

INTERNATIONAL CIVIL
AVIATION ORGANIZATION



REPORT ON VOLUNTARY EMISSIONS
TRADING FOR AVIATION
(VETS REPORT)

REPORT

Approved by the Secretary General
and published under his authority

INTERNATIONAL CIVIL
AVIATION ORGANIZATION



REPORT ON VOLUNTARY EMISSIONS
TRADING FOR AVIATION
(VETS REPORT)

REPORT

Approved by the Secretary General
and published under his authority

Published in English 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 9950, *Report on voluntary emissions
trading for aviation (VETS Report)***

Order Number: 9950

ISBN 978-92-9231-671-6

© ICAO 2010

All rights reserved. No part of this publication may be reproduced, stored in a
retrieval system or transmitted in any form or by any means, without prior
permission in writing from the International Civil Aviation Organization.

TABLE OF CONTENTS

CHAPTER 1	VOLUNTARY EMISSIONS TRADING CONCEPTS	- 6 -
1.1	INTRODUCTION	- 6 -
1.1.1	Discussions in ICAO CAEP	- 6 -
1.1.2	Aviation's role in the global economy	- 6 -
1.1.3	Climate impact	- 7 -
1.1.4	International regulatory framework	- 8 -
1.2	VOLUNTARY EMISSIONS TRADING EXPLAINED	- 8 -
1.2.1	Rationale behind emissions trading	- 8 -
1.2.2	Description of voluntary emissions trading	- 9 -
1.2.3	Key considerations	- 10 -
1.2.4	Opportunities for airlines created by voluntary emissions trading	- 11 -
CHAPTER 2	EXISTING & RECENT VOLUNTARY EMISSIONS TRADING SCHEMES	- 12 -
2.1	UK EMISSIONS TRADING SCHEME (UK ETS)	- 12 -
2.1.1	Overview	- 12 -
2.1.2	Participants and incentives	- 13 -
2.1.3	Identifying emissions sources and calculating a Baseline	- 13 -
2.1.4	Allocation of allowances	- 14 -
2.1.5	Trading of allowances	- 14 -
2.1.6	Reporting, verification and compliance	- 14 -
2.1.7	Results	- 15 -
2.2	JAPAN'S VOLUNTARY EMISSIONS TRADING SCHEME (JVETS)	- 15 -
2.2.1	Overview	- 15 -
2.2.2	Participants and incentives – first phase	- 16 -
2.2.3	Calculating baseline emissions and emission reductions – first phase	- 16 -
2.2.4	Allocation of allowances – first phase	- 16 -
2.2.5	Trading allowances – first phase	- 17 -
2.2.6	Reporting, verification and compliance – first phase	- 17 -
2.2.7	Results – first phase	- 17 -
2.2.8	Second phase of JVETS	- 17 -
2.3	TRIAL VOLUNTARY EMISSIONS TRADING SCHEME IN JAPAN (2008 - 2012)	- 17 -
2.3.1	Overview	- 17 -
2.3.2	Participants	- 18 -
2.3.3	Airline participation	- 18 -
2.3.4	Results	- 18 -

2.4	SWITZERLAND'S VOLUNTARY EMISSIONS TRADING SCHEME	- 18 -
2.4.1	Overview	- 18 -
2.4.2	Participants and incentives	- 19 -
2.4.3	Calculating baseline emissions and emissions reductions	- 19 -
2.4.4	Allocation of allowances	- 19 -
2.4.5	Trading of allowances	- 19 -
2.4.6	Reporting verification and compliance	- 20 -
2.4.7	Results	- 20 -
2.4.8	Future prospects	- 20 -
2.5	CHICAGO CLIMATE EXCHANGE (CCX)	- 20 -
2.5.1	Overview	- 20 -
2.5.2	Participants and incentives	- 21 -
2.5.3	Identifying emissions sources, calculating baselines and setting emission reduction targets	- 22 -
2.5.4	Emission offsets	- 23 -
2.5.5	Allocation of allowances and offsets	- 23 -
2.5.6	Trading of allowances and offsets	- 24 -
2.5.7	Reporting, verification and compliance	- 24 -
2.5.8	Results	- 25 -
2.6	EUROPEAN CLIMATE EXCHANGE (ECX)	- 25 -
2.6.1	Overview	- 25 -
2.7	MONTREAL CLIMATE EXCHANGE (MCEX)	- 25 -
2.7.1	Overview	- 25 -
2.8	ASIA CARBON EXCHANGE (ACX-CHANGE)	- 25 -
2.8.1	Overview	- 25 -
2.9	AUSTRALIAN CLIMATE EXCHANGE (ACX)	- 26 -
2.9.1	Overview	- 26 -
	CHAPTER 3 FUTURE DEVELOPMENT OF VOLUNTARY EMISSIONS TRADING SCHEMES INVOLVING AVIATION	- 27 -
3.1	INTRODUCTION	- 27 -
3.2	PARTICIPATION IN AN EXISTING VOLUNTARY EMISSIONS TRADING SCHEME	- 27 -
3.3	DEVELOPMENT OF VOLUNTARY AGREEMENTS AS A PRECURSOR TO AN EMISSIONS TRADING SYSTEM	- 28 -

3.4	ESTABLISHMENT OF A VOLUNTARY EMISSIONS TRADING SCHEME FOR AVIATION	- 28 -
3.4.1	Commonalities between voluntary and mandatory emissions trading schemes	- 28 -
3.4.2	Differences between voluntary and mandatory emissions trading schemes	- 30 -
3.5	HOW VOLUNTARY EMISSIONS TRADING FOR AVIATION COULD DEVELOP	- 31 -
3.6	ROLE OF ICAO	- 31 -
3.7	FURTHER INFORMATION	- 31 -
	GLOSSARY	- 32 -
	APPENDIX A	- 37 -

CHAPTER 1 VOLUNTARY EMISSIONS TRADING CONCEPTS

1.1 Introduction

1.1.1 Discussions in ICAO CAEP

In evaluating alternative approaches to addressing aviation's impact on the global climate, ICAO's Committee on Aviation Environmental Protection (CAEP) concluded that, relative to other market-based measures, an emissions-trading system would be a cost-effective measure to limit or reduce CO₂ emitted by civil aviation in the long term, provided that the system is an open one across economic sectors¹.

The 33rd ICAO Assembly (2001) endorsed the "development of an open emissions trading system for international aviation" and "requested the Council to develop as a matter of priority the guidelines for open emissions trading for international aviation, focusing on establishing the structural and legal basis for aviation's participation in an open trading system, and including key elements such as reporting, monitoring, and compliance, while providing flexibility to the maximum extent possible consistent with the UNFCCC process."

Subsequently, at its 35th Assembly (2004), ICAO endorsed the "further development of an open emissions trading system for international aviation" and requested the Council, in its further work on this subject, to focus on two approaches, namely to "support the development of a voluntary trading system that interested Contracting States and international organizations might propose" and to "provide guidance for use by Contracting States, as appropriate, to incorporate emissions from international aviation into Contracting States' emissions trading schemes consistent with the UNFCCC process".

Under both approaches, the Council was instructed to ensure that the guidelines for an open emissions trading system address the structural and legal basis for aviation's participation in an open emissions trading system, including for example key elements such as reporting, monitoring and compliance.

The preliminary edition of this report was developed for CAEP by its Emissions Trading Task Force in response to the request to the Council to support the development of a voluntary trading system that interested Contracting States and international organizations might propose. This revised edition was prepared for CAEP by the Market-Based Measures Task Force which was established at the CAEP/7 meeting in February 2007.

1.1.2 Aviation's role in the global economy

Aviation plays a vital role in facilitating economic growth, particularly in developing countries. It provides the only rapid worldwide transportation network, and transports about 2.2 billion passengers annually, as well as 35% of all international trade in goods (by value). According to industry sources², its global economic impact is estimated at US\$ 3,560 billion (equivalent to 7.5% of world Gross Domestic Product (GDP)) while generating a total of 32 million jobs globally.

¹ "Market-Based Measures:" Report from Working Group 5 to the fifth meeting of the Committee on Aviation Environmental Protection. CAEP/5-IP/22. 5/01/01.

² ATAG (2008). The Economic and Social Benefits of Air Transport 2008.

The demand for air transport has increased steadily over the years. Passenger numbers have grown by 45% over the last decade and have more than doubled since the mid-1980s. Freight traffic has increased even more rapidly, by over 80% on a tonne-kilometre performed basis over the last decade and almost three-fold since the mid-1980s.

1.1.3 Climate impact

Inclusion of aviation in an emissions trading system would require a decision regarding aviation emissions to be covered by the scheme.

The primary direct greenhouse gas emissions of aircraft are carbon dioxide (CO₂) and water vapour (H₂O). Other emissions are oxides of nitrogen (NO_x), particles containing sulphur oxides (SO_x) and soot. The total amount of aviation fuel burned, as well as the total emissions of carbon dioxide, NO_x, and water vapour by aircraft, are well known relative to other parameters such as aerosols. These gases and particles alter the concentration of ozone (O₃) and methane (CH₄), may trigger formation of condensation trails (contrails), and may increase cirrus cloudiness – all of which may contribute to climate change.

