How big are global military carbon emissions?

Stuart Parkinson, SGR, summarises the latest research on what is – and isn't – known about the size of global military carbon emissions.

In the latest set of reports[1] by the Intergovernmental Panel on Climate Change (IPCC) – which together comprise over 8,000 pages – the subject of carbon emissions from military activities is mentioned just three times. And not one of these entries discusses the potential size of these military emissions. This is despite, for example, academic research pointing out that the US Dept of Defense (DOD) is probably the world's largest single institutional consumer of oil.[2]

It is this sort of glaring gap in the scientific literature that led SGR to carry out its own research in this field. Based on initial scoping of the publicly available data, we published a ballpark estimate for the global military carbon footprint in early 2020.[3] This was followed by a series of reports examining in much more depth the size of the military carbon footprint of the UK (published in mid-2020[4]), the EU (in 2021[5]), and the world (in 2022[6]).

A new estimate for global military emissions

In the 2022 report – launched as a contribution to the COP27 climate negotiations, and in collaboration with the Conflict and Environment Observatory (CEOBS) – we estimated the global military carbon footprint to be approximately 2,750 million tonnes of carbon dioxide equivalent (MtCO2e) or 5.5% of global emissions.

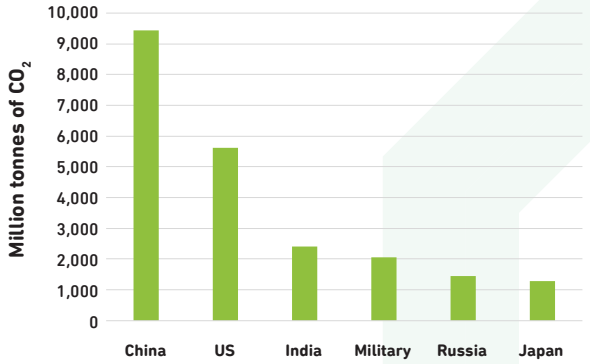
We based this estimate on data on four key parameters:

- Numbers of active military personnel;
- 'Stationary' military carbon emissions per head, i.e. emissions from energy use at military bases per head of military personnel;
- Ratios of 'mobile' military emissions to stationary military emissions, based on the relative sizes of mobile emissions – arising from fuel consumption by military aircraft, ships, and land vehicles – to those of military bases; and
- Supply chain multipliers for military activities.

We were able to source data from all the major militaries in the world on the numbers of active personnel, but data on the other parameters was sparse, obtained from only a small number of nations and regions, principally the UK, the USA, Germany and the EU. The largest fraction of the total footprint, we concluded, was the supply chain emissions.

If the world's militaries were a single nation, our estimate would put it fourth – behind China, the USA, and India – but above Russia and Japan (see Figure 1). This means that the reduction of a potentially large source of carbon emissions is currently not widely recognised, let alone prioritised. Given the degree of control that governments have over the sizes of their militaries, there is a huge and largely unrecognised opportunity to reduce emissions.

Figure 1. Global military carbon footprint compared with top five nations, 2019[7]



NB: Figures are for CO_2 only, not CO_2e[8]

What isn't yet counted?

Our estimate does have quite a wide uncertainty – we calculated from 3.3% to 7.0% – but it is also important to note that these figures do not take account of the broader impacts of war. Such impacts include: fires at fossil fuel storage facilities and buildings; fires and other damage to forests, crops and other biological carbon stores; movement of refugees; healthcare for survivors; and post-conflict reconstruction. Our estimate also does not include climate heating due to the effects of military aviation emissions in the stratosphere. We have also assumed that military sources of data on carbon emissions are reliable, even though lack of transparency can mean this is not the case.

Some clues as to the size of the neglected emissions of war come from a handful of new studies, also published in 2022. Arguably the most significant was an assessment of the carbon emissions to date of the Ukraine war, produced by a consortium

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including the Ukrainian Ministry of Environmental Protection.[9] It estimated that the first seven months of the war were directly responsible for approximately 100 $MtCO_2e$. Only 9% of these emissions were due to military consumption of fuel and ammunition – i.e. factors included in SGR's assessments above. The three largest factors in the Ukraine study were: post-conflict reconstruction (emissions which would occur over several years and, of course, are yet to take place), 50% of the total; fires (mainly in forested areas), 24%; and leakage of methane due to damage to the Nord Stream gas pipelines, 15%.

