption-based emissions, indicating a rise in the embodied CO₂ exports, and this growth is increasing rapidly since 2012.

According to Carbon brief, India's production emissions have increased by 349% and its consumption emissions by 319% since 1990 while China's production emissions have increased by 430%, while its consumption emissions have increased by 400%.

Like China, since 1995 the top importer of Indian exports is also the US with 86,845 Kt of CO₂ imports in 2015 alone. China's exports to the US have grown 317% between 1995-2015 while Indian exports to the US have grown 350% during the same period.

The other top importers from India are China, UAE, UK, Germany, and Japan.

7. WHY CHINESE PRODUCTS ARE MORE CO₂ INTENSIVE?

Production of steel, cement or aluminum in China produces more CO₂ than if the same amount of these products were produced in Europe, America or Latin America. For example, China's steel

industry, on average, emits 23 percent more carbon dioxide per ton of steel produced than American and German manufacturers do.

Now one might wonder what is the reason for this disparity, and the answer is Coal. China's economic growth was mainly driven by coal, and since coal is rich in carbon, burning coal releases a large amount of CO₂ in the atmosphere, up to double the amount of CO₂ as compared to other fossil fuels. Chinese industry is heavily dependent on coal; about 70% of the total energy derived in China between 1985-2016 came from coal alone. Although this figure of 70% came down to 60.4% in 2017, China still consumes more coal than the rest of the world combined as obvious by the fact that in 2017, almost 50% of the total coal mined globally was mined in China alone.

Coal burning is responsible for almost 73% of Chinese emissions, i.e. bigger than the combined emissions of the entire European Union. It means that CO₂ emissions could've been significantly lower if the same amount of steel or cement was produced in America or Europe rather than being imported from China.

India is no exception to this with roughly 75% of India's electricity being generated by burning coal. Therefore, it comes as no surprise that 22 of the most polluted 30 cities of the world are in India according to a new study by 'IQ Air Visual and Greenpeace'. To add to this, 7 cities made their way into the top ten lists with Gurugram and Ghaziabad getting the first and second spots respectively.

8. THE SOUTH-SOUTH TRADE: THE GROWING TREND

When we talk about carbon outsourcing, the first thing that comes to our mind is developed countries importing goods from developing countries, and for the most part, this is true as it has been the case since the '90s. However, since the global financial crisis of 2008, these imports have stabilized or even decreased slightly in some cases. On the contrary, the trade between developing countries i.e. south-south trade over this period, has grown and in fact, has doubled between 2004 - 2011 according to a study in Nature Communications titled 'The rise of South-South trade and its effect on global CO₂ emissions'.

According to the UNCTAD Handbook of Statistics 2019, in 2018 merchandise worth 19.5 trillion US\$ were traded globally, out of which goods worth US\$6.9 trillion (28% of the global trade) were exchanged between developing countries (the south-south trade).

China is not only the biggest exporter of goods worldwide, but also plays a significant role in the South-South trade. Around 21% of exports and 27% of imports of all South-South trade in 2014 were related to China alone. In 2011, China imported 190 Mt CO₂ from developing countries, while India imported 145 Mt CO₂, which is more than three times its 2004 imports, i.e. 44 Mt.

