

## Consumption-based accounting reveals global redistribution of carbon emissions

It is well recognized that the Paris Agreement target of keeping global warming below 2°C requires a radical cut in global greenhouse gas (GHG) emissions. These emissions all occur within a national territory, within the purview of a local and national government. But with international trade growing, and wealth disparities widening, it is relevant for climate mitigation efforts to look beyond the simple territorial (or production-based) accounting of emissions and incorporate complementary perspectives.

Consumption-based emissions accounting (see box) is one such perspective, which offers useful insights for tackling questions of responsibility for emissions, fairness in burden-sharing, and the most effective mix of climate mitigation policies. Consumption-based accounting also reveals cases of “carbon leakage”, where emissions-producing activities shift from one territory to another – which is particularly pertinent if the leakage is from a state with a binding emissions-reduction target to one without.

This brief presents some consumption-based emissions calculations for the period between 1992 (the year of adoption of the UN Framework Convention on Climate Change) to 2010. It reveals notable patterns in the distribution of territorial and consumption-based emissions between countries in different economic categories, not least the growing share of “imported” emissions in high-income countries during a period when many of them were levelling or reducing their territorial emissions.



The Danish registered container ship *Lica Maersk* unloading in Canterbury, New Zealand: importing goods – and emissions.

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### What can consumption-based accounting tell us about global trends?

The examples of consumption-based accounting presented here are based on data drawn from two multiregional input-output (MRIO) models: Eora (<http://worldmrio.com/>; Lenzen et al. 2012; Lenzen et al. 2013) and SEI’s IOTA (<http://www.sei-international.org/iota>). The graphs collate national results from these models into country-income groupings – high, middle and low income – based on those used by the World Bank. The high-income countries are further split into members and non-members of the OECD. All of the data presented are for CO<sub>2</sub> emissions.

### What is consumption-based emissions accounting?

The most common way of attributing GHG emissions to a particular country or actor is based on production-based, or territorial, accounting, which estimates emissions released (along with carbon sequestered in sinks) within a specific geographical area. Production-based accounting is the basis for on-going international negotiations on climate mitigation under the UNFCCC framework.

Consumption-based accounting, in contrast, attributes emissions to the final consumers of goods and services. Consumption-based accounting methodologies take as their starting point the goods and services consumed within a territory, and then reallocates the emissions from production, wherever in the world that production may have occurred, to those final goods and services.

A national consumption-based accounting system requires three types of information: 1) how much of different goods and services are consumed within the national economy, 2) supply chain information to link goods and services back to their original place of production, and 3) the environmental pressures typically associated with the production of the goods and services in that locality.

Many countries regularly compile national input-output tables as part of their national accounts. These capture financial representations of the level of consumption of different categories of products and of the supply chains in an economy. They express the interactions (sales and purchases) between the different parts of an economy – usually between industrial sectors – as well as final demand. Most follow standards defined by the Organisation for Economic Co-operation and Development (OECD) and the United Nations Statistical Commission (UNSC), although they may differ in how they aggregate industrial and service sectors, and the categories of goods and services included.

While these stop at the territorial border, some projects have constructed global models, multiregional input-output tables, that combine data from different national input-output tables to represent interactions both within and between countries, making it possible to model international supply chains, from consumers back to producers. By combining the economic data with information on environmental pressures, these data tables can be used to calculate consumption-based accounts.



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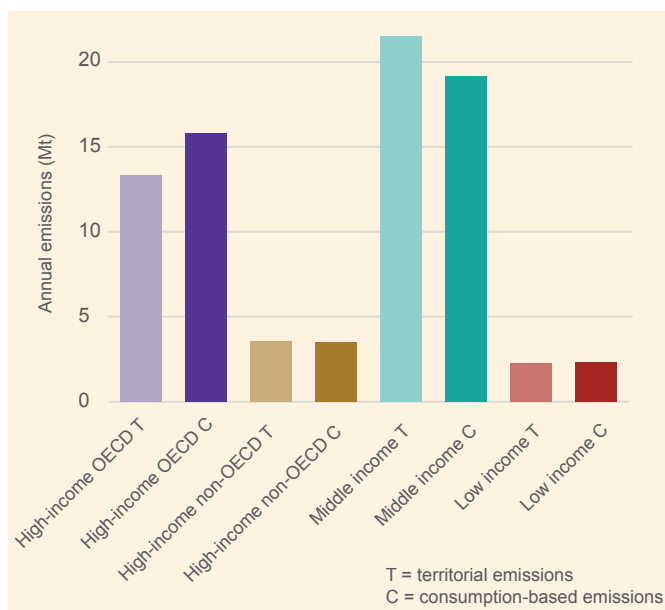
Imported goods bring us great choice, but how much responsibility should consumers take for the environmental impacts of their production?

