Doc 9951

Offsetting Emissions from the Aviation Sector

Approved by the Secretary General
and published under his authority

First Edition — 2011

International Civil Aviation Organization

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Published in separate English, Arabic, Chinese, French, Russian
and Spanish editions by the
INTERNATIONAL CIVIL AVIATION ORGANIZATION
999 University Street, Montréal, Quebec, Canada H3C 5H7

For ordering information and for a complete listing of sales agents
and booksellers, please go to the ICAO website at www.icao.int

Doc 9951, *Offsetting Emissions from the Aviation Sector*
Order Number: 9951
ISBN 978-92-9231-768-3

AMENDMENTS

Amendments are announced in the supplements to the *Catalogue of ICAO Publications;* the Catalogue and its supplements are available on the ICAO website at www.icao.int. The space below is provided to keep a record of such amendments.

RECORD OF AMENDMENTS AND CORRIGENDA

AMENDMENTS		
No.	Date	Entered by

CORRIGENDA		
No.	Date	Entered by

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EXECUTIVE SUMMARY

THE UNDERSTANDING OF OFFSETTING

In general terms an offset is a “compensating equivalent”. As an activity, offsetting is the “cancelling out” or “neutralizing” of emissions from a sector like aviation with emissions reductions achieved in a different activity or location that have been rigorously quantified and verified.

Offsetting can occur in either a regulatory or a non-regulatory context. In a non-regulatory context, offsetting is an idealistically or politically motivated action. In a regulatory context, offsetting is an action by companies or nations to achieve compliance with a mandatory emissions commitment.

In a regulatory context, it is only when credits are acquired from outside the emissions trading scheme or linked schemes and used to meet commitments/obligations under the scheme that the activity is referred to as offsetting. On the other hand, if a regulated emitter acquires compliance units (allowances or credits) from another regulated emitter within the same emissions trading scheme, or from a linked scheme, this is referred to simply as emissions trading.

OFFSETTING WITHIN AVIATION UP TO NOW

Within the aviation sector, the only offsetting that is currently taking place is non-regulated voluntarily passenger-based offsetting. The airlines’ roles are limited to offering an opportunity for the passengers to offset emissions caused by their travel.

Several concerns related to offsetting activities are discussed in this report. The most important relate to difficulties airline passengers have navigating on websites, limited participation, lack of transparency about the credits being offered, including the general absence of rigorous verification requirements.

On the positive side, buying offsets mitigates GHG emissions. Airline consumers are being educated about the effects of air travel on climate change, the development of carbon markets is encouraged, and the need for improved standards and verification requirements for the generation of offset credits is becoming more accepted.

OFFSETTING IN THE FUTURE

Despite the rapid ongoing growth of voluntary offsetting by air passengers, the potential for this type of voluntary approach for mitigating the effects of aviation emissions on global climate change is likely limited. Despite what appears to be widespread support, the willingness to actually purchase credits on a voluntary basis has been weak.

Nevertheless, steps might be taken to increase demand and quality of non-regulatory offsetting. For example, ensuring offset credits meet internationally accepted rigorous standards for quantification and verification, and improving systems for tracking credits to ensure they are used only once, should be pursued.

Offsetting in a regulatory context may be an important tool in the future. If there is a decision to regulate emissions from aviation that allows for emissions trading and emission sources not covered by a regulated system that can reduce emissions at a cost less than reducing emissions from aviation itself, an offsetting mechanism is likely to be part of the scheme.

This report concludes with a discussion of opportunities to use offsetting in the future. At the passenger level, it is possible to draw on current voluntary experience. However, there is also the possibility of using offsetting at a global sectoral level, either in a regulated emissions trading system or through an emissions charge. Offsetting can also be applied at an air carrier level rather than at the passenger level. These options offer some interesting possibilities for the future.

GLOSSARY

The terms contained herein are intended to clarify concepts as used in this document.

Additionality. To avoid giving credits for GHG emissions reductions that would have happened anyway, eligibility criteria have been developed to determine whether the reductions are "additional" — that is, are more than would have occurred in the absence of the project (environmental additionality) or in the absence of the incentive from the clean development mechanism (CDM) (project additionality).

Allocation. The initial distribution of allowances to accountable entities for a compliance period. This allocation could, for example, be based on historical emissions or a performance standard and level of production and could be made "gratis" or through an auction process.

Allowance (emissions allowance). An allowance is a tradable emissions permit that can be used for compliance purposes in a cap-and-trade system. Each allowance allows the holder to emit a specific quantity of a pollutant (e.g. one tonne of CO_2) one time.

Annex I Parties or Countries. A group of industrialized countries and economies in transition included in Annex I to the United Nations Framework Convention on Climate Change (UNFCCC) that committed individually or jointly to returning to their 1990 levels of GHG emissions by the year 2000.

Assigned amount units (AAUs). Emissions targets for industrialized country Parties to the Kyoto Protocol are expressed as levels of allowed emissions or "assigned amounts" for the 2008-2012 commitment period. Such assigned amounts are denominated in tonnes of CO_2 equivalent emissions (CO_2e).

Auctioning. The distribution of allowances — either the initial distribution or from a set-aside. This is achieved through an auction in which system participants bid for the right to purchase allowances. Different auction models could be used. Auctions often complement other forms of allowance allocation.

Aviation bunker fuels. The international share of fuel sold to aircraft.

Banking. A banking provision permits allowances issued for one compliance period to be saved for use during a subsequent compliance period.

Baseline-and-credit (emissions intensity) system. An emissions trading system that establishes an emissions performance standard and allows regulated participants to generate tradable credits (or emissions performance credits/allowances) by reducing their emissions intensity below that standard. Regulated participants that remain with an emissions intensity above the standard would need to submit credits to the regulating authority.

Benchmarking. A reference level, such as emission per unit of output, that can be part of the formula for the free allocation of allowances under a cap-and-trade system or that can define the target in an emission intensity system.

Buyer. A legally recognized entity (individual, corporation, not-for-profit organization or government) that acquires allowances or other compliance units from another legally recognized entity (the seller) through a purchase, lease, trade or other means of transfer.

Cap-and-trade emissions trading system. A cap-and-trade system allows for the trading of emissions allowances that are limited or "capped" in quantity by a regulatory authority. Before each compliance period, the regulatory authority distributes the allowances through a free allocation, sale and/or auction. At the end of the compliance period each accountable entity must surrender sufficient allowances to cover its actual emissions during the period. The trading of allowances promotes cost-efficient emissions reductions because entities that can reduce emissions at lower cost have the incentive to pursue these emissions reductions and to then sell their surplus allowances to entities that face higher emissions reduction costs.

Carbon dioxide equivalent (CO_2e). The unit of measurement that denotes the global warming potential (GWP) of a greenhouse gas. This metric enables the impact on the climate of different greenhouse gases to be easily compared.

Certified emission reductions (CERs). A compliance unit under the Kyoto Protocol issued for emissions reductions achieved from project activities in non-Annex I Parties that meet the requirements of the clean development mechanism (CDM). One CER is equal to one metric tonne of CO_2 equivalent.

Cirrus cloud. A type of cloud composed of ice crystals and shaped like hair-like filaments. May be partly induced by aviation.

Clean development mechanism (CDM). A mechanism established by the Kyoto Protocol that enables emissions reduction projects in non-Annex I Parties to earn CERs that can be sold to entities in Annex I Parties for compliance with their emissions limitation or reduction commitments under the Kyoto Protocol.

Climate change. A change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and is in addition to natural climate variability over comparable time periods.

Contrails. The condensation trail left behind jet aircraft. Contrails only form when hot humid air from jet exhaust mixes with ambient air of low vapour pressure temperature.

Credit or offset credit. In this report the term "credit" or "offset credit" is used to denote the compensating emissions reductions (product) that have been achieved and can be applied in the activity of offsetting. An offset credit could equate to a one-tonne reduction of carbon dioxide (CO_2) emissions or a one-kilogram reduction of nitrogen oxide (NOx) emissions, for example. These credits can be tradable units.

Domestic aviation emissions. Emissions from civil domestic passenger and freight traffic (commercial, private, agriculture, etc.) that departs and arrives in the same country including take-offs and landings for these flight stages.

Emissions intensity target. An emissions target defined in terms of emissions per unit of output.

