Beyond ICAO's CORSIA: Towards a More Climatically Effective Strategy for Mitigation of Civil Aviation Emissions

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Abstract

Pursuant to a referral by the UNFCCC through the 1997 Kyoto Protocol, the International Civil Aviation Organization (ICAO) has developed a 'basket' of emission-mitigation measures for international aviation. Technical and operational measures proved inadequate to counter traffic growth and finally, in October 2016, ICAO adopted a framework for a market-based measure. The Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) is the primary emission-mitigation tool for international aviation. It aims at 'carbon-neutral growth' (CNG) from 2020 onward. Yet, even with an increased use of alternative fuels and comprehensive implementation of CORSIA, ICAO's basket of measures will not produce a reduction in global aviation emissions. This article describes the legal and governance framework and the implementation process of CORSIA, assesses the scheme's potential contribution to climate-change mitigation, and proposes a derivative but more ambitious strategy. This would include incorporation of international aviation emissions in the NDCs of Parties to the Paris Agreement and a more direct role for the UNFCCC in determining eligibility of emission units and alternative fuels, with ICAO remaining accountable for 'Monitoring, Reporting and Verification'.

Keywords

Aviation emissions; market-based measures; carbon-neutral growth; alternative fuels; carbon offsets; emission trading.

1. The ICAO Remit

In 1997, the UNFCCC's COP3 *inter alia* produced the Kyoto Protocol, which eventually entered into force in February 2005. The Protocol excluded international aviation emissions from country targets because of the difficulty in allocating them to countries. Aircraft in international operations move from sovereign jurisdiction to jurisdiction, and often over the 'high seas' where no nation has sovereign responsibility. Similar issues apply in the case of international shipping. Given the aim of committing Parties by setting internationally binding emission reduction targets. and the pressures of time, COP3

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decided (Article 2(2) of the Protocol): 'The Parties included in Annex I shall pursue limitation or reduction of emissions of greenhouse gases not controlled by the Montreal Protocol from aviation and marine bunker fuels, working through the International Civil Aviation Organization and the International Maritime Organization, respectively.'[2]

ICAO has been addressing this remit since early 1998. The remit has proved to have substantial constraints, particularly as far as market-based measures are concerned. ICAO's geographic and policy ambit reflects its membership of 192 states, well beyond the UNFCCC's 40 Annex I countries (Developed Nations and Nations with Economies in Transition). Moreover, there are significant barriers to applying an Annex I/non-Annex I industrialized/other-country-type concept in relation to 'equality of treatment' and certain other provisions in the 1944 Convention on International Civil Aviation (known as the Chicago Convention).[3]

The 1944 Convention would seem to proscribe nation-based discrimination. Article 1 of the Convention recognizes the complete and exclusive sovereignty of every state over the airspace above its territory; Article 11 declares that the laws and regulations of a state relating to the admission, departure, or operation, of aircraft are to be applied to the aircraft of all states without distinction as to nationality; and Article 15 (on 'Airport and similar charges') enunciates that 'conditions' (not further specified) applied by a state must be uniform as between national and foreign aircraft. The Convention is silent on sovereignty regarding airspace over the high seas, where it is recognized that no state should exercise sovereignty; however, Article 12 declares that in airspace above the high seas the rules in force are to be those established under the Convention, and ICAO has proceeded to establish such rules.

With the adoption of the Paris Agreement and ongoing developments in the UNFCCC, the Kyoto Protocol is expected to lapse after the current commitment period through to 2020. Specific text addressing international aviation and shipping emissions was cut out of the Paris Agreement during COP21—with cursory consultation at most—and it proved too difficult to reintroduce such text in the pressures of the final hours. So, while there is a general assumption that States will continue to work through ICAO pursuant to the Kyoto Protocol's reference, this is open to question, as international aviation may conceivably now fall - at least in part - under the Paris Agreement. In the meantime, ICAO reports to each session of the UNFCCC's Subsidiary Body on Scientific and Technical Advice (SBSTA). In turn, SBSTA routinely notes the views expressed by parties and invites the ICAO Secretariat to continue its reporting to sessions of the SBSTA on its ongoing work on relevant issues.[4]

There is a fundamental governance difference between the Paris Agreement and the ICAO provisions. Paris uses a 'bottom up' model, based on individual country contributions. The primary role of ICAO is setting and auditing global safety and security standards, for which a 'top down' process is key. The Organization has no precedent for

[2] In the case of aviation, bunker fuels are effectively those fuels used in international (but not domestic) operations.
[3] *Convention on International Civil Aviation*, ICAO Doc7300/9, *Part I, Air Navigation*; through *Part II*, the Convention formed ICAO, now a Specialized Agency of the United Nations.
[4] See most recently FCCC/SBSTA/2017/L.20.

a bottom-up process, which is more pragmatic for economic matters, and ICAO's provisions apply equally to all its member States.

One elemental weakness in the treatment of international aviation emissions through ICAO is that there is no directly identifiable national commitment, only a global 'sector-determined' contribution; and so, the contribution of international aviation emissions does not have a high profile nationally. Not only is potential action diluted, international aviation is treated in a silo and not in the context of differing national circumstances and the relative contribution of aviation to the economy—notably for cases where tourism is critical. Moreover, while membership of the UNFCCC and ICAO is essentially the same, the UNFCCC's mandate is to reduce greenhouse gas concentrations in the atmosphere while general motivation of ICAO is to protect and promote international aviation.

ICAO's past and ongoing success has lain predominantly with air navigation, safety, and security matters. The Organization has never managed to reach a multilateral aviation agreement on economic issues, despite several attempts. This has led to the extensive bilateral regulatory process (with some regional regulation) for air services that remains in place today. ICAO has also long recognized that each State will move at its own pace according to circumstances, and that the Organization's role on matters of economic policy is to provide analysis and guidance, not to prescribe.[5]

2. Need for Market-Based Measures

One of ICAO's strategic objectives is to improve air navigation capacity and efficiency. Technical and operational improvements in aviation *inter alia* reduce airline fuel consumption and hence greenhouse gas emissions per traffic unit. Yet even with implementation of the new ICAO CO_2 'Standard' for aircraft[6] and an anticipated increase in the use of alternatives to fossil fuels, the resulting per-unit reductions will be significantly exceeded by growth in traffic. Aviation's greenhouse gas emissions are expected to increase exponentially for the foreseeable future at a rate of around 3.5 per cent a year, doubling in twenty years.[7] Thus market-based measures (MBMs) are crucial if the impact of greenhouse gas emissions is to be mitigated for international air transport without prescribed restrictions on operations.

