Greenwashing Fact Sheet Series

'Greenwashing' is misinformation presented by an organisation in order to mislead others about the environmental impact of its current or future activities.

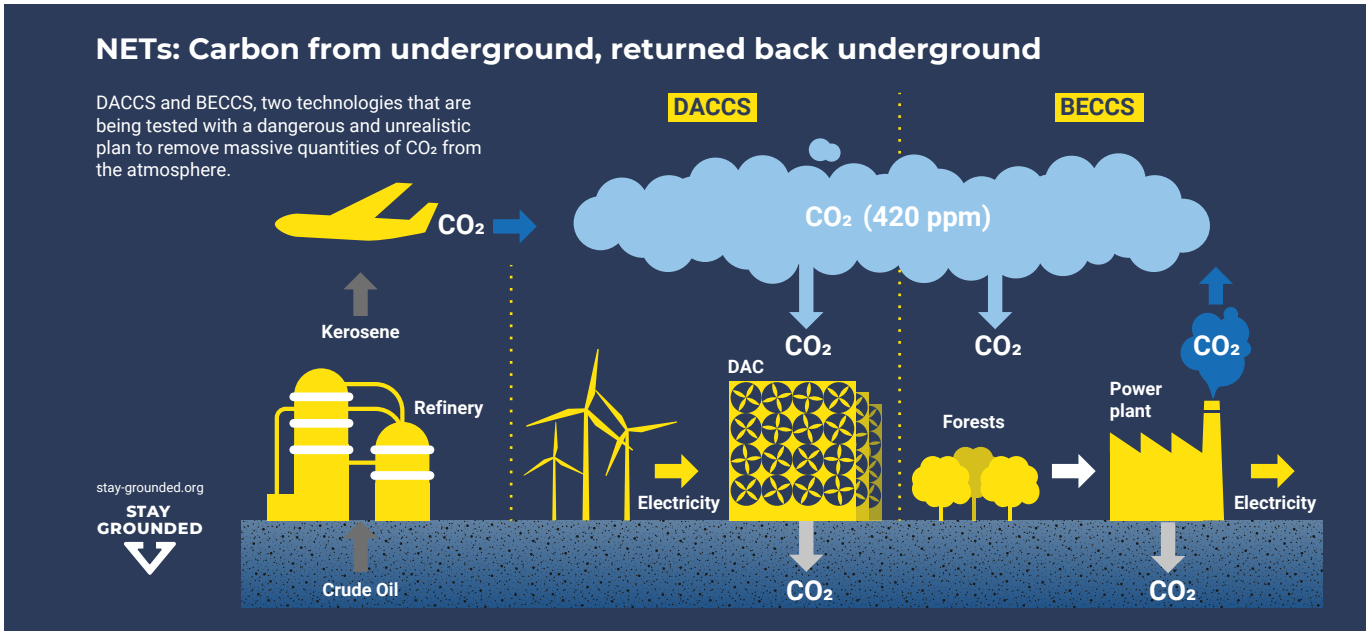
Globally, the aviation industry plans to triple in size by 2050 (versus 2019). If this happens, we could see aviation fuel consumption and therefore greenhouse gas (GHG) emissions double by 2050.[1] Governments, lobbied by the industry, use unrealistic distracting promises of technological solutions and offsets to greenwash this growth.[2] They also use economic growth and job arguments to justify subsidies and tax breaks for airports, airlines, manufacturers and fossil fuel companies. In this series of Fact Sheets, we examine these claims and debunk common myths and misconceptions.

Fact Sheet 8 - Negative Emissions Technologies (NETs)

Like most governments and many sectors, the aviation sector has an objective of "Net-zero" emissions by 2050. This will not meet Paris Agreement goals without ambitious near-term reductions of emissions they appear unable or unwilling to deliver (See Fact sheet #6: Net Zero & Carbon Neutrality). They justify continuation of high emission levels or even growing emissions by planning for the use of **negative emissions** [also referred to as 'Carbon Dioxide Removal' (CDR) or 'Greenhouse Gas Removal' (GGR)] in the fairly distant future. However, as this fact sheet explains: this is a dangerous and reckless strategy.