Emissions trading. Emissions trading is a market-based tool that provides entities the flexibility to select cost-effective solutions to achieve their environmental targets. With emissions trading, entities can meet these targets either by reducing their own emissions or by securing, through the market, compliance units that take account of emissions reductions achieved elsewhere.

Flexible mechanisms. To give countries with binding obligations to limit or reduce emissions more options for meeting their targets, the Kyoto Protocol contains three market-based "flexibility mechanisms" — the clean development mechanism, joint implementation and international emissions trading.

Global warming potential (GWP). Global warming potentials (GWPs) are calculated as the ratio of the radiative forcing of one kilogramme GHG emitted to the atmosphere to that from one kilogramme of CO_2 emitted over a period of time (100 years). For example, with carbon dioxide assigned a GWP of 1, methane has a GWP of 23.

GHG (GHG). The atmospheric gases responsible for causing global warming and climate change. The major GHGs are carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). Less prevalent but very powerful GHGs include hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6).

GHG reduction or emissions reduction. A reduction in emissions intended to slow down the process of global warming and climate change. GHG reductions are often measured in tonnes of carbon dioxide equivalent (CO_2e), which is calculated according to the GWP of a gas.

Intergovernmental Panel on Climate Change (IPCC). The Intergovernmental Panel on Climate Change (IPCC) was established by the World Meteorological Organization (WMO) and the United Nations Environmental Programme (UNEP) to assess scientific, technical and socio-economic information relevant for the understanding of climate change, its potential impacts and options for adaptation and mitigation.

Joint implementation (JI). Joint implementation is a flexible mechanism established by Article 6 of the Kyoto Protocol for project-based emissions reduction activities in Annex B countries. Emissions reductions from JI projects earn ERUs.

Kyoto Protocol. An international agreement reached in Kyoto in 1997 that is linked to the UNFCCC and inscribes, among other things, the emissions limitation and reduction commitments made by developed countries for the 2008-2012 First Commitment Period.

Offset or offset credit. See definition of ***credit or offset credit.***

Offsetting. In this study offsetting is the activity of "cancelling out" or "neutralizing" emissions from a sector like aviation using offset credits — compensating emissions reductions created in a different activity or location that have been rigorously quantified and verified. It is only when credits are acquired from outside the emissions trading scheme or linked schemes and used to meet commitments/obligations under the scheme that the activity is referred to as offsetting. On the other hand, if a regulated emitter acquires compliance units (allowances or credits) from another regulated emitter within the same emissions trading scheme, or from a linked scheme, this is referred to simply as emissions trading.

Retirement. The permanent surrender of offset credits (or allowances) to achieve compliance with a regulatory or voluntary obligation or a country's international GHG commitment.

Seller. A legally recognized entity (individual, corporation, not-for-profit organization, government, etc.) that transfers allowances or credits to another legally recognized entity via a sale, lease or trade in return for a monetary or other consideration.

Surrender of allowances/credits. The submission of emission allowances/credits by an accountable entity to fulfil its obligations under an emissions trading scheme.

Tradable unit. A generic term for compliance units that can be traded either domestically or internationally, including allowances from a cap-and-trade system, credits from a baseline-and-credit scheme, and offset credits created from either domestic or regional trading regimes or through the Kyoto flexibility mechanisms (from clean development mechanism and joint implementation projects).

United Nations Framework Convention on Climate Change (UNFCCC). The UN Convention on Climate Change has been ratified by 192 countries, and it sets an overall framework for intergovernmental efforts to tackle the challenge of climate change. Under the Convention, governments share information on GHG emissions, national policies and best practices, commit to GHG limitation/reduction activities/targets, and provide financial and technical support for the adaptation and mitigation activities of other countries.

Verification. Verification provides independent assurance that the emissions quantification and reporting have been accurately completed. The "level of assurance" provided depends on the system requirements. In most systems the verifiers must be accredited by a standard-setting organization.

Voluntary action or commitment. An action or commitment, undertaken by an entity, that reduces GHG emissions in the absence of any requirements to undertake such reductions.

Voluntary market. Markets in which emissions reductions are purchased and then cancelled by entities which seek to manage their emissions for non-regulatory purposes.

ACRONYMS

AAU	Assigned amount unit
CAD	Canadian dollars
CAEP	Committee on Aviation Environmental Protection
CDM	Clean development mechanism
CCX	Chicago Climate Exchange
CER	Certified emissions reduction
ERU	Emissions reduction unit
ERU	Emission reduction unit
ETS	Emissions trading scheme
EU	European Union
GHG	Greenhouse gas
GTP	Global temperature potential
GWP	Global warming potential
IATA	International Air Transport Association
IPCC	Intergovernmental Panel on Climate Change
ISO	International Organization for Standardization
JI	Joint implementation
MBMTF	Market-based Measures Task Force
NSW GGAS	New South Wales GHG abatement scheme
RF	Radiative forcing
RFI	Radiative forcing index
RGGI	Regional GHG initiative
UNEP	United Nations Environmental Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNWTO	United Nations World Tourism Organization
USD	United States dollars
WMO	World Meteorological Organization

Chapter 1

OFFSETTING AS A MEANS OF MITIGATING THE EFFECTS OF AVIATION EMISSIONS ON GLOBAL CLIMATE CHANGE

1.1 BACKGROUND

1.1.1 During the Seventh Meeting of the Committee on Aviation Environmental Protection (CAEP) in February 2007, the reports "Guidance on Emissions Trading for Aviation" and the "Report on Voluntary Emissions Trading for Aviation" were finalized and adopted by CAEP.[1] To further CAEP's work on emissions trading and other market-based measures, the Market-Based Measures Task Force (MBMTF) was created with a mandate of scoping out several issues related to the use of market-based measures to address air emissions from the aviation sector.

1.1.2 One of the items identified for the MBMTF was to: "Examine the potential for emissions offset measures as a further means of mitigating the effects of aviation emissions on global climate change". This document was prepared in response to that request.[2]

1.2 CONTEXT

1.2.1 The Kyoto Protocol of the United Nations Framework Convention on Climate Change (UNFCCC) requires Parties listed in Annex I of the Convention (largely developed countries) to reduce their emissions of greenhouse gases (GHGs).[3] The Kyoto Protocol covers the period 2008 to 2012; its successor is currently under discussion (see Glossary for a brief description of the Kyoto Protocol and Annex 1 Parties).

1.2.2 The Kyoto Protocol treats international and domestic emissions from the aviation sector differently. Domestic aviation emissions are included in national targets listed in Annex B of the Kyoto Protocol.[4] Emissions from domestic aviation include emissions from civil domestic passenger and freight traffic that departs and arrives in the same country (commercial, private, agriculture, etc.), including take-offs and landings for these flight stages.[5] On the other hand, international aviation emissions are not included in the national targets, the Protocol assigns the UNFCCC Annex 1 Parties, working through ICAO, the responsibility of pursuing the limitation or reduction of GHG emissions from

1. ICAO. *Guidance on the Use of Emissions Trading for Aviation* (Doc 9885). Montréal, 2008, and the *Report on Voluntary Emissions Trading for Aviation (VETS Report)* (Doc 9950). Montréal, 2010. <http://www.icao.int/icao/en/m_publications/html> <http://www.icao.int/icao/en/env/vets_report.pdf>
   Note.— It should be mentioned that there was a European Union reservation to adoption of these reports.
2. Steering Group Meeting, CAEP-SG/20071-WP/20 (6/11/07) and CAEP-SG/20082-WP/23 (1/9/08).
3. Throughout this report, reference to developed countries implies Annex I Parties; reference to developing countries implies non-Annex I Parties.
4. ICAO. *ICAO Environmental Report 2007*. Montréal, 2007, p. 149. <http://www.icao.int/icao/en/env2010/pubs/Env_Report_07.pdf>
5. Intergovernmental Panel on Climate Change (IPCC). Prepared by the National GHG Inventories Programme. H.S. Eggleston et al. (eds.). *2006 IPCC Guidelines for National GHG Inventories*. Volume 2, *Energy*. Institute for Global Environmental Strategies (IGES), Hayama, Japan, 2006. pp. 3.57–3.58.
   <http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_3_Ch3_Mobile_Combustion.pdf>

aviation bunker fuels.[6] Emissions from international aviation include emissions from flights that depart in one country and arrive in a different country, including take-offs and landings for each flight stage.

