# Can the aviation sector be sustainable using market based solutions alone?

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## Introduction

The international aviation sector is responsible for 2% of all Carbon Dioxide ($CO_2$) global emissions (Terrenoire et al., 2019), this is increased to 4-5% when considering all green-house gas (GHG) emissions (Lee et al., 2010). This essay explores the primary mitigation strategy to reduce carbon emissions to meet the Paris Agreement of limiting global temperatures below 2°C (UNFCC, 2015). The International Civil Aviation Organization (ICAO, 2016) announced the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) scheme to produce 'carbon neutral' operation from 2020 onwards employing the principle of carbon offsetting as the main mechanism. Carbon offsets allow $CO_2$ production to be 'offset' by purchasing carbon credits where the same amount is removed elsewhere (Kollmuss et al., 2010, p.6).

The following box summarises the CORSIA scheme, how it works, its adoption and timeline.

**CORSIA Scheme – how does it work? Adapted from (ICAO, 2021a)**

**Goal**: global market-based solution to achieve carbon-neutral aviation growth from 2020 onwards.

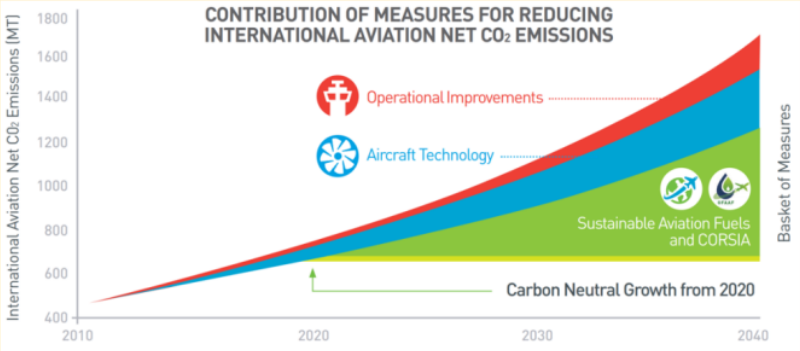
**Key Policy features:**

- Adopted in 2016, with 191 countries participating
- Funded by 2% of sector revenues
- Not linked to Paris Agreement
- Regulates international aviation, which represent 60% of emissions.

**Phases of adoption**

1. 2019 – 2020: **reporting and monitoring** for all ICAO countries, requires third party verification.
2. 2021 – 2026: **voluntary offset** applies to 70 countries who have agreed to participate. Notable exceptions include India and Russia. Airlines will need to purchase offset credits above 2019 levels.
3. 2027 – 2035: **mandatory offset** for majority of countries except for Least Developed, Landlocked Developing and Small Island Developing countries.

Pathway for GHG reduction (ICAO, 2019) summarised in the infographic below:



The emergence of the CORSIA scheme is influenced by the EU Emissions Trading Scheme (ETS), adopted in the European Economic Area (EEA) in 2005, and covers 40% of the EU's GHG emissions (EC, 2016). However, aviation was only included in 2012 for intra-EU flights (Larsson et al., 2019). Prior to this, aviation related emissions were governed by the Kyoto Protocol which mandated only domestic flights be reported through Nationally Determined Contributions (NDC) (Dings, 2010), thus, limiting mitigation strategies to national contexts (Maertens et al., 2019). It was the EU's proposal to widen ETS to further include flights outside of the EU that prompted ICAO to implement the CORSIA offset scheme (Larsson et al., 2019).

The first part of this essay argues shortcomings of offset schemes whilst the second part of the essay explores regulatory solutions and a discussion on framings and narratives. Throughout the essay, emissions refer specifically to $CO_2$ emissions, unless otherwise stated, and EU refers to the European Economic Area (EEA) when discussing the EU Emissions Trading Scheme (ETS).

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## Are carbon offsets even real?

From the get-go, the CORSIA scheme has received much criticism (Maertens et al., 2019), primarily, that it will lead to tripling of emissions and accounting for 25% of the carbon budget by 2030 (Graver, 2018). The most recent literature review by Larsson et al. (2019) demonstrate that both the EU ETS and CORSIA scheme will actually increase GHG emissions, thus, the CORSIA scheme provides license to further pollute. Furthermore, the international council on clean transport (ICCT, 2016) estimate that the aviation sector will only pay 3% of the total environmental cost via the 2% levy employed by the CORSIA scheme, thus a discounting rate of 97% for environmental destruction!