"Negative Emissions Technologies" (NETs) refers to industrial processes (rather than natural processes such as tree growth) which actively remove carbon dioxide (CO_2) by capturing it from the atmosphere and storing it, supposedly permanently. The technologies usually proposed are:[3]

- Direct Air Carbon Capture & Storage (DACCS) – capturing CO_2 directly from the atmosphere via industrial processes and storing it underground.
- Bioenergy with Carbon Capture & Storage (BECCS) – producing energy from biomass, then storing part of the resulting carbon underground or in the soil.



WHAT THEY TELL YOU

WE NEED NETs: We can continue to emit now, and re-capture CO_2 later, in order to continue growing air traffic.

PROVEN: Processes to remove CO_2 from the atmosphere work and have been demonstrated.

EFFICIENT: NETs can immediately and safely remove large quantities of CO_2 from the atmosphere and store it permanently.

LOW-COST: Their cost may be high today but costs will decrease when scaled up.

FAIR: As flying is so important to society and the global economy – rather than flying less – it is fair to keep increasing aviation emissions and pay to remove CO_2 from the atmosphere, when and where it is more cost effective.

GOVERNMENT SUPPORT REQUIRED: Due to their significant high prices, governments should provide financial support for NETs, to shield air travellers from these costs and so that aviation growth is not affected.

WHAT THEY ***DON'T*** TELL YOU

WE NEED TO REDUCE FLYING, NOW: Relying on NETs – not available at any significant scale for decades – provides aviation with a 'licence to pollute' which will contribute to heating the atmosphere beyond 1.5°C.

UNPROVEN: both DACCS and BECCS are unproven **at scale** and present a high number of severe technical, economic, humanitarian and environmental risks.

INEFFICIENT: These processes are massively energy- and resource-intensive. It doesn't make sense to waste scarce energy and resources on NETs rather than use them to decarbonise other activities more efficiently.

HIGH-COST: Even with optimistic efficiency improvements, NETs will remain energy and resource-intensive and therefore expensive well into the future.

UNFAIR: NETs are unjust as they justify high emissions from a wealthy minority, while grabbing resources that are essential to the majority. There is also an intergenerational injustice.

SUBSIDISING HAS PERVERSE EFFECTS: Any taxpayer money would incentivise continued fossil fuel extraction and emitting of carbon for as long as possible, in order to maximise the profits of the fossil fuel industry today and the size of the atmospheric CO_2 removal market tomorrow.

WE CAN'T RELY ON NETS, WE NEED TO REDUCE FLYING, NOW

The aviation industry promotes NETs as a solution for "hard to abate" emissions, relying on a scale-up of these technologies to achieve their "net zero 2050" goal.[4,5,6] However even if they kept this goal (which is very unlikely), it would come much too late.

Keeping global warming below 1.5°C is critical to avoid catastrophic runaway global heating. At present emissions levels, the 1.5°C threshold will be exceeded around 2030.[7,8] Above this, climate feedback loops may lead to permanent, potentially irreversible impacts such as: loss of Arctic summer sea ice, loss of glaciers, rainforest dieback and the extinction of many species.[9,10] **NETs won't be scaled-up before then and may be incapable of lowering global temperatures back to a safe level afterwards.**

Therefore, the potential existence of large-scale NETs, sometime in the future, should not distract from the need to reduce emissions this decade. Reducing aviation emissions in this timeframe will primarily involve flying less.