1.2.3 Aviation emissions contribute to climate change via radiative forcing (RF).[7] Of importance are emissions of carbon dioxide (CO_2), nitrogen oxides (NO_x), aerosols and their precursors (soot and sulphate), and increased cloudiness in the form of persistent linear contrails and induced cirrus cloudiness.

1.2.4 The Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report estimated aviation's contribution to global GHG emissions in 2005 to be 3 per cent[8] (see Glossary for a brief description of the IPCC). The report also estimated that aviation was responsible for approximately 2 per cent of the world's carbon dioxide (CO_2) emissions.[9] Total aviation RF (excluding cirrus) in 2005 was 3.5 per cent of total anthropogenic RF. Including estimates for aviation-induced cirrus, RF increases the total aviation RF in 2005 to 4.9 per cent of total anthropogenic RF.[10]

1.2.5 Even though the aviation sector continues to improve the relative efficiency of its operations via improved scheduling/routing, fuel efficiency and other technical advances, operational adjustments alone will not mitigate CO_2 emission increases that are expected to be in the range of approximately 3–4 per cent[11] per year as traffic growth continues to grow. Though the cutting or rationing of flights would be strongly resisted by aviation operators and passengers, other measures that allow the sustainable growth of the sector and contribute to further mitigation of CO_2 emissions could be implemented. For example, reductions in CO_2 could be achieved indirectly through offsetting; that is, through the purchase and retirement of emissions reduction credits generated from sources outside of the sector.

1.2.6 The global warming impacts of CO_2 emissions are the same regardless of where the emissions occur. Understanding the role of offsetting in mitigating GHG emissions is becoming increasingly important. For example, airlines are providing the opportunity for their customers to voluntarily offset part or all of the emissions associated with their taking a flight. While this service is growing in popularity among airline customers, it is also being offered by a greater number of airline companies. At the same time, an increasing number of States and industries are beginning to establish emissions trading systems as a means to mitigate their GHG emissions. The use of offsetting is often an element of these emissions trading systems.

1.2.7 Finally, flexible mechanisms under the Kyoto Protocol include offsetting, and the use of this tool is growing. Understanding the role of offsetting will help the aviation sector assess its usefulness in reducing the carbon footprint of the industry.

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6 . United Nations. *Kyoto Protocol to the United Nations Framework Convention on Climate Change*. 1998. Article 2, paragraph 2: "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." <http://unfccc.int/kyoto_protocol/items/2830.php>

7. Radiative forcing components arise from: emissions of CO_2 (positive RF); emissions of NO_x (positive RF), including the sum of three components: production of tropospheric O_3 (positive RF), a longer-term reduction in ambient methane (CH_4) (negative RF), and a further longer-term decrease in O_3 (negative RF); emissions of H_2O (positive RF); formation of persistent linear contrails (positive RF); aircraft-induced cirrus cloudiness (potentially a positive RF); emission of sulphate particles (negative RF); and emission of soot particles. David S. Lee et al. "Aviation and Global Climate Change in the 21st Century." *Atmospheric Environment*, Volume 43, Issues 22 and 23, 2009.

8. *ICAO Environmental Report 2007*, p. 104.

9. IPCC. IPCC Fourth Assessment Report: Climate Change 2007 (AR4). Working Group III Technical Summary, 2007, p. 49. <http://www.ipcc.ch/ipccreports/ar4-wg3.htm>

10. David S. Lee et al.

11. IPCC Fourth Assessment Report: Climate Change 2007 (AR4), p. 49.

Chapter 2

DEFINITION OF OFFSETTING

2.1 INTRODUCTION

The purpose of this section is to provide a clear understanding of the terms “offsetting” and “offset credits” as used in this report. In order to provide such an understanding, explanations are given of how offsetting may occur and how offset credits are created. The activities of offsetting and the creation of offset credits are distinguished, and an explanation of how offset credits may result in offsetting by being retired or cancelled is also provided.

2.2 OFFSETTING AS AN ACTIVITY AND THE CREDITS USED FOR OFFSETTING

2.2.1 In general terms an offset is a “compensating equivalent”. As an activity, offsetting is the “cancelling out” or “neutralizing” of emissions from a sector like aviation with emissions reductions achieved in a different activity or location that have been rigorously quantified and verified. It is only when credits are acquired from outside the emissions trading scheme (ETS) or linked schemes and used to meet commitments/obligations under the scheme that the activity is referred to as offsetting. On the other hand, if a regulated emitter acquires compliance units (allowances or credits) from another regulated emitter within the same ETS or from a linked scheme, this is referred to simply as emissions trading.

2.2.2 It is important to distinguish between the activity of offsetting and the creation of an offset credit used for offsetting emissions — the term offset has been used to refer to both. For the purposes of this paper, offsetting is used to describe the action to compensate for GHG emissions. On the other hand, the terms “offset credit” or “credit” are used to describe the product for reducing emissions that is used in the activity of offsetting. Offset credits are quantified in units of CO_2e (one tonne of CO_2 equivalent emissions reductions) and can be traded.

2.2.3 Both regulated emitters (or entities) and unregulated emitters may choose to offset their emissions. A regulated entity could use offsetting as one means to comply with an emissions commitment. An unregulated entity’s motive for offsetting is to comply with its voluntary goals. In both cases, the emitters need to acquire offset credits that can be used for offsetting their emissions. However, the regulated entity can only use credits that are approved by a regulatory authority, whereas the unregulated entity can choose freely among the credits available for offsetting.

2.2.4 Offsetting must also be distinguished from emissions trading. If, for example, a regulated emitter acquires emission credits or emission allowances from another regulated emitter within the same ETS or from a linked scheme, this is referred to as emissions trading. These credits or allowances could be used to achieve compliance with a regulatory obligation or could be banked for future use (compliance or trading). It is only when credits are acquired from outside the ETS or linked schemes and used for compliance that the activity is referred to as offsetting.

2.2.5 Thus offsetting can take place in both regulated and unregulated contexts. Offset credits that are accepted for offsetting are created according to different rules or standards. Sections 2.3, 2.4 and 2.5 explain in more detail how credits available for offsetting are created, the standards that could be used to ensure their quality, how offsetting could take place, and finally the effects of offsetting.

2.3 CREATION OF OFFSET CREDITS

2.3.1 Many types of activities and projects can generate emissions reductions which could create credits used for offsetting, for example:

a) increasing energy efficiency in energy production and consumption;

b) using “waste” energy in cogeneration;

c) fuel switching to reduce emissions of greenhouse gases generated by the burning of fossil-based fuels, e.g. generating electricity from renewables such as wind, solar, small hydro, geothermal and biomass energy;

d) sequestration of carbon dioxide in forests and agricultural soils;

e) capture and storage of CO_2 from powerplants and industry;

f) capturing methane from landfills or livestock; and

g) destruction of potent GHGs such as halocarbons.

2.3.2 In the case of aviation, offsetting might include the renewal of a carrier’s fleet prior to the point at which aircraft would normally be retired. The replacement of older, less fuel-efficient aircraft with newer, more fuel-efficient aircraft would result in lower emissions by the carrier. The net emissions reduction resulting from the acquisition of new aircraft and early retirement of old aircraft must be verified as occurring prior to normal fleet turnover and resulting in emissions reductions that would not have occurred otherwise. These net reductions can potentially be recorded as offset credits.

2.3.3 The verification of offsets as additional to that which would have occurred otherwise is an important component of creating an offset credit. Emissions reductions must be over and above business as usual. In the example of creating an offset credit from aircraft fleet renewal, new aircraft would need to replace aircraft that had not reached their full service life. This could be defined as the number of hours an aircraft would fly before it is scheduled for a major overhaul or for retirement.

2.3.4 Offset credits are typically measured in tonnes of CO_2 equivalents (tCO_2e). They can be bought and sold through international brokers, online retailers or trading platforms that operate either on a commercial or not-for-profit basis.

2.3.5 Offset providers are companies or non-profit organizations that create emissions reduction credits. They do this by managing projects or programmes that reduce emissions that are eligible for the generation of offset credits. These emissions reductions are then quantified. Some level of third party verification to confirm the reductions have been accurately monitored, quantified and reported is usually required. The credits are then issued and can be used for compliance, sold or banked for future use or sale. A tracking system to ensure the credits are used only once is also needed.

