



**INFORMATION PAPER**

**GROUP ON INTERNATIONAL AVIATION AND CLIMATE CHANGE (GIACC)  
FOURTH MEETING**

**Montréal, 25 to 27 May 2009**

**Agenda Item 2: Review of aviation emissions-related activities within ICAO and internationally**

**WORK ALREADY DONE BY ICAO ON MARKET-BASED MEASURES  
AND REFERENCE DOCUMENTATION**

(Presented by the Chairman of the Market-based Measures Working Group)

**Summary**

CAEP has undertaken detailed analysis of market-based measures pursuant to ICAO Assemblies resolutions since 1998. Analysis has been undertaken on the options for CO<sub>2</sub>-based aviation emission charges, emissions trading and voluntary measures. Both CAEP<sup>1</sup> and the Legal Committee have participated in the analysis of options.

In 2001, the estimates by CAEP of the costs and benefits of different emission-reducing measures done with the AERO model<sup>2</sup> demonstrated that the most cost effective measure to reduce international air service emissions, from all the ones assessed, was an open emission trading system. The effectiveness of levies was found to be greater for the air transport industry when the proceeds were returned to the industry to reduce further its emissions.

In 2004, the Assembly could not reach a consensus on emission charges or emissions trading but there was general agreement on voluntary approaches.

In 2005, a Special Group of the ICAO Council undertook a legal review of market-based measures. Although it was not possible to reach agreement on many of the issues, there was agreement that emissions charges linked to the damage caused by climate change would not be in contravention of the Chicago Convention. In addition, the Group agreed that exemption or waiver based on technical criteria, a transitional approach or a phased implementation of charges could potentially align with the Chicago Convention.

In 2007, the Assembly recommended the creation of GIACC with a mandate to propose a global plan with short, mid and long term goals and a number of possible measures to meet the goals, including market based measures.

<sup>1</sup> Two groups within the CAEP were tasked to look at market-based measures: WG5 and FESG. WG5 – Market Based Options Working Group was established at CAEP/4 with the goal to “identify and evaluate the potential role of market based options, including emissions charges, fuel taxes, carbon offsets and emissions trading regimes”. FESG – Forecasting and Economic analysis Support Group. The FESG was tasked to conduct an analysis of the economic effects of the market-based options under consideration.

<sup>2</sup> AERO-MS – Aviation emissions and Evaluation of Reduction Options Modelling System. AERO-MS is a policy-testing tool developed by the Dutch Civil Aviation Authority to assess the environmental and economic impacts of possible emission-related measures related to air transport system (i.e. aircraft engine emissions), under different future developments. The AERO-MS is an internationally accepted tool capable of analysing a wide range of measures in the aviation sector.

## 1. BACKGROUND from 1998 to 2001

1.1 The first consideration of market-based measures by the Assembly appeared in 1998 where resolutions directed CAEP to "study policy options to limit or reduce the greenhouse gas emissions from civil aviation" included a request to continue pursuing emission-related levies.<sup>3</sup>

1.2 Between the 1998 Assembly and the 2001 Assembly both CAEP WG5 and the Forecasting and Economic analysis Support Group (FESG) evaluated the potential role market-based measures could play in reducing CO<sub>2</sub> emissions from aviation. Three options were considered: emission-related levies, voluntary measures and emissions trading. WG5 focussed on evaluating the legal and administrative issues and looked at qualitative aspects of equity and competition issues. The FESG conducted modelling-based analysis to determine potential economic impacts on the industry, competitiveness and the environment.

1.3 The market-based options considered in the CAEP/5 analysis were assessed against three CO<sub>2</sub> emission-reduction targets for 2010:

- Target 1: the "Kyoto" target of 5% below 1990 levels;
- Target 2: 50% reduction in the emission growth projections in the base case developed by FESG<sup>4</sup>;
- Target 3: 25% reduction in the base case projected growth by FESG.

### 1.4 Emissions-related Levies

1.4.1 The analysis of emission-related levies focused on three options:

- a fuel (or en-route emissions) tax with revenue going to the national treasury;
- a revenue-neutral aircraft efficiency charge; and
- an en-route<sup>5</sup> emissions charge with revenues returned to the aviation sector.

1.4.2 CAEP found that implementing a fuel tax would raise legal issues concerning air services agreements and ICAO policies, and, if not applied worldwide, could cause tankering practices. An en-route emission charge would be consistent with ICAO policies, provided revenues were used to mitigate the environmental impact from emissions. If not applied worldwide, the en-route emission charge would raise equity and competitiveness issues. A revenue-neutral charge would be consistent with ICAO policies but would require an acceptable method to be developed for defining aircraft efficiency, and could not be implemented in those areas which do not have en-route charges.