On the technical and operational fronts, since fuel costs are a substantial proportion of air-carrier costs, the incentive for increased efficiency is considerable. Efforts to improve aircraft types and air-navigation services have been commendable. Nonetheless, aviation will be predominantly fossil-fuel-dependent for the foreseeable future. Some of today's aircraft, as well as most aircraft entering into service between now and 2020, are likely to still be around in 2050. Radically new commercial aircraft types—such as blended wing-body, open-rotor, hydrogen-fuel-cell-powered, solar-assisted, and electric—exist at

[5] This was effectively recognized through Article 2(2) of the Kyoto Protocol being addressed not to ICAO directly but to Annex I Parties 'working through' ICAO.
[6] Applicable from 1 January 2018, the Standard will apply to new aircraft type designs from 2020, and to aircraft type designs already in-production as of 2023. Those in-production aircraft which by 2028 do not meet the standard will no longer be able to be produced unless their designs are sufficiently modified.
[7] Summarized from ICAO *Environmental Report 2016, Chapter 1: Aviation and Environmental Outlook,* Environmental Trends in Aviation to 2050, at 18-19.

present only on the drawing board or in small scale, and heavy investment in research is required soon if they are to have a major and timely impact. This will not be not easy to achieve in light of the scale of the needed investment and the increasing reluctance of governments to provide subsidies.[8]

Both industry and ICAO are assertively pursuing the evolution of sustainable alternative fuels (essentially biofuels), which would reduce greenhouse gas emissions per litre of fuel consumed—if only on the basis of their own conception of sustainability. While some such fuels have been proven to be technically viable, there remain questions as to their full life-cycle benefits, their impact on direct and indirect land-use change, and the availability of sustainable feedstock, along with considerable barriers regarding the necessary investment, pricing, and scaling up to a commercial level.[9] While no definitive assessment of the future contribution of alternative fuels for aviation emissions mitigation—particularly on a full life-cycle basis—can be made at present, they are unlikely to make a substantial contribution before 2040.[10]

When the concept of a global MBM was initially proposed for international aviation it was anticipated to be only a short-to-medium-term measure until such time as technology and sustainable alternative fuels delivered significant benefits. An MBM would not only help to achieve carbon-neutral growth (CNG) but would also lower emissions. There is now a realization that there is a 'wedge gap' to be filled merely to achieve CNG. Without additional mitigation measures, that gap will keep growing larger (Figure 1).

[8] B. Chèze et al. (2013), *Will technological progress be sufficient to stabilize* CO_2 *emissions from air transport to the mid-term?* Transportation Research Part D: Transport and Environment, 18, at 91-96; Lynnette Dray, *An analysis of the impact of aircraft life cycles on aviation emissions mitigation policies*, 28 Journal of Air Transport Management (2013), at 62-69; M. D. Moore, *Misconceptions of Electric Aircraft and their Emerging Aviation Markets,* paper presented at the 52nd Aerospace Sciences Meting (2014)*;* Paul Peeters et al. *Are technology myths stalling aviation climate policy*, Transportation Research (Elsevier) Part D 44 (2016), at 30-42; Paul Peeters, *Tourism's impact on climate change and its mitigation challenges*, NHTV Breda University of Applied Sciences, November 2017, at 177-180; Tim Robinson, *Can easyJet short circuit electric airliner flight?,* Royal Aeronautical Society, 6 October 2017; and more generally, Royal Aeronautical Society, *Greener by Design* programme and *Aerospace* magazine.

[9] Sammy El Takriti et al (2017), *Mitigating international aviation emissions: Risks and opportunities for alternative jet fuels*, International Council on Clean Transportation; European Parliament, *Emission Reduction Targets for International Aviation and Shipping*, IP/A/ENVI/2015-11, November 2015, at 18-19.

[10] See for example ICAO *Environmental Report 2016, Chapter I: Aviation and Environmental Outlook, Environmental Trends in Aviation to 2050*; International Council on Clean Transportation, briefing on *Alternative Jet Fuel Development and Deployment in North America*, June 2017; Paul Peeters, *Mitigating Aviation's Long Term Impact on Climate Change* (2016), paper presented at the Greener Aviation conference: Achievements and perspectives, Brussels, Belgium; and Peeters, supra note 8, *Tourism's impact*, at 179.

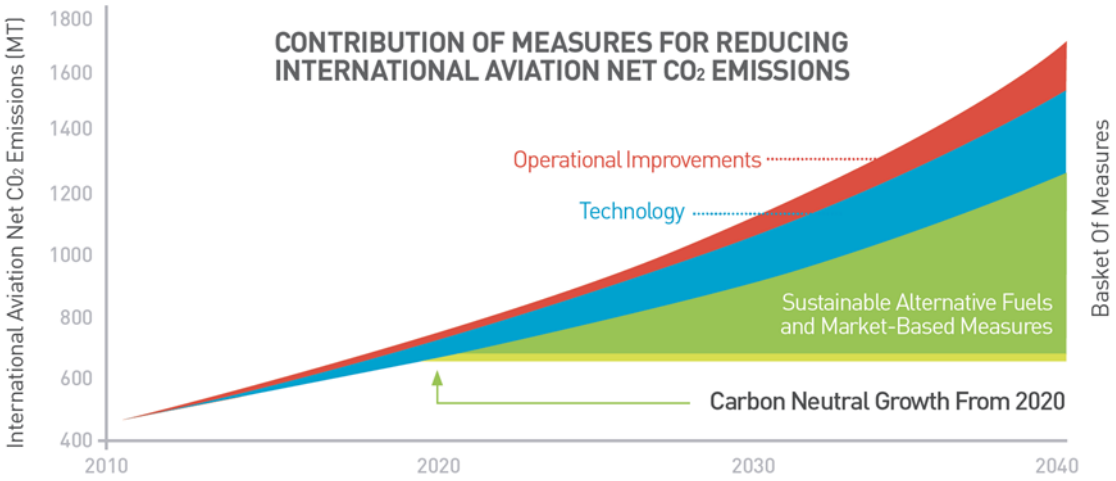

Figure 1. The figure shows the potential contribution of measures to mitigate a business-as-usual increase in net CO_2 emissions from international civil aviation from 2010 through 2040. The red band displays the anticipated impact of operational improvements. The blue band stands for the improvement expected from technology developments. The green band—the wedge gap—represents the additional mitigation required to achieve ICAO's goal of CNG from 2020 onward. Use of alternative fuels and the application of market-based measures are shown here as filling the wedge gap.[11]

3. The CORSIA Framework

After years of consideration by ICAO, in October 2016 the Organization's Assembly adopted a framework for a globally applicable market-based measure, the so-called Carbon Offsetting and Reduction Scheme for International Aviation.[12] CORSIA is designed to address an aspirational goal of keeping global CO_2 emissions from international aviation from 2020 onward at the same level.[13] There is a planned 'pilot' phase of application starting in 2021, a 'first' phase starting in 2024, and a phase of full effectiveness from 2027 through 2035.[14]

CORSIA has an equal application to air carriers on a route-by-route basis. In this manner, it gets around the potential conflict between the UNFCCC's principle of Common But Differentiated Responsibility (CBDR) and the uniform-condition provisions of the Chicago Convention. Emissions are attributable not directly to a country but to each

[11] ICAO, *On Board: A Sustainable Future* (brochure), 2016, p. 2, <www.icao.int/environmental-protection/Documents/ICAOEnvironmental_Brochure-1UP_Final.pdf>. The figure also appears in an ICAO 'CORSIA implementation' video and, more formally, with additional information, in ICAO Assembly Working Papers presented by the Council of ICAO on *Present and future trends in aircraft noise and emissions*, A38-WP/26 (2013) and A39-WP/55 (2016); also available on the ICAO public website. Reproduced with permission.

