Action Brief

A Radical New Plan for Aviation

Aviation needs a radical new plan to achieve its climate goals. Industry emissions are growing faster than original forecasts and long-term solutions are nowhere in sight. By 2020, carbon dioxide from aviation will reach 1 gigaton per year and the industry will contribute between 3% and 9% of annual global emissions.[i] The Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) currently covers 75% of flights,[ii] but these offset efforts don't do enough to meet established goals, let alone address climate stability targets. Aviation needs a radical new plan. This Action Brief describes current barriers to success and suggests a plan to forge solutions together.

Aviation is Not Likely to Meet Its Climate Goals

In the past decade, airlines and aerospace manufacturers have adopted ambitious goals, such as committing to yearly efficiency gains of least 1.5%, meeting growing travel demand without increasing net emissions, or reducing total emissions to 50% below 2005 levels by the year 2050.

However, the industry is not on track to meet these goals:

- For the past four years industry efficiency has not kept pace with passenger demand, resulting in an average of 5.1% annual fuel burn growth.[iii]
- There are no firm timelines for commercializing revolutionary aircraft design.
- Sustainable aviation fuel (SAF) is less than 0.01% of global consumption.

New Research Shows the Problem Is Worse than We Thought

Rocky Mountain Institute (RMI) generated three new, plausible scenarios for aviation carbon emissions, showing there will be either 23.5, 32.3, or 51.6 gigatons to abate by 2050 (see Figure 1).

- The mid-level volume (32.3 gigatons) is based on industry's 3.5% growth estimate. This is the same magnitude as total global CO_2 emissions growth.
- The high-level volume (51.6 gigatons) is based on emissions increases from the past four years (>5%).
- The low-level volume (23.5 gigatons) is based on emissions from the past 10 years, including two years of decrease due to recession (~2%).
- The 2050 goal is to limit annual emissions to 0.3 gigatons which is 50% less than the 2005 level.

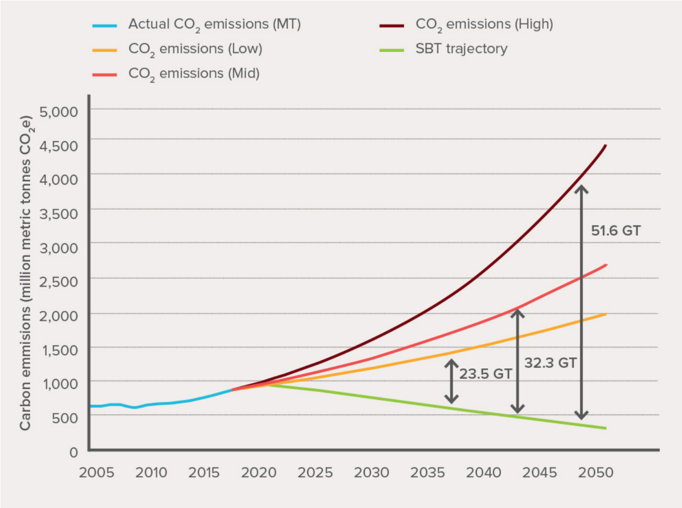

Figure 1. Aviation Carbon Emissions Scenarios

CORSIA Is Not Enough

Emissions are growing faster than the aviation industry anticipated. The Environmental Defense Fund estimates that by 2035, airlines will purchase around 2.5 gigatons of out-of-sector carbon-project credits,[iv] which could cost $1.5–23.9 billion per year.[v] Yet this substantial purchase is still almost 1 gigaton less than RMI's mid-level volume of forecast carbon emissions (see Figure 2).

CORSIA also does not address a gap of 5.6 gigatons of emissions that would be necessary to make linear progress toward the industry goals of 50% reduction by 2050. Aviation needs to achieve significant emissions reduction by 2030 to keep warming below 2 degrees Celsius (also known as "science-based" targets).

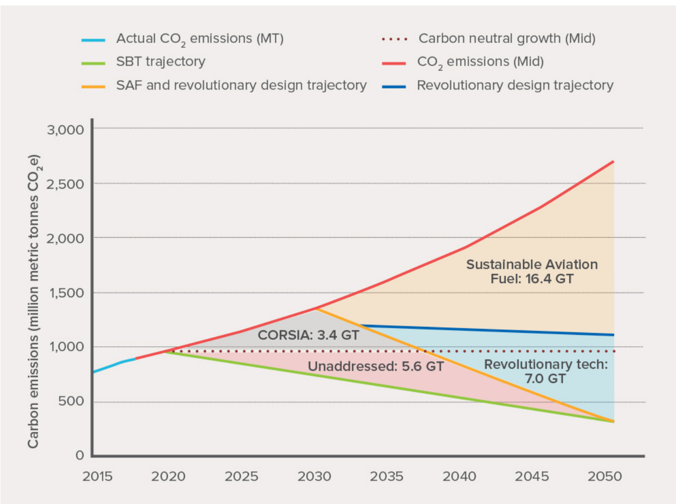

Figure 2. Aviation Carbon Emissions Roadmap

Efficiency Improvements Alone are Insufficient

Aviation efficiency gains are not enough to keep emissions growth under 3%. Passenger growth exceeds forecasts.