According to estimates produced in the IPCC aviation report (1999), the overall radiative forcing from aircraft effects (excluding that from changes in cirrus clouds) in 1992 was a factor of 2.7 larger than the forcing by aircraft carbon dioxide alone³. The IPCC concluded that there were varying levels of scientific understanding (e.g. ranging from “very poor” in the case of cirrus to “good” for CO₂⁴) associated with these effects. Further research into such non-CO₂ effects is ongoing. The IPCC, in its fourth assessment report released in 2007, referred to more recent studies by Sausen et al. (2005) which estimated total aviation radiative forcing for the year 2000 of 47.8 mW/m² compared with a radiative forcing for CO₂ alone of 25.3 mW/m² giving a radiative forcing index of about 1.9. These radiative forcings represent the best estimate of the effects of aviation on climate for the reported year, i.e. 1992 and 2000. However, for aviation’s past, present or future emissions, the radiative forcing index should not be used to derive relationships between emissions and marginal changes in climate, as the Global Warming Potential (GWP) is intended to do.

The Global Warming Potential (GWP) metric was developed by the IPCC, to compare the climate impacts of changes on emissions of long lived well mixed gases to that of CO₂ over a specific time horizon. It is used by the UNFCCC process in establishing emissions equivalencies for emissions reduction targets and activities. CO₂ impacts from aviation are the longest lived and most well defined and are readily defined in terms of GWP. Formulating GWPs from non-CO₂ effects from aviation has conceptual difficulties and the IPCC (1999) stated that such GWPs were not adequate to describe the climate impacts of aviation (see IPCC, 1999 Chapter 6 section 6.2.2).

For further information on emissions from the aviation sector please refer to the most current IPCC Assessment Report and the IPCC Special Report on Aviation and the Global Atmosphere.

³ The so-called RFI or radiative forcing index, is defined by the IPCC 1999 report as the sum of all the forcings divided by the CO₂ forcing (chapter 6 paragraph 6.2.3).

⁴ For further details see the 1999 IPCC Special report on Aviation and the Global Atmosphere and the 2001 IPCC Third Assessment Report (TAR).

1.1.4 **International regulatory framework**

The United Nations Framework Convention on Climate Change (UNFCCC), adopted at the Rio Earth Summit in 1992, aims to stabilize greenhouse gas concentrations in the global atmosphere. Under the UNFCCC, industrialized countries (named “Annex I Parties”) shall adopt national policies and take corresponding measures on the mitigation of climate change by limiting their greenhouse gas emissions.

The UNFCCC is supplemented by the Kyoto Protocol of December 1997 which requires participating Annex I Parties to reduce their overall emissions of greenhouse gases by at least 5% below 1990 levels in the period 2008-2012, in accordance with the quantified emissions limitation/reduction commitments (QELRCs) as assigned to each of them individually in Annex B of the Protocol.

Parties’ commitments under the Kyoto Protocol include emissions from domestic aviation, but emissions from international flights are not currently included. Article 2.2 of the Protocol states that “[T]he Parties included in Annex I shall pursue limitation or reduction of emissions of greenhouse gases (...) from aviation and marine bunker fuels, working through the International Civil Aviation Organization and the International Maritime Organization, respectively”.

Although non-Annex I Parties have no quantified obligations under the Kyoto Protocol, all Parties to the UNFCCC are called upon to take mitigation and adaptation measures, within the confines of their respective capabilities⁵.

Voluntary participation in emissions trading schemes is equally relevant to Annex I and non-Annex I Parties and may be considered as a cost-effective complement to technology transfer and other mechanisms to reduce fuel consumption and increase resource efficiency.

1.2 **Voluntary emissions trading explained**

1.2.1 **Rationale behind emissions trading**

Emissions trading is a market-based policy tool that can be used to promote economic efficiency in achieving environmental goals. By harnessing market forces, emissions trading regimes can create incentives for economic agents to discover and implement cost-effective approaches to complying with environmental targets.

The basic argument for using emissions trading as an environmental policy tool relates to the potential costs saving a trading system can generate relative to a conventional command and control approach. In particular, when regulated entities are allowed to buy and sell emission instruments, market forces can create an incentive for firms with relatively low-cost emission reduction options to reduce their emissions by more than needed to satisfy their regulatory requirements.

These entities are then able to sell surplus emission instruments to other regulated firms that are faced with relatively high-cost emission control options. The opportunity to sell surplus emission instruments can create incentives for cost-effective compliance with environmental targets. As a

⁵ See Article 4 UNFCCC.

result, incorporating an emissions trading system into an environmental policy can mean that the same level of environmental protection can be achieved at a lower overall cost. Care must be taken, however, that the savings in mitigation costs across all participants are large enough to more than offset the combined administrative and transactions costs.

1.2.2 Description of voluntary emissions trading

Various interpretations exist as to what is meant by voluntary emissions trading and specifically what is meant by the term 'voluntary'. According to the Organization for Economic Co-operation and Development (OECD), for example, there are many different examples of voluntary initiatives, ranging from unilateral actions at the company level to negotiated agreements between governments and sectors⁶. The OECD also points to different ways in which voluntary programs can be combined with other measures such as taxes (most commonly involving some exemption), subsidies or standards. In practice, many voluntary agreements are in fact combined with some sort of incentive measure.

This report defines a voluntary trading scheme as any scheme in which participation is not made mandatory by a State. Schemes that involve some kind of government incentive for companies to participate therefore also fall under this definition. For the purpose of this report, voluntary emissions trading for international aviation is considered to be one of the following:

1. a group of airlines decides to create its own ETS

For example, airline alliance partners set up an ETS among themselves. This would be a sectoral trading system that could be designed in a way that would allow participants to purchase offsets outside the scheme in order to keep costs down.

2. the airline sector creates a new ETS together with other sectors

For example, members of a national air transport association get together with the national electricity companies and agricultural sector to establish and participate in a national emissions trading scheme.

3. an airline/a group of airlines decides to unilaterally join an existing ETS

- a) run by own government*
- b) run by other government(s)*
- c) run by a commercial entity*

For example, as part of national efforts to drive technology efficiency and reduce emissions, a group of national airlines choose to participate in a trading scheme a) administered by its own government; or b) run in a neighboring State; or c) run by an independent trading platform.

Under these scenarios, the money paid by those buying allowances helps to finance the development and/or implementation of CO₂ control measures by others who are selling the allowances. In addition to these options, more direct mechanisms may also be considered, for example:

⁶ See OECD (2003) *Voluntary approaches for environmental policy- effectiveness, efficiency and usage in policy mixes*, and OECD (1999) *Voluntary Approaches for environment policy: an assessment*, OECD, Paris.

4. *an airline/a group of airlines decides to compensate for carbon emissions by using an offset mechanism*

a) *run by the airline(s) itself (possibly as an option for passengers/customers)*

b) *run by an independent service provider.*

While the preliminary edition of this report contained a description and discussion of carbon offset schemes, that material and further examination of offset schemes has been superseded by the report, '*Offsetting Emissions from the Aviation Sector*' prepared for CAEP by the Market-Based Measures Task Force.

1.2.3 Key considerations

A number of considerations are key in designing a workable and credible voluntary trading scheme. These include:

- ***Environmental results***—how stringent are the environmental targets, with what degree of certainty are these results achieved, how likely are entities to participate and how broad is the emissions coverage under the agreement, and what factors might undermine achieving the environmental results⁷;
- ***Flexibility***—does the approach offer sufficient flexibility to ensure environmental benefits while allowing for economic growth within the sector and does it enable participants to take those actions that will most effectively reduce emissions and to encourage innovation in emissions reduction;
- ***Administrative & transaction costs***—how costly will requirements of the system be for the central administrative body and other entities (incl. the government) to administer and enforce, and how expensive will it be for entities to participate in the broad range of activities (such as monitoring and verification, reporting, and trading);
- ***Transparency***—how complex will the administration of the scheme be, how complex will it be for entities to participate in the scheme (incl. monitoring, verification, reporting and trading) and how transparent will the scheme be for third party stakeholders;
- ***Overall cost and cost-effectiveness***—does the option have adverse effects on the cost-effectiveness (i.e., the cost per tonne of CO₂ reduced) of control, or on overall control costs (i.e., the total costs of abatement plus purchase/sale of emission allowances and/or credits) for the aviation sector (domestic or international);
- ***Competitiveness***—how will the design of a trading scheme affect the competitive positions of participants and non-participants within the aviation sector, and between aviation and other transportation modes;

⁷ OECD assessment of voluntary initiatives in environmental policy concludes that their environmental effectiveness and economic efficiency is generally low compared to other approaches, but when measured against other criteria (so called 'soft' criteria) such as awareness raising they have been seen to have a very important role. See *supra* note 7.