2.4 STANDARDS AND VERIFICATION OF OFFSET CREDITS

2.4.1 Offset credits can be created under any GHG regulatory system when the regulatory authority establishes or accepts procedures for the creation of offset credits, including the processes for quantification and verification of reductions as well as the requirements for issuing and tracking of the credits.

2.4.2 Emissions trading systems create tradable units, which allow emitters to trade between themselves to achieve compliance with their absolute cap or emissions intensity target. In capped systems, these are usually referred to as "allowances" and in emissions intensity systems as "credits". In some cases these units have also been adopted by unregulated emitters for their own use; that is, allowances or credits from a regulated emissions trading system could be used for offsetting by emitters outside the system.

2.4.3 Under the Kyoto Protocol, the approved credits to be used for offsetting are called certified emissions reductions (CERs) and emissions reduction units (ERUs).

2.4.4 The Kyoto Protocol allows Annex I Parties to partly meet their Kyoto targets by financing GHG emissions reductions projects in developing countries.[1] Clean development mechanism (CDM) projects generate emissions credits called CERs — each CER is equal to one tonne of carbon dioxide equivalent — which may then be bought or sold. Projects that generate CERs must meet a stringent set of requirements, including an additionality assessment (i.e. reductions that generate credits must be additional to those that would have occurred otherwise), contribution to sustainable development, third-party project validation and independent verification of emissions reductions. The CDM executive board, established under the United Nations Framework Convention on Climate Change (UNFCCC), reviews CDM projects and issues CERs when all requirements are met. These credits are generally perceived as having a relatively high level of environmental integrity. According to the World Bank, in 2007 the primary CDM market traded 551 $MtCO_2e$ of CERs valued at approximately USD 7.4 billion and the secondary market[2] traded 240 $MtCO_2e$ or USD 5.5 billion of CERs.[3]

2.4.5 Joint implementation (JI) is also a project-based flexible mechanism under the Kyoto Protocol. Here the host country is not a developing nation but another Annex 1 country. The tradable units from JI projects are called ERUs. JI credits are created in developed countries under their own authority (Track 1) or under the authority of the JI Supervisory Committee (Track 2). The credits are issued by the Kyoto Party. To avoid double counting of emissions reductions achieved, an equivalent number of assigned amount units (AAUs) (i.e. allowances belonging to the issuing state) must be cancelled when the ERUs are issued. These projects also undergo a rigorous verification process. The JI programme started much later than the CDM programme, and relatively few ERUs have so far been issued. The World Bank estimated the trading of ERUs earned through JI to be 41 $MtCO_2e$ in 2007 with a value of USD 499 million.[4]

2.4.6 Other sources of credits could be a non-profit organization that develops sustainable energy projects in developing countries and participates in a process to create credits. These processes may or may not have rigorous requirements related to the quantification, verification and tracking of reductions achieved. Common project-types for these voluntary programmes include bio energy, clean non-emitting electricity generation (e.g., wind, solar, hydro), and forest-based carbon sequestration.

2.4.7 ERUs not issued under the Kyoto Protocol are sometimes referred to as voluntary or verified emissions reductions (VERs). The quality of VERs is highly variable, though some assurance of quality and integrity is often provided through various standards.

2.4.8 To better ensure the quality of offset credits, a variety of formal standards and certifications for carbon offset credits have emerged, including the Voluntary Carbon Standard, International Organization for Standardization (ISO) 14064 series and the Gold Standard. The latter expands upon the CDM requirements of the Kyoto Protocol. The Gold Standard will only recognize clean energy and energy efficiency projects that meet their additionality definition and that have sustainable development benefits (such as supporting communities). Both voluntary offset projects and

1. Flexible mechanisms are intended to be supplemental to a country's primary focus of reducing GHG emissions internally.
2. A secondary market occurs when investors purchase securities or assets from other investors rather than from issuing companies.
3. Karan Capoor and Philippe Ambrosi. "State and Trends of the Carbon Market 2008." *The World Bank Annual Report 2008: Year in Review*. 2008, p. 19. <http://siteresources.worldbank.org/NEWS/Resources/State&Trendsformatted06May10pm.pdf>
4. Ibid., p. 19.

CDM/JI projects could be recognized under the Gold Standard. However, contrary to requirements for many regulatory programmes, there is no standard for the level of verification required for a voluntary project, and no accreditation for third party verifiers.[5]

2.4.9 Government agencies in some countries provide approval for carbon offsetting mechanisms, for instance the Government of New Zealand approves VERs. The role of agencies and their impact on the verification process is not yet clear. As well, the United Kingdom has developed a quality assurance system for carbon offset providers. Again, it remains to be seen how government intervention will affect how permits are issued, tracked and ultimately valued in the market.

2.5 OFFSETTING ACTIVITIES

2.5.1 The activity of offsetting is separate from the creation of offset credits. For example, offsetting can be one way to meet a regulatory requirement to reduce emissions or not exceed an emissions cap. In such a context, the activity of offsetting can be highly regulated with respect to the quality or quantity of credits used. In a context where an unregulated entity voluntarily undertakes to offset its emissions, the offsetting activity is not regulated, though some countries have issued guidance on the types of credits that should be considered of acceptable quality.

2.5.2 A regulated emissions trading system requires participating entities to monitor or calculate their emissions. In a system where total emissions are capped, and emissions allowances are allocated to the emitters either without cost or via sale/auctioning — a cap-and-trade system — each entity must periodically provide the regulatory authority with allowances or credits equal to its actual emissions.

2.5.3 An emissions intensity system is a system where regulated entities have an emissions intensity target, and there is no pre-allocation of allowances. At the end of each compliance period the entity must submit allowances or credits to cover any excess of actual emissions over target emissions or will receive credits from the regulatory authority to the extent its actual emissions are less than its target emissions. Offset credits may sometimes be used to meet the obligations of the regulated entity depending on the rules established in the system.

2.5.4 Each trading system sets its own rules for the use of offset credits including the proportion of offset credits which can be used to meet the target. For example, a large number of industrial installations located in the European Union (EU) are mandatory participants in the EU ETS and have the flexibility to achieve compliance under the system by submitting offset credits. However, the EU ETS only allows the use of CERs and ERUs issued under the Kyoto Protocol. On average, the EU Member States have limited the proportion of offset credits that will be accepted for compliance to 13.4 per cent of the installations' emissions. Other ETSs may allow the creation of offset credits by the emitters themselves. Emission trading systems can be mandatory such as the EU ETS or voluntary such as the Chicago Climate Exchange (CCX) or the proposed Western Climate Initiative.

2.5.5 Schemes to reduce GHG emissions can also be voluntarily adopted by an organization (e.g. an airline), or by a citizen to compensate for actions or activities they undertake that result in emissions. Offsetting can be undertaken for the good of the environment or to demonstrate corporate social responsibility. British Airways launched the first airline promoted voluntary carbon offset scheme via its website in September 2005. Since then, the availability of offsetting opportunities and programmes for the aviation sector has multiplied, with many airlines selling carbon offsets to their passengers in partnership with offset providers.

5. Third party verification is often performed by a certified auditor that has a professional designation.

2.6 RETIREMENT AND CANCELLATION OF OFFSET CREDITS

2.6.1 Credits available for offsetting can be either retired or cancelled. Retirement is the surrender of offset credits (or allowances) to achieve compliance with a regulatory or voluntary obligation or a country's international GHG commitment. Offsetting in effect allows a regulated entity or a voluntary participant to increase emissions or avoid decreasing emissions (depending on the nature of the commitment) equivalent to the value of the offset credits submitted and retired. As a result, retiring an offset credit effectively has no net impact on total emissions. However, for regulated emitters the retirement of offset credits in the place of allowances may reduce the emitter's compliance costs.

2.6.2 On the other hand, when an offset credit (or an allowance) from a regulated emissions trading system is cancelled, it is removed[6] from the system and cannot be used for achieving compliance with any regulatory obligation. Similarly unregulated entities or individuals can cancel credits. In both cases a credit removed from circulation — that is, made unavailable for offsetting — has a net effect of reducing global emissions. This is the case because the reduction in GHGs that was captured in the offset credit cannot be used to offset emissions occurring elsewhere.