[12] Approved through ICAO Assembly ResolutionnmA39-3, *Consolidated statement of continuing ICAO policies and practices related to environmental protection – Global Market-based Measure (MBM) scheme*, linked to Resolution A39-2 *Consolidated statement of continuing ICAO policies and practices related to environmental protection—Climate Change.* The texts of all *Assembly Resolutions in Force (as of October 2016*) may be found in ICAO Doc10075.

[13] ICAO Assembly Resolution A39-3, Clause 3.

[14] Ibid., Clause 9.

carrier operating on each flight stage, with a country responsible for monitoring, verifying, and reporting on the emissions data and related offsets for each of its international aircraft operators on that flight stage. There are exemptions for flight stages to and from countries with a minimal share of international aviation traffic, Least Developed Countries, Landlocked Developing Countries, and Small-Island Developing States, although an exempted country may decide voluntarily to participate in CORSIA.[15]

The pilot and first phases of CORSIA are based on the voluntary participation of states. As at the end of February 2018, 73 States, representing 88 per cent of current global traffic (measured in international revenue tonne-kilometres), had indicated that they would participate from the outset.[16] This includes 20 States (of which 14 are European) in the group of 44 minimal-share-exempted countries, as well as twelve of the 90 other exempted countries. ICAO estimates that State representation after 2027 will cover more than 90 per cent of traffic; however, coverage would in practice be around 75 per cent, because the *flight-stage* exemptions will apply to carriers from non-exempted States as well as to those from exempted States.

Intensive implementation activity is underway. Key elements under development include Emissions Unit Criteria (EUC, used to define the quality of offsets and avoid double counting); Monitoring, Reporting and Verification (MRV); and the establishment of registries (which may be for individual countries or for groups of countries, with ICAO maintaining a consolidated central registry).[17]

4. Some Current Issues

The CORSIA framework is a notable achievement, the result of a long, painstaking, and resource-heavy process for both ICAO and its member States. Some important challenges remain before CORSIA is implemented.

In addition to the considerable complexity inherent in achieving a common approach for 192 States, other issues are now having to be addressed. For example, there was considerable debate both prior to, and at, ICAO's 2016 Assembly on whether each aircraft operator should be responsible for offsetting its own increase in emissions in a given year of the scheme, or whether a collective sector-growth factor should be used. In the end, a phase-in from global to operator-level emissions was applied, supported by seemingly complex mathematical formulae.[18] Another issue is that the CNG goal is not fully global but defined with reference to participating states, requiring an adjustment in the baseline each time an additional State decides to participate.[19]

[15] Ibid., Clauses 9 and 10. In a seemingly counterintuitive provision to mitigating emissions, a new carrier entrant is exempted from the application of CORSIA for the first three years or until its annual emissions exceed 0.1% of total 2020 emissions, whichever comes first (Clause 12). Exemptions also exist for small operators, humanitarian, medical and firefighting operations (Clause 13).
[16] As reported on the ICAO website, at <www.icao.int/environmental-protection/Pages/market-based-measures.aspx>.
[17] ICAO Assembly Resolution A39-3, Clause 20.
[18] Ibid., Clause 11.
[19] Ibid., Clause 11(g).

There are more fundamental issues regarding participation. ICAO carefully avoids use of the word 'mandatory' for the period from 2027 onward—and with good reason: the Organization has no direct authority over its member States, and so it will be up to each State to decide whether to stay in CORSIA right through to 2035. Consideration was given some years ago to developing a legally binding convention on a global MBM (or more broadly on implementation of the 'basket' of measures), but as even an ICAO Assembly Resolution[20] is not binding,[21] the approach was quickly abandoned as unwieldy, time-consuming, lacking in flexibility, and liable to induce disputes.

EUC and MRV are to be based on ICAO 'Standards and Recommended Practices' (SARPs). CORSIA-related SARPs are being fast-tracked for final review by the ICAO Council in June 2018, with a deadline for disapproval or filing of differences in September 2018, and applicability from 1 January 2019 onward.[22] ICAO is looking at how the contribution of alternative fuels with their relatively lower greenhouse gas emissions might be assessed in the CORSIA context. It has yet to articulate definitively what is a sustainable alternative fuel or what are eligible emission units (both are controversial issues, which might more appropriately be the responsibility of the UNFCCC). One concern at present is that CORSIA may be a competitor to airline biofuel use since it would be considerably cheaper to buy offsets than biofuels.[23]

Applying SARPs to what, in effect, are economic regulatory issues is a new venture for ICAO, with potentially broad and worrisome ramifications. SARPs have evolved from Article 37 of the Chicago Convention, on the adoption of international standards and procedures, linked with Article 38 on departures from these standards and procedures. A Recommended Practice is essentially a suggestion, and even in relation to a Standard a

[20] The CORSIA framework was adopted through an Assembly Resolution (A39-3).

[21] Brian F. Havel and Gabriel S. Sanchez, *The Principles and Practices of International Aviation Law*, Cambridge University Press (2014), at 59.The ICAO legal framework is also addressed in Michael Milde, *International Air Law and ICAO* (third edition, October 2016, Elsevier). A more general reference is Pablo Mendes de Leon), *Introduction to Air Law* (Tenth Edition, 2017, Deventer: Wolters Kluwer). A more specific and directly relevant book, if written prior to the evolution of CORSIA is Alejandro Piera, *Greenhouse Gas Emissions from International Aviation, Legal and Policy Challenges*, Eleven International Publishing, Netherlands (2015). Distinctions between the legal regimes of air navigation and international air transport were addressed by Thomas Leclerc in a doctoral thesis at Leiden University in November 2017 entitled *A Corrective Approach to Reduce* Aircraft *Greenhouse Gas Emissions* (in French).

[22] A so-called 'CORSIA package' of proposed SARPS was transmitted to all ICAO 192 member states on 5 December 2017 (ICAO State letter AN 1/17.4-17/129). States were requested to forward their comments on the proposals to ICAO by 5 March 2018, an unusually short consultation period. The 128-page document includes administrative procedures, draft Implementation Elements and supporting documents (the SARPS themselves taking up 31 pages).

[23] Delegations of Brazil and Indonesia, Second ICAO Conference on Aviation and Alternative Fuels, (CAAF2), Mexico City, Mexico, 11-13 October 2017, WP/18 on *Proposals for an ICAO Vision on Aviation and Alternative Fuels and for Ensuring a Smooth Transition to the Phase Out of CORSIA MBM;* also articulated by speakers at ICAO *Alternative Fuels Seminar* and *CORSIA Seminar*, 8-9 February and 10-11 May 2017, Montreal, Canada. See, in addition, John Broderick, *Voluntary Carbon Offsetting for Air Travel*, in *Climate Change and Aviation*, Gössling and Upham Eds, Earthscan 2009, at 339-346; International Council on Clean Transportation, briefing on *Alternative Jet Fuel Development and Deployment in North America*, June 2017*;* Stockholm Environment Institute, *Supply and sustainability of carbon offsets and alternative fuels for international aviation*, Working Paper 2016-03; P. Peeters, *Mitigating Aviation's Long-Term Impact on Climate Change* (2016): Paper presented at the Greener Aviation conference: Achievements and perspectives, Brussels, Belgium.

