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KEY FINDINGS

EMBODIED CARBON IN TRADE: CARBON LOOPHOLE

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ABOUT THE AUTHORS



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The Climate Leadership Council supported and advised the production of Embodied Carbon in Trade: Carbon Loophole, a November 2022 report from Global Efficiency Intelligence by authors Ali Hasanbeigi and Aldy Darwili. The following is a summary of the study's key findings.

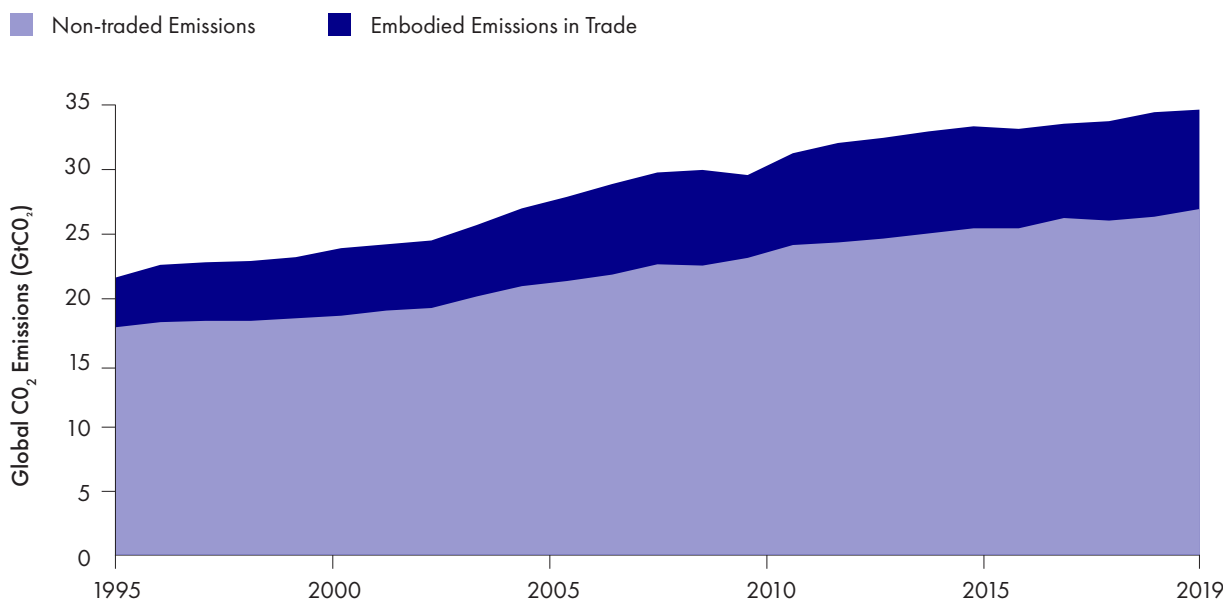
KEY FINDINGS: CARBON LOOPHOLE

There is an 8-billion-ton hole in how advanced countries like the United States think about addressing climate change. It's equal to one and a half times all U.S. annual CO₂ emissions and is getting bigger every year. It represents nearly 25% of total CO₂ emissions globally, and there are currently no policies anywhere in the world specifically designed to mitigate it. If we are going to adequately respond to climate change, we must close the carbon loophole.

The “carbon loophole” represents the CO₂ emissions associated with the production of goods and services in one country that are ultimately consumed in another. For example, the emissions associated with steel manufactured in China that goes on to form the chassis of an automobile rolling off an assembly line in Germany. Or the emissions associated with manufacturing aluminum abroad that turns into a soda can manufactured and used in the United States.

Over the last 25 years, developing markets have assumed an increasing role as major manufacturers, producing goods and services for consumption at home and abroad. Meanwhile, advanced economies have shifted toward service-based sectors, increasingly satisfying their large and growing consumer demand with imports from abroad. With this shift in manufacturing and emissions from the Global North to the Global South, global carbon emissions have increased by about 60 percent. Emissions in the carbon loophole have doubled to nearly 8 gigatons CO₂ (GtCO₂) per year.

Figure 1. Global CO₂ emissions and the share of embodied emissions in trade



(Source: Hasanbeigi and Darwili 2022)

In the context of meaningfully lowering global greenhouse gas emissions, the carbon loophole highlights a major shortcoming in traditional international climate accounting and raises questions about how emissions associated with international trade should be accounted for. A convention of international climate diplomacy is for each country to account for emissions on a production basis; all countries track and report the emissions released within their borders.