6. The credit or allowance is placed in an account in the tracking system (usually referred to as a "cancellation account") from which it cannot be transferred or used for any purpose.

Chapter 3

CURRENT STATUS OF OFFSETTING IN REGULATORY AND NON-REGULATORY MARKETS

3.1 INTRODUCTION

Since emissions trading systems set their own rules and take a variety of approaches to offsetting, the following three examples will help to illustrate the different ways that offsetting has been used in different schemes.

3.2 REGIONAL GHG INITIATIVE (RGGI)

3.2.1 RGGI is a cap-and-trade allowance-based system established for the electricity sector in the north-eastern United States. RGGI limits the use and the location of offsets. Depending on the price of allowances, offsets can be used to fulfil 3.3 to 10 per cent of the compliance obligation. If the price of allowances is below USD 10/ton[1], then only domestic offsets can be used. Above this price threshold, international GHG reductions are also eligible if they are generated within a carbon constraining programme that places a specific tonnage limit on GHG emissions, or if they are issued by the United Nations Framework Convention on Climate Change (UNFCCC) or protocols adopted through the UNFCCC process.[2]

3.2.2 The RGGI programme also limits the types of eligible offset projects. At this time, only the following five project categories are eligible for offsets:

a) landfill methane capture and destruction;

b) reduction in emissions of sulfur hexafluoride (SF_6);

c) sequestration of carbon due to afforestation;

d) reduction or avoidance of CO_2 emissions from natural gas, oil or propane end-use combustion due to end-use energy efficiency in the building sector; and

e) avoided methane emissions from agricultural manure management operations.[3]

3.3 EU ETS

3.3.1 The EU ETS is a regulatory trading system established by EU Member States. Apart from the trading of emissions allowances, this system allows for the use of offset credits from JI and CDM. Each Member State has to

1. Adjusted up or down each year according to the consumer price index, plus 2 per cent.
2. RGGI. “Amendment to Memorandum of Understanding.” 2006. <http://www.rggi.org/docs/mou_amendment_8_31_06.pdf>
3. Ibid., “Overview of RGGI CO_2 Budget Trading Program.” 2007. <http://www.rggi.org/docs/program_summary_10_07.pdf>

decide how many JI and CDM credits it will collectively allow its companies to use for compliance during the second phase of the system, which covers the first compliance period of the Kyoto Protocol. On average, Member States have decided to limit a participant's use of credits from CDM and JI to 13.4 per cent of the total cap in each Member State during the 2008–2012 period. In its directive for the emissions trading system in the 2013–2020 period, the EU Commission has introduced more extensive quantitative limitations on the use of credits from CDM and JI.[4]

3.3.2 Biomass sequestration and nuclear power projects are not allowed as potential projects, and the use of hydroelectric power is restricted to schemes meeting World Bank guidelines for environmentally sensitive implementation.

3.4 NEW SOUTH WALES GHG ABATEMENT SCHEME (NSW GGAS)

NSW GGAS is a regulatory programme that aims to reduce GHG until 2012 in Australia's power sector using a mandatory GHG benchmark. This programme issues offset credits for reductions achieved from specified emissions reduction projects and allows power sector participants to use these credits to meet their mandatory benchmark. This system does not allow the use of credits earned outside of the state such as those from CDM or JI initiatives.[5]

3.5 CURRENT STATUS OF OFFSETTING IN VOLUNTARY MARKETS

3.5.1 The voluntary carbon market transacted 42 $MtCO_2e$ in 2007 valued at USD 265 million,[6] a tripling of the voluntary carbon market from 2006 to 2007.[7] This market is fragmented and for the most part operates on a bilateral over-the-counter basis rather than through a formal exchange. According to Ecosystems Marketplace research, the top two drivers for offsetting are corporate responsibility/environmental ethics and public relations/branding. While two thirds of offsetting is undertaken to compensate for organizational emissions (total or part of total emissions generated by the organization), some of the other less common purposes include offsetting emissions generated by electricity use (5 per cent), commuting/vehicle use (4 per cent), and business-related flights (6 per cent).[8]

3.5.2 Some retailers give customers the option to pay an additional charge for offsetting the emissions associated with the product or service being purchased. Participating companies sell anything from carpeting to clothing to flights. For example, California's Pacific Gas and Electric Company provides an opportunity for customers to offset their electricity emissions on their monthly statement. Airlines are also becoming more involved in offsetting. As of December 2007, there were 21 airlines partnered with an organization to allow for the offsetting of customers" emissions.

3.5.3 Offset providers also offer services for individuals to offset the carbon emissions from their daily activities. Individuals answer an online questionnaire that provides details about their lifestyle, and the provider then calculates the individual's GHG emissions. Offset credits can then be purchased from the provider to fully or partially cancel out these emissions.

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4. "Directive 2004/101/EC of the European Parliament and of the Council of 27 October 2004 Amending Directive 2003/87/EC Establishing a Scheme for GHG Emission Allowance Trading Within the Community, in Respect of the Kyoto Protocol's Project Mechanism." *Official Journal of the European Union*, Volume 47, 13 November 2004. <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2004:338:0018:0023:EN:PDF>
5. Katherine Hamilton et al. "Forging a Frontier: State of the Voluntary Carbon Markets 2008." Ecosystem Marketplace and New Carbon Finance, 8 May 2008, p. 23. <http://www.ecosystemmarketplace.com/documents/cms_documents/2008_StateofVoluntaryCarbonMarket2.pdf>
6. Trading volume from the Chicago Climate Exchange excluded from this total.
7. Karan Capoor and Philippe Ambrosi. "State and Trends of the Carbon Market 2008." *The World Bank Annual Report 2008: Year in Review*. 2008, p. 19. <http://siteresources.worldbank.org/NEWS/Resources/State&Trendsformatted06May10pm.pdf>
8. Katherine Hamilton et al., pp. 67–69. <http://www.ecosystemmarketplace.com/documents/cms_documents/2008_StateofVoluntaryCarbonMarket2.pdf>

3.5.4 Several countries, e.g. Denmark, Finland, Norway and United Kingdom, offset emissions from government air travel, and many companies are becoming "carbon neutral" by reducing their GHG emissions as much as feasible and then offsetting the remainder of the emissions. HSBC, Goldman Sachs and Swiss Re are financial institutions that have become carbon neutral.[9] Some airports, such as Christchurch International Airport in New Zealand, have also used this approach to become carbon neutral for those activities for which they have operational control, and in 2006, the Swedish airport and air navigation service provider LFV Group chose to make their whole organization climate neutral. Events by the Rolling Stones, World Cup Soccer, Super Bowl, schools, cities and even organizations like The World Bank are becoming carbon neutral.[10]

3.5.5 The CCX is a voluntary but legally binding cap-and-trade programme that uses both allowance and offset credits. In 2007, the CCX transacted 23 $MtCO_2e$, which more than doubled 2006 volumes, and represents a value of approximately USD 72 million.[11] Offset credits can be used to meet up to 50 per cent of a participant's annual emissions reduction commitment.[12]

3.6 CARBON CALCULATOR

3.6.1 In June 2008, ICAO posted on its website an impartial, peer-reviewed Carbon Emissions Calculator[13] that estimates the carbon dioxide emissions from air travel for use in offset programmes. The calculator allows passengers to estimate the emissions attributed to their air travel through a simple interface that requires the user to enter only their origin and destination airports and their class of service. The method used by the calculator applies the best publicly available industry data to account for various factors such as aircraft types, route specific data, passenger load factors and cargo carried.

3.6.2 ICAO's Carbon Emissions Calculator supports the United Nations Climate Neutral Initiative which calls for all organizations of the UN system to determine their total carbon emissions. It makes it possible to harmonize the emissions estimates attributable to the air travel component of their operations. Sister agencies such as the UN World Tourism Organization (WTO) will be using and promoting the calculator. For airline-specific programmes, the International Air Transport Association (IATA) has issued guidance recommending that its members use the ICAO methodology coupled with their own airline-specific data for use in their carbon offset programmes to achieve a more consistent approach to estimating the CO_2 footprint of a flight, while providing more precision through airline-specific data.