NETs ARE UNPROVEN AND RISKY

The aviation sector is counting on NETs for their decarbonisation plans as if there was no doubt that this will work.[11] However, there are only a small number of small-scale prototype NETs facilities in operation around the world. In 2023, the largest DACCS facility – commissioned in Iceland in 2021 – was only capturing 4000 tonnes of CO_2 per year (tCO_2/year). There will be two large-scale DACCS plants of up to 1 million tCO_2/year, each expected to be operating by the mid-2020s.[12] This will be only 0.2% of 2019 global aviation CO_2.[13]

NETs processes are yet to be demonstrated at any significant scale and that scale is likely to present a high number of severe technical, economic, humanitarian and environmental risks or issues. For example:

BECCS will require a massive expansion of industrial agriculture or forestry which may:[14]

- cause more GHG emissions than it captures CO_2;
- require huge land areas that aren't available;
- increase the use of polluting fertilisers and pesticides.

DACCS will require a massive energy input which may:

- divert limited resources of low-carbon electricity away from the more efficient and effective decarbonisation of other sectors;
- prolong our dependence on fossil fuels. For example, a leading developer (Carbon Engineering) plans to burn fossil gas to power their DACCS process;[15]
- open the door to incredibly expensive, dangerous and long-lead time nuclear energy.[16]

Both technologies have a significant risk of CO_2 leakages from pipelines and geological storage[17] as well as requiring large amounts of water, with associated problems.[18,19]

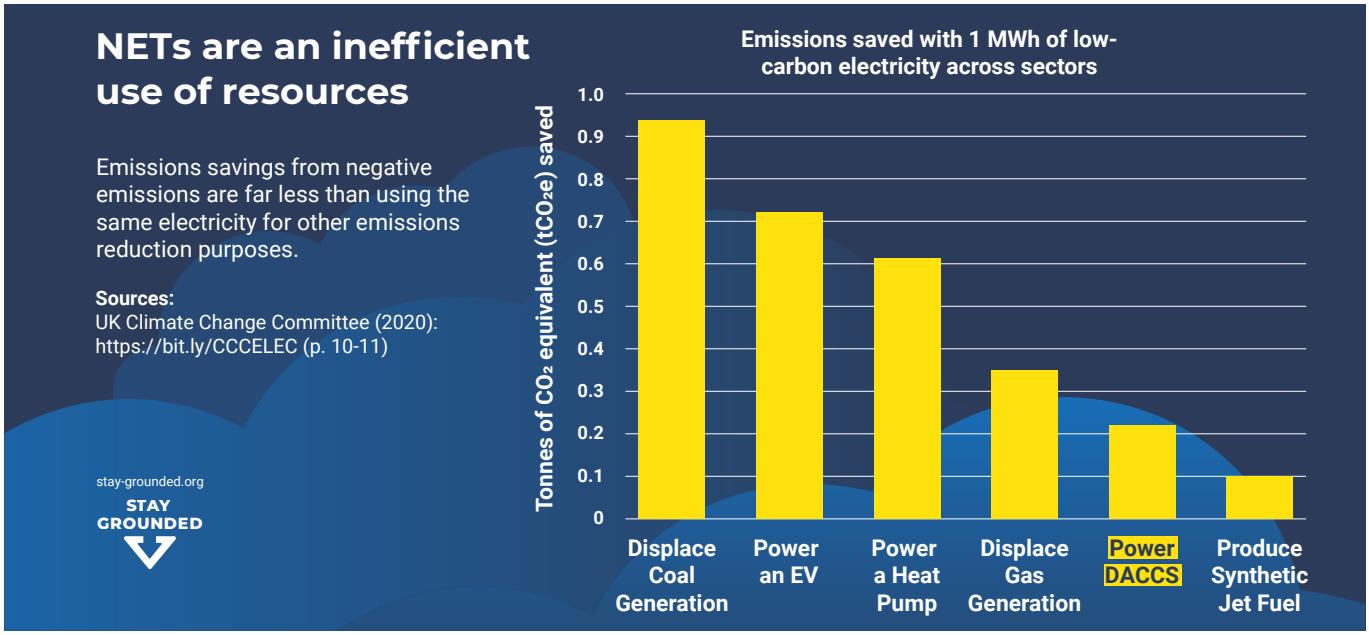
The fanciful scale of "required" carbon removal emerging from the models underpinning governments' thinking on climate breakdown is breathtaking. *"By the middle of this century many of the models assume as much removal of CO_2 from the atmosphere by NETs as is absorbed naturally today **by all of the world's oceans and plants combined.**"* Despite the climate modelling community's reliance on NETs, *"there are **no proven means** by which we can remove carbon dioxide at such unprecedented scales"* says Dr Glen Peters, a Senior Researcher and NETs specialist.[20]