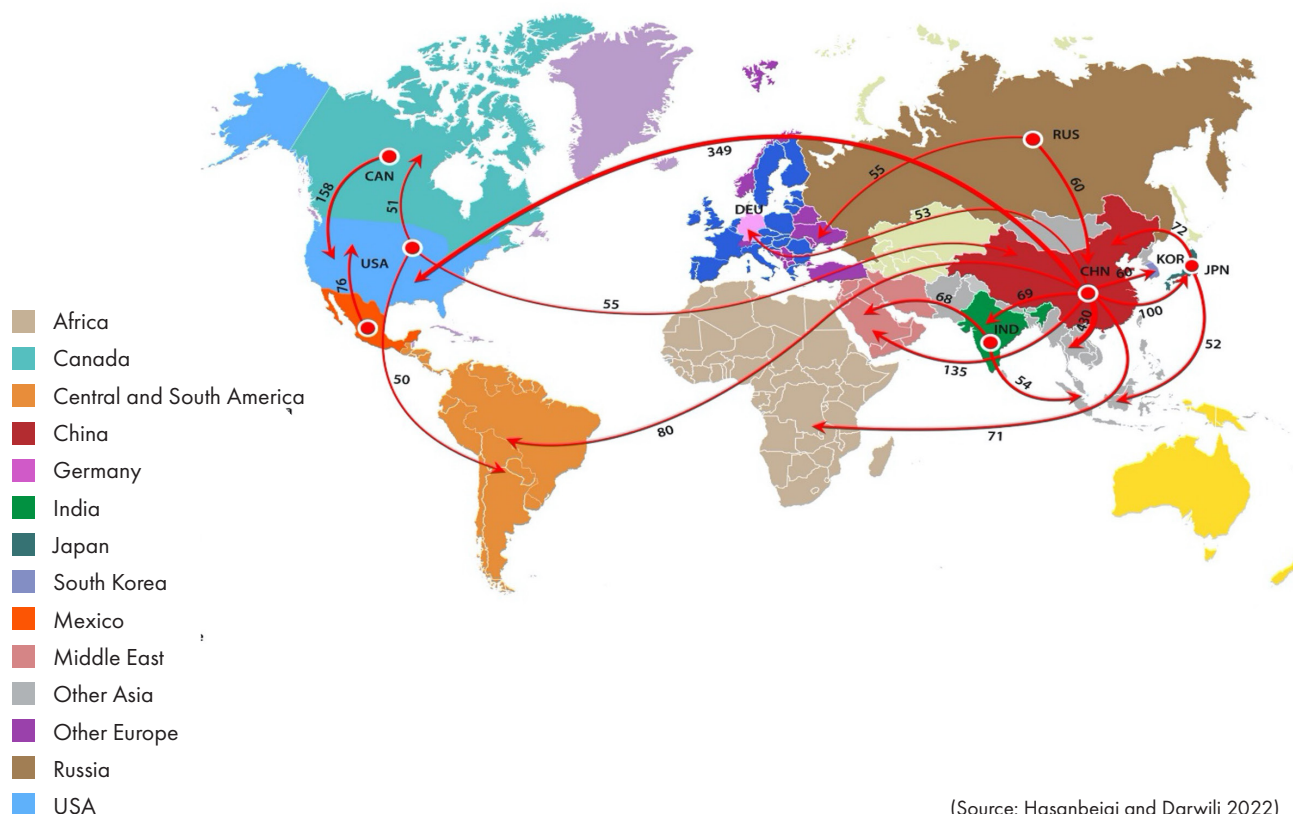
But as the most climate-ambitious countries tend to be those that import the most embodied emissions from abroad, and the least ambitious national reduction commitments tend to be from countries whose net emissions exports are the greatest, the loophole shows us that our carbon accounting conventions may be undermining global emissions mitigation efforts.

TRACKING CARBON FLOWS

All countries engaged in international trade both import and export embodied carbon. The largest exporters of embodied carbon tend to be major manufacturers and fuel producers. The largest importers tend to be sizeable

consumer markets with considerable domestic economic activity. This international carbon flows data assesses the global embodied emissions in trade in 2019.