1.4.3 FESG analysed the three options, in light of the three possible targets outlined by CAEP WG5 using the Dutch AERO model.<sup>6</sup> Fuel taxes and en-route charges had similar effects since fuel consumption is correlated to emissions. Absent a manufacturers' response<sup>7</sup>, a levy of \$1.80/kg would be

<sup>3</sup> Ref. [CAEP/5-WP/86]. Final report of the fifth meeting of the Committee on Aviation Environmental Protection, held in Montreal (Canada) on February 8-17, 2001. Report on Agenda Item 2. Review of market-based options to limit or reduce emissions. [CAEP/5-WP/24] "Economic Analysis of Potential Market-Based Options for Reduction of CO<sub>2</sub> Emissions from Aviation". Working paper submitted by FESG.

<sup>4</sup> Emissions in the FESG base case were projected to increase by 57% from 1990 through 2010.

<sup>5</sup> En-route is defined as

<sup>6</sup> Ref. [CAEP/5-WP/86]. Final report of the fifth meeting of the Committee on Aviation Environmental Protection, held in Montreal (Canada) on February 8-17, 2001. Report on Agenda Item 2. Review of market-based options to limit or reduce emissions.

<sup>7</sup> Manufacturer's response in the form of additional technology development triggered by an increase in fuel prices. In its analysis, the FESG considered the impact of levies both with and without a manufacturer's response.

required to meet Target 1, \$0.50/kg to meet Target 2, and \$0.23/kg to meet Target 3. This compared with the 1992 fuel price of \$0.23/kg. About 70 per cent of the emissions reduction was to be achieved through reduced demand with the remaining 30 per cent of the reduction arising from technology effects<sup>8</sup>.

1.4.4 The FESG analysis assessed re-channelling revenues into the aviation sector using proceeds of the levy to (1) accelerate retirement of older aircraft; (2) accelerate technology improvements of new aircraft; and, (3) reduce airborne delays by improving ATC<sup>9</sup> systems. The 2010 target could be achieved using accelerated retirement of aircraft. The results indicated this option would lead to an additional 20-40 per cent CO<sub>2</sub> reduction relative to flowing funds to the national treasury.

1.4.5 Revenue-neutral charges could only achieve less stringent targets than those used for the purposes of the analysis.

## 1.5 Emissions Trading

1.5.1 FESG analysis suggested that open trading of emissions permits would likely be the most efficient and effective measure to meet Kyoto Protocol targets<sup>10</sup>. Impacts on costs and the growth of aviation would be lower than all the other options, provided the required emissions permits could be purchased from other industry sectors at the prices used in the analysis (\$5/tCO<sub>2</sub>, \$10/tCO<sub>2</sub>, \$15/tCO<sub>2</sub>, \$25/tCO<sub>2</sub>, \$45/tCO<sub>2</sub>, \$100/tCO<sub>2</sub>).<sup>11</sup>. Because of the high relative costs of aviation technology and the lack of substitute energy sources, the permit price for an open trading system would be substantially lower than under a closed trading system. Under these assumptions, open trading would be the only option likely to achieve the Kyoto target of a 5 per cent reduction in emissions below 1990 levels in 2010.

1.5.2 The distribution of allowances through an auctioning system did raise issues regarding the use of funds collected. No consideration was given to this issue by the FESG in 2000.

## 1.6 Voluntary Measures

1.6.1 The main options considered by CAEP were:

- an industry initiative, including a target and a set of actions to achieve it;
- a negotiated agreement between industry and government to take a set of actions, and/or to achieve a specific emission target;
- a hybrid option, under which one of the two above-mentioned options are used in conjunction with another market-based measure.

1.6.2 The main findings were that voluntary measures alone could not achieve an ambitious emission reduction target. They would have to be used in conjunction with other measures. Voluntary measures were regarded as transitional, allowing industry to undertake activities related to "capability building". A key issue was the need to ensure that such actions would be to the advantage of the participants if market-based, or other regulatory measures, were imposed at a later date.

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<sup>8</sup> All prices are expressed in 1992 US dollars per kg of fuel.

<sup>9</sup> ATC – Air Traffic Control.

<sup>10</sup> As the aviation sector faces higher abatement costs than most other sectors, it is likely to be a net purchaser of permits and most of the emissions reductions would be realized outside the aviation sector.

<sup>11</sup> CAEP/5-IP/09

### 1.7 Summary

1.7.1 In 2001, implementation of an open emissions trading system was considered a long-term objective since an international cap on emissions was required and the Kyoto Protocol had not been ratified. In the interim, voluntary measures were considered the best approach for early action. With regard to voluntary measures, it was felt that priority should be given to developing guidelines for their rapid implementation, including the establishment of a transparent mechanism to evaluate the improvements achieved.