Attempts to define a carbon removal certification framework within the EU[21] has also demonstrated the many issues around the credibility of certified units. However, even with perfect certification processes, the problem with scaling NETs described above will remain.

NETs ARE INEFFICIENT AND THEIR USE SHOULD BE MINIMISED

The processes used in NETs are highly inefficient, energy-intensive and resource-intensive. This is a fundamental issue and is very unlikely to change, even as technology is developed and improved. The issue stems from the fact that NETs are essentially acting to reverse the fuel combustion process. During combustion a fuel consisting of concentrated, energy-dense chemicals is burned to produce heat and useful power (e.g. thrust from an aircraft engine), whilst CO_2 is emitted as a by-product. These emissions dissipate into the atmosphere, becoming very dispersed and difficult to re-capture (the atmospheric concentration of CO_2 was 421 ppm [parts per million] in Dec 2023.[22] Therefore, removing large quantities of CO_2 from the atmosphere will require filtering very large quantities of air – either industrially (DACSS) or via biomass (BECCS).

For **DACCS** we'd need 30% of the 2022 global renewable electricity supply to provide enough DACCS for aviation at 2019 levels of air traffic[23] – this would divert scarce renewable electricity away from other areas of the economy where it would be better utilised for greater emissions reductions.[24]



When it comes to **BECCS**, whether from trees[25] or crops,[26] only a small part of the CO_2 emitted is captured (10.6% at Duiven, Netherlands, the biggest plant in operation in 2021) and less CO_2 is removed than by simply stopping deforestation and promoting natural forest restoration. This makes BECCS particularly inefficient, requiring vast areas of land: we would need 0.8 to 1.4 times the area of India planted with forests to produce enough wood residues to compensate for aviation emissions at 2019 levels of air traffic.[27]

We simply cannot plan for large-scale BECCS and other forms of bioenergy (e.g. aviation biofuels), without huge risk to people and planet. Therefore, reasonable land priorities should be:

- Land used for preserving or restoring biodiversity and carbon sinks (forests, peatland, mangroves, etc.) but not as offsets or associated Nature Based/Natural Climate Solutions (NBS/NCS) as a commodification; whilst securing indigenous lands and their forms of governance, since indigenous people maintain 80% of the planet's biodiversity.
- Land used for agriculture: maximising plant-based agriculture as an efficient use of resources in shifting toward a vegetarian diet for climate impact reasons; minimising livestock farming as an inefficient use of resources; and maximising the land required for agricultural crops used for food, not biofuel feedstock.

We should be calling for a systemic approach to land use and a profound change in the agricultural model taking into account all the environmental aspects, rather than using just the narrow metric of carbon uptake.

NETs WILL REMAIN HIGH COST

The aviation sector argues that even though the cost of NETs is high today, it will decrease with time as the technologies are scaled-up.[28] However, even with optimistic efficiency improvements, they will remain expensive into the future due to the fundamental thermodynamic inefficiencies of the processes explained above. The scarcity of the supply of resources (e.g. biomass and renewable electricity) required for NETs, versus the high demand and competition across sectors for those same resources, is also very likely to keep the operating costs of NETs very high. The initial capital costs for building NET facilities are also unlikely to drop very far. Constituent components are already produced off-the-shelf and therefore economies of scale will most probably not produce large benefits.