Figure 2. Top global flows of embodied CO2 emissions in trade



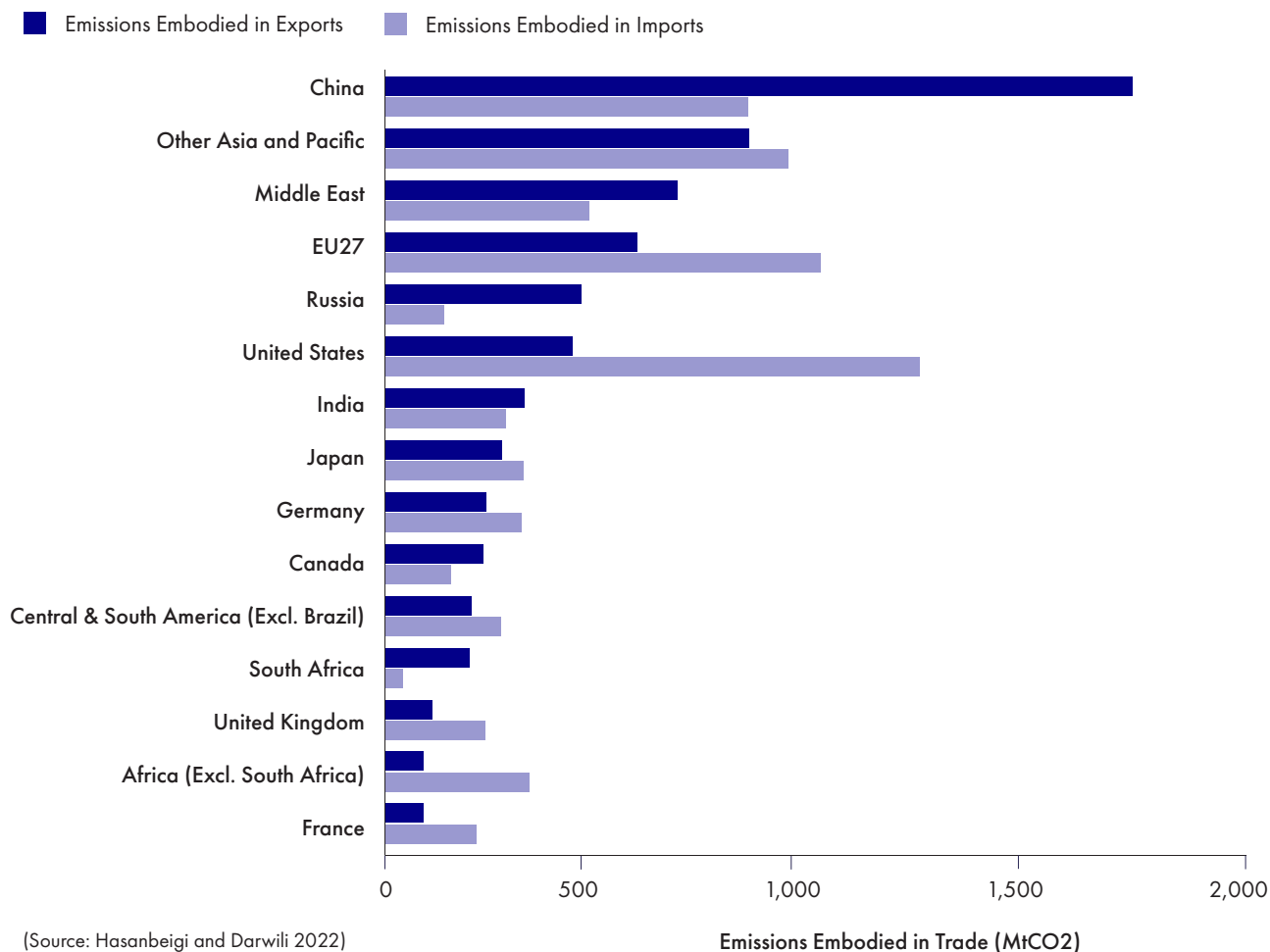
China is far and away the single largest exporter of embodied emissions. Of the twenty largest international carbon flows, nine originate in China. In aggregate, it exported nearly 1.8 GtCO₂ in 2019, representing more than a fifth of the carbon loophole and 5% of all global greenhouse gas emissions. Its largest export shares include other emerging Asian markets like Indonesia and Vietnam (430 MtCO₂), the United States (349 MtCO₂), the Middle East (135 MtCO₂), and Japan (100 MtCO₂). China is also the third largest importer of embodied emissions, importing 900 MtCO₂ from other Asian markets (205 MtCO₂), the Middle East (110 MtCO₂), and Japan (72 MtCO₂). On net, China exported about 900 MtCO₂ in 2019.