The effectiveness of carbon offsets is further debated based on methodological practice, Cames et al. (2016) found that of 5,500 'offset' projects, 87% of emission reductions were not 'additional', meaning they would have occurred anyway. Moreover, analysis of the Clean Development Mechanism (CDM) indicate that offsets projects over estimated reduction by as much as 40%, as well as double counting and double claiming (Kollmuss et al., 2010). This leads to issues of 'quality' and the 'realness' of such offsets. Increasingly, there are also reports of unsustainable practices where indigenous communities are deprived of their ancestral lands and livelihoods (Kill and Franchi, 2016). Moreover, there are issues of permanence - $CO_2$ emissions by aviation sector stay in the atmosphere for 100 years or more (Graver, 2018), whereas, it is operationally difficult to maintain 'permanence' of reduction either due to natural events such as forest fires and droughts or impracticality of projects monitoring for at least 100 years, the American Carbon Registry (ACR), the world's first private GHG registry, says it can only do so for up to 40 years (ACR, 2020). Therefore, there are significant challenges of whether carbon offsets are real, permanent or cause harm.

Finally, although the CORSIA mentions the possibility of Sustainable Aviation Fuels (SAF), ICAO does not mandate, nor set any quotas (ICAO, 2021b) and it is unlikely to be utilised by the sector due to the prohibitive costs versus purchasing carbon offset credits (Larsson et al., 2019).

## Is there hope?

Although market-based solutions have increasingly been deployed to tackle environmental issues, there is still scope for regulation. The current regulatory context for international

aviation is CORSIA, however, this will not meet the GHG aviation reduction goals (Terrenoire et al., 2019). Larson et al. (2019) provide the most comprehensive review and analysis for whether the aviation sector will meet climate goals; they conclude that national policies need to be enhanced and provide better strategies for direct 'real' reductions. These are predicated upon reducing demand and decreasing the costs of frontier technology, these include option such as (Larsson et al., 2019):

1. Global carbon tax on jet fuel – this currently does not exist and would require ambitious international agreements to avoid 'leakage' where airlines could refuel in jurisdictions outside of this policy. This would reduce demand if the carbon tax was large enough.
2. Passenger air tax based on distance – this exists in the UK and easier to implement at country level, however, it absconds responsibility of airlines.
3. Biofuel quota obligations – there is currently no minimum standards, whereas this is now becoming the norm for road transport. Sweden announced 100% biofuel for domestic aviation from 2050 onwards. Overall, this has the most direct impact on GHG reduction but is hindered by efficiency.

The most promising GHG reduction is likely to emerge from Sustainable Aviation Fuel (SAF), however, this is played down in the CORSIA scheme (ICAO, 2021b), instead, national innovation strategies present the best hope for reductions (Larsson et al., 2019). Although biofuels are currently presented as sustainable solutions, there are considerable challenges as they compete with premium agricultural lands, and currently, the best option costs five times in abatement costs than jet fuel (Pavlenko, 2021). Promisingly, alternative fuels could reduce emissions by 68.1% by 2050 (Staples et al., 2018) – the table below provides an analysis of three possible candidates:

| Alternative Fuel | Limitations | Opportunity | Appraisal |
|---|---|---|---|
| Electric aircrafts (Reimers, 2018) | 30x heavier than jet fuel. It would need to increase density by 3x from the current 170 Wh/kg. | This would cover aircrafts that could cover trips up to 500km, covering 5% of all GHG emissions. | Technological opportunity would exclude 95% of GHG emission from aviation. |
| Hydrogen (Dincer and Acar, 2016) | By-product produces twice as much water vapour, which acts as GHG at high altitudes thus requiring flight at lower altitudes, this would require new aircraft fleet. | Better range of travel than battery and carbon emissions can be eliminated. | Could offset all carbon emissions and reduce water vapour, however technological transformation of an entire fleet takes approx. 40-65 years. |
| Electro-fuels (Transport and Environment, 2017) | Frontier technology, current costs are prohibitive EUR 7/L, expected to decrease to EUR 1-3 L until 2050. | Low carbon power production (wind, solar etc) coverts electricity to variety of synthetic fuels. Only 8 million hectare of land is needed to deliver 50% of EU aviation needs vs 33 million hectare with biofuel (Transport and Environment, 2017) . | Alternative to biofuels, however, is under researched; significant potential to overcome scale lock-in for fossil-fuel-based energy production as well as requiring less land use. Better suited to aviation due to low choice of fuels. |