The income-grouped results are inevitably influenced by populous developed and emerging economies in each group; for example, Russia in the non-OECD high-income group, and China and India in the middle-income group. However, the results still reveal broad trends and illustrate the kinds of insights available from a consumption-based approach.

## Examples of insights from consumption-based accounting

**1. The OECD members' consumption is linked to higher emissions than those released in their territories; the opposite is true of middle-income countries.**

See Figure 1. This finding reflects the relative import-dependence of the OECD members and the export-dependence of some middle-income countries, particularly China, during this period. Russian emissions dominate the results for high-income non-OECD countries, making up nearly 60% of the total territorial emissions for that group and nearly half of the total consumption-based emissions.

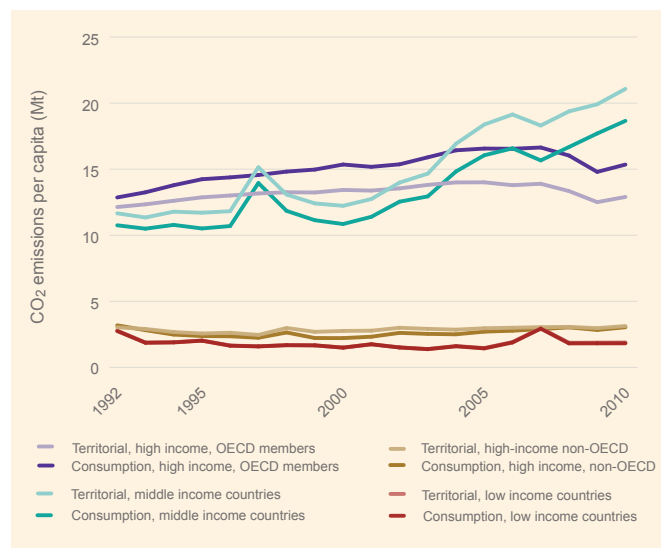


**Figure 1: Consumption-based and territorial CO<sub>2</sub> emissions of different country-income groupings, 2010**

Source: Eora database

**2. Consumption-based emissions have risen faster than territorial emissions in high-income countries. In middle-income countries, both consumption-based and territorial emissions have risen rapidly.**

See Figure 2. Tracking changes in consumption-based and territorial emissions over time can help build a more nuanced picture of countries' progress in climate mitigation. In high-income countries, consumption-based emissions were rising much more than territorial emissions until 2008. Despite the marked drop in consumption-based emissions in the high-income group, both territorial and consumption-based emissions in the middle-income group have risen sharply since 2007.

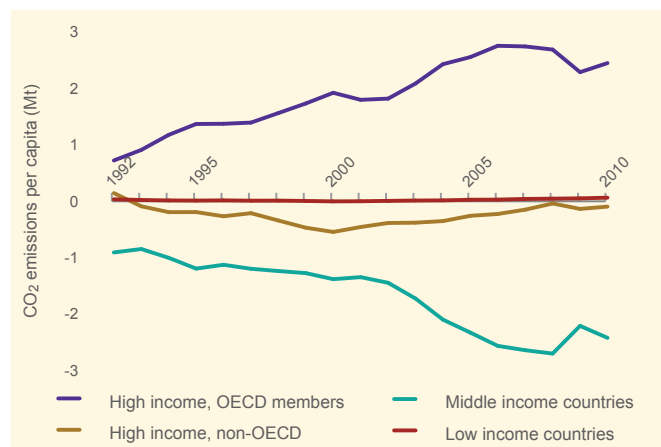


**Figure 2: Total consumption-based and territorial CO<sub>2</sub> emissions (kt), 1992–2010**

Source: Eora database

**3. International transfers of emissions have grown rapidly since 1992, mostly between middle-income and high-income countries.**