3.7 AVIATION EMISSIONS REDUCTIONS AS OFFSET CREDITS

3.7.1 It is unlikely that emissions reductions in the aviation sector will be candidates for offset projects. Research conducted by the Forecasting and Economic Analysis Sub Group (FESG) at ICAO found that the lack of an alternative fuel source in combination with relatively high capital costs makes aviation emissions more expensive to mitigate than many other sectors. The high cost of reducing aviation emissions relative to other sectors is an important reason to support offsetting which is capable of achieving emissions reductions at a lower cost than could otherwise be achieved.

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9. *The Economist*. "Companies and Climate Change: Can Business be Cool: Why a Growing Number of Firms are Taking Global Warming Seriously." 8 June 2006. <http://www.economist.com/business/displaystory.cfm?story_id=7037026>
10. David Suzuki Foundation. "What you can do: Go Carbon Neutral." <http://www.davidsuzuki.org/Climate_Change/What_You_Can_Do/carbon_neutral.asp>
11. Karan Capoor and Philippe Ambrosi, p. 17.
12. Katherine Hamilton et al, p. 39.
13. The ICAO Carbon Emission Calculator can be accessed through the ICAO website at www.icao.int.

3.7.2 A recent analysis of all CDM projects which have been registered reveals that only 0.24 per cent of projects and 0.14 per cent of GHG reductions come from the transportation sector, and none of these are in the aviation sector.[14] A review of two organizations purchasing credits from emissions reductions projects — The Climate Trust and Swiss Climate Cent — revealed that 16 and 8 per cent, respectively, of their offset credits came from transportation projects; aviation projects, if any, were not identified separately.[15]

3.7.3 The *ICAO Environmental Report 2007* calculated that in 2005 total emissions from all global passenger air transport (2 022 million passengers) was approximately 600 $MtCO_2$.[16] Offsetting all aviation emissions is not likely to occur solely within the context of voluntary initiatives. However, for illustrative purposes, it appears these emissions could be offset at an average cost of less than USD 6 per passenger, assuming a cost of USD 20 per tonne of emissions.

14 International aviation is not eligible for the generation of offset credits under the CDM, though reductions from domestic aviation could be eligible.

15. Haites, Erik. "Emissions Trading Systems and Transportation: An Overview of Recent Results and an Assessment of Best Practices." Report prepared for Transport Canada, 31 March 2008.

16. *ICAO Environmental Report 2007*, p. 189.

Chapter 4

STATUS AND ASSESSMENT OF CURRENT AVIATION OFFSETTING ACTIVITIES

4.1 INTRODUCTION

4.1.1 To get a better understanding of the offsetting activities in the aviation sector, an overview and assessment of relevant aviation offsetting programmes is presented in this section.

4.1.2 A web-based survey of 16 airline offsetting schemes was conducted by the MBMTF during 2008 for this report. The airlines chosen were mainly European, North American or Australian ranging from big companies with large global market shares, to low-fare airlines or smaller businesses that focused on just a few destinations. The companies in the survey used a range of business models and offset providers to deliver this service. Some companies bought credits directly from a project partner, while others worked with offset providers such as the CarbonNeutral Company or myclimate. These initiatives may not be representative of all airlines' offsetting programmes.

Note.— The survey results have not been updated since their completion in August 2008 and therefore do not capture any subsequent developments.

4.2 MARKET VOLUMES

4.2.1 Offsetting schemes are a very recent phenomenon and the prevalence of such schemes has increased rapidly in recent years. According to Gössling et al.[1] only six voluntary offset providers existed in 2000, but the number grew to 40 by 2006. Out of these 40 providers, 17 started operation in 2005–2006. Few of these providers are dedicated to the creation of offset credits for use within the aviation sector exclusively, but they often partner with airlines to provide the service.

4.2.2 Gössling et al. estimated that in 2005 approximately 200 000 tonnes of offset credits (CO_2 equivalent) were purchased for the purpose of offsetting GHG emissions from aviation. The authors concluded that "the voluntary carbon offsetting market is thus, in volume terms, in an early development phase, with a growth factor of 400 needed to become significant — i.e. achieving a 10 percent reduction of GHG emissions from aviation."

4.2.3 Data on the volume of offset credits purchased to offset air travel are very limited. Two major airlines in Australia reported that in 2008, 10 to 12 per cent of their passengers took up the voluntary offset option. A recent survey by Ecosystem Marketplace indicates that 6 per cent of emitting activities their customers chose to offset in 2007 were business-related flights.[2] Ecosystem Marketplace research corresponds to a volume of 2.5 $MtCO_2e$. Compare this to Gössling et al. who estimated total carbon offsets in 2005 from all aviation-focussed voluntary carbon offsetting schemes

1. Stefan Gossling et al. "Voluntary Carbon Offsetting Schemes for Aviation: Efficiency, Credibility and Sustainable Tourism". *Journal of Sustainable Tourism*, Vol. 15, No. 3, 2007.
2. Katherine Hamilton et al., pp. 68–69.

to be a maximum of 0.2 $MtCO_2e$.[3] The escalation between 2005 and 2008 in the number of airlines offering offsetting to their customers may explain the increase in the total annual volume of emissions offset.

Note.— The Gössling survey may not include an exhaustive list of schemes in place.

4.2.4 The public's increased willingness to reduce and even neutralize its own carbon footprint has helped the offset market to expand. The rising demand for offset credits is fuelled by both individuals and businesses and has helped the global carbon market grow by a factor of over 1.5 from 2006 to 2007; that is, in 2006 the global market transacted an estimated value of USD 40 billion growing to USD 66 billion in 2007.[4] A larger carbon market creates more price stability and leads to many initiatives to streamline the creation of carbon credits to better ensure that the credits represent real verified reductions.

4.2 5 Another positive effect of the growing number of individuals and corporations buying offset credits on a voluntary basis is the signal of a growing willingness to pay and take responsibility for GHG emissions. This sends a message to governments about their citizens' concerns and support for action.

4.2.6 While survey results suggest a growing interest in offsets among air travelers, or the public at large being willing to take responsibility for the emissions they cause, in reality only a small percentage of airline customers purchase offset credits when purchasing tickets. This paradox is clear from the results of a Swedish survey from May 2009 in which participants were asked whether they would consider paying an extra 50 SEK (approximately $8 US) for a flight within Europe to offset the carbon dioxide emissions of their flight.[5] The survey showed that 86 per cent of respondents were willing to pay the extra cost to offset their emissions. Furthermore, 88 per cent answered that they thought the cost to offset the emissions should be included in the ticket price, while only 9 per cent answered that it should be up to the passengers to decide whether they wanted to participate in offsetting or not. In the same survey, 8 per cent of respondents said that they had actually paid to offset the carbon dioxide emissions from a flight. This may be explained in part by the significant cost of offsetting for greater distances. Also, customers may not believe that their individual actions matter relative to the total action needed. It should be noted that not all of the respondents travelled by aeroplane themselves.

4.2.7 In the SAS and Lufthansa study carried out in 2007 by Gössling et al., 2 per cent of all respondents stated that they had actually offset their emissions. Out of the 24 per cent that knew about carbon offsetting, only about 8 per cent actually compensated for the emissions associated with their flights, even though the number within this group was higher than the overall result. Among respondents with a previous understanding about offsetting, 51 per cent were willing to compensate future flights, while this share was 76 per cent in the group who previously did not know about the concept of offsetting. These figures seem to reflect a more negative attitude towards voluntary carbon offsetting among informed travellers, who tend to show more scepticism towards offsetting.

4.3 OFFSET PROJECT TYPES AND SOURCES OF OFFSETS

4.3.1 The most common offset project types supported by the airline offsetting programmes include bio energy, clean non-emitting electricity generation (e.g. wind, solar, hydro), and forest-based carbon sequestration.

4.3.2 Four of the 19 offset providers working with aviation companies in this study used only CERs while another four companies used a mix of CERs and VERs. The remaining 11 appear to have used a range of VERs, though the verification procedures were not always clear, and there was no accepted definition of a VER.

3. Stefan Gössling et al., p. 239.
4. Katherine Hamilton et al., p. 6.
5. SIFO Research International. "Aviation and the Environment." 8 May 2009.

