

# Carbon offsets for freight transport decarbonization

A freight carbon offset presents an opportunity for transport operators and their customers to invest carbon offset capital within the freight transport sector itself, accelerating the transition to a more sustainable global transport network.

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Freight transportation is a central element in nearly every supply chain and is almost exclusively powered by fossil fuels<sup>1</sup>. While fossil fuel use by passenger vehicles is trending downward, fuel consumption and emissions from freight are on the rise. Global freight transport by trains, ships, planes and trucks was the source of 2.9 billion tonnes of carbon dioxide (CO<sub>2</sub>) in 2015, which is expected to more than double by 2050 if business continues as usual<sup>2</sup>.

Advanced technologies and sustainable practices to improve freight transport efficiency exist, but they are not being deployed nearly fast enough to deliver the savings needed to meet climate targets in the face of surging demand<sup>2,3</sup>. Without a widespread and concerted effort, transportation is set to overtake energy as the most carbon-intensive sector by 2040.

A lack of ready low-carbon transport options has led companies like Shell, Lyft, Etsy and Anglo American to turn to carbon offsets to mitigate emissions and meet climate goals<sup>4–7</sup>. Shell alone has pledged to invest US\$300 million to offset transportation emissions over the next three years<sup>4</sup>. Carbon offsets are also the primary tool in the aviation sector's climate strategy; the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) is expected to generate demand for over three billion tonnes of carbon offsets through 2035<sup>8,9</sup>.

While carbon offsets are not a novel approach, companies can make their offset investments more impactful by strategically aligning their offset portfolios not only with their ethics, but also with the reality of their climate impact. For example, a company that has 20% of its annual emissions coming from freight transport might spend 20% of their offset capital on projects within the sector.

That said, the application of offsets within the transport sector has been minimal. The majority of compliance and



**Fig. 1 | Two targets for emissions reduction. a,b**, Cookstoves (a) and trucks (b) emit both greenhouse gases and black carbon, making both technologies effective targets for emissions reduction using carbon offsets. Credit: Pixabay (a,b).

voluntary carbon offsets pertain to forestry, low-carbon energy and landfill methane projects; offsets related to passenger or freight transport represent less than 1% of the marketplace<sup>10,11</sup>. While nature- or energy-based projects are certainly worthwhile, they do not address the climate impact from transportation itself, nor its related co-pollutants, such as fine particulates (including black carbon), ozone and nitrogen oxides.

In fact, the shared nature of global freight illuminates an opportunity to leverage carbon offsets to finance a decarbonized freight network following the model of two common carbon offsets — renewable energy and cookstoves.

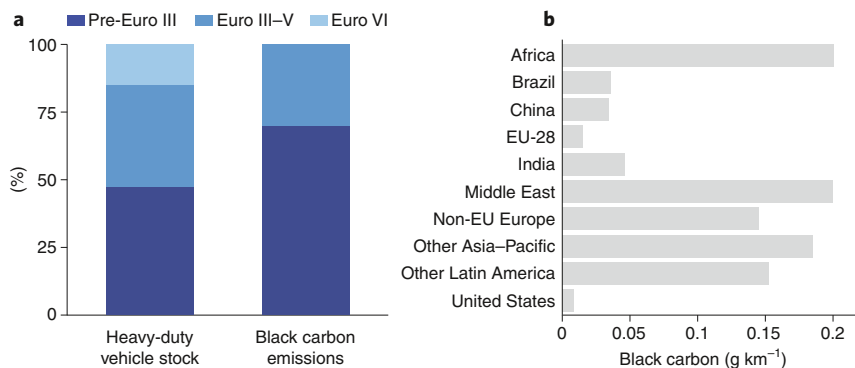
## Paving the way for freight

Organizations routinely invest in renewable energy offsets whether or not they receive the resulting electricity themselves,

accepting that any investment in our shared energy infrastructure collectively drives society towards carbon neutrality. A freight-focused carbon offset offers the same prospect, allowing companies to invest in a green freight network, whether they shipped their goods using these means or not.

While renewable energy provides a template for shared financing, cookstoves provide the offsetting mechanism to eliminate carbon. Cookstoves fuelled by wood, coal or fossil fuels emit CO<sub>2</sub>, as well as black carbon, a human health hazard and potent short-lived climate pollutant<sup>12,13</sup> (Fig. 1a). Carbon offset funds are regularly used to replace high-emitting cookstoves; over two million tonnes of eliminated cookstove CO<sub>2</sub> emissions were sold on the voluntary carbon offset market in 2017<sup>11</sup>.

Like cookstoves, trucks, ships, trains and planes also emit black carbon and CO<sub>2</sub>.



**Fig. 2 | Black carbon emissions based on heavy-duty vehicle engine type and regional area.** **a**, Black carbon emissions from heavy-duty vehicles vary depending on the engine technology, shown here by Euro engine class. Older truck engines, such as Pre-Euro III, represent a disproportionate share of global black carbon emissions. **b**, Countries that operate older truck fleets have higher rates of black carbon emissions per kilometre driven<sup>14,18</sup>.

There is an opportunity to use the cookstove approach to incentivize decommissioning of the most highly polluting freight transport equipment. Trucks represent a low-hanging fruit (Fig. 1b), making up one-quarter of the global diesel road fleet but contributing 75% of its CO<sub>2</sub> emissions and 78% of its black carbon emissions<sup>14</sup>. The following section describes how carbon offset could be leveraged to decommission high-emitting trucks.