- ***Interactions with other mitigation options***—what types of issues arise regarding compatibility or conflicts with other policy instruments (standards, taxes, charges, other trading schemes, etc.) that exist or are being considered to address greenhouse gas emissions from aviation. Measures should not detract from other efforts to improve overall environmental performance;
- ***Political acceptability***—how will the trading scheme be viewed by the relevant stakeholders, including airlines and other industry actors that have an influence on aviation emissions but are not direct participants in the agreement (e.g. engine manufacturers, air traffic controllers), governmental and non-governmental bodies, etc.

1.2.4 Opportunities for airlines created by voluntary emissions trading

There are a number of reasons why voluntary emissions trading schemes may provide a helpful option for addressing aviation emissions, particularly from international flights.

1.2.4.1 Flexibility

Voluntary trading schemes are not necessarily constrained by the framework of international agreements. This could allow early action under a voluntary framework while discussions on a possible mandatory approach are ongoing. It could also allow action that is broadly inclusive.

1.2.4.2 Cost containment

Successful voluntary measures can help to minimise costs, especially compared with the perceived cost of regulatory actions. As the action that needs to be taken to achieve a reduction target becomes more costly – approaching the cost of potential “command and control” regulations – the incentive to pursue voluntary trading diminishes. Therefore, successful voluntary measures should be cost-effective and have low administrative and transactions costs.

1.2.4.3 Competitiveness

Voluntary trading has potential to attract broad geographic participation by States and airlines. If the system attracts broad geographic participation, and since airlines are unlikely to join if they anticipate doing so will significantly hamper their ability to compete, competitive impacts are likely to be small.

1.2.4.4 Learning by doing

For companies not involved in mandatory trading schemes, a key benefit of voluntary trading might derive from “learning-by-doing” and from “institutional capacity building” within the airline sector. Starting out with a voluntary trading regime offers the important advantage of allowing participants the opportunity to develop skills and learn trading strategies that may be useful as emissions trading develops in the future. Voluntary emissions trading can be a step toward demonstrating to governments and the public that global warming concerns are being addressed responsibly.

The next chapter describes some examples of voluntary emissions trading schemes for greenhouse gases in which aviation participates or could participate.

CHAPTER 2 EXISTING & RECENT VOLUNTARY EMISSIONS TRADING SCHEMES

At the present time there are only a handful of examples around the world of voluntary emissions trading schemes for greenhouse gases. Only two of these trading schemes have included the activities of an airline operator. While the overall contribution of these schemes to global emissions reduction is small at present, the potential exists for this contribution to multiply over time if more schemes are developed.

This chapter summarises the key elements of the following voluntary schemes:

- United Kingdom Emissions Trading Scheme;
- Japan's Voluntary Emissions Trading Scheme (JVETS);
- Trial Voluntary Emissions Trading Scheme in Japan (2008-2012);
- Switzerland's Voluntary Emissions Trading Scheme;
- Chicago Climate Exchange (with reference to the European Climate Exchange and the Montreal Climate Exchange);
- Asia Carbon Exchange; and
- Australian Climate Exchange.

2.1 UK Emissions Trading Scheme (UK ETS)

2.1.1 Overview

The UK ETS for greenhouse gases was launched by the Government in April 2002 as part of a wider range of measures in the UK designed to reduce greenhouse gas emissions under the UK Climate Change Programme. At the launch, it was claimed to be the world's first economy-wide greenhouse gas trading system.

A range of organisations, including British Airways as the only airline operator (domestic operations only), voluntarily undertook to reduce their emission of carbon dioxide equivalent (CO₂e) to below set targets. In return, these organisations (Direct Participants) received incentive payments totalling £215 million from the Government. Over the lifetime of the scheme (2002-2006), almost 12 million tonnes of CO₂e emissions releases were to have been avoided. The UK ETS ended in December 2006 with final reconciliation completed in March 2007.

The scheme was also open to the companies with Climate Change Agreements with the Government. These negotiated agreements set energy-related targets and companies meeting their targets received an 80% discount from the Climate Change Levy, a tax on the business use of energy. These companies could use the scheme either to buy allowances to meet their targets, or to sell any over-achievement of these targets. In addition, anyone could open an account on the registry to buy and sell allowances.

Transaction log data for the scheme indicated that there were over 9,000 transactions in the period

from the commencement of the scheme to 31 March 2006⁸. Trades constituted almost 40% of all transactions, with allocations, retirements and cancellations constituting around 40% and the remaining 20% being intra-group transfers.

It was reported that over the lifetime of the scheme (2002 - 2006), Direct Participants achieved emissions reductions totalling 7.2 million tonnes of CO₂e.

2.1.2 Participants and incentives

Entry into the scheme was voluntary and open to all individuals or organisations in the UK. There are two principal types of participants - Direct Participants and Agreement Participants.

Direct Participants are organisations that agreed to take on voluntary targets for a five-year period, 2002-2006, in exchange for financial incentives provided by the Government. Thirty-three such organisations, including British Airways, committed to reduce their annual emissions against 1998-2000 levels by 3.96 million tonnes of CO₂e by the end of the scheme in 2006. In addition to fulfilling the total annual reduction target by 2006, Direct Participants had to comply with interim targets for years 2002-2005. Each year, the reduction target was increased by one-fifth of the overall (2006) target. As a result, the original commitment made by Direct Participants equated to delivering 11.88 (that is, $(1/5+2/5+3/5+4/5+5/5) \times 3.96$) million tonnes of CO₂e worth of cumulative emissions releases avoided over the lifetime of the scheme.

As an incentive, the Direct Participants received a total of £215 million in payments from the Government over 5 years or approximately £43 million (£30 million after tax) per year. The level of incentive payment and the associated targets for each Direct Participant were set through a competitive bidding process.

Agreement Participants were those 6000 companies which already had emission or energy targets set through Climate Change Agreements with the Government. Companies meeting these targets received an 80% discount from the Climate Change Levy, which is a tax on the business use of energy. These companies could use the scheme either to buy allowances to meet their targets, or to sell any over-achievement of these targets.

In addition to these participants, the UK ETS allowed other parties to participate in the scheme as traders without compliance commitments.

2.1.3 Identifying emissions sources and calculating a Baseline

The Baseline for each Direct Participant was calculated on the basis of historic emission levels and was generally the average annual emissions in the three years up to and including 2000.

The Baseline was made up of emissions from individual sources, which Direct Participants had to list by way of an approved protocol. The total emissions calculated using the approved protocol formed the Baseline expressed in tonnes of carbon dioxide equivalent (tCO₂e). Emissions included both direct emissions such as those from fossil fuel combustion or other industrial processes, and indirect emissions associated with energy use.

The Scheme made provision for adjustments to the Baseline to take account of changes in the

⁸ Appraisal of Years 1-4 of the UK Emissions Trading Scheme – a report by ENVIROS Consulting Limited for the UK Department for Environment, Food and Rural Affairs, December 2006.

structure or operations of a Direct Participant.

2.1.4 Allocation of allowances

For Direct Participants, a ‘descending clock’ auction was used to allocate the incentive money and the associated targets for emission reductions. Auction participants bid amounts of emission reductions in response to prices for tCO₂e announced by the Department for the Environment, Food & Rural Affairs (DEFRA), starting at a nominal £100. Companies submitted new bids in response to successively lower prices for tCO₂e until the total incentive payment implied was no more than the incentive budget of £215 million. This process gave a final price of £53.73 per tCO₂e reduction in 2006.

Because participants were required to make progressively larger reductions in each year of the Scheme, the 2006 reductions relative to the Baseline represented one-third of the cumulative total reductions from 2002-2006. The final price of £53.73 therefore corresponded to £17.79 per tCO₂e of cumulative reductions over the life of the Scheme, or £12.45 per reduction tCO₂e net of the maximum corporation tax due on the incentive payments.

The thirty-three Direct Participants pledged emissions reductions totalling 3.96 million tCO₂e in 2006, which is equivalent to 11.88 million tCO₂e of cumulative emissions releases avoided in total over the life of the Scheme. The 2006 target corresponded to a 13% reduction from verified baseline emissions.

Direct Participants were subject to a ‘cap and trade’ emissions trading system. They were allocated allowances equal to the target for each year, provided they had been in compliance in the previous year. At the end of each compliance year, Direct Participants had to reconcile their verified emissions against their allowances and undertake any further trading necessary to meet their target.

Companies entering the Scheme through the Climate Change Agreements participated in a ‘baseline and credit’ trading system. They did not receive allowances up front. At the end of each year in which they had targets, they received allowances if they had beaten their target, or they were able to buy additional allowances if they had not beaten their target.

2.1.5 Trading of allowances

A computerised registry was the centralised means of managing all transactions. Anyone wanting to hold, buy or sell allowances or credits had to have an account in the registry. The registry recorded all allowance holdings and tracked allowances from their initial allocation through all transfers of ownership until final cancellation or retirement.

Anyone holding an account in the registry was allowed to buy and sell allowances. Participants in the scheme were able to trade directly between themselves or through third party brokers.

2.1.6 Reporting, verification and compliance

At the end of each compliance period (calendar years for Direct Participants and every two years for Agreement Participants), target holders reported their emissions over that period. All target holders had to ensure that they either held sufficient allowances to cover their verified emissions (for Direct Participants), or that they held sufficient allowances to cover any emissions or energy

use in excess of their target (for Agreement Participants).