## Current policy based on dominant narratives

Challenges of sustainability are defined by the stories presented and the framing of problems and solutions (Stone, 1989). Political Ecology approaches emphasise the idea of 'manufactured scarcity', in the context carbon offsets, the total amount of carbon allowed in the atmosphere is inherently a political process (Asiyanbi, 2016; Osborne, 2010; Mehta et al., 2018; Scoones, 2016), although 'science' can demarcate ecological boundaries beyond which adverse climate impacts materialise (Steffen et al., 2015), the concession of the aviation industry to pollute above its threshold indicates that the aviation sector has managed to secure its position of non-reduction in aviation emissions.

Moreover, political ecology attempts to highlight the unequal nature of exchange, where the benefits of aviation emissions are realised in the rich world (Graver, 2018) - USA accounted for 24% of all aviation emission in 2018 and the EU with 18%. Additionally, frequent fliers (the 1%) account for half of global aviation emissions (Gössling and Humpe, 2020). Conversely, 80% of humanity has never flown on a plane (majority in developing countries) and the responsibility of mitigation plans are left to developing countries to manage (Eco Watch, 2021).

Market-based proponents such as International Air Transport Association (IATA) argue the necessity of the aviation sector to grow, citing that the aviation sector has already made 800% efficiency since the first aircraft production and that 35% of all aviation emission relates to freight which promotes international trade (Gill, 2017). However, this is in contrast with NGOs such as Stay Grounded (Guerrilla Foundation, 2019), who argue that sustainable aviation growth has to be within planetary limits and argue for degrowth, a discipline which promotes reduction of global production and consumption in favour of ecological sustainability and social justice (Escobar, 2015).

In the midst of ideological debates where carbon offsets are seen as an extension of neoliberal policies promoting excessive free trade (Osborne, 2010) and degrowth - where the economy is planned within planetary boundaries, there lies indigenous communities in developing countries whose voices are marginalised. Anis, who is at risk of displacement by a new airport development, tells The Jakarta Post (2021) that developers of the new Dhoho airport in East Java, Indonesia, bribed local residents with 'business loan' contracts only to be served eviction notices the next day. Another resident, Yanti recalled the harrowing experience of having her streetlights turned off in a phycological attempt at land grabbing – she asks: "if this development is intended to improve the economy of the poor, why are we becoming victims again? Why are they sacrificing poor people again?" (The Jakarta Post, 2021).

## Where do we go from here?

There is benefit of both market-based and regulatory approaches and each have their own shortcomings. Carbon offsetting schemes have the potential to redistribute global economic resources towards developing countries and stimulate new green sectors such as forestry management skills and job creation (Reddy and Assenza, 2009), however, there is greater risk of capital accumulation which are captured at the level of richer countries e.g. highly volatile carbon pricing means that European residents can purchase 'cheap' carbon credits which developing countries are responsible for maintaining over decades (Osborne, 2010), leading some to argue this type of policy is a new form of climate policy neo-colonisation (Domínguez and Luoma, 2020; McAfee, 2016).

There is probably a mix of policy required and further clarity is required to harmonise the incongruous policy across the international aviation sector (Larsson et al., 2019). Offsets should not compete at national level against Nationally Determined contributions (NDCs) under the Paris Agreement, nor should EU airline operators be penalised by both EU ETS and CORSIA at the same time (Maertens et al., 2019), and passengers should not be relied upon for using voluntary offset schemes (Mair, 2011). Therefore, from a political ecology approach, sustainable aviation transition is a Political endeavour which requires negotiations at all levels.

## Conclusion

The international aviation sector should not rely upon market-based solutions exclusively to meet reduction goals, instead, the framing of the necessity of the aviation sector to grow unabatedly should be challenged, especially, when the benefits accrue to a small portion of humanity living in developed countries and where the adverse consequences are managed largely by developing countries. Instead, national regulatory policies could provide direct interventions to reduce GHG emission and stimulate innovations in alternative biofuels which has been largely dismissed by the international aviation sector on a cost benefit basis.

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# Can the aviation sector be sustainable using market based solutions alone?

