Net zero 2050: offsetting and carbon capture

Fact sheet

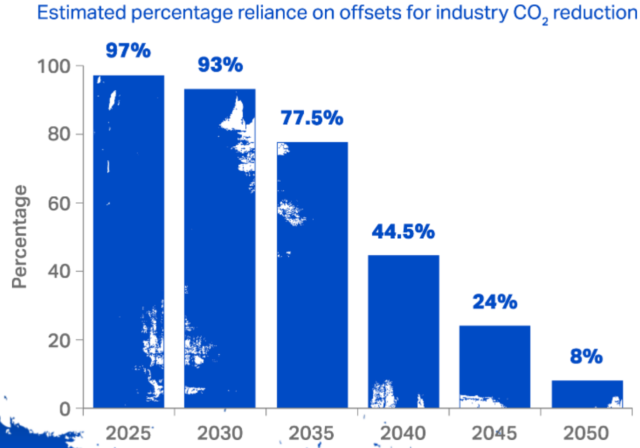
The aviation industry's net-zero carbon emissions target is focused on delivering maximum reduction in emissions at source, through the use of sustainable aviation fuels (SAF), innovative new propulsion technologies, and other efficiency improvements (such as improvements to air traffic navigation).

The industry plan for net-zero foresees a rapid decline in the use of offsets as in-sector solutions take over (see chart below). If it proves impossible to completely eliminate emissions at source, however, the industry is committed to mitigating the remaining emissions using offsetting mechanisms, including carbon capture technologies. This fact sheet explains more about these options. (For more on the existing Carbon Offsetting and Reduction Scheme for International Aviation program, see the dedicated CORSIA factsheet.)

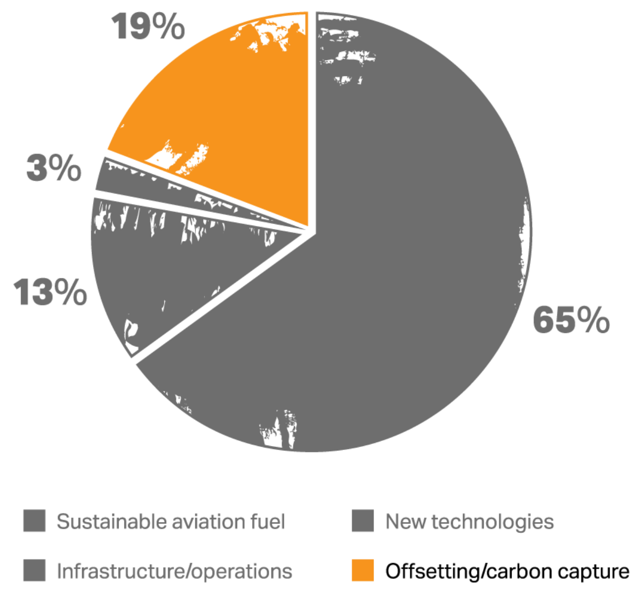
Offsetting has been criticized as poorly-regulated, with the quality of some schemes called into question. The aviation industry therefore subscribes to some key criteria to ensure that offsetting is robust:

- CO_2 reduction or removal used as an offset be 'additional' to business-as-usual activity.

Estimated percentage reliance on offsets for industry CO_2 reduction



Contribution to achieving Net Zero Carbon in 2050



Offsets must also represent a permanent reduction of emissions that cannot be reversed.
- To quantify the greenhouse gas (GHG) reduction benefits from an offsetting project, a baseline must be determined to represent what would have happened if the project had not been implemented. Emissions reductions will need to be quantified using accurate measurements, valid protocols, and be audited.
- Procedures must be in place to track units and to avoid that an emissions reduction is counted more than once towards attaining climate change mitigation.
- Carbon offsetting projects must comply with local, national and international laws, and must have safeguards in place to manage environmental and social risks.