State is free to 'notify a difference', with numerous such filings on record. While ICAO undertakes audits in member States of many of the Standards it sets, and while it can make proposals where a discrepancy is found, it is not in a position to apply penalties or sanctions. Where a State objects to a difference filed by another State, or perceives an inadequacy by another State in meeting an ICAO Standard, it may take its own remedial action (Article 33 of the Convention). This has included conditioning or prohibiting the operation to its territory of a carrier from the State in question—although such drastic action is almost always predicated on a safety or security issue. Hopefully, in the case of CORSIA, responsive action would be in the form of remedial assistance to a 'defaulting' State. In their authoritative and comprehensive *Principles and Practices of International Aviation Law*, Havel and Sanchez summarize a reliance on SARPs to achieve emission reductions as 'problematic: they are, at best, legally ambiguous'.[24]

One issue with CORSIA's MRV SARPs is the filing of data. This is expected of all international air carriers from 2019 onward, and it applies as well to those from exempted countries.[25] The provision of statistics to ICAO is a legal requirement under Article 67 of the Chicago Convention, yet submission has by no means been universal. The ICAO Secretariat has had to use a number of additional information sources to achieve comprehensive data estimates. Its estimating procedure is essentially for planning purposes; it is not one with financial, and hence potential policy or legal implications, as with data for CORSIA. More broadly, there is the issue of achieving participation by all States in the filing of data. Given the high proportion of global traffic coverage, this issue seems more administrative than substantive, especially as a number of countries have no international airline.

The above issues are for the most part recognized and are being assessed by ICAO member States as part of the CORSIA implementation programme. Ultimately, there may be a need to establish a dispute-resolution process to deal with, among other things, the EUC and MRV aspects of CORSIA. The Chicago Convention provides for dispute settlement (Article 84); however, it is the type of adjudication that leads to laborious, time-consuming, and expensive proceedings and has rarely been invoked.

A substantial constraint of CORSIA is not only that is it a lowest-common-denominator scheme amongst a wide range of options, individual States are not encouraged to be more ambitious, not even voluntarily. The directive in the relevant ICAO Assembly Resolution, namely that 'CORSIA, or any other scheme decided by the Assembly, is to be the MBM applying to CO_2 emissions from international aviation',[26] is designed to counter additional ambition. Such exclusivity contrasts with the generic application provisions of the Paris Agreement, where Article 6 recognizes that some parties will choose to pursue voluntary cooperation to allow for higher ambition.

CORSIA's exclusivity feature was aimed primarily at the European Union with its EU Emissions Trading System. In 2008 the European Union decided to incorporate aviation into its ETS from 2012 onward; however, after concerns raised by a number of non-EU countries regarding the inclusion of their carriers, the European Union decided to exempt

[24] Havel and Sanchez, supra note 21, at 232.
[25] ICAO Assembly Resolution A39-3, Clause 20 (b).
[26] Ibid., Clause 19.

flights to and from (but not within) Europe, pending the outcome of ICAO's work on a global MBM.[27] The European Union is currently undertaking a general review of its ETS and considering how to integrate the aviation element consistently with CORSIA.[28] An important distinction is that the EU ETS applies to all aviation emissions, not just to those above 2020 levels, and one option might be to retain the ETS's applicability to emissions below CNG 2020. (A related issue is whether the United Kingdom will continue to participate in the EU ETS after Brexit.)

5. Adequacy of Offsetting and CNG

Beyond the challenges faced in implementing CORSIA, there are some fundamental concerns regarding its concept.

Carbon offsetting is not the primary emission-mitigation measure or even the primary MBM in almost any country. There are ongoing concerns regarding certain types of offset projects, notably those that change primary and secondary agricultural land usage and those targeted at reducing deforestation (on the ground that they serve to avoid emission increases rather than effect emission reductions).[29]

Particularly with an aviation-specific EUC, there are likely to be political pressures from individual governments regarding prices and selection of offset projects (notably in favour of local, domestic ones, including, it has been suggested, domestic aviation). This is already an issue in ICAO negotiations, where some countries, including Brazil and China, reportedly reject the idea that the list of eligible units should be determined by the ICAO Council and prefer that States be allowed to apply the EUC criteria directly.[30] Furthermore, as noted earlier, the ICAO framework would include a range of exemptions and not be legally binding or by any means universally applied in practice.

More broadly, there are increasing concerns about the value and effectiveness of offsetting. According to a study for the European Commission,[31] carbon offsets are not working. The research found that 85 per cent of the offset projects used by the European

[27] Oeko Institut, Study prepared for ENV1 Committee, *Emission Reduction Targets for International Aviation and Shipping* (2015); also see *Proposal for a regulation of the European Parliament and of the Council amending Directive 2003/87/EC to continue current limitations of scope for aviation activities and to prepare to implement a global market-based measure from 2021*, COM(2017) 54, 3.2.2017, 2017/0017(COD), Ordinary legislative procedure (COD) (Parliament and Council on equal footing; formerly 'co-decision').

[28] For a comparative analysis, see: CE Delft (2016) *A comparison between CORSIA and the EU ETS for Aviation*; and Janina Scheelhaase et al, *EU ETS versus CORSIA: A critical assessment of two approaches to limit air transport's CO_2 emissions by market-based measures*, 67 Journal of Air Transport Management (2018), at 55-62.

[29] Susanne Becken and Brendan Mackey, *What role for offsetting aviation greenhouse gas emissions in a deep-cut carbon world*?, 63 Journal of Air Transport Management (2017), at 71-83; Brendan Mackey et al, *Untangling the confusion around land carbon science and climate change mitigation policy*, 3 Nature Climate Change (2013), at 552-557.

[30] Interventions in joint meeting of European Parliament Committee on Industry, Research and Energy and Committee on the Environment, Public Health and Food Safety, 11 September 2017, followed up by correspondence with author.

[31] Oeko Institut, Study prepared for DG CLIMA, *How additional is the Clean Development Mechanism?* Reference: CLlMA.B.3/SERl2013/0026r, Berlin, March 2016.

Union under the Clean Development Mechanism failed to reduce emissions. The European Union had decided that an aircraft operator was entitled to use international credits 'up to a maximum of 1.5% of its verified emissions' during the period from 2013 to 2020, but that such carbon offsets (for aircraft operators or more generally for 'stationary installations') would not be allowed for the purpose of meeting European emission goals after 2020.[32] CORSIA, being founded on carbon offsetting, would appear to be in contradiction with the European regulation. A Griffith University (Australia) study on the offsetting of aviation greenhouse-gas emissions raises a number of concerns.[33] Other studies address weaknesses in CORSIA's offsetting provisions.[34]

Former UNFCCC Executive Secretary Christiana Figueres has pointed out that offsetting 'is not a silver bullet, nor an alternative to the deep and decisive emission reductions that economies and communities have to make now and into the future'.[35] Offsets carry the risk of encouraging people to believe that they need not change their behaviour, thus creating irreversibility in consumption and production patterns. Offsetting often lacks due diligence on effectiveness and requires costly management and administration.[36] Ultimately, while carbon offsetting may function as a tolerable interim mechanism, it is not a means of reducing air-transport emissions.