GRADEMARK REPORT

FINAL GRADE

75/100

GENERAL COMMENTS

## Instructor

This essay examines if  market based solutions such as carbon offsetting can make aviation sustainable.

Best features

This essay is well written and flows well. It was very enjoyable to read.

It has a good structure, with a clear introduction, a main part which discusses carbon offsetting schemes and regulatory possibilities, as well as connects with broader issues of framing. The conclusion  sums up the argument well.

The analysis done is good at compressing the issues in a way that shows that you understand the issues at stake and can apply the concepts and themes of the module to this case study.

Things to improve

It provides a good discussion of some of the key issues with offsetting but I would have liked at points to have more detail and to go deeper into some of these. It covers a lot of ground but that means leaving the details behind. Could you give examples of carbon offsetting programmes or CDM etc that have not been 'real', for instance? Perhaps. a better balance would make the essay stronger.

Overall, an excellent essay, well done!

PAGE 1

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## Comment 1

good

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## Comment 2

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## GRAMMAR

Grammar & Syntax

| | |
|---|---|
| BELOW 40% | Little to no understanding of the grammatical and syntactic structures. Few or no acceptable structures in the target language, and unacceptable ones used. |
| 40-49% | Broad understanding of grammatical and syntactic structures, but with a significant number of errors. Some acceptable structures used. |
| 50-59% | Fairly good understanding of the grammatical and syntactic structures. Acceptable structures used, but some unacceptable ones still present. |
| 60-69% | A good to very good understanding of the grammatical and syntactic structures. Mostly acceptable structures used, with maybe a small number of unacceptable ones. |
| 70-84% | An excellent understanding of the grammatical and syntactic structures. Predominantly acceptable structures used, with few or no unacceptable ones. |
| 85% OR HIGHER | A near perfect understanding of the grammatical and syntactic structures. Only acceptable structures used, with no unacceptable ones. |

## LEXICAL USAGE

| | |
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| BELOW 40% | A substantial number of errors and/or inappropriate use of vocabulary. |
| 40-49% | Limited and/or repetitive vocabulary range that impedes understanding. Errors in the use of appropriate vocabulary. A minimum effort. |
| 50-59% | A number of errors in the use of vocabulary but with a broader range. |
| 60-69% | A limited number of lexical errors and predominantly appropriate vocabulary. A more sophisticated range of lexis. |
| 70-84% | A sophisticated range of vocabulary with accurate use throughout and few or no lexical errors. |
| 85% OR HIGHER | A highly sophisticated range of vocabulary with very accurate use throughout and no lexical errors. |

## STRUCTURE

| | |
|---|---|
| BELOW 40% | Displays an inability to present a coherent structure. No apparent or suitable introduction or conclusion. |
| 40-49% | The main issues are broadly identified, but a number of passages do not address the topic satisfactorily. The structure lacks clarity and might not contain a clear introduction or conclusion. |

| | |
|---|---|
| 50-59% | The content broadly addresses the main issues raised by the title, but some passages might not be relevant. The structure is broadly clear but might contain a weak introduction and conclusion. |
| 60-69% | The structure is coherent with a suitable introduction and conclusion. The content is well focused in general, but might have occasional digressions. |
| 70-84% | The work is structurally sound and evident from the introduction. The body of the exercise follows the structure accurately with little or no digressions. The conclusions offered are strong. |
| 85% OR HIGHER | The work is structurally sound and clearly evident from the introduction. The body of the work follows the structure accurately with no digressions. The conclusions offered are strong. |

## ARGUMENTATION

| | |
|---|---|
| BELOW 40% | The main issues are not made clear and the arguments presented are basic, poorly developed, and lack clarity. There is no evidence of critical thinking or secondary reading. |
| 40-49% | Arguments are partially developed. There is little or no evidence of critical thinking or secondary reading. |
| 50-59% | Arguments are mostly developed satisfactorily, but parts of the argument might only be partially developed. There is some evidence of critical thinking and secondary reading. |
| 60-69% | Arguments are well developed on the whole and mostly well balanced. There is evidence of critical thinking and secondary reading. |
| 70-84% | Arguments are coherent and well-balanced. There is strong evidence of critical thinking and secondary reading throughout. |
| 85% OR HIGHER | Arguments are highly coherent and balanced. There is strong evidence of critical thinking and secondary reading throughout. |