This and other similar studies indicate that the total carbon emissions of the world's militaries and war – which we call the 'global military carbon bootprint' – could be significantly higher than SGR's figures above.

Reducing emissions: low carbon weapons... or peace?

With some nations – especially those in NATO and the EU – starting to improve reporting of their military carbon emissions, attention is slowing turning to strategies to reduce these emissions.

In general, the military approach is to focus on lower carbon technological change to maintain advantage on the battlefield. Britain's Ministry of Defence (MOD) summarises this as being able to "fight and win in ever more hostile and unforgiving physical environments".[10] The US DOD puts it even more simply: "Less fuel, more fight".[11]

So military interest is growing in range of high technology options. Firstly, there is the potential to increase energy efficiency in warships, combat planes, and armoured vehicles, as well as on military bases. One growth area is robotic vehicles, especially aerial drones, which are generally smaller and lighter – and therefore more energy efficient – than those with an onboard pilot. Another key area is 'alternative fuels'. This includes expanding the use of small nuclear reactors in submarines, large warships, and remote military bases. Other alternative fuels include biofuels and synthetic fuels for use especially in military aviation. There is also interest in greater use of renewable energy on military bases.

There are numerous ethical concerns about these options. Greater use of aerial drones opens the door further to lethal autonomous weapons, and a general reduction in the accountability of armed forces during war. Placing more nuclear reactors in situations of potential conflict obviously brings with it the greater likelihood of a major uncontrolled release of radioactivity spreading far beyond the battlefield. Biofuels have significant environmental problems – and, if sourced from energy crops, compete for land with food crops. Synthetic fuels are at a very early stage of development and current evidence points them being very energy intensive to produce and therefore a very inefficient way to use energy (including renewable sources).

The obvious alternative to trying to find slightly less environmentally damaging ways to wage war is to more vigorously pursue peace. Obviously, this has become a lot more difficult since Putin ordered Russian troops to mount a full-scale invasion of Ukraine, but it still remains the best option.

Although data is sparse, research on historical military carbon emissions does show that periods of decreased military activity and disarmament can lead to major falls. For example, after the end of the Cold War, US and UK military emissions dropped dramatically. Between 1990 and 2000, US military emissions declined by 41%[12] and UK emissions from military aviation and shipping alone fell by 45%.[13] It is likely that falls in other NATO and former Soviet nations were even higher during this period. There is little evidence that technological change could bring down military emissions as fast – or even at all – and that's before the wider problems of that approach are considered.

Prioritising human security

When the global threats to human society and the natural environment are considered – such as poverty, inequality, climate disruption, mass extinction, and pandemics – it becomes clear that the current focus on military approaches to tackling security problems is misplaced. The United Nations argues that governments and society should shift from a 'national security' approach towards one much more focused on 'human security'. Such an approach underpins the UN's 75th anniversary declaration, Our Common Agenda, launched in 2021.[14]

The available data on global military carbon emissions shows that it is a major, but largely unrecognised problem. It also shows that the most effective way to tackle it is through peacebuilding and demilitarisation activities. Yet, in the wake of the war in Ukraine, military budgets across the world are growing – not least in NATO countries – and arms races are accelerating. What interest there is in reducing military carbon emissions is focused almost entirely on low carbon weapons systems – despite little evidence that this will succeed. Governments urgently need to refocus on peacebuilding – both to help reduce military carbon emissions and bring about a more peaceful world.

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2 Crawford, N. (2019) Pentagon Fuel Use, Climate Change, and the Costs of War. Brown University, USA. https://watson.brown.edu/costsofwar/papers/ClimateChangeandCostofWar

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7 National carbon footprint data from: Global Carbon Project (2021) https://www.icos-cp.eu/science-and-impact/global-carbon-budget/2021

8 On average, CO_2 represents 74% of global GHG emissions. Hence, the global military carbon footprint based on CO_2 only is 2,050 $MtCO_2$.

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11 Lorincz (2015) Demilitarization for Deep Decarbonization. https://www.sgr.org.uk/events/messages-paris-conference-forgotten-dimensions-climate-change

12 Calculation based on data from: Crawford, N. (2019) – as note 2.

13 Calculation based on data from: BEIS (2022) UK territorial greenhouse gas emissions national statistics. https://www.gov.uk/government/collections/uk-territorial-greenhouse-gas-emissions-national-statistics

14 UN (2021) Our Common Agenda. https://www.un.org/en/common-agenda