In regard to other MBM options, emission trading and carbon taxes have been proven viable and effective for other industries, although in the case of international aviation they have been shown as likely to have a minimal effect on traffic, and hence on emissions.[37] While taxes did not figure in the evolution of ICAO's MBM, they were proposed by the Russian Federation at ICAO's 2016 Assembly session,[38] in the form of a flat charge per tonne of aviation fuel used for international flights and in association with use of CDM offsets. Other options suggested from time to time have included 'fee and dividend',[39] a

[32] Commission Regulation (EU) No 1123/2013 of 8 November 2013 on determining international credit entitlements pursuant to Directive 2003/87/EC of the European Parliament and of the Council.
[33] Becken and Mackey, supra note 29.
[34] Aoife O'Leary, Columbia Law School Sabin Center for Climate Change Law, *Transparency and ICAO's Aviation Offsetting Scheme: Two Separate Concepts?*, November 2017; Carbon Market Watch, *Visibility Unlimited: Transparency of the New Aviation Carbon Market*, November 2017; Fern, *Cheating the climate: the problems with aviation industry plans to offset emissions*, September 2016; Fern, *Unearned Credit: Why aviation industry forest offsets are doomed to fail*, November 2017.
[35] UN Climate Change Secretariat Press Release *Purchasing of Offsets to Generate Funds for Vulnerable Communities*, Bonn, Germany, 9 July 2014.
[36] S. Gössling et al., *Voluntary Carbon Offsetting Schemes for Aviation: Efficiency, Credibility and Sustainable Tourism*, 15(3) Journal of Sustainable Tourism (2007), at 243-248.
[37] See, e.g., Richard S. J. Tol, *The impact of a carbon tax on international tourism*, Transportation Research Part D: Transport and Environment, Volume 12 Issue 2, March 2007, at 129-142; also many internal ICAO analyses and working papers.
[38] ICAO Assembly, 39th Session, 2016, Working Paper 387, *The Clean Development Mechanism (CDM) as an alternative to the to CORSIA*. See also M. Cames et al., *How additional is the Clean Development Mechanism? Analysis if the application of current tools and proposed alternatives* (No. CLIMA.B.3/SER2013/0026r), Oeko Institut, Berlin.
[39] Fee and dividend is an MBM for reducing carbon emissions, levying a progressively-rising tax on carbon-based fuels, then returning some or all of the revenue to the general public as a regular energy dividend.

global departure tax,[40] and a frequent-flyer tax.[41] The revenues from such options would be directed to emission mitigation. If imposed in the form of excise duties, such levies would be consistent with ones applied by governments generically, or to other industries, and they would not infringe directly on the present regime of tax exemption for international air transport.[42]

While a current ICAO Assembly Resolution assets that, with its member States, the Organization will 'strive to limit or reduce the impact of aviation greenhouse gas emissions on the global climate,[43] the focus is almost entirely on CO_2, although ICAO has also developed a Standard for aircraft on non-volatile particulate matter.[44] ICAO, lacking a long-term emission-reduction target, has agreed rather on an 'aspirational goal' for a global fuel-efficiency improvement of 2 per cent per annum through to 2050.[45] The air-transport industry, since 2009, has had a reduction target for net aviation CO_2 emissions of 50 per cent by 2050 relative to 2005 levels.[46] In 2019, the ICAO Council is expected to consider a long-term aspirational emission-mitigation goal in the context of efforts to limit the increase in the global average temperature to less than 2.0/1.5ºC above pre-industrial levels. This is to be developed through an analysis by ICAO's Committee on Aviation Environmental Protection (CAEP). However, such an evaluation would be better carried out in the framework of the UNFCCC and the Paris Agreement.

Based on an environmental trend assessment by CAEP, international aviation fuel consumption is estimated to grow between 2.8 and 3.9 times by 2040 compared to 2010 levels.[47] Implementation of CORSIA will contribute *pro rata* much less than any of the first NDCs to which 169 Parties had committed under the Paris Agreement as at the end of February 2018. Targeted emission reductions for aviation may understandably be lower than for other sectors due to the current non-availability on scale of alternative fuels, but if Paris Agreement targets are to be achieved, reductions from aviation are necessary. Such (relative) reductions by 2030 are already being considered in the European Union;[48] and the United Kingdom's Committee on Climate Change has stated that UK aviation emissions should be capped at 2005 levels (compared to the 1990 baseline used for all other sectors).[49]

6. CORSIA: The Bottom Line

[40] Numerous countries and airports already charge departure taxes, for funding aviation—notably airports, or for the general exchequer (a prime example of the latter being the United Kingdom's Air Passenger Duty).
[41] For example, *Levy on frequent leisure flyers proposed to make airport expansion unnecessary*, The Guardian, 20 June 2015.
[42] ICAO, infra note 70.
[43] ICAO Assembly Resolution A39-1, Appendix A Clause 1.
[44] ICAO Assembly, 39th Session, 2016, Working Paper 51, Civil aviation and the environment, at 5.1.
[45] ICAO Assembly Resolution A39-2, Clause 4.
[46] ICAO Assembly, 39th Session, Working Paper 155 Revision No. 1, *Industry views on a global market-based measure for international aviation*, at para 1.1.
[47] ICAO, supra note 7.
[48] European Parliament, *Emission Reduction Targets for International Aviation and Shipping*, IP/A/ENVI/2015-11, November 2015.
[49] *Meeting the UK aviation target: Options for reducing emissions to 2050*, 8 December 2009.

UNEP's *Emissions Gap Report 2017* states that 'International aviation emissions are expected to grow from 0.5 Gt CO_2 e in 2017 to around 1.1 Gt CO_2 e in 2030'; moreover, 'ICAO's CORSIA is estimated to have a reducing impact of 0 to 0.3 Gt CO_2 e per year on global emissions in 2030', and that this wide range 'implies that the result will depend on the way the offsetting rules will be set'.[50]

If the CNG 2020 goal were actually to be achieved through carbon offsetting and other measures, according to ICAO's own estimates it would still mean that some 750 Mt of CO_2 would be churned out unchecked annually from 2020 onwards by international civil aviation. From 2020 to 2035 this would produce some 12 Gt of unmitigated CO_2. A further annual tonnage of CO_2 rising to 142-174 Mt in 2025, 288-376 Mt in 2030, and 443-596 Mt in 2035 would be subject to the questionable carbon-offsetting process and the longer-term availability of offsets.[51] Thus, in addition to the unmitigated emissions, international aviation would produce 3.5 to 4.5 Gt of offset CO_2 over those 15 years. Given the exemptions and the unmitigated emissions, CORSIA would cover only about 25 per cent of world international air traffic, according to the International Council on Clean Transportation (Figure 2).[52]