The two largest importers of embodied emissions are the United States and the European Union. The U.S. imported a

total of nearly 1.3 GtCO₂ in 2019, with the largest sources of emissions coming from China (349 MtCO₂), Canada (158 MtCO₂), and emerging Asian markets (114 MtCO₂). The U.S. is also the fourth largest exporter of emissions, shipping 440 MtCO₂ to international partners in Asia (China and other emerging markets) and North America (Canada and Mexico). On net, the U.S. imported 800 MtCO₂ in 2019.

The EU imported a total of 1 GtCO₂ in 2019 from China (201 MtCO₂), Russia (154 MtCO₂), and other Asian countries (125 MtCO₂). The EU is also the world's second largest exporter of emissions, shipping out nearly 600 MtCO₂ to the U.S., European partners like the United Kingdom, China, and the Middle East. On net, the EU imported 430 MtCO₂.

Figure 3. Top countries by CO₂ emissions embodied in exports and imports in 2019



THE CARBON LOOPHOLE AND CLIMATE AMBITION

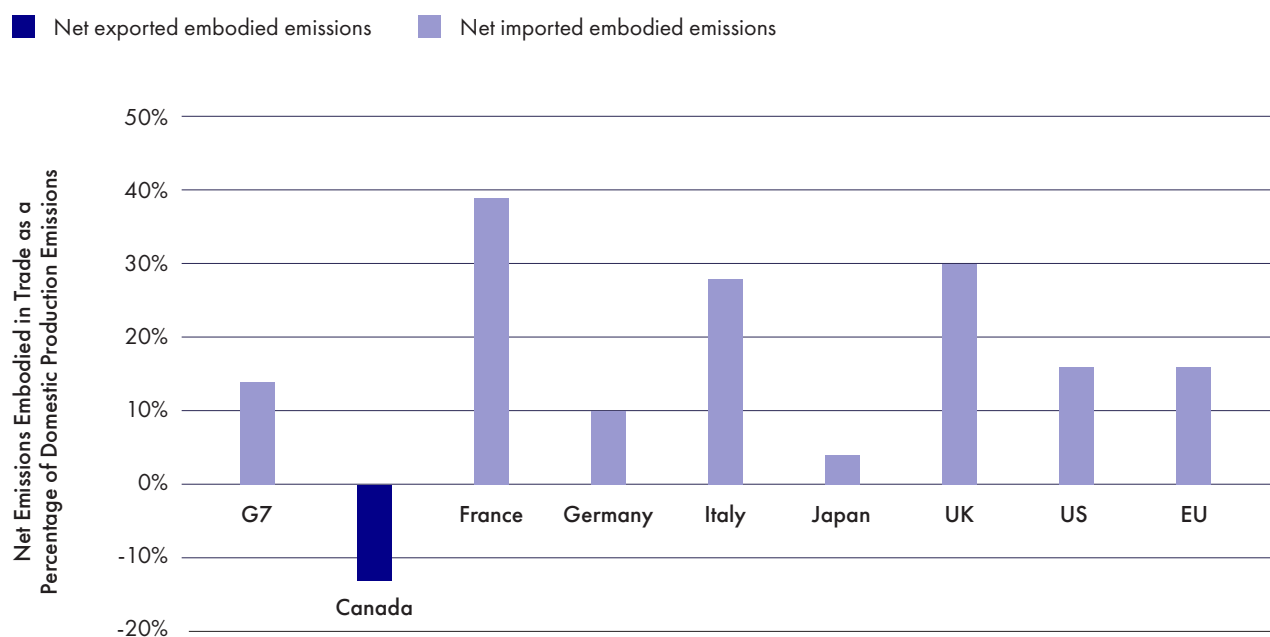
Conventional climate accounting tells us that countries are responsible for the emissions produced within their borders. But as climate-ambitious countries adopt mid-century deep decarbonization targets, there's a risk that emission reductions made in furtherance of these goals will be offset by or even increase the carbon loophole – particularly if those emissions are simply offshored. If we appropriately accounted for the emissions embodied in international trade, many promising climate trends would be moderated or even reversed.