4.4 USE OF RECOGNIZED STANDARDS AND VERIFICATION

The use of recognized standards for quantification and verification provides greater quality assurance of an offset credit. Greater uniformity in the quality of offset credits will allow customers to make an easier and more informed choice when shopping around for offset credits. The web-based survey of airline offsetting programmes indicates that nearly three quarters of the programmes (68 per cent) follow a recognized standard such as ISO, CDM or Gold Standard, and 63 per cent use either third party or independent verification. An increased uniformity in verification requirements could streamline the next generation of offset credits and increase the credibility of voluntary offsetting. Furthermore, using schemes that comply with relevant standards may also help to solve the problem of transparency by reducing the amount of information required to make an informed choice (cf. section 4.9).

4.5 USE AND MANAGEMENT OF SEQUESTRATION PROJECTS

4.5.1 Five of the studied airline offsetting programmes work with forestry sequestration project providers. Though some of these companies acknowledge the concerns around permanency, none have identified a means to address strategies related to the permanency of GHG removals from sequestration projects.

4.5.2 It is important to understand that forestry and agricultural carbon sequestration projects store carbon in the trees and soil, but this storage is not guaranteed to be permanent. Reversal events such as forest fires can cause previously stored carbon to be re-released into the atmosphere. Many offsetting programmes have inadequate provisions in place to manage carbon reversals. There is limited tracking of forestry projects to ensure the carbon is preserved in the sink, and when carbon is released, few programmes ensure an equivalent GHG reduction/removal occurs elsewhere. Since the residence time for carbon in the atmosphere is considered to be about 100 years, forestry projects must be guaranteed a lifespan in the same order to be equivalent to the amount of carbon emissions that are being or must be offset. Where a sequestration project is offered, it is important to consider how the forest is managed and the means in place to address risks of losing the sink. Criteria may include a review of how forest management contributes to sustainable development and whether the project provides a genuine “additional” benefit; that is, the projects would have taken place regardless of the financial incentive provided by the offset credit.

4.5.3 Unlike the Kyoto Protocol CDM initiative, some offset providers do not accept sequestration or other forestry-related offset projects. The CarbonNeutral Company, on the other hand, works with forestry projects and has a Science and Policy Background to Sequestration by Forestry document available at their website.[6]

4.6 CREDIT TRACKING SYSTEMS

4.6.1 Most of the airline companies do not have information about how the used carbon credits are tracked or registered. Without registration and tracking, the credits (or the reductions/removals from which they were created) may be sold more than once. In most cases this information is only available at the website of the offset provider. All CERs are tracked through national registries under the Kyoto Protocol, and Gold Standard VERs are tracked using the Gold Standard Registry. Beyond these two cases, it is not always easy, or even possible, to find information about how credits are tracked.

6. The CarbonNeutral Company. “Science and Policy Background to Sequestration by Forestry.” Version 1.1, September 2005. <http://www.carbonneutral.com/uploadedfiles/Sequestration per cent20by per cent20forestry-TCNC.pdf>

4.6.2 As more air carriers develop offsetting systems, the use of credits for offsetting becomes more common. Increase in the use of airline offset systems may increase the scrutiny of credit tracking both by the general public and by the airlines themselves. An increase in transparency and accountability could help strengthen offset credit tracking.

4.7 CARBON PRICES AND ADMINISTRATION COSTS

4.7.1 Most airlines provide a fair degree of transparency about the price of offsetting a flight. There is a huge variation between the price per tonne of CO_2 that customers can pay to offset their aviation emissions. In the 2008 MBMTF study, Delta was the cheapest with an approximate price of EUR 3.70 (approximately USD 5) per tonne of CO_2 for a domestic flight. Lufthansa and Swiss airlines were at the other end of the scale with a price of approximately EUR 19.5 (approximately USD 26) per tonne of CO_2. In addition, Lufthansa and Swiss add EUR 3 on amounts lower than EUR 20 to cover administration costs associated with the offsetting programme. This gives a factor of almost 6:1 between the highest and lowest price per tonne of offsetting flight emissions provided by the airlines. It is necessary to explain to customers why airlines choose to charge the amount they do, otherwise it could be very confusing for customers and lead to mistrust towards the whole system.

4.7.2 Seven of the 19 airline offset programmes studied provide information about the share of the purchase price that goes directly to offset projects. Both KLM and Virgin Blue claim that 100 per cent of the amount paid by their customers goes directly to the development of their clean energy offset projects. Among other offset providers, who provide information about the breakdown of the price paid for offsetting, typically 80–90 per cent of the cost goes to the project, with the remaining 10–20 per cent covering administrative costs.

4.8 COVERAGE OF NON-CO_2 CLIMATE IMPACTS

4.8.1 The airlines do not typically include possible effects of GHG emissions other than CO_2 to calculate the volume of offsets needed for a flight; however, Virgin Atlantic Airlines provides this option. A customer who orders offset credits has an option of paying more to “take into account other climate relevant emissions (not just CO_2)”. The CarbonNeutral Company sometimes offers their clients a choice — one offer claims to “save the CO_2 *equivalent* to the flight” and offers one price of the offset, and another offer claims to “save the same amount of CO_2 as your flight produces”. The difference in price between the two offers seems to be the result of a multiplier of approximately 1.9.

4.8.2 It is more common among offset provider organizations that also work with offsetting aviation emissions, such as myclimate, Atmosfair, the CarbonNeutral Company and Offsetters Climate Neutral Society, to use a multiplier on the CO_2 emissions to reflect what they argue is the total impact from aviation on the climate. On average they use a multiplier of two or three times the CO_2 emissions.

4.8.3 Most of the airlines clearly state that their offset schemes only account for carbon emissions. Some airlines say that the additional climate impact that aviation has is due to its emissions at high altitude, but they say that since research in this area is still very uncertain, they await better scientific results before including emissions other than CO_2.

4.8.4 It is widely recognized that the climate impact from aviation does not derive from CO_2 emissions alone. There are also impacts from nitrous oxide (NO_X) emissions, water vapour, creation of contrails and high cirrus clouds. However, there are significant uncertainties in the estimates of the magnitudes of these effects.

4.8.5 In response to ICAO's request, in 1999 the IPCC developed a special report on "Aviation and the Global Atmosphere",[7] which estimated the radiative forcing index (RFI) from aviation emissions in 1992 to be 2.7, with aviation's total contribution to RF being approximately 3.5 per cent. Based on more recent scientific knowledge, data in the 2007 IPCC Fourth Assessment Report shows an RFI of 1.9 for aviation emissions in 2005, and aviation's total contribution estimated at 3.0 per cent. It is important to note that the RFI metric was never intended to be a multiplier applied to CO_2 emissions in order to account for the effects of non-CO_2 gasses. RFI is a backward-looking metric and does not permit the evaluation of a future scenario.

4.8.6 There are other metrics, such as the global warming potential (GWP) and global temperature potential (GTP) that strive to overcome this limitation. However, in order to properly apply these metrics, the time horizon for the analysis needs to be determined and this depends on the question that the analysis intends to answer.

4.8.7 A weight factor has been suggested to account for the non-CO_2 effects of aviation. Based on today's knowledge, using a climate indicator similar to the GWP approach and the time horizon of (100 years) used in the Kyoto Protocol, the scaling factor has been estimated to be 1.2.[8] Based on this work, another group of scientists have estimated the factor to be 1.8 if the possible effects of cirrus clouds also are included.[9]

4.8.8 Many approaches are available for addressing the impact of aviation on climate change. The answer will depend heavily on the time perspective chosen and the indicators of the effect on the climate. By using a different approach with different climate indicators and time horizons, the estimates may change dramatically.[10] In recognition of the significant legal and budgetary considerations of choosing a methodology where scientific consensus has not yet been reached, the ICAO calculator only computes CO_2 at this time.

4.8.9 The climate impact of aviation is also discussed by Robert Sausen and Ulrich Schumann in the *ICAO Environmental Report 2007*. They conclude that "... proper methods to account for the climate effects of non-CO_2 effects have still to be established, and further research must be undertaken to reduce uncertainties."[11]

4.9 DEGREE OF TRANSPARENCY

4.9.1 To provide a cursory indication of the information provided to airline customers related to the offset initiative, a simple transparency metric was used in the MBMTF study that assigns a transparency score based on the percentage of questions our researchers were able to answer in our web survey. The following questions were scored: offset provider, type(s) of offset projects, source of offsets, use of a recognized standard, use of multiplier, verification approach, additionality criteria, sustainability, management of sequestration projects, uniqueness, information about carbon calculators, cost per tonne, percentage of fee that pays for the project vs. administrative cost, tonnes offset and money collected. A score of one was assigned for each subject area where information was provided, and a score of zero was assigned for each subject area where no information was provided.