Offsets: forestry and natural climate solutions

Some 15-20% of the world's GHG emissions come from deforestation. The move to use forestry as a source of carbon credits has been investigated for many years and is under discussions at the UN as part of the Paris Agreement. But there are challenges: ensuring that the forestry protection is permanent and looking after indigenous communities are just two areas that must be considered. The accounting framework for the international transfer of credits must also be decided on.

Moreover, there is increasing pursuit of other climate solutions which could not only prevent CO_2 emissions, but actually remove CO_2 from the atmosphere. Reforestation, though, must come with safeguards to ensure that trees planted grow to maturity. Rehabilitation of peatlands which cover 3% of the earth, could also provide significant carbon sinks.

At this stage, the scale of the 2050 potential from these natural climate solutions is unknown, although estimates suggest up to 11.3 billion tonnes of carbon could be reduced annually through such measures.

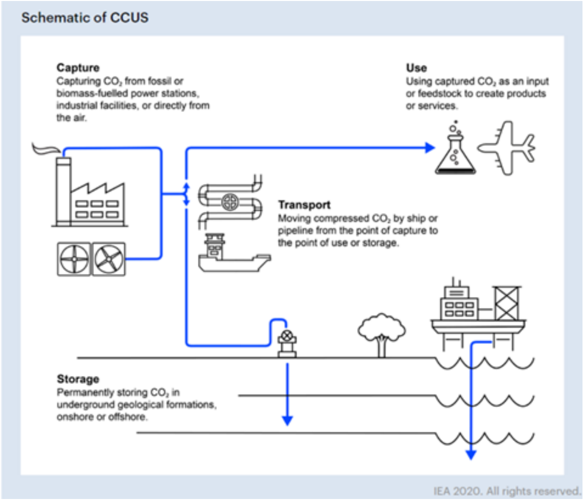
Direct air carbon capture and sequestration

Direct air capture (DAC) is a nascent technique in which CO_2 (and potentially other greenhouse gases) are removed directly from the atmosphere. The current technique uses large fans that move ambient air through a filter, using a chemical adsorbent to produce a pure CO_2 stream that could be stored or re-used. Significantly, unlike traditional carbon capture technologies, it removes CO_2 from the atmosphere, rather than being attached to a power station or other source of emissions.

To have any significant effect on global CO2 concentrations, DAC would need to be rolled out on a vast scale – perhaps up to 30,000 large DACs facilities would capture some 30Gt of CO_2 per year (or up to 30 million small scale plants by the end of the century).

Carbon capture utilization and storage

Carbon Capture Utilization and Storage (CCUS) is a technology that can capture up to 90% of the CO_2 emissions produced from the use of fossil fuels in electricity generation and industrial processes. Furthermore, the use of CCUS with renewable biomass is one of the few carbon abatement technologies that can be used in a 'carbon-negative' mode – actually taking carbon dioxide out of the atmosphere. It can even then be used to create SAF.



The CCUS chain works by capturing and transporting the carbon dioxide, recycling the CO_2 for other industrial purposes, and securely storing it underground. Despite being a technology available for many years, there has not so far been widespread use of the method and there is some skepticism as to its ability to be a major part of the world's climate response. One of the key arguments against the use of CCUS technology is that it could facilitate a prolonged use of fossil energy, rather than pushing investment towards low carbon and renewable energy. However, the Intergovernmental Panel on Climate Change (IPCC) states that CCUS will be absolutely critical to limit global warming to 1.5° C and that without the use of these technologies the target cannot be met*. And the International Energy Agency has indicated that CCUS could reduce global carbon dioxide emissions by 19%.

**https://www.ipcc.ch/report/ar6/syr/

IATA also published in April 2025 a study on carbon dioxide removals (CDR), an overview of the different methods for capturing and storing carbon dioxide from the atmosphere. This report looks at the most common CDR technologies currently deployed, their relative costs, technological readiness, and associated co-benefits and risks.