A RELIANCE ON NETS WOULD BE UNFAIR

The aviation sector argues that it is fair to keep increasing aviation emissions and pay to remove CO_2 from the atmosphere, when and where it is more cost effective. They even wish for governmental subsidies for this instead of applying higher taxes, with the argument that flying is important for society and should be kept affordable for low-income groups.[29]

In reality, the future promise of NETs provides relatively high-income, high-emitting groups with an apparent *"licence to pollute"* and presents relatively low-income, low-emitting groups with greater exposure to climate risks. Low income groups are relatively unlikely to fly (80% of the population has never flown and 1% of the population are responsible for 50% of aviation emissions[30]) and so don't actually benefit from the price of aviation being artificially cheap by the emissions remaining low priced or unpriced. This is a large economic injustice.

There is also an intergenerational injustice. By emitting now and paying for removal later, future generations would need to remove huge quantities of emissions from the atmosphere, for which they were not responsible. The future costs are not being budgeted and it is probable that future economic growth will be curtailed by the increasing frequency and severity of natural disasters and the depletion of natural resources, e.g. loss of agricultural crop yields and ability to use fossil fuels; making it more difficult to raise the necessary revenue in the future. A high proportion of the income of future generations might need to be spent on NETs as climate breakdown bites harder. This would present a huge social injustice.

Finally we should note that the aviation sector has identified that NETs will be limited in capacity in the future and intends to secure a high percentage of it, to the detriment of other sectors with higher social value.[31]

GOVERNMENT SUPPORT FOR NETS WOULD HAVE PERVERSE EFFECTS

NETs could be paid for in a variety of ways: via government funding from general tax revenue; from dedicated taxes on aviation (Kerosene tax, Frequent flying levy…) or from voluntary payments from the aviation sector.

The sector argues that due to the significant cost of NETs, governments should provide financial support to scale-up the technology, so that aviation growth is not affected. However, taxpayers subsidising NETs would be a perverse move for a number of reasons:

- As discussed above, most people either never fly, or rarely fly, so money raised from their taxes will be used to subsidise the high-emitting activities of a small high-income group.
- Subsidies for NETs risk wasting public money on an expensive solution and would keep flying artificially cheap, resulting in more air traffic and emissions, than if the aviation sector paid for NETs.

- This taxpayer money would incentivise continued extraction and emitting of carbon for as long as possible. The fact that the **Oil & Gas industry is mostly benefiting from government contracts and spending on carbon capture & storage means that they have a perverse incentive to maximise pollution today, in order to maximise the size of the removal market tomorrow.**[32] This is like awarding window-repair contracts to the vandal who is walking around the city at night smashing all the windows.
- Subsidising NETs would not only incentivise continued extraction of fossil fuels with a greenwash smokescreen but also make large new CO_2 volumes available and affordable that would allow the Oil & Gas industry to recover huge quantities of oil and gas from declining fields via EOR or EGR (Enhanced Oil/Gas Recovery)[33] that would otherwise remain underground.

CONCLUSION

Big polluters like the aviation sector, oil and gas, agribusiness and big tech, are strongly advocating for NETs and offsetting opportunities, to prolong business as usual and hence dependence on fossil fuels. Such schemes will give complete freedom to continue polluting while claiming that unproven and inefficient NETs like BECCS and DACCS will one day balance out all the carbon emitted across previous decades.

This undermines demands for real deep emissions cuts and would be used to excuse and justify new oil and gas infrastructure, locking us into decades of continued fossil fuel use and potentially causing us to miss a **pivotal, short window for radical change.**

The development of NETs cannot serve as a substitute for deep emissions reductions now. For aviation this means an immediate reduction of flights. Every tonne of promised future NET carbon dioxide removal represents emissions that are bringing us more climate chaos today.