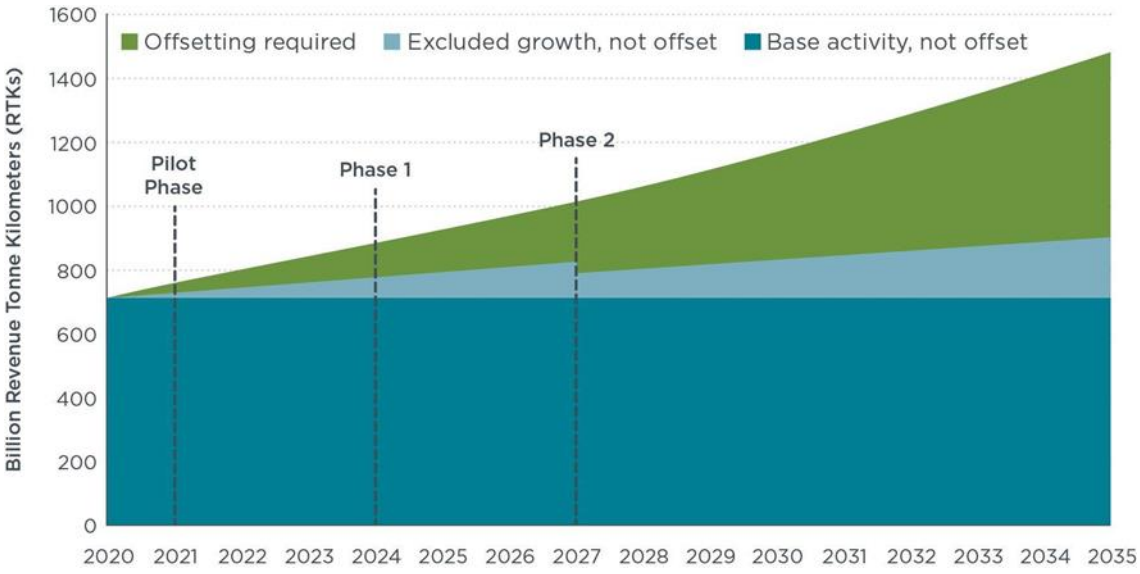

Figure 2. CORSIA's coverage of international revenue tonne-kilometres (in billions of RTKs) based on current commitments.[53]

There are a large number of voluntary commercial carbon-offsetting schemes dealing with aviation emissions already in existence, of varying price and quality and with

[50] November 2017, at 18-19.
[51] Author's calculations from ICAO *Environmental Report 2016, Chapter 1: Aviation and Environmental Outlook*, Environmental Trends in Aviation to 2050, <www.icao.int/environmental-protection/Pages/A39_CORSIA_FAQ3.aspx>.
[52] International Council on Clean Transportation, *ICAO's CORSIA*, February 2017; see, in particular, Figure 1 and associated text at 3.
[53] International Council on Clean Transportation, *Policy Update on ICAO's CORSIA*, February 2017, <www.theicct.org/sites/default/files/publications/ICAO%20MBM_Policy-Update_13022017_vF.pdf>. Reproduced with permission.

relatively low participation rates.[54] Independent offset brokers will presumably recognize and draw attention to the unchallenged annual 750 Mt and continue to offer offsets to cover at least the difference between CNG and full emissions, but airlines with existing offset programmes may refer to their participation in CORSIA and drop their individual programmes.

According to a cost analysis conducted by the International Air Transport Association (IATA),[55] the offsetting costs related to the implementation of a global MBM scheme are expected to have a much lesser impact on international aviation than that caused by fuel-price volatility. The estimated offsetting cost in 2030 is equivalent to that of a $2.6 rise in jet-fuel price per barrel. (Thus a $10 rise would cost the industry about four times as much as the estimated cost of offsets in 2030.) IATA claims that, over the past decade, the standard deviation of the jet-fuel price annually has been almost $40 per barrel, which means that airlines have managed to cope with oil-price volatility (mostly upwards) that is more than 15 times the estimated offsetting cost in 2030. It follows that CORSIA should have a minimal effect on traffic.

In summary, CORSIA is a step forward, but not a great advance towards cutting aviation GHG emissions. It took nineteen years from the Kyoto Protocol's referral of mitigation of international aviation emissions to ICAO to agree on the CORSIA framework, and it will take another three years before pilot implementation. It is by no means too early to start thinking about the design of a more substantive and climatically effective strategy for international aviation, if in parallel with implementation of CORSIA and drawing on the experience of its evolution. Awaiting experience of CORSIA's operation before initiating stronger mitigation action will simply result in 'too little, too late'. Strategic rejuvenation may benefit from a return to conceptual fundaments.

7. Transcending the Silos

Aviation emissions are generally addressed from a narrow perspective, that of air transport, rather than in the broader and more appropriate context of travel and tourism, travel and business, or greening the economy as a whole.

The ICAO process has fostered disingenuous statements, such as the Air Transport Action Group's statement that 'aviation produces only 2 per cent of man-made CO_2 while contributing 8 per cent of the world's GDP'.[56] This draws attention away from the fact that international aviation's CO_2 contribution is comparable to the total CO_2 emissions of countries such as Canada, the United Kingdom, Australia, or France. More deceptively, it includes an economic spectrum for GDP much broader than that of the aviation sector, without counting the emissions generated by that wider range of economic activity. [57]

[54] S. Gössling et al., supra note 36.
[55] *Comments on the cost impact of a global carbon offsetting mechanism*, ICAO Assembly Working Paper, A39-WP/153, Revision No 1 (2016,; picked up by ICAO, <www.icao.int/environmental-protection/Pages/A39_CORSIA_FAQ3.aspx>).
[56] ATAG, *Aviation: Benefits Beyond Borders*, 2016.
[57] There is general acceptance that aviation contributes just over 2 per cent of global CO_2 emissions, with international aviation at 1.4 per cent, but this may well underestimate the impact of aviation on climate change. The impact of other greenhouse gases such as methane and oxides of nitrogen could be twice that of CO_2 emissions and there may well be additional impact from cirrus clouds induced by condensation

Moreover, there has been no attempt by the aviation sector to assess the impact of aviation's emission-mitigation measures on the broader spectrum—rather confining it to aviation itself.

The tourism sector has produced an analysis entitled *Climate Change and Tourism: Responding to Global Challenges*.[58] It encompasses travel and tourism as an all-inclusive entity. A draft of this study formed the basis of the Second International Conference on Climate Change and Tourism, which was held with the participation of the World Economic Forum, in Davos, Switzerland, in October 2007, and led to the Davos Declaration.[59] A key conclusion was that the travel and tourism sector generated 4.95 per cent of global CO_2 emissions in 2005 (a similar proportion to its economic contribution in terms of GDP). Transport from global tourism generated the largest proportion of CO_2 emissions (75 per cent), with approximately 40 per cent of the total being caused by air transport alone. In the case of international tourism, the air-transport contribution was 60 per cent. However, while the international tourism sector continues efforts to reduce its emissions from ground transportation, accommodation, and other tourism activities, it seems largely unconcerned about the implications for the sustainability of the sector of the 60 per cent share of travel and tourism emissions from international aviation.

An important contribution to understanding the aviation-tourism silo issue has recently been published by one of the authors of the aforementioned study, Paul Peeters, in the form of a doctoral dissertation on *Tourism's Impact on Climate Change and its Mitigation Challenges*.[60] Basing his analysis on a global tourism and transport model, Peeters concludes that 'tourism's contribution to CO_2 emissions and climate change is very likely to increase for the remainder of the twenty-first century', and that 'tourism will most likely develop in a climatically unsustainable way'.[61] A primary driver is the growth of long- and medium-haul air transport, even taking into account the impact of CORSIA—it is the 'Achilles heel' of sustainable tourism.[62]

While aviation clearly provides a vehicle for international trade, a parallel assessment of its proportional CO_2 contribution has not featured in the work of the World Trade Organization and, to the knowledge of this author, is not available elsewhere.[63]

Over the past several years, the international aviation sector has increasingly managed to disassociate its climate action from the UNFCCC. This was noticeable at the ICAO 2016 Assembly in language changes to draft Resolutions. The United States made a reservation

trails. However, at present the scientific community feels that more work is required to identify an appropriate metric suited to future policy measures.