There are a number of other factors to blame:

- Airlines have already optimized "passenger load" and have few available empty seats to fill.
- Meeting increased demand requires flying additional aircraft, which increases fuel burn.
- Fuel prices remain low, and airlines may be retaining their fleets for longer durations to accommodate passenger growth. Aging fleets translate to higher fuel burn.

Another under-researched factor is how the changing climate impacts aviation:

- More severe storms, stronger winds/turbulence, and more frequent delays require more fuel.
- Larger storms require longer flights to avoid extreme weather.
- Higher ambient temperatures require more takeoff energy to compensate for reduced lift.
- Carrying additional contingency fuel to cover weather uncertainty requires more energy to move the heavier aircraft.
- Higher wind speeds require more engine thrust. Flying downwind does not save as much fuel as the extra fuel required when flying into a headwind.

There Is No Clear Path to Revolutionary Aircraft

Transforming commercial aircraft with blended-wing technology and other breakthrough features could generate at least 50% fuel savings compared with existing designs.[vi] In the RMI model, these aircraft could be responsible for around 7 billion tons of carbon reduction, which is double CORSIA's climate action contribution (see Figure 2).

However, there is no clear path for using these designs in commercial aircraft:

- Massive manufacturing investments are necessary to shift from the traditional production processes.
- Existing practices offer cost-effective aircraft size options for airlines with changes limited to the length of the cabin; blended-wing models would disrupt this advantage.
- Airlines prefer uniformity in their fleets to maximize flexibility for pilot changes and simplify maintenance.
- Airports would require significant infrastructure changes, including wider taxiways.

Electric aircraft may also be a factor after 2030, but likely will not contribute meaningful carbon reduction for the next two decades.

There Are Many Barriers to Lower-Carbon Fuels

Sustainable aviation fuel provides the greatest potential for carbon reduction, and lower-carbon alternatives to jet fuel have been proven to be as safe and effective as drop-in blends with conventional fuel. In the RMI model, lower-carbon fuels will be responsible for over 16 gigatons of carbon reduction (see Figure 2).

However, there are many barriers to the adoption of SAF:

- SAF is currently at least 2–3x the price of fossil fuel.
- There is currently only a single dedicated production refinery operating in the world.
- The International Civil Aviation Organization (ICAO) estimates that 140 new commercial production facilities are needed each year between now and 2050 to reach industry goals.

In the RMI model, rapid SAF growth needs to occur in 2030, leaving minimal time to identify production cost reductions and to invest in the thousands of needed production facilities.

The Industry Needs to Move Forward Together

We envision a new forum that broadens the discussion to include the travel industry and business travelers. The group will build on accomplishments from ICAO, the International Air Transport Association (IATA) and the Air Transport Action Group (ATAG), the International Coordinating Council of Aerospace Industries Associations (ICCAIA), the Commercial Aviation Alternative Fuels Initiative (CAAFI), the International Business Aviation Council (IBAC), Federal Aviation Administration (FAA), and Airports Council International.

By working collaboratively, we can mitigate industry competition dynamics and generate practical market-based answers to the critical issues the industry faces. This new forum has the power to advance efficiency, establish in-sector offsets, leverage new and existing coalitions, accelerate revolutionary aircraft design, and grow SAF supply.

Climate disruption won't wait for incremental action. Now is the time to mobilize together.

Following the Clean Skies for Tomorrow session at the World Economic Forum (WEF) annual meeting at Davos, RMI and WEF are planning a Solutions Workshop for broad industry participation. The two-day forum will be held in New York City in late spring 2019 to address the challenges identified in this Action Brief.

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[i] *The 9% figure includes estimates for climate impact from radiative forcing from contrails*
[ii] https://www.airlines.iata.org/analysis/countdown-to-corsia
[iii] https://www.iata.org/whatwedo/Documents/economics/IATA-Economic-Performance-of-the-Industry-end-year-2016-report.pdf
[iv] https://www.edf.org/climate/icaos-market-based-measure
[v] https://cfapp.icao.int/environmental-report-2013/files/assets/basic-html/page165.html
[vi] https://ntrs.nasa.gov/archive/nasa/casi.ntrs.nasa.gov/20140012638.pdf