### Focus on fleet renewal

Old trucks can linger in fleets for decades, making them a ready target to address both climate and health impacts. As Fig. 2 shows, older trucks often lack emissions-control technologies like diesel particulate filters, contributing to a disproportionate share of emissions. Progress towards removing these trucks has been uneven across countries, with developed nations widely adopting the cleanest Euro VI-equivalent standards, while most developing countries have yet to adopt them<sup>14</sup>.

While the decision to replace a truck with a greener model ultimately rests with the commercial entity that owns or operates the vehicle, governments and green freight programs offer various schemes to encourage the replacement of inefficient trucks. These programs tend to fast-track emissions reduction not by adding new technologies, but by safely scrapping the highest polluting vehicles. Targeting the removal of trucks with Euro 0–II engines addresses hotspots of both CO<sub>2</sub> and black carbon.

Port drayage fleets, which move ocean-borne cargo between port terminals and nearby freight facilities, represent an effective opportunity for fleet renewal.

Ports often operate the oldest trucks in some of the most densely populated and polluted urban areas. The Port of Los Angeles' Clean Truck Program serves as a best practice example; from 2008 to 2012, the port provided financial incentives to truck operators that replaced or retrofitted high-emitting trucks with cleaner technology<sup>15</sup>. By leveraging a combination of financial instruments, the Port of Los Angeles was able to achieve an 80% reduction in drayage truck pollution in just four years.

Fleet renewal programs typically use incentives or subsidies to encourage private-sector participation; carbon offset funds could provide this financing. Both the compliance and voluntary offset marketplaces offer methods and mechanisms for transport offsets, but have struggled in the past to effectively quantify and verify emissions reductions due to a lack of harmonized methods and emissions factors<sup>16,17</sup>. A suite of new methodologies, data sets and practical guidance to calculate, report and reduce emissions is now available for freight transportation, providing a robust framework for carbon accounting that works for both transport operators and their customers<sup>18,19</sup>. In addition, once a truck is decommissioned, the offset project is effectively complete, simplifying emissions accounting and eliminating the need for maintenance funding — an issue that makes some offset projects vulnerable to degradation over time.

If implemented correctly, a fleet renewal-based carbon offset program will provide benefits beyond the immediate climate and air-quality improvements. Operators of the dirtiest trucks are often small carriers or owner-operators with limited financial resources that prevent investment in green

technologies; investments that can improve their competitive edge and save maintenance and fuel costs. Despite the challenges to reach out to this highly fragmented sector, a successful program needs to target them specifically.

Program benefits would be further leveraged if replacement trucks were as clean as possible, ideally equivalent to Euro VI standards, the lowest-pollution trucks to date besides full-electric trucks. Governments can support this by offering green transport subsidies to encourage the adoption of the most up-to-date technologies. Policies mandating stricter air quality, fuel sulfur content and engine standards would further amplify green freight efforts. Offset programs should not, however, be promoted as an economic stimulus instrument to encourage new vehicle sales. New vehicle sales will happen indirectly, but should not be the primary goal of the program.

### Moving freight forward

While other sectors show indications of progress towards decarbonization, carbon emissions from freight transport are on the rise. New offset pledges related to transport emissions are infusing fresh investment in the voluntary offset marketplace. If even a fraction of this new offset capital was directed to freight, there is an opportunity to support the development of a low-carbon transport network in line with the climate, health and social dimensions of the United Nations Sustainable Development Goals.

Freight carbon offsets may be particularly relevant for companies that outsource their products' transport, or have a business model that increases demand for transport, such as e-commerce. While companies can contract with green transport providers, logistics decisions are often based on the cheapest or fastest solution; investing in offsets provides another pathway to address these emissions outside sales and procurement processes. These offsets also provide a meaningful strategy where sustainable technologies are unavailable, such as in aviation or in regions with higher emitting vehicle fleets, allowing mitigation funds to stay within the transport sector.


Like other offset projects, freight carbon offsets can be implemented by industry groups, governments and non-profit organizations who organize projects, verify emissions reductions and administer offset revenues. Transport operators take advantage of offset funds by partnering with these organizations. The voluntary offset marketplace is an ideal test bed for a freight carbon offset, with a track record

of effectively supporting the growth of new offset strategies, which can lead to broader adoption within compliance markets<sup>11</sup>.

While the decommissioning of trucks is highlighted here as an offset with high potential benefit, many other options within the freight transport sector exist and should be explored further. For example, decommissioning high-polluting ships represents another ready application. Electrification of transport equipment and infrastructure, alternative fuels, green financing for low-carbon fleet upgrades, and other projects that contribute to the advancement of a low-carbon transport network can and should be put forth as additional carbon offset opportunities.

Countries with older fleets are suggested as a focus, though it should be noted that decreases in CO<sub>2</sub> and black carbon in regions with relatively low-emitting fleets can still experience meaningful climate and health benefits<sup>14</sup>. In terms of air quality, highly populated regions are primary targets for human health benefits, and areas upwind of snow and ice, such as South Asia and the Arctic, offer a strong potential for climate

mitigation, where black carbon deposits can accelerate ice melt<sup>3,20</sup>.

The transport sector and the thousands of companies that rely on freight transport must make a widespread change in order to meet climate goals. Freight transport-related carbon offsets offer a meaningful opportunity to advance freight transport decarbonization. 

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Published online: 21 October 2019

<https://doi.org/10.1038/s41893-019-0413-0>

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