7 . IPCC. J.E. Penner et al. (eds.). "Aviation and the Global Atmosphere." A Special Report of IPCC Working Groups I and III. Cambridge University Press, Cambridge, 1999.

8. P.M.D. Forster et al. "It Is Premature to Include Non-Co_2 Effects of Aviation In Emission Trading Systems." *Atmospheric Environment*, Vol. 40, Issue 6, 2006, pp. 1117–1121, and Vol. 41, Issue 18, 2007, p. 3941.

9. Avinor et al. "Aviation in Norway: Sustainability and Social Benefit." Oslo, 2008. <http://www.avinor.no/tridionimages/Aviationper cent20inper cent20Norwayper cent20Sustainabilityper cent20and per cent20social per cent20benefit_tcm181-51014.pdf>

10. Piers Forster and Helen Rogers. "Metrics for Comparison of Climate Impacts from Well Mixed Greenhouse Gases and Inhomogeneous Forcing Such as Those from UT/LS Ozone, Contrails and Contrail Cirrus." <http://www.faa.gov/about/office_org/headquarters_offices/aep/aviation_climate/media/ACCRI_SSWP_VII_Forster.pdf>

11. *ICAO Environmental Report 2007*, pp. 182–184.

4.9.2 According to the results of the web-based survey, the scores ranged from 20 to 85 per cent, reflecting a wide variation in details provided on the offsetting schemes.

4.9.3 In all cases, however, the information is quite limited, and it is difficult for customers to make an informed decision about the rigour and environmental integrity of the offsetting programme unless they are aware of recognized standards. Many offset providers lack transparency in terms of the source of offsets, the standards applied to create offsets, the procedures followed by the offset supplier, and the emissions calculator. As such, the customers in many cases have no certainty that their offsetting activity will fully compensate for the emissions generated by air travel.

Chapter 5

OPPORTUNITIES FOR OFFSETTING IN REGULATORY AND NON-REGULATORY CONTEXTS

5.1 INTRODUCTION

So far the only experience of offsetting in relation to aviation is in a non-regulatory context where the opportunity to voluntarily offset the emissions associated with their flight is offered to passengers. The rapid development of passenger-based offsetting in recent years provides an indication of the potential value for this kind of measure as a means of mitigating the effects of aviation emissions in the future. However, the opportunities for offsetting in the aviation sector could include any of the following:

a) passenger-based offsetting;

b) airline-based offsetting;

c) offsetting in the context of a regulatory emissions trading system; and

d) offsetting through an emissions charge.

5.2 PASSENGER-BASED OFFSETTING

5.2.1 On the positive side, it is clear that passenger-based offsetting reduces emissions if the offset covers full CO_2 costs of a flight, and the offset credits represent real and verified reductions. Furthermore, offsetting can educate consumers about the environmental consequences of aviation and the possible means to reduce emissions caused by aviation. In addition, non-regulatory passenger-based offsetting can stimulate the development of a carbon market. An efficient global carbon market that generates a global price for carbon is of key importance to reducing CO_2 emissions in a cost-efficient manner.

5.2.2 On the other hand, despite fast-growing offsetting activities in recent years, the actual willingness to purchase offset credits on a voluntary basis has been rather limited, and the demand varies significantly from passenger to passenger and from region to region. To address low participation an “opt-out” approach could be employed. Passengers purchasing tickets would be required to not take-up, or deselect, the offset purchase during a transaction. In addition, weaknesses with current offsetting activities could also be addressed including navigation problems on websites, lack of transparency about the source of credits, uncertainty regarding the permanency of GHG removals, and the lack of adequate verification in the generation of offset credits. If these shortcomings are adequately addressed, support of voluntary passenger offsetting is likely to increase.

5.3 AIRLINE-BASED OFFSETTING

5.3.1 In this report the discussion regarding offsetting in a non-regulatory context has focused on passengers. However, a more comprehensive coverage of emissions could be achieved if the initiative or responsibility to voluntarily offset emissions is transferred from the passenger to the airline; that is, aviation operators could choose to purchase offsets by incorporating the cost of offsetting into the ticket price, e.g. placing a surcharge on tickets, or from other sources of revenue.

5.3.2 It is up to airline management rather than passengers to decide to what degree emissions should be offset. Voluntary airline-based offsetting may also lead to the development of voluntary ETS.

5.3.3 The most important argument against the approach to mitigating climate effects is its voluntary nature. Airlines may choose not to offset their emissions in order to save money and increase market share on the assumption that consumers will choose lower prices over environmental responsibility.

5.4 OFFSETTING IN THE CONTEXT OF A REGULATORY EMISSIONS TRADING SYSTEM

5.4.1 Another option for managing emissions from the aviation sector would be by means of a regulated cap on emissions that allows for emissions trading, including the use of offset credits. Such a system is about to be implemented in the EU where emissions from aviation will be included in the EU ETS beginning in 2012.

5.4.2 As long as there is no global emissions cap covering all nations and sectors, which more or less will always be the case, there will be an offsetting potential within the emissions trading system. Offsetting will be one of several options to comply with the obligations that may apply to the aviation sector. It is expected that access to offsetting would be of great benefit to the aviation sector faced with high reduction costs and may benefit society as a whole in providing cost-efficient emissions reductions.

5.4.3 Existing criticisms of offsetting could be a barrier to extensive application of offsetting in a regulatory context. Concerns about the creation of credible offset credits (for example, demonstrating that the reductions would not have occurred without the incentive provided by the credit) and political views on the importance of “domestic” emissions reductions in preference to credit-based reductions are examples of such criticisms. Some of these issues are touched upon in the linking report.[1] For example, it is noted that in the EU-ETS aviation can only offset up to 15 per cent of its emissions in the year 2012.

5.4.4 If aviation were to be included in a regulatory system, questions might arise as to the role of non-regulatory passenger-based offsetting. One view is that offsetting by passengers should lead to relief of the airline’s obligation. If 15 per cent of an airline’s emissions is being offset voluntarily by passengers, the emissions cap or obligation should be reduced by an equivalent number to avoid having two sets of reductions for the same emissions. However, if voluntary offsetting by passengers were to be deducted from an airline’s obligations in a regulated context, it would in effect represent a transfer of wealth from the passenger to the airline without any added effect on reducing emissions. Furthermore, there would have to be some sort of control to ensure that the voluntary offsetting from passengers actually took place and that the offset credits used indeed represented real reductions.

1. ICAO. *Scoping Study of Issues Related to Linking “Open” Emissions Trading Systems Involving International Aviation.* (Doc 9949 in preparation).

5.4.5 An opposite view is that any voluntary offsetting from passengers should be additional to the airline's obligations in a regulated context, even if this theoretically were to result in the emissions from a specific flight becoming neutral or even negative. The argument is that passengers who decide to offset their emissions presumably do so with the intent to achieve incremental real emissions reductions.

5.5 OFFSETTING FUNDED BY AN EMISSIONS CHARGE

5.5.1 As offsetting in a non-regulated context has uncertain environmental outcomes and regulatory emissions trading systems can be administratively complex, a hybrid approach can be considered which could achieve specific environmental outcomes. The approach would involve imposing a charge on fuel uplifted by international flights departing a State/region and using the revenue generated to fund the purchase of offset credits that meet agreed criteria.

5.5.2 The first steps would be to project absolute emissions from international aviation in the particular State/region and determine a net emissions reduction goal (from the absolute level) and a timeframe for achieving this goal. It would then be possible to assess the cost of offset credits necessary to achieve the required emissions reduction. A charge on fuel uplifted would be calculated on the basis of funding the necessary offset over a specific timeframe. For maximum efficiency the level of the charge and the identification of offset credits would be determined on a global basis though this is not essential. Verification to confirm that the revenue had been spent on obtaining the appropriate number of internationally accepted offset credits would be required.

5.5.3 Advantages of this approach include practical, transparent and relatively straight forward administration; avoidance of commercial distortions between competing air carriers while rewarding efficiency; potential for global application; and the purchase of offset credits could be targeted to developing countries thereby assisting in effort sharing among countries.

— END —

ISBN 978-92-9231-768-3