[58] UNWTO/UNEP, 2008.

[59] Subsequently adopted at the UNWTO General Assembly in Cartagena de Indias, Colombia, 23-29 November 2007, and presented at the United Nations Climate Change Conference (COP13) in Bali, Indonesia, in December 2007.

[60] NHTV Breda University of Applied Sciences, Netherlands, November 2017. Since published in book form (ISBN: 978-94-028-0812-4).

[61] Ibid., at 170.

[62] Ibid., at 183.

[63] The relative contribution of air freight to international aviation capacity and hence emissions is difficult to assess because of the significant amount of carriage in the 'bellyholds' of passenger-carrying aircraft, but it is estimated as some 20 to 25 per cent.

to one Resolution 'because it does not consider that the principles of the international climate regime apply to ICAO, which is governed by its own regime'.[64] In contrast, Argentina, China, India, the Russian Federation, Saudi Arabia, and Venezuela made reservations regarding the application of CNG to developing countries and to ICAO's interpretation of CBDR. At the May 2017 intersessional meeting of the UNFCCC in Bonn, some of the latter States called for 'consistency with the Paris Agreement rulebook' and work under ICAO 'to reflect common but differentiated responsibilities'.[65]

The 1999 Intergovernmental Panel on Climate Change (IPCC) special report on *Aviation and the Global Atmosphere* [66] was pivotal in framing ICAO action. An update in the light of more advanced scientific knowledge is overdue but, as with the above-cited development of an aspirational emissions goal in the context of limiting the increase in the global average temperature to less than 2.0/1.5ºC above pre-industrial levels, ICAO has decided not to request an update from the IPCC but rather to keep that in-house: CAEP has been given an instruction to carry out the analysis, with a report due in February 2019.[67]

The aviation industry is very close to, and is in effect the driver of, the ICAO process. It describes the current ICAO path as a 'licence to grow'.[68] ICAO and the industry repeatedly express concern regarding international aviation as a potential source for the mobilization of climate finance to other sectors[69] (aside from the application of CORSIA), while international aviation is in practice favourably biased, through exemption from fuel, value added, and some other taxes.[70] Aviation infrastructure is subsidized at many airports through the 'single till' approach, whereby some of the profits from non-aeronautical revenues, including duty-free sales, are set against landing charges.[71]

There is a crucial, overwhelming need to transcend the silos. Only against the much broader contributions of tourism and trade to the three pillars of sustainability (economic,

[64] Reservations on ICAO Assembly Resolutions may be found in ICAO Doc10075, *Assembly Resolutions in Force (as of October 2016)*.
[65] International Institute for Sustainable Development, IISD, 12(692) *Earth Negotiations Bulletin* (9 May 2017), Bonn Highlights, under Bunker Fuels.
[66] J. E. Penner, et al. (eds), Cambridge University Press.
[67] ICAO Council Decision (posted on internal website).
[68] Air Transport Action Group, various publications.
[69] For example, ICAO Assembly Resolution A39-2, Clause 16, and ICAO Assembly Resolution A39-3, tenth Whereas Clause.
[70] Fuel brought in by an aircraft to a state and retained on board for departure is exempt from duties through Article 24 of the Chicago Convention. ICAO's more general policy on taxation is contained in Assembly Resolution A39-15 Appendix B and *ICAO's Policies on Taxation in the Field of International Air Transport*. Doc8632, which recommends: exemption from any tax on fuel used in international air transport operations, subject to reciprocity—which has become legally binding through the vast majority of bilateral and multilateral air services agreements that form the basis of the economic regulation of international air transport around the world; and that 'Each Contracting State shall reduce to the fullest practicable extent and make plans to eliminate as soon as its economic conditions permit all forms of taxation on the sale or use of international transport by air, including taxes on gross receipts of operators and taxes levied directly on passengers or shippers' (ICAO Council Resolution of 14 December 1993), which is also widely followed (see *Supplements* to Doc8632).
[71] Concept elaborated at ICAO Conference on Economic of Airports and Air Navigation Services, Montreal, 19-28 June 2000, see ANSConf-WPs 17, 30, 48 and 50.

social, and environmental) can a balanced, coherent role be assessed for the international aviation sector.

International aviation should be brought under the direct responsibility of States through their NDCs. Despite the evolution of the process, and particularly of considerably improved data availability, the attribution issue has not been revisited substantively since the adoption of the Kyoto Protocol in 1997. With the Protocol now effectively ending in 2020, it is time for another look. Some ways of ascription are offered below in the final section of this article (8. Attribution of Emissions to States).

The advantages of bringing international aviation into the NDCs would include:

1. Transcendence of the silos, through an imperative on each State to balance out the various sources of emissions in its territory (air transport compared with livestock farming, use of synthetic fertilizers, industrial processing, commercial and residential, land transport, and so on). This would be according to the situation of each country, rather than ICAO attempting to do this for a single source at a multinational level.[72]

2. Choice of emission-mitigation measures would be at the discretion of individual governments in reflection of their particular circumstances.

3. Avoiding having to work with different mechanisms for international aviation and for various sectors domestically (including domestic aviation, which is difficult to separate from international aviation, and international and domestic airports).

4. Each country would take into account in its emission reductions the relationship between aviation and its other industries, including its competitiveness in tourism and trade—with aviation at a generic company-wide level (as with the application of corporate taxes). [73]

5. Each country would be in a position to create incentives for, or impose sanctions on, air carriers, as necessary under its sovereign jurisdiction.

6. Governments would be held directly accountable for reducing international aviation emissions, rather than indirectly through their airlines (which would avoid government ‘subservience’ to a global lowest common denominator).

7. Application of the generic CBDR principle as agreed to in Paris, rather than a different, complex, and perhaps inconsistent application for aviation alone (it would also remove the perceived conflict between the uniform application provisions of the Chicago Convention and the UNFCCC’s principle of CBDR).

[72] For example, the contribution of aviation to economic well-being may be relatively far less for a major economy with a wide variety of commercial and industrial sectors than for a Small Island State heavily dependent on international tourism.

[73] In this way not infringing directly on the present regime of tax exemption for international air transport, see supra note 70.

8. Overlap and inconsistency between ICAO's Emissions Unit Criteria and the UNFCCC's carbon-offsetting provisions would be avoided (indeed the UNFCCC provisions would rightly take precedence).

9. There would be a reduction of concerns, and a provision of safeguards, regarding the double-counting of offsets.

10. Most importantly, it would not proscribe national action.

As to global governance, NDCs would obviously continue to fall within the aegis of the UNFCCC, while now taking account of international aviation. In addition, the UNFCCC would by functional definition be more appropriate than ICAO to provide guidance or directives on the criteria for determining emissions units and on the sustainability criteria for alternative fuels. Thus a hybrid arrangement may be envisaged, led by the UNFCCC but with ICAO remaining responsible for the provision of operational data and for Monitoring, Reporting and Verification. Benefits would not only include simplification and a decrease in actual and potential duplication. More fundamentally, ICAO would be released from the resource-heavy climate-policy aspects of its function, with reduced distraction from its fundamental role in safety, security, and air-traffic management.