While the development of new technologies and fuels may be helpful, it cannot be an excuse to delay emissions reductions that are needed NOW to mitigate the climate crisis. The only way to effectively reduce aviation emissions is to reduce air travel. To achieve this, we need effective regulations to limit air traffic. In our Degrowth of Aviation[34] report, we lay out how a set of measures could lead to a just reduction of aviation. In our Just Transition[35] paper, we present the idea of how a conversion of the aviation industry can guarantee security for the livelihood of workers.

END NOTES & LITERATURE

[1] See Fact sheet #1: https://bit.ly/SGGreenwashing

[2] See previous issues of our Greenwashing fact sheet series: https://bit.ly/SGGreenwashing

[3] There are a wide-array of different NETs and different ways of implementing both BECCS and DACCS which we don't go into detail explaining in this factsheet but you can read about them further here: https://bit.ly/NETs
All of the arguments and points used in this factsheet still apply, regardless of specific technology implementation.

[4] IATAG (Sept. 2021): https://bit.ly/waypoint2050, p. 92-97

[5] Greenair (2020): https://bit.ly/UnitedCDR

[6] Airbus (2022): https://bit.ly/AirbusCDR

[7] Short video: https://bit.ly/C-budget

[8] Stay Grounded Greenwashing Fact sheet #6: https://bit.ly/SGGreenwashing

[9] Coalition for Negative Emissions (2021): https://bit.ly/CoalitionNE

[10] Armstrong McKay D. et al (20222): https://bit.ly/McKay22

[11] "DAC technology, says the airline [United], is one of the few proven ways to physically correct for aircraft emissions and can scale to capture millions, and potentially billions, of tonnes of CO_2 per year": Greenair (2020): https://bit.ly/UnitedCDR

[12] DeSmog (2023): https://bit.ly/DACCS_US

[13] 1,036 Mt CO2 in 2019: IEA: https://bit.ly/AviationCO2

[14] Brack D. et al. ([2020]): https://bit.ly/BrackD

[15] Keith D. et al (2018): https://bit.ly/KeithDAC

[16] US Department of Energy (DOE) (Sept. 2023): https://bit.ly/DOE-DAC

[17] The Verge (2021): https://bit.ly/CO2pipelineExpl

[18] Keith D. et al (2018): https://bit.ly/KeithDAC (p. 1581)

[19] Rosa et al. (2020): https://bit.ly/RosaL

[20] The University of Manchester (2016): https://bit.ly/Caddiction

[21] Carbon market watch (Feb. 2024): https://bit.ly/CRCFfailure

[22] NOAA Global Monitoring Laboratory: https://bit.ly/ppmCO2

[23] See calculation doc: https://bit.ly/4a8GjND

[24] UK Climate Change Committee (2020): https://bit.ly/CCCELEC, (pages 10-11)

[25] Biofuelwatch (2022): https://bit.ly/BECCShype

[26] Pure CO_2 captured when making bioethanol from corn is only 19% of the C in the corn: Zang et al. (2021) (Fig 4): https://bit.ly/ZangFT

[27] See calculation doc: https://bit.ly/4a8GjND

[28] ATAG (Sept. 2021): https://bit.ly/waypoint2050, p. 94

[29] TravelWeekly (2023): https://bit.ly/Jet2taxes

[30] Gössling S. et al: https://bit.ly/Goessling-Global-Aviation

[31] "There will be a restricted market for next generation offsets in the 2035+ timeframe, with many sectors looking to forestry, natural carbon sinks and carbon capture opportunities. Airlines should investigate partnerships with these providers at an early stage, helping to accelerate early action in these areas and lock-in long-term offset agreements." ATAG (Sept. 2021): https://bit.ly/waypoint2050, p. 96

[32] DeSmog (2023): https://bit.ly/DACCS_US

[33] DeSmog (2023): https://bit.ly/DACCS_US

[34] Stay Grounded (2019): http://bit.ly/DegAvR

[35] Stay Grounded (2021): https://bit.ly/JustTransitionAviation

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