A three-month reconciliation period was allowed following each compliance period to enable participants to continue trading if required before a final deadline. After this, the Government checked the total holdings in each participant's account and all allowances needed to cover emissions over the preceding year were retired. Any allowances that remained could be banked for future use or sold.

Penalty provisions applied for non-compliance which were intended to be sufficiently strong to ensure the scheme operates effectively but not disproportionate for a voluntary scheme. For Direct Participants penalties could include financial penalties, non-payment of the financial incentive and a reduction in the number of allowances for the next compliance period. There was also the option for the Government to publicly list those Direct Participants who failed to hold sufficient allowances at the end of the reconciliation period. For Agreement Participants, the penalty was the removal of the 80% discount on the Climate Change Levy.

2.1.7 Results

British Airways operated successfully within the UK ETS, meeting the reporting and verification requirements of the scheme, and keeping within its agreed emissions cap. Successful participation was greatly helped by agreeing a protocol with the UK government, which dealt with the key issues of monitoring and measuring emissions from mobile sources.

British Airways reported that participation in the UK ETS had brought valuable experience of operating with an emissions trading scheme. In addition to making cuts in CO₂ emissions and associated energy costs, the scheme has led to improvement in data accuracy and energy management information in a number of areas of operation.

The airline also cited a number of strategic benefits from participation in the scheme:

- Exposure to the concept within the business by taking into account the price of carbon in network planning decisions within its domestic network and integrating emissions trading into fuel hedging and financial management activities;
- Gaining experience of the processes and strategic implications, including the reporting of verifiable emissions data and credit trading; and
- Demonstration that emissions trading is a deliverable and practical policy tool for managing air transport emissions.

2.2 Japan's Voluntary Emissions Trading Scheme (JVETS)

2.2.1 Overview

In May 2005, the Ministry of the Environment launched the first phase of Japan's Voluntary Emissions Trading Scheme (JVETS). Under the scheme, the Ministry subsidised the installation of emissions reduction equipment for selected participants who made a commitment to specific reductions in their CO₂ emissions. The scheme also allowed these participants to trade CO₂

emission quotas to meet their reduction targets. The total emissions reductions for fiscal year (FY) 2006 were forecast to be almost 0.28 million tCO₂, while the total reduction over the officially-recognised service life of the subsidised equipment was calculated at about 3.8 million tCO₂. The actual emissions reduction achieved for FY2006 was 0.38 million tCO₂.

A second phase of JVETS was implemented for FY2007.

The main purpose of the scheme was to achieve a cost-effective and substantial reduction in greenhouse gas emissions and to accumulate knowledge and experience relating to domestic CO₂ emissions trading.

A graphic illustration of the scheme is provided in Appendix A to this report.

2.2.2 Participants and incentives – first phase

An open invitation was made to private companies and other appropriate groups in Japan to participate in the JVETS. Of the thirty-eight entities that applied, thirty-one companies and corporate groups were selected to participate based on the cost effectiveness of their emissions reduction proposals. In return for adopting specific emissions reduction targets, these thirty-one participants became eligible for Government subsidies for the installation of the emissions reduction equipment. Subsidies were only available for new facilities to improve energy efficiency or to promote renewable energy leading to greenhouse emissions reduction. The subsidies were capped at one third of the cost of installation involved and 200 million yen for each site. The total Government budget for the subsidies was about 3 billion yen (about US\$ 27.2 million) for the first phase and 2.76 billion yen (about US\$ 25.1 million) for the second phase.

The scheme provided for trading by the participants as required to meet their emissions reduction targets. There was also provision for ‘trading participants’ who were able to operate trading accounts but who were not eligible for subsidies or the allocation of allowances. Eight companies were selected as trading participants.

2.2.3 Calculating baseline emissions and emission reductions – first phase

The calculation of baseline emissions for each participant was based on their average annual CO₂ emissions between 2002 and 2004. For the thirty-one participants involved this equated to a total of over 1.3 million tCO₂. The total emissions reductions promised by the individual companies for FY2006 was almost 0.27 million tCO₂, or 21% of their average annual CO₂ emissions in the base years. The total reduction over the officially recognised service life of the subsidised equipment was calculated at about 3.8 million tCO₂.

Participants received subsidies for new facilities and their installation during FY2005. The new facilities were to be set-up before the end of FY2005 (end March 2006) and the calculation of base year emissions also had to be completed by November 2005.

Base year emissions for all participants were verified by a Ministry accredited verification entity.

2.2.4 Allocation of allowances – first phase

The Ministry of the Environment allocated emissions quotas based on the results of the base years verification process. The allocation for each participant was the average emissions for the base

years minus the estimated or pledged emission amount for FY2006.

2.2.5 Trading allowances – first phase

Throughout FY2006, participants implemented their CO₂ reduction projects using the newly installed equipment. Participants were able to trade their allowance throughout FY2006 which finished at the end of March 2007. At that time, actual greenhouse gas emissions were calculated and verified. Participants could trade allowances again if necessary before August 2007 when they were required to retire allowances in the registry.

2.2.6 Reporting, verification and compliance – first phase

At the completion of FY2006, participants had the period April to August 2007 to calculate their actual emissions for FY2006 and to submit the results to the third party entity for verification. The Ministry of the Environment funded the cost of verification.

Participants would have been non-compliant if they could not retire sufficient allowances corresponding to the actual amount of their emissions. In the case of non-compliance, the participant would have had to return the subsidy received to the Ministry for the Environment.

2.2.7 Results – first phase

The total emissions reductions for FY2006 was forecast to be 273,076 tCO₂, while the total reduction over the officially recognised service life of the subsidised equipment was calculated at about 3.8 million tCO₂.

All participants with commitments met their reduction targets by making the most of their emissions reduction facilities, as well as using the emissions trading system (when necessary), which resulted in a total annual emissions reduction of 377,056 tCO₂. This was equivalent to a 29% reduction of the total base year emissions from participants' installations.

2.2.8 Second phase of JVETS

The Ministry of the Environment selected sixty-one companies and corporate groups as subsidised participants for the second period of JVETS. The total emissions reductions were estimated to be 217,167 tCO₂ for FY2007 while the total reduction over the officially recognised service life of the subsidised equipment were calculated as 2.8 million tCO₂. The operational period for FY2007 ended in March 2008 with final trading allowed up to August 2008.

All participants with commitments met their reduction targets by making the most of their emissions reduction facilities, as well as using the emissions trading system (when necessary), which resulted in a total annual emissions reduction of 280,192 tCO₂. This was equivalent to a 25% reduction of the total base year emissions from participants' installations.

2.3 Trial Voluntary Emissions Trading Scheme in Japan (2008 - 2012)

2.3.1 Overview

In October 2008, the Japanese government announced the trial of a new emissions trading scheme

to apply for FY2008 to FY2012, with fiscal years ending 31 March. Participation in the trial is voluntary. Companies that volunteer to participate in the scheme must set themselves CO₂ emission reduction targets for their business operations in Japan for every financial year during the five-year period. Targets are submitted by each company for approval by the Japanese government. Companies that manage to achieve their CO₂ emission reduction targets and exceed them can trade credits with other companies in the scheme that have not managed to meet their own targets. Companies will not be penalised if they do not meet their targets. Participants were able to begin buying and selling each other's emissions as soon as the government had approved their targets.

2.3.2 Participants

When launching the scheme, the government set a notional target of 1,000 companies to volunteer as participants by the deadline of 12 December 2008. By the time the deadline was reached, over 500 companies had signed up to participate in the scheme. Participants included the largest power companies, chemical manufacturers and oil producers.

A large number of iron and steel manufacturers intended to join as one collective entity in the trial, aiming to cut emissions by 9% below 1990 levels over the period of the trial. The Automobile Manufacturers Association set a target of 22% below 1990 levels. All Nippon Airways (ANA) and the JAL Group are voluntarily participating in the scheme.

2.3.3 Airline participation

ANA has committed to an average 200,000 tonne reduction in annual CO₂ emissions from FY2008 to FY2011, compared with FY2006.

During the period of the scheme, the JAL Group has set itself, for each fiscal year, a target for cutting CO₂ emissions per available seat kilometre (ASK) of its Japan domestic fleet, when compared to 1990 levels. This includes all domestic operations by JAL and JAL Group airline subsidiaries HAC, J-AIR, JAC, JEX, JTA and RAC.

The JAL Group is targeting a 16% cut in CO₂ emissions per ASK of its domestic fleet each year up until FY2012.

2.3.4 Results

As at October 2009, the scheme was still in its early stages of implementation and results were not yet available.

2.4 Switzerland's Voluntary Emissions Trading Scheme

2.4.1 Overview

The Swiss emissions trading scheme took effect on 1 January 2008. The scheme provides an opportunity for companies, especially those industries with substantial CO₂ emissions from use of heating fuels, to obtain exemptions from the CO₂ tax on heating fuels which has been levied since 1 January 2008 under the Federal Act on the Reduction of CO₂ Emissions (CO₂ Act). The CO₂ tax is an incentive tax aimed at promoting an economical use of heating fuels. Companies can be

exempted from the CO₂ tax if they commit to restricting their CO₂ emissions.