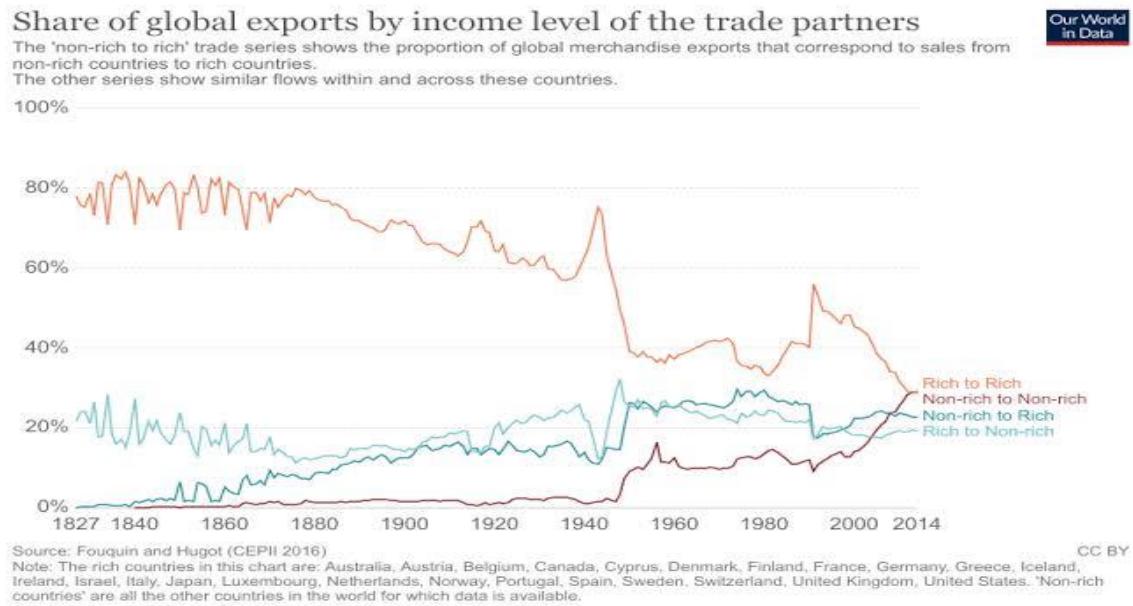


Figure 9: Fouquin and Hugot (CEPII 2016)

Steven J. Davis, a scientist at the University of California, Irvine and co-author of that study 'The rise of South-South trade and its effect on global CO2 emissions' said, "Just as China's starting to deal with its emissions, it's been pushing some of its more carbon-intensive activities into countries like Cambodia, Vietnam, and India".

He further said that from a climate policy context it's a game of 'whack-a-mole' which means that it's a solution that will result only in temporary or minor improvement. He has a point in saying that because at the current pace, sooner or later, exports from low economy countries to countries like China grow significantly and then in terms of curbing the carbon loophole, we'll come back to square one.

9. 'BUY CLEAN CALIFORNIA': A SILVER LINING?

In October 2017, the Californian government passed a law known as 'Buy Clean California' which requires the state agencies to consider the quantity of embedded carbon while buying materials like steel, glass and mineral wool (fibrous material formed by spinning or drawing molten mineral or rock materials, commonly used in construction work) for state-funded projects meaning these materials should meet a certain low-carbon standard to become eligible to be used in state-funded projects.

This law came into existence against the backdrop of a controversy over the renovating of San Francisco's Bay Bridge when steel was bought from a heavily polluting Chinese mill while cleaner alternatives were present in California and Oregon. Since Chinese and Indian mills are more polluting than the US ones, the law automatically promotes buying from domestic mills and

discourages imports from China and India, favoring domestic producers and reducing the overall carbon footprint of the US.

Although there are concerns regarding cement and wood, two of the most used construction materials, being left out of the law. Still, this is a first-of-its-kind law in the world dealing with embedded carbon.

The effectiveness of the law remains to be seen, but if this law proves to be a success, other states too may follow the suit and who knows. If more countries enact such laws that promote buying from cleaner sources, this will automatically promote research and investment in cleaner technologies, which will result in reduced global carbon-footprint.

If implemented properly, environmentalists believe that this law has the potential to prove to be a milestone in dealing with climate change and carbon outsourcing.

10. CONCLUSION

The planet is warming rapidly, so rapidly that even if all the parties to the Paris deal achieve their targets, the average global warming is still estimated to be between 2.6-3.2°C by 2100, well beyond the overall target of "well below 2°C" of the Paris agreement. But that's not even the whole picture since the Paris agreement only deals with around 75% of the total global emissions as it does not include the carbon embodied in imports. Carbon outsourcing is not a new concept, everyone knows about it, everyone knows its negative impact on the ongoing efforts of curbing climate change, but no one is willing to do something about it. There were talks about including the embodied carbon exports during the signing of the Kyoto Protocol but the idea was finally dropped as this whole process of quantifying and acting on the carbon embodied in imports was too complex. Can we even justify the fact that we decided not to act on a problem that has such serious impacts on climate change just because the problem was too complex to tackle. It seems like that; we just kicked the can down the road and felt good about having solved the problem. When the issue is too complex then how we can expect to solve it with no serious efforts.

The first step in solving a problem is accepting that there exists one. Then what we need is the will to tackle this and then combined efforts we can reach the right solution to this problem. California's "Buy Clean" is a great start in this direction and we need more and more of such initiatives.

The problem of climate change is continuously evolving and gets amplified by the carbon loophole, so it is necessary that we also evolve our methods of dealing with this by including the carbon embodied in imports in some way in our current inventories. The world was aware of the problem of carbon outsourcing at the time of the Kyoto Protocol but didn't try to solve it, the results, the problem got much bigger. The world was aware of this carbon loophole at the time of the Paris agreement, but again it failed to act on it. And If we still don't act on it, then it would be the same scenario of "shooting oneself in the foot", as we will keep putting up our efforts to curb the carbon emissions while we know that simultaneously our improvements are being reversed by the carbon loophole, as it has been the case in the past.

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