International aviation emissions are of such a size that ascribing them to States under their NDCs would significantly increase the overall national CO_2 emissions of a number of countries, and, depending on the apportionment method, could have a severe impact on the carbon budget of some countries.[74] In some cases, the inclusion of international aviation in an NDC could simply be seen as a ratcheting up of ambition, while in others there may be a need to adjust the NDC accordingly. But a key message of this article is that international aviation needs to be brought into the mainstream of climate change regulatory control as soon as possible, if effective and economically balanced emission mitigation is to be achieved.

8. Attribution of Emissions to States

Every state claims the right to determine the contribution to international aviation emissions that it is prepared to accept as its own responsibility. But it is, of course, desirable that the methodology used to determine the contribution of each state is uniform. In pursuance of transcending the silos, uniform determination should be based on generic national economic and social circumstances rather than on aviation traffic. Yet CORSIA takes the latter course.

In essence, the purchaser of any good or service is ultimately responsible as the source of the emissions. In the case of aviation, it is the passenger or the shipping initiator, but mitigation measures are generally addressed to the supplier of the good or service—and in the case of CORSIA, this is essentially the air carrier. At the same time, both the origin and destination countries, as well as the air carrier, are economic beneficiaries. In the case of aviation-related products, outgoing tourism is an import while outgoing freight is an

[74] For example, see Griffith University, *Global Sustainable Tourism Dashboard*, which shows aviation emissions and all CO_2 by country and per capita.

export. If any part of a good or service includes imports, the relevant emissions are attributed to the exporting country, not the importing one.

Reflecting the elemental root of the emissions has become feasible in recent years in the case of international air transport, with true origin and destination data and routings for passengers and freight routinely recorded by carriers. The emissions attributed to a country could be based on the originating market for passengers (round trip, which would tend to apportion towards more wealthy countries) and origin or destination market for freight. Consolidated data could be filed without breaching privacy, and public registries could used for monitoring and verification. This approach could see the aviation sector as an innovative leader in its treatment of exported and imported emissions.

Another approach would be to build on CORSIA by dividing emission data for each flight stage, say 50:50 between the territories of the two States concerned, amalgamating the data for each and every state, and assigning responsibility accordingly. In this way, the emission data would be more closely aligned with the balance of economic benefit.

A simpler, if less rationally satisfying, approach would be to apply CORSIA provisions directly. Consistent with attribution to a service supplier, emissions would be ascribed on the basis of the 'principal place of business' of each air carrier—a well-established regulatory criterion in international aviation—into national inventories and commitments. Thus, international aviation would be treated like any other export/import business. As with the above approaches, exemptions could still apply consistent with the CORSIA framework. Indeed, the mitigation commitment defined by the MRV function of a State would simply become the responsibility of that State rather than that of its air carriers. The emissions would be assigned entirely to the origin country of the carrier concerned and none to its destinations, but this limitation has already been tacitly accepted by a large number of States in the evolution of CORSIA. There would be no specific attribution to exempted flight stages but, as with CORSIA, obligations and exemptions by flight stage, and in total, would be included in public registries in order that they could be monitored against the emission-mitigation action taken generically, or specifically for aviation, by each state concerned.

Application would be voluntary, and in the first instance applicable to (below CNG) emissions not covered by CORSIA, with ratcheting up of the CORSIA effect by interested parties as a later phase (and perhaps at some point factoring in GHG emissions other than CO_2)[75]. Ideally, co-operative frameworks would be agreed amongst interested States to establish a 'higher-level' regime, but individual state action would not be ruled out. The ICAO role would be to maintain the registry and MRV process. Limited participation, even just by the EU States, or a few other major aviation nations, could produce a larger mitigation impact than a global application of CORSIA.

IATA's concerns regarding having to deal with 'a patchwork of different regulations, taxations, and different financial systems',[76] perhaps over-indulged in today's era of data management, would be minimized, particularly with a single higher-level regime.

[75] See *supra* note 57.
[76] See, for example, IATA, *Carbon Offsetting Scheme for International Aviation, Why is a single global market-based measure necessary?*

Various other economic sectors are already and increasingly covered by differing carbon-pricing regimes around the world, which are able to relate to each other without an overarching global accord.

Transparency is critical in ensuring action on climate change generally, and for international aviation there is a need to move forward from the opaque and secretive ICAO silo, within which many meetings, documents, and databases are closed or restricted to public view and NGO participation is severely hampered.[77]

The withdrawal from the Paris Agreement by the United States is immaterial to the above, since the United States would in any event have been unlikely to participate in anything more stringent than CORSIA. If the US government should withdraw from CORSIA, as is apparently being considered,[78] the US carriers—which strongly support the scheme[79] but have remained silent on the Paris Agreement—might find ways of continuing their participation outside the regulatory process.

The immediate imperative is for the creation of a multilateral dialogue on a strategic, silo-breaking, overview of aviation and climate-change policy from economic, trade, tourism, and emission-mitigation perspectives, centred on but also beyond, aviation interests. Climate-change concerns are already influencing airport expansion, and there are calls for more drastic measures, such as slot constraints and fleet-capacity limits, and even for restrictions on air services.[80] Continued exemptions for international aviation from economic regulation of greenhouse gases (to add to tax exemptions for fuel and value-added tax[81]) will only strengthen the hand of opposition to aviation expansion (the debate on a third runway for London Heathrow provides an example of how that can be effective). The concept of demand management, of rationing air transport, either directly or through infrastructure-capacity squeezing, is becoming a reality.[82]

An increasing apprehension in the aviation community is that the growth constraints imposed by insufficient or inadequate infrastructure and environmental concerns are playing an increasing role in inhibiting development strategy. Efficiency, at which the aviation industry in general excels, is not the same as sustainability. While civil aviation may have a positive balance in respect of the economic and social pillars of sustainability, for the time being it makes a patently negative contribution to the third pillar, environmental sustainability. Rather than a 'licence to grow', civil aviation requires a

[77] See for example Aoife O'Leary, supra note 34.
[78] US State Department email to media, including Reuters, affirming that US participation in CORSIA is 'under review' in response to questions raised in the aftermath of US notice of intended withdrawal from the Paris Agreement, June 2017.
[79] For example, see IATA Director General's *Report on the Global Air Transport Industry* at IATA Annual General Meeting, Cancun, Mexico, 5 June 2017.
[80] For example, Peeters, supra note 8, *Tourism's Impact*, at 18; Peter Forsyth, *The Impact of Climate Change Policies on Airline Fares, Profitability and Emissions*, Department of Economics, Monash University Clayton, Australia, June 2010; Transport and Environment, *Environmental concerns slow down airport expansion*, 8 March 2017.
[81] Supra note 70.
[82] While such rationing may well occur, directly or indirectly, in individual jurisdictions, multilateral agreement on operational restrictions is extremely unlikely because of the competitive forces of trade, tourism and aviation, and market-based measures are likely to continue to be a more acceptable approach.

more substantive and justifiable licence to enable a balanced, coherent role for the sector—a ‘sustainability licence’.