The G7 economies of Canada, France, Germany, Italy, Japan, the United Kingdom, and the United States, along with the European Union, are among the most climate-ambitious economies in the world.¹ Representing more than half of the global economy, they are also powerful actors on the international stage and set the market conditions that constrain or advance decarbonization efforts.

On average, G7 members import 14% more emissions than they produce domestically. For some countries, their net imports account for huge portions of domestic consumption, particularly recognized climate leaders like France, Italy, and the UK. And while G7 countries can report a collective cut in production-based CO2 emissions since 1995, adding in consumption-based emissions increases their collective CO2 emissions over the same period. The climate leadership of G7 countries is much more moderate in this context.

By the same measure, emerging economies have taken advantage of the carbon loophole by helping to drive more carbon-efficient but higher-operating-cost competitors out of business in advanced economies, with the build out of large, carbon-intensive and lower-operating-cost manufacturing. This pattern tends to drive more domestic activity in emerging markets while creating an incentive to delay taking meaningful action to reduce domestic emissions.

Figure 4. Net importers and net exporters of embodied emissions, G7



(Source: Hasanbeigi and Darwili 2022)

SQUEEZING THE BALLOON

The current rules of international trade tend to favor low-cost, low-regulation markets like China.² These countries can undercut competitors adhering to higher standards, claiming market share and absorbing manufacturing capacity. As a consequence, the carbon loophole may be contributing to rising global carbon emissions. Here’s how.

The loophole tends to shift emissions from advanced economies to developing economies. In this way, the loophole reflects the phenomenon of “carbon leakage,” the tendency of economic activity to shift from countries with stringent environmental regulation to countries with more lenient environmental regulation.³ Carbon leakage is a lot like squeezing a balloon: reducing emissions in one country causes them to increase in another. But in this analogy, the size of the balloon—i.e., global emissions—may actually be getting bigger in the exchange.

Countries vary widely in the emissions-intensity of domestic economic activity, meaning they require different amounts of CO₂ emissions to produce comparable goods. Prior Climate Leadership Council research has demonstrated that the Chinese economy requires, on average, 3.2 times more emissions than the U.S. economy to create the very same dollar of value.⁴ The five largest net carbon exporters all have average domestic carbon intensities 1.3 times to 4.4 times higher than the U.S. The five largest net carbon importers have significantly lower domestic carbon intensities. It takes as much as 7 times the CO₂ emissions to create the same dollar of value in a carbon net exporting country as in a carbon net importing country.

Table 1. Relative Emissions Intensities of Major Carbon Net Exporters and Importers

(U.S. = 1.0)*

Largest Carbon Net Exporters	Relative Emissions Intensity	Largest Carbon Net Importers	Relative Emissions Intensity
China	3.2	United States	1.0
Russia	4.2	France	0.6
South Africa	4.4	United Kingdom	0.6
Canada	1.3	Italy	0.9
Taiwan	2.1	Japan	1.1

*Showing the carbon intensities for individual countries, rather than country groupings explored in the Carbon Loophole report. (Sources: Hasanbeigi and Darwili 2022; Rorke and Bertelsen 2020)

If manufacturing production in the United States is displaced by more carbon intensive manufacturing production abroad, U.S. emissions will fall but global emissions will increase.

This phenomenon of carbon leakage driving up global emissions is a consequence of a globalized economy, the

large differences in the carbon efficiencies of advanced and emerging markets, and the imperfections inherent in focusing exclusively on reducing emissions within a country's own borders. For climate ambitious countries to bend the curve on global emissions, they need a new policy approach that squarely addresses the carbon loophole.

GLOBAL COOPERATION

The carbon loophole is hampering global decarbonization efforts. Achieving net-zero emissions on domestic production can be more than offset by importing goods and services from higher-emitting countries for domestic consumption. Economies like China and Russia exploit the carbon loophole by allowing low domestic environmental standards to give their firms a competitive edge over rivals in cleaner markets, while taking a pass on setting and following through on meaningful domestic emission reduction targets.⁵ The U.S. and EU have been enablers in this practice by pursuing climate policies that myopically focus on reducing their domestic emissions without ensuring those emissions aren't simply being sent abroad. And for the poorest of countries, little thought in the current paradigm is given to how they will be able to improve the living standards of their citizens, inevitably requiring higher domestic emissions while ensuring that global emissions continue to fall.