1.7.2 On the issue of emission-based levies, more research was required taking into account the Council Resolution on Environmental Taxes and Charges and the concerns of Developing Countries that charges increased costs to their travellers and reduced their markets.

1.7.3 The impact on demand of market-base measures differed from one measure to another. The market-based measure with the smallest impact on demand was the open emission trading system. A closed emission-trading scheme was not considered by CAEP to be appropriate due to the high estimated cost to industry.

## 2. BACKGROUND from 2001 to 2004

2.1 In 2001, the Assembly (A-33) created the market-based measures framework which integrated the three approaches discussed by CAEP 5 (levies, trading and voluntary mechanisms). The Council was directed to develop guidelines for voluntary measures and a template voluntary agreement. Emission-related levies were to respect existing ICAO policies on aviation charges and be given further study. In the following extract from Resolution A33-7 Appendix I, the Assembly:

- 1) *Endorses* the development of an open emissions trading system for international aviation; and
- 2) *Requests* the Council to develop as a matter of priority the guidelines for open emissions trading for international aviation focussing 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.

2.2 Between 2001 and 2004 the CAEP Working Group 5 and the ICAO Secretariat undertook further analysis pursuant to the Assembly Resolutions. The FESG undertook further analysis of levies on developing countries (note that in CAEP/6 FESG also conducted further analysis on voluntary agreements and open emissions trading systems for the limitation of CO<sub>2</sub> emissions, as a follow-up the analysis done in CAEP/5 on MBO, as reported in CAEP/6-WP/57, Report on Agenda Item 2.)

### 2.3 Emissions-related levies

2.3.1 CAEP Working Group 5 addressed a list of outstanding issues which guided their work up to the 2004 Assembly.

#### 2.3.1.1 International Versus Individual Levies

2.3.1.1.1 From the time of the 2001 Assembly Resolution on an open emission trading system, Contracting States had differing views on its implications. Some felt the resolution required guidance on actions which could be undertaken depending on a States individual circumstances; others believed the resolution was intended to develop a framework for designing and implementing a charge regime.

2.3.1.1.2 The different views at CAEP marked the beginning of the debate on the role of ICAO in an international levy and the application of an international approach versus an individual nation state approach.

### 2.3.1.2 Legal and policy issues

2.3.1.2.1 The ICAO Secretariat presented a paper which concluded that the establishment of emission related charges would in principle be compatible with the Chicago Convention and ICAO policies, but taxes would not. Not all of the group supported the conclusions; and a suggestion was made that the Legal Committee review legal aspects of an emission levy.

### 2.3.1.3 Design of Charges

2.3.1.3.1 A number of issues related to the design of an emission-based levy were reviewed by the WG5. There were differing views on whether airlines registered outside a State that was imposing a charge should be subject to the charge or if that charge should be limited to airlines registered within the State. The geographic scope of a levy was also reviewed, including emissions over the high seas. There appeared to be consensus that any measure must be consistent with other international obligations; and that States could act jointly in a harmonized manner under a global agreement to address emissions. Discussion included how a levy aligned with those responsible for creating emissions, including air traffic control and airport congestion. It was generally agreed that costs ultimately flowed to consumers and a breakdown of responsibility within the sector would be impractical.

### 2.3.1.4 Developing Countries

2.3.1.4.1 The FESG considered the implications for developing countries of various types of charges under different assumptions. It looked at the percentage of emissions from developing country airlines, the age of their fleet compared to developed country airlines, the impact of excluding routes to or from developing countries from any charge regime, and the competitiveness impacts on developed country airlines if developing country airlines were exempt from such charges. FESG came to the conclusions that: under globally applied charges, where the proceeds do not flow back to the aviation sector but are used to pay damage costs, the impact on Annex I and non-Annex I carriers do not differ significantly; when the proceeds are returned back into the aviation sector, to the carriers affected by the charge, the impact is smoothed, but Annex I carriers still suffer a (small) loss, while non-Annex I carriers gain a (small) benefit.

### 2.3.1.5 Revenue Neutral Charge

2.3.1.5.1 The FESG calculated that only a minor environmental benefit would accrue from such a charge. The option of establishing a charge for higher emitting aircraft and reducing charges for lower emitting aircraft was not supported as viable given the lack of information on aircraft efficiency and the inconsistency in charges internationally.

### 2.3.1.6 Application of Funds

2.3.1.6.1 The CAEP WG5 considered how funds would be used. In accordance with existing ICAO policies, CAEP suggested revenue be used to address specific environmental damage, fund research and development and fund aviation technology and operational improvements. In addition, the use of funds in other sectors to offset the impact of aviation emissions was considered.

## 2.4 Emissions Trading

2.4.1 