See Figure 3. Burgeoning trade drove a major relocation of emissions between 1992 and 2010. High-income OECD members increased their net imported emissions: their emissions imports accounted for just 2% of their total consumption-based emissions in 1992 but for 16% by 2010. These emissions came mostly from middle-income countries. The non-OECD high-income countries transitioned from net importers of emissions to net exporters.

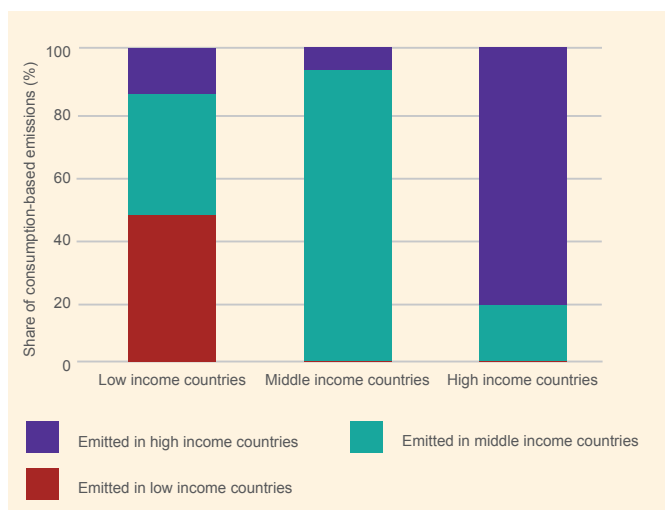


**Figure 3: Total net imported CO<sub>2</sub> emissions (imported emissions minus exported emissions), 1992–2010**

Source: Eora database

#### 4. In 2007, most consumption-based emissions of the high- and middle-income countries were released in countries within the same income group.

See Figure 4. Consumption-based emissions models such as IOTA show where a country's consumption-based emissions were actually emitted. In 2007, on average only 46% of consumption-based emissions of low-income countries were released within the territories of members of that group; the rest were released in middle- or high-income countries. In the middle-income countries, the figure rises to 93%, with the remaining emissions released in high-income countries. For the highest-income countries, only 17% of consumption-based emissions were emitted outside the group (in middle-income countries). No significant share of the consumption-based emissions of high- or middle-income countries were released in low-income countries.



**Figure 4: The origin of consumption-based emissions, by income group, 2007**

Source: IOTA model (in order to show the original source of emissions)

### Conclusion

Consumption-based emissions accounts can play an important role in informing climate-mitigation policy. For example, they can help to identify cases of leakage and facilitate policy efforts for prevention and can help countries decide where to target technical assistance and mitigation efforts globally.

Discussions of burden-sharing and responsibility for emissions reduction can also be enriched by consumption-based emissions accounts. The data presented here suggest that a large share of the new emissions released in middle-income countries are embedded in products and services that are enjoyed by consumers in high-income countries (while providing middle-income countries with a financial benefit). Claims that some high-income countries have decoupled emissions from economic growth are usually based on territorial emissions; consumption-based emissions may tell a different story. It has also been argued that consumption-based accounting could stimulate emissions reduction policies that involve countries working closely with their trading partners (Caro et al. 2014).

This brief was written by Elena Dawkins and Simon Croft, and is an output of the SEI Initiative on Producer to Consumer Sustainability.

### Where to find consumption-based emissions accounts

Consumption-based emissions accounts are now published consistently for a number of countries, and in the future may become a standard component of national environmental accounts. Increased national consumption-based accounting, along with accepted standardized methodologies, would provide a more reliable and comparable source of information for discussions on climate change and trade agreements. Several MRIOs such as Eora and WIOD ([www.wiod.org](http://www.wiod.org)) are freely accessible for research purposes in an effort to encourage trade-based emissions accounting in an increasingly globalized world.

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