A new paradigm can improve global emissions mitigation efforts; benefit countries and firms leading the way in innovation and decarbonization investments; de-leverage China and Russia; and give emerging markets better access to advanced economies, accelerated economic development, and rapid decarbonization.

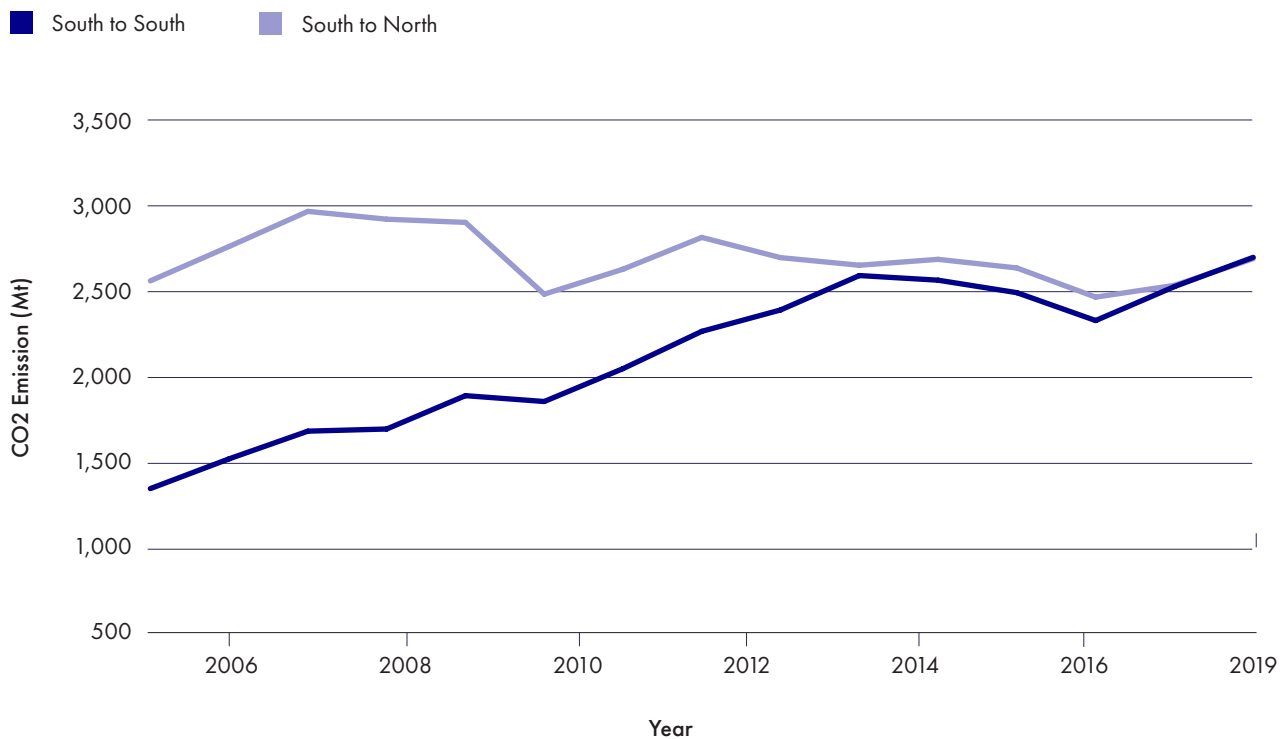
The most advanced economies in the G7 represent about 40% of total emissions imports and over 50% of the global economy, giving them enormous leverage to shrink the carbon loophole.^{6,7} Working together, these and other climate-ambitious countries can mobilize new policies and their trade relationships to appropriately value lower-carbon goods and services, shift economic activity to the most carbon efficient markets and producers, support least developed countries, and cut global emissions.

The U.S. economy is 40% more carbon efficient than the world average. If the U.S. were able to ensure that imports matched domestic carbon intensity—by onshoring production or selecting for cleaner imports—global emissions could fall by 600 MtCO₂.⁸ If all members of the G7 were able to do the same, implementing policies that favor lower-carbon goods on a par with domestic carbon intensity, we could cut global annual CO₂ emissions by more than 1.8 GtCO₂, a 5.5% cut in total global CO₂ emissions.⁹ Improving the competitive position of the cleanest firms in the U.S. and in other G7 economies can increase investment and manufacturing jobs and drive down emissions.