The scheme is linked to pre-2008 voluntary agreements to reduce emissions. Companies covered by voluntary agreements can convert these agreements into legally binding CO₂ emissions targets, allowing them to participate in emissions trading and be exempted from the CO₂ tax.

2.4.2 Participants and incentives

The scheme primarily concerns companies that assume a legally binding commitment to reduce their energy-related CO₂ emissions and thus accept a target for 2008-2012. In return, these companies are exempted from the CO₂ tax. Each company, which has been exempted of the CO₂ tax by an official decision, receives emission allowances corresponding exactly to its reduction target. Small companies, for which no reduction target has been stipulated but which have set a specific target value for their emissions or a plan of actions, do not receive any emission allowances. However, they can buy emission credits to fulfill their commitment.

2.4.3 Calculating baseline emissions and emissions reductions

The Energy Agency for the Economy (EnAW) is mandated by the Swiss confederation to identify CO₂ emission reduction and energy efficiency potentials in trade, industry and service companies. In collaboration between the company and the EnAW, an action plan is developed and a reduction target is defined. These are audited by the Federal Office of the Environment (FOEN) and the Swiss Federal Office of Energy (SFOE) to become legally binding commitments that grant exemption from the CO₂ tax. Reduction targets in absolute terms are calculated using a bottom-up approach. A company's potential to reduce emissions, from a technical and economic viewpoint, is assessed on the basis of projected production and emissions, taking into account any CO₂ reduction measures already implemented. A simplified approach is used for small companies.

2.4.4 Allocation of allowances

Emissions allowances are allocated to the companies free of charge, in accordance with the targets negotiated for 2008-2012. Each year the FOEN adapts the CO₂ targets to the changed production growth. The last time this will be done is 2010.

Businesses that obtain an exemption from the CO₂ tax must open an account in the National Emissions Trading Registry (Registry) and this account is credited with emissions allowances corresponding to the company's emissions cap for that year.

2.4.5 Trading of allowances

Starting in 2008, emissions allowances equivalent to the amount of CO₂ emitted have to be surrendered each year. Allowances not required for compliance can be sold to other companies or carried over to the post-2012 commitment period. To cover excess emissions, allowances have to be purchased on the domestic or international markets and/or earned through emissions reduction projects abroad. The acquisition of allowances on the international market is limited to 8% of the targeted emissions reduction to ensure that a substantial part of the target is achieved domestically.

2.4.6 Reporting verification and compliance

Companies must annually surrender emissions allowances up to the amount they effectively emitted the preceding year. The companies do this themselves, surrendering the credits necessary to cover the emissions reported in the monitoring system of the EnAW. The emission credits are transferred from the holding account to the surrendering account within the Registry. The FOEN uses this account to check whether the company has surrendered sufficient emissions credits. In the case of non-compliance, the company has to pay the CO₂ tax plus any interest retroactively for the entire period since it was granted exemption.

2.4.7 Results

The numbers from the first year (of the commitment period) prove that companies took seriously their commitments and invested in early emission reductions.⁹

2.4.8 Future prospects

Within the CO₂ Act of May 2000, the federal council is obliged to propose further reduction targets for the time after 2012. Following public consultation, the federal council put forward a climate policy proposal for parliament. Main points were the continuation of CO₂ tax on heating fuels and the further development of the national emissions trading scheme with a view to linking it to the EU scheme. The proposal also mentioned the option to include international aviation in the emissions trading scheme. Progress on this matter can be followed on the website of Switzerland's Federal Department of Environment, Transport, Energy and Communications¹⁰.

2.5 Chicago Climate Exchange (CCX)

2.5.1 Overview

The Chicago Climate Exchange (CCX) is a voluntary, contractually binding, greenhouse gas emissions registry, reduction and trading system for emission sources, with offset projects worldwide. The development of the CCX was initiated through a feasibility study funded by a grant from the Chicago-based Joyce Foundation. A subsequent grant was given to initiate research on market implementation.

CCX is a self-regulatory, rules-based exchange designed and governed by CCX members. Members make a voluntary but legally binding commitment to reduce their emissions of greenhouse gases. By the end of Phase I (December 2006) all Members should have reduced direct emissions by 4% below the average of their 1998-2001 baseline. Phase II, which extends the CCX reduction program through to 2010 requires all members to reduce greenhouse gas emissions by 6% below the baseline.

Continuous electronic trading of greenhouse gas emission allowances and offsets began on 12 December 2003. CCX reduction commitments and trading apply for years 2003-2010. With a total emission baseline of over 365 million tCO₂e for 2006, the CCX program achieved a total

⁹ Further details are available on the website of Switzerland's Federal Department of Environment, Transport, Energy and Communications. Link:

<http://www.bafu.admin.ch/dokumentation/medieninformation/00962/index.html?lang=de&msg-id=27786>

¹⁰ Link: <http://www.bafu.admin.ch/dokumentation/medieninformation>

emissions reduction of over 35 million tCO₂e by the end of Phase I in December 2006 which was substantially better than the target for Phase I.

The CCX market price in June 2008 for CO₂ was about US\$ 7 per tonne. The price has risen from around US\$ 0.98 in December 2003.

2.5.2 Participants and incentives

Membership of the CCX is open to a wide range of participants. There are six categories of CCX membership, which together are referred to as CCX Registry Account Holders. The categories are:

- a) Members are entities that have direct GHG emissions. Members make a legally binding commitment to the CCX Emission Reduction Schedule and are subject to annual verification by the Financial Industry Regulatory Authority (FINRA).
- b) Associate Members are office-based businesses or institution with negligible direct GHG emissions who commit to report and fully offset 100% of indirect emissions associated with energy purchases and business travel from year of entry through to 2010, and to have their emissions data verified by FINRA.
- c) Offset Providers are owners of title to qualifying offset projects that sequester, destroy or reduce GHG emissions. Offset Providers register and sell offsets directly on the CCX.
- d) Offset Aggregators are entities that serve as the administrative representative, on behalf of offset project owners, of multiple offset-generating projects. Offset projects involving less than 10,000 metric tons of CO₂e per year should be registered and sold through an Offset Aggregator.
- e) Liquidity Providers are entities or individuals who trade on the CCX for purposes other than complying with the CCX Emissions Reduction Schedule such as market makers and proprietary trading groups.
- f) Exchange Participants are entities or individuals who purchase Carbon Financial Instrument contracts and retire them to offset emissions associated with special events or other specified activities.

As at 12 October 2009 CCX membership totalled over 370. No airline operators or aircraft manufacturers were included in the membership. While Rolls-Royce is a member, this is in the context of its manufacturing activities and not in the context of aircraft engine emissions.

There are no Government funded incentives to participate in the CCX. The CCX promotes the benefits of membership as being:

1. Be prepared: mitigate financial, operational and reputational risks
2. Reduce emissions using the highest compliance standards with third party verification

3. Prove concrete action on climate change to shareholders, rating agencies, customers and citizens
4. Establish a cost-effective, turnkey emissions management system
5. Drive policy developments based on practical, hands-on experience
6. Gain leadership recognition for taking early, credible and binding action to address climate change
7. Establish early track record in reductions and experience with growing carbon and GHG markets

2.5.3 Identifying emissions sources, calculating baselines and setting emission reduction targets

Emissions of the following greenhouse gases from facilities owned by CCX members are included in the scheme as applicable: carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride.

Emissions of all non-CO₂ greenhouse gases are converted to metric tonnes CO₂ equivalent using the one hundred year Global Warming Potential (GWP) values established by the Intergovernmental Panel on Climate Change.

The unit of emissions measurement, reporting, price quotation and trading is metric tons of carbon dioxide equivalent or tCO₂e. Each CCX Carbon Financial Instrument represents one hundred tCO₂e.

CCX emitting Members make a voluntary but legally binding commitment to reduce direct emissions below an emissions baseline. An emissions baseline is calculated by taking the average of emissions inventories from a specific timeframe, or 'baseline period'. Baselines are adjusted to reflect acquisition or disposal of facilities.