International partnerships to address the emissions in the carbon loophole will be most effective if they engage developing economies to reduce emissions intensity. Over the last 15 years, there has been a four-fold increase in emissions traded between emerging markets in the Global South.¹⁰ Trends indicate that emissions traded between emerging economies will soon overtake emissions traded between emerging economies and advanced economy trading partners. Unquestionably, a huge part of closing the carbon loophole involves the Global North implementing policies to decrease the amount of imported emissions. Globally, we also need to increasingly focus on addressing emissions being traded within the Global South.

Novel approaches are needed that can shrink the size of the carbon loophole while strengthening international trade and accelerating global decarbonization. One example of how to accomplish this: inclusive climate clubs that pair trade policies with investments and technology assistance for emerging market economies. If the U.S. takes the lead in successfully brokering mutually beneficial agreements with the likes of India and other emerging economies, there's also enormous geopolitical upside.¹¹

Figure 5. Embodied CO2 emissions in trade of Global South countries



(Source: Hasanbeigi and Darwili 2022)

CONCLUSION

At 8 GtCO₂, nearly a fourth of global emissions, the carbon loophole represents a significant obstacle to meeting global carbon emissions targets. Flows in the carbon loophole tend to relocate emissions from the balance sheets of advanced economies to developing economies whose carbon emissions continue to increase year-over-year. This is directly undermining net-zero and deep decarbonization targets in climate-ambitious advanced economies and exacerbating emissions trends in the Global South.

The carbon loophole reflects unintended “carbon leakage,” the tendency of economic activity to shift from areas of stringent environmental regulation to markets where environmental standards and other costs are lower. As a consequence, China and other countries with relatively high carbon intensities are also the largest net exporters of carbon; the U.S., EU, and other lower-carbon markets are the largest net importers.

New policy approaches are necessary to address the loophole and support global decarbonization. Through climate and trade policies that value lower-carbon production across the global supply chain, climate-ambitious countries can leverage their strong consumer economies

to create market incentives that drive domestic and global decarbonization. And by partnering with emerging economies through new trade deals, economic partnerships, technology and investment access, or multilateral climate clubs to lower emissions intensities, the carbon loophole can be further closed.

The carbon loophole sheds light on a major shortcoming of the conventional approach to determining national contributions to global emissions. More importantly, the loophole highlights an enormous opportunity for policymakers in the U.S. and elsewhere to maximize current emission reduction policies, create new economic opportunities for cleaner manufacturers at home, and strengthen relationships in emerging markets—all in service of a lower-carbon future.

NOTES

1 "Climate Action Tracker," Climate Action Tracker, last updated November 7, 2022, <https://climateactiontracker.org/>.

2 "China," Climate Action Tracker, last updated November 3, 2022, <https://climateactiontracker.org/countries/china/>.

3 "Carbon Leakage," Climate Action, European Commission Directorate-General for Climate Action, accessed November 1, 2022, https://climate.ec.europa.eu/eu-action/eu-emissions-trading-system-eu-ets/free-allocation/carbon-leakage_en.

4 Catrina Rorke and Greg Bertelsen, America's Carbon Advantage (Climate Leadership Council, September 2020), <https://clcouncil.org/report/americas-carbon-advantage/>.

5 Ibid.

6 Ali Hasanbeigi and Aldy Darwili, Embodied Carbon in Trade (Global Efficiency Intelligence, November 2022).

7 Catrina Rorke, The Case for Climate and Trade (Climate Leadership Council, May 2022), <https://clcouncil.org/report/case-for-climate-and-trade/>.

8 Ibid.

9 Ibid.

10 Ali Hasanbeigi and Aldy Darwili, Embodied Carbon in Trade (Global Efficiency Intelligence, November 2022).

11 Christopher S. Chivvis and Ethan Kapstein, U.S. Strategy and Economic Statecraft: Understanding the Tradeoffs (Carnegie Endowment for International Peace, April 28, 2022), <https://carnegieendowment.org/2022/04/28/u.s.-strategy-and-economic-statecraft-understanding-tradeoffs-pub-86995>.



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