Phase I Members: By the end of Phase I (December 2006) all Members should have reduced direct emissions by 4% below a baseline period of 1998-2001. Members that participate in Phase II will reduce emissions by an additional 2% below baseline by 2010 to achieve the Phase II reduction target of 6% below baseline. CCX Members were issued greenhouse gas emission allowances at the inception of the program for the four-year period (2003-2006) in an amount reflecting the CCX emission reduction schedule below:

Phase I	CCX Emission Reduction Target
2003	1% below Member's baseline
2004	2% below Member's baseline
2005	3% below Member's baseline
2006	4% below Member's baseline
Phase II	CCX Emission Reduction Target
2007	4.25% below Member's baseline
2008	4.5% below Member's baseline
2009	5% below Members baseline
2010	6% below Members baseline

Phase II Member joining in 2006: New Phase II Members' emission baseline is the annual average of emissions from facilities included in the baseline period 1998-2001. If data is insufficient, new Phase II Members may use a year 2000 baseline. The Phase II reduction target is 6 % below baseline by 2010. CCX Phase II Members will be issued greenhouse gas emission allowances in an amount reflecting the CCX emission reduction schedule below:

Phase II	CCX Emission Reduction Target
2007	1.5% below Member's baseline
2008	3% below Member's baseline
2009	4.5% below Member's baseline
2010	6% below Member's baseline

2.5.4 Emission offsets

Emissions offsets are issued to owners or aggregators of eligible offset projects that sequester, destroy or displace greenhouse gases. Offsets are issued after mitigation occurs and required verification documentation is presented to the CCX. Project eligibility, project baselines, quantification, and monitoring and verification protocols are specified in the CCX Rulebook.

Eligible offset projects include but are not limited to the following types of projects (for which CCX has developed standardised rules for issuing CFI contracts):

- Agricultural methane;
- Coal mine methane;
- Landfill methane;
- Agricultural soil carbon;
- Rangeland soil carbon management;
- Forestry;
- Renewable energy; and
- Ozone depleting substance destruction.

Other projects to be approved on a project-by-project basis, may include:

- Energy efficiency and fuel switching; and
- Clean Development Mechanism (CDM) eligible projects.

2.5.5 Allocation of allowances and offsets

The tradable Carbon Financial Instruments employed in CCX are Exchange Allowances (XA's) and Exchange Offsets (XO's). Exchange Allowances are issued to emitting Members in accordance with each Member's Emission Baseline and Emission Reduction Schedule, subject to provisions outlined in the CCX Rulebook. Exchange Offsets are generated by qualifying offset projects.

Each CCX Carbon Financial Instrument resides in the CCX Registry in a manner that designates the Instrument's annual vintage. Each Carbon Financial Instrument is recognized as equivalent when surrendered for compliance. Carbon Financial Instruments may be used for compliance in their designated vintage year or banked for use in later years, subject to provisions outlined in the CCX Rulebook. CCX Carbon Financial Instruments may not be used for compliance in years that

precede the vintage of an Instrument.

2.5.6 Trading of allowances and offsets

The CCX Trading System has three component parts:

1. *The CCX Trading Platform* is an internet-accessible marketplace that is used to execute trades among CCX Registry Account Holders. The system utilizes SUN java technology to bring live and active content to a screen. The Platform features a price transparent marketplace that displays order size, market depth and a market ticker. The system supports both exchange-cleared trades which preserve anonymity, and bilateral trades that are established through private negotiations off-system.
2. *The Clearing and Settlement Platform* receives information daily from the CCX Trading Platform on all trade activity. It processes all transaction information, nets out positions, and produces payment instructions for settlement of trades. Daily statements are provided to members when trading occurs. All corresponding changes are automatically updated in a Registry Account Holders' holdings of Carbon Financial Instruments in the CCX Registry.
3. *The CCX Registry* is an electronic database that serves as the official holder of record and transfer mechanism for Carbon Financial Instruments owned by Registry Account Holders.

The three components are integrated to provide Registry Account Holders with real-time data to support trading, assist in managing member emissions baselines, reduction targets and compliance status.

2.5.7 Reporting, verification and compliance

CCX has contracted with the Financial Industry Regulatory Authority (FIRA), formerly the National Association of Security Dealers (NASD), to provide regulatory services. FIRA assists in the registration, market oversight, and compliance procedures for CCX members. FIRA independently verifies Member's Baseline and annual emissions reports for Phase I and Phase II program years for accuracy and completeness, and to ensure compliance with the CCX Emission Reduction Schedule. FIRA utilises its state-of-the-art market surveillance technologies to monitor CCX trading activity. To ensure environmental integrity, offset verification services are provided by CCX-approved verifiers and are required for all exchange offset projects. FIRA also reviews all verifiers' reports for offset projects.

Compliance with the CCX Emissions Reduction Schedule is enforced by the CCX Environmental Compliance Committee. Members whose emissions do not meet annual emission reduction targets must use banked allowances from previous years or purchase CFI contracts on the CCX Electronic Trading Platform to meet their compliance requirements.

2.5.8 Results

As of October 2009, results had been released for the emission reduction compliance periods up

to 2007. The results can be viewed on the CCX website¹¹.

2.6 European Climate Exchange (ECX)

2.6.1 Overview

The European Climate Exchange (ECX) is a marketplace for trading carbon dioxide emissions in Europe and internationally. ECX is a subsidiary of Climate Exchange plc (CLE) which also owns the CCX. ECX currently trades two types of carbon credits: EU allowances (EUAs) and Certified Emissions Reductions (CERs). Trading on the ECX began in April 2005 when futures contracts were launched for EUAs. Trading of options for EUAs was launched in October 2006. Futures and options on CERs were introduced in 2008.

There is no information available at this time as to whether the ECX has the potential to also support a voluntary emissions trading scheme involving aviation, but given the link with the CCX, voluntary trading could be a matter that interested airlines or other parties could explore with the ECX. ECX daily prices per tonne of CO₂ have ranged from € 20 or US\$ 25 (April 2005) to € 30 or US\$ 37 (April 2006). The ECX market price in April 2009 for CO₂ was about € 12 or US\$ 16 per tonne (for settlement in December 2009).

2.7 Montreal Climate Exchange (MCeX)

2.7.1 Overview

The Montreal Climate Exchange (MCeX) was established in July 2006 as a partnership arrangement between the Montreal Exchange (MX) and the Chicago Climate Exchange (CCX). It is intended to accelerate the development of a structured environmental market in Canada. The MX brings to the new climate exchange its expertise in leading-edge trading systems, clearing, market regulation and financial risk management. The CCX contribution is its extensive experience in operating climate exchanges in North America and Europe.

The mission of the MCeX is to offer price transparency, environmental integrity, low cost, wide access and reliability to those sectors of the Canadian economy involved in air quality and climate change concerns. The MCeX commenced its carbon trading activities in May 2008. Companies that earn greenhouse gas credits through environmental programs can use the new market to sell them to carbon-emitting firms.

2.8 Asia Carbon Exchange (ACX-Change)

2.8.1 Overview

The Asia Carbon Exchange (ACX-Change) was soft launched in May 2005 and became fully operational in November 2005. It is a fully owned subsidiary of the Asia Carbon Group, which is headquartered in Singapore. The ACX-Change is focussed both on the compliance market as well

¹¹ Link: <http://www.chicagoclimatex.com/content.jsf?id=250>

as on the voluntary carbon market (VERs). It is the world's first CDM focussed – auction based exchange. It claims to be uniquely positioned as a global platform for sellers and buyers of Certified Emission Reductions (CERs), having a presence globally. It gives sellers of CERs an exposure to a large number of potential buyers while giving buyers a broad range of CER sources with varied risk/benefit profiles to choose.

2.9 Australian Climate Exchange (ACX)

2.9.1 Overview

The Australian Climate Exchange (ACX), the first emissions trading platform in Australia, was created in 2007 to respond to growing demand for voluntary carbon offset products and is essentially a marketplace for buying and selling emissions commodities. The platform provides suppliers and purchasers of emissions offsets real time access to information concerning the state of the offset market and the prevailing market price for carbon. The exchange initially offered government accredited VERs and has since expanded, listing credits from multiple international verification standards.

To ensure the integrity of the trading system, ACX has established an offset registry that tracks the transfer of accredited offsets, both domestic and international, from creation through to the retirement of "spent" offsets, which have been used to reduce a quantity of GHG emissions. In conjunction with VER transfer protocols established between the ACX and various international registries, this is intended to ensure the correct transfer and maintenance of good title history, increased transparency and to provide an unbroken audit trail of offset custody eliminating double counting of offsets, thereby addressing a source of much of the speculation over the credibility of carbon offsetting to facilitate environmental benefits.

CHAPTER 3 FUTURE DEVELOPMENT OF VOLUNTARY EMISSIONS TRADING SCHEMES INVOLVING AVIATION

3.1 Introduction

As can be seen from Chapter 2 of this report, voluntary emissions trading schemes are becoming established in a number of countries – including two of the largest economies of the world, United States and Japan. Aviation participation has been confined so far to the UK Emissions Trading Scheme and the Trial Voluntary Emissions Trading Scheme in Japan (2008-2012). Even there, only domestic aviation services have been involved. However, there is scope for more airlines to become involved in some form of voluntary emissions trading. While there are a number of possible options for achieving this, as identified in Section 1.2.2, this chapter considers three broad ways in which this might be done:

- through participation in an existing voluntary emissions trading scheme;
- through the development of voluntary agreements as a precursor to an emissions trading system; and
- through the establishment of an aviation-only voluntary emissions trading scheme.

3.2 Participation in an existing voluntary emissions trading scheme

The extent of significant voluntary emissions trading schemes worldwide is generally as described in Chapter 2. On this measure, there would presently appear to be few opportunities available for airlines to participate in existing voluntary schemes. Furthermore, some of these schemes are either not open to new participants, are limited to certain countries, or do not appear to be readily adaptable for participation by airlines. These existing voluntary schemes may nevertheless be a first step towards voluntary emissions trading and might be expanded in the future.

Trial Voluntary Emissions Trading Scheme in Japan (2008 – 2012) is accessible to airline operators but only those operating domestic services in Japan. All Nippon Airways (ANA) and the JAL Group have chosen to participate in the scheme. Given the early stages of the operation of this scheme, its success has yet to be demonstrated.

Switzerland's Voluntary Emissions Trading Scheme would appear to be accessible to airline operators.

The Chicago Climate Exchange (CCX) and similar schemes would seem to have potential for providing a voluntary emissions trading facility for aviation. Even here there are significant implications for airlines that may wish to participate particularly in relation to the emissions reductions targets specified by the CCX.

It is likely that new voluntary emissions trading schemes for ground sources will be developed in the future. The adaptability of future schemes for aviation is a matter that cannot be assessed in advance. When considering the possible integration of aviation into such voluntary schemes, it could be expected that the aviation specific issues that arise would generally be similar to those applying to the integration of aviation into mandatory emissions trading schemes. Entities considering participation in a voluntary trading scheme should therefore refer to the *ICAO*

Guidance on the Use of Emissions Trading for Aviation (Doc 9885) for a detailed discussion of relevant issues.

3.3 Development of voluntary agreements as a precursor to an emissions trading system

ICAO has created a Template for Voluntary Measures that may be used by airlines and/or governments as a starting point for the development of voluntary agreements to achieve emissions reductions. For example, such agreements might be based upon the establishment of a future fuel efficiency target for aircraft operators. To provide a basis for emissions trading such an agreement should include an enforceable commitment to achieve emissions reductions that are below an appropriate baseline.

To the extent that voluntary trading would be part of a voluntary agreement between government and industry partners, the ICAO Template for Voluntary Measures may be a useful reference document. It should however be noted that the ICAO Template was not designed with voluntary emissions trading schemes in mind and would have to be adapted for this purpose. The ICAO Template is available from ICAO at http://www.icao.int/icao/en/env/Caep_Template.pdf.

3.4 Establishment of a voluntary emissions trading scheme for aviation

One approach might involve the establishment by a group of airlines of a new voluntary emissions trading scheme for international aviation. This option would have more chance of being realised if it had the support of government(s). Given the greater worldwide focus by governments on solutions to climate change issues, the likelihood of such government support could be expected to increase over time.

This section will not attempt to address all of the issues involved in establishing a new emissions trading scheme but will only focus on aviation specific issues. In doing so, it is recognised that many of the aviation issues would be common to participation in either a voluntary scheme or a mandatory scheme. For other aviation issues, there would be specific differences between voluntary and mandatory schemes.

3.4.1 Commonalities between voluntary and mandatory emissions trading schemes

The *ICAO Guidance on the Use of Emissions Trading for Aviation (Doc 9885)* discusses the aviation specific issues relevant to the inclusion of international aviation in mandatory emissions trading scheme. This section draws on the guidance provided in that document to identify issues whose consideration in voluntary or mandatory schemes would be similar.

3.4.1.1 Accountable entities

Given that the voluntary emissions trading scheme considered in this section is assumed to be established by a group of airlines, then it follows that the accountable entities would be aircraft operators.

Accountable entities participating in a voluntary emissions trading scheme will be required, individually or jointly, to hold at the end of a trading period the necessary number of allowances (or credits) covering all relevant emissions, based on measured or modelled (calculated)

emissions of their operations under the scope of the scheme.

3.4.1.2 Emission sources

The relevant sources of emissions that are to be controlled by the aircraft operator need to be defined. It is preferable that for international aviation the emission source be defined as all civil flights by the aircraft operator within the geographic scope of the scheme. Depending on the number and type of aircraft operators seeking to join the scheme, to lower the administrative burden it may be necessary to make exceptions by establishing an inclusion threshold based on aggregate air transport activity, aggregate emissions (measured in CO₂) or aircraft weight.

3.4.1.3 Emissions species

While participants are free to choose which emissions species to include in the scheme, there are several factors that could lead airlines to only include their CO₂ emissions. CO₂ emissions are the largest and most certain of the greenhouse gas emissions from the aviation sector. While non-CO₂ gases are potentially significant, there currently exists a high degree of scientific uncertainty associated with most of them. A CO₂ based scheme is most likely to be compatible with other trading schemes and so increase the potential for future trading between schemes. This would not preclude the inclusion of other aircraft emissions that contribute to climate change in the longer run.

3.4.1.4 International and domestic emissions

As States may take action to address international or domestic emissions in the future, any voluntary emissions trading scheme should take the precaution of distinguishing between international and domestic aviation emissions.

The IPCC definition of international and domestic emissions should be used for the purposes of accounting for greenhouse gas emissions from civil aviation. This approach is internationally accepted and will help ensure consistency between the various approaches of States and participants in voluntary schemes.

3.4.1.5 Distribution of allowances

Distribution of allowances could occur through grandfathering, auctioning or benchmarking. Grandfathering and auctioning do not raise specific issues that are significantly different for aviation than for other sectors. If benchmarking is being considered for distributing emissions allowances within the scheme, then recognition should be given to previous investment in new technology. Incentives should also be provided to operate the most emissions efficient aircraft in the most efficient way in the future.

3.4.1.6 Monitoring, reporting and verification

To ensure the integrity of the trading system clear procedures should be defined for monitoring, reporting and verification of emissions data. These procedures are primarily needed to help accountable entities identify and correct data and/or calculation errors. To avoid misrepresentation of actual emissions, verification procedures are important to ensure equitable treatment of all participants and to publicly demonstrate that obligations are fulfilled. Scheme participants would be responsible for the accurate and timely reporting of emissions data.

3.4.2 Differences between voluntary and mandatory emissions trading schemes

There are a number of issues that would clearly be different in a voluntary scheme compared with a mandatory scheme. One overarching consideration is whether the voluntary scheme would be accepted for trading by other emissions trading systems. Additional considerations are as follows:

3.4.2.1 Participation

By definition, there would be no compulsion to participate in a voluntary emissions trading scheme. In order to widen the scope of the scheme, increase the potential environmental benefits and the economic efficiency, and minimise competitive effects, airlines could consider joint participation, for example, as part of an airline association or airline alliance. New entrant airlines would not be obliged to participate in a voluntary scheme but should be able to join if they wished. Once emissions reductions commitments were made, there would need to be an enforceable obligation for participants to meet their targets.

3.4.2.2 Incentives

Governments may see benefits in providing financial support or incentives for the establishment or ongoing administration of a voluntary trading initiative. A voluntary scheme with incentives may encourage wider industry participation leading to additional environmental benefit. Incentives may also facilitate quicker implementation.

3.4.2.3 Targets and timelines

Participants could decide amongst themselves the stringency and the timing of the emissions reduction targets that would apply under the scheme. Targets would need to be set at a level that would give credibility to the scheme as an effective emissions reduction initiative. Conceivably, airline trade bodies could facilitate the negotiation and definition of relevant targets and timelines.

3.4.2.4 Types of trading systems

There is more flexibility in designing a voluntary trading scheme. Besides having the choice between adopting a capped system with allowances or some form of baseline and credit system, participants could opt for meeting their reduction targets separately and individually or for example jointly under a “bubble” agreement. The latter approach may combine a semi-open trading system with a clearinghouse function managed by a central administrator¹².

3.4.2.5 Trading unit

The participants in a voluntary scheme can decide amongst themselves the nature of the trading unit (or “allowance”) to be used in the scheme. The allowance could represent an absolute amount of emissions (e.g. 1 tonne of CO₂) or, alternatively, an amount of emissions related to some measure of output (e.g. grammes of CO₂ per ATK, RTK, ASK, or RSK).

To avoid the drawbacks of a ‘closed’ trading system, the scheme could be designed in a way that would allow participants to purchase offsets outside the scheme in order to keep costs down.

¹² The role of administrator could be filled for instance by a governmental agency, an industry body or an independent entity.

However, selling scheme allowances into other trading schemes would depend on whether those other schemes accept these.

3.5 **How voluntary emissions trading for aviation could develop**

Looking at how voluntary emissions trading measures involving aviation have developed to date may provide some insight as to how new measures may develop into the future.

Voluntary agreements, depending on their nature, can be seen as a first step towards wider voluntary emissions trading although it is recognised that this is not a prerequisite. With airlines having experience with voluntary agreements, it might be easier for them to turn their attention to a voluntary trading scheme as a group in the future.

Government support would appear to be an important ingredient in a voluntary emissions trading scheme although not essential. With the back-up of well established voluntary agreements, airlines may find that government support for a trading scheme is more forthcoming.

The establishment of an airline-only emissions trading scheme would be within the capability of a group of airlines. The limitations of a closed trading system could be overcome by the ability to purchase offsets from other sectors. The level of sophistication and degree of integration with other sectors could then evolve over time.

3.6 **Role of ICAO**

While the possibility exists in theory, ICAO would not normally be directly involved in setting up voluntary emissions trading schemes. There are however roles that ICAO could pursue to encourage and support the development of voluntary schemes that interested Contracting States and international organisations might propose. ICAO has already taken a first step by developing the ICAO Carbon Emissions Calculator. Other steps could include:

- Providing a forum to develop and review voluntary emissions trading schemes;
- Providing technical information to support such schemes;
- Encouraging consistency between such schemes;
- Encouraging the use and recognition of such schemes; and
- Facilitating or assisting in the verification of aviation emissions data.

3.7 **Further information**

Further information can be found in the *ICAO Guidance on the Use of Emissions Trading for Aviation (Doc 9885)* where the various design options are discussed in more depth and a number of recommendations are provided.

3.7.1 Finally, more general background information on emissions trading is available from the ICAO web site at (www.icao.int).

GLOSSARY

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

Accountable entity

The entity in a cap and trade emissions trading system that is responsible for measuring and reporting actual emissions and for submitting sufficient allowances to cover those emissions.

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 (emission allowance)

An allowance is a tradable emission 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 CO₂) one time.

Annex B Parties or Countries

Group of industrialized countries and economies in transition listed in Annex B of the Kyoto Protocol that have commitments to limit or reduce their greenhouse gas emissions over the 2008-2012 period.

Annex I Parties or Countries

Group of industrialised 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 greenhouse gas emissions by the year 2000.

Auctioning

The distribution of allowance - 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.

Banking

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

Baseline

A reference level of emissions. A baseline can be used for example to calculate the total quantity of allowances to be distributed under a cap-and-trade scheme or the quantity of credits generated under a baseline-and-credit (emission intensity) system. A baseline also sets the level of emissions that would occur without policy intervention in an offset program.

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 "emission 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.

Bubble

A bubble is a regulatory concept whereby two or more emission sources are treated as if they were a single emission source.

Buyer

A legally recognised entity (individual, corporation, not-for-profit organisation or government) that acquires allowances or other compliance units from another legally recognised 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 emission 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 emission reductions, as entities that can reduce emissions at lower cost have the incentive to pursue these emission reductions and to then sell their surplus allowances to entities that face higher emission reduction costs.

Carbon dioxide equivalent (CO₂e)

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 emission 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 CO₂ 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 emission 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 which 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 emission 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 (CO₂) emissions or a one kilogram reduction of nitrogen oxide (NO_x) emissions, for example. These credits can be tradable units.

Distribution

The allocation of allowances among accountable entities in a cap and trade system.

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.

Domestic operations

Domestic flights and other aviation activities undertaken by an airline relating to those flights.

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 emission reductions achieved elsewhere.

Fiscal year

A fiscal year (or financial year) is a 12 month period used for calculating (“yearly”) financial reports in business and other organisations. The specific 12 month period varies between countries.

Global Warming Potential (GWP)

Global Warming Potentials (GWP) are calculated as the ratio of the radiative forcing of one kilogramme greenhouse gas emitted to the atmosphere to that from one kilogramme of CO₂ emitted over a period of time (100 years). For example, with carbon dioxide assigned a GWP of 1, methane has a GWP of 23.

Grandfathering

A method for the initial distribution of allowances to entities in an emission trading scheme that is based on historical data (e.g., gross emissions, entity/industry performance standard multiplied by production) and distributed free of charge.

Greenhouse gas

The atmospheric gases responsible for causing global warming and climate change. The major GHGs are carbon dioxide (CO₂), methane (CH₄) and nitrous oxide (N₂O). Less prevalent but very powerful greenhouse gases include hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF₆).

Greenhouse gas reduction or emissions reduction

A reduction in emissions intended to slow down the process of global warming and climate change. Greenhouse gas reductions are often measured in tonnes of carbon-dioxide-equivalent (CO₂e), 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 Organisation (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.

Kyoto Protocol

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

Non-Annex I Parties or Countries

Countries not included in Annex I of the United Nations Framework Convention on Climate Change (UNFCCC). Non-Annex I Parties do not have emissions limitation or reduction commitments under the Kyoto Protocol.

Offset or offset credit

In this report the term ‘offset’ or ‘offset credit’ is used to denote the compensating emission 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 (CO₂) emissions or a one kilogram reduction of nitrogen oxide (NO_x) emissions, for example. These credits can be tradable units.

Offsetting

In this report offsetting is the activity of “cancelling out” or “neutralising” emissions from a sector like aviation using offset credits – compensating emission 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 emission 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 emission trading scheme or from a linked scheme, this is referred to simply as emissions trading.

Open emissions trading

An emissions trading system where allowances or credits from outside the scheme can be used for achieving compliance with obligations under the scheme.

Retirement

The permanent surrender of offset credits (or allowances) to achieve compliance with a regulatory or voluntary obligation or a country’s international greenhouse gas commitment.

Seller

A legally recognised entity (individual, corporation, not-for-profit organisation, government, etc.) that transfers allowances or credits to another legally recognised 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.

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 greenhouse gas 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.

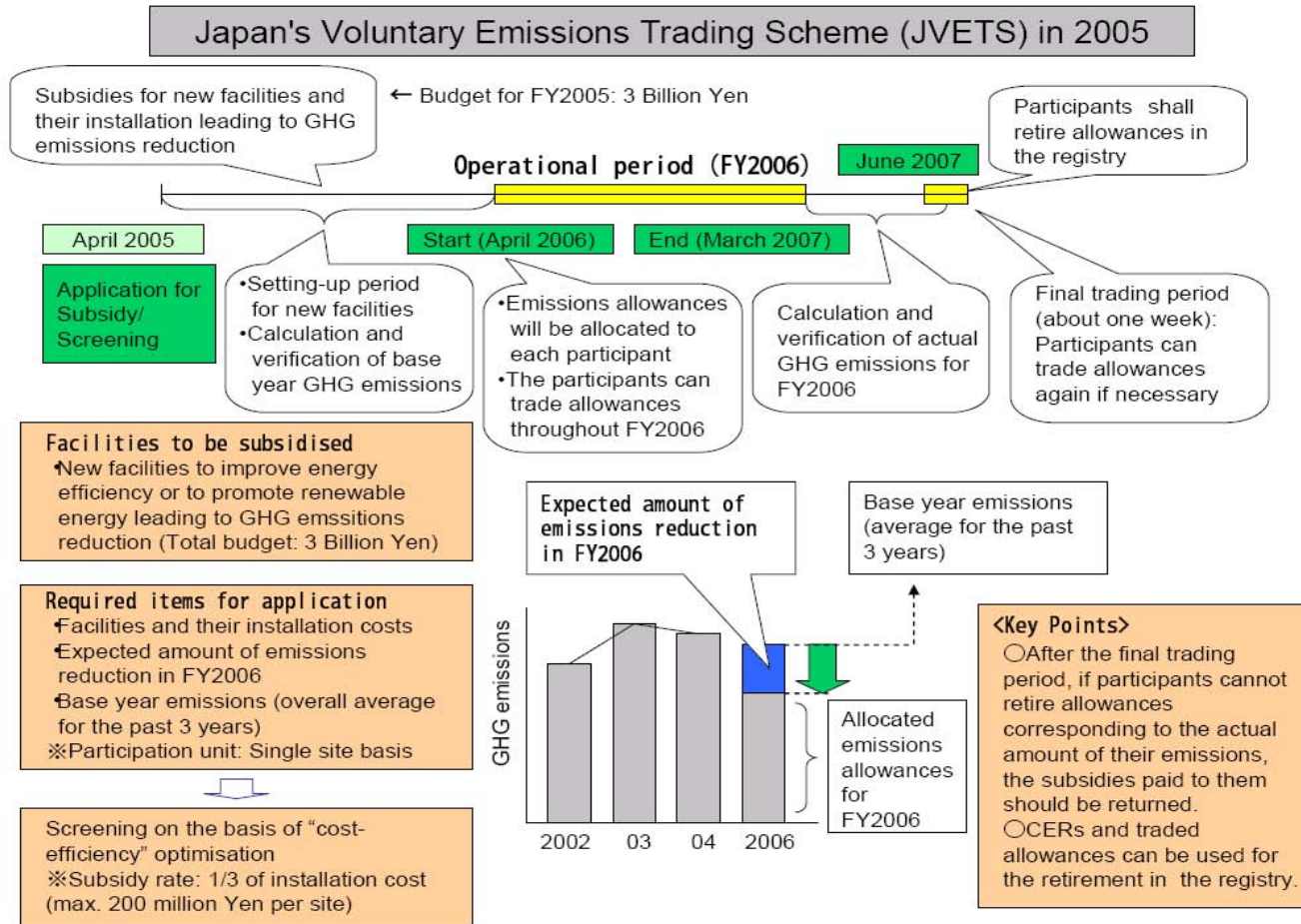
Verification

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 greenhouse gas emissions in the absence of any requirements to undertake such reductions.

APPENDIX A



ISBN 978-92-9231-671-6



9 7 8 9 2 9 2 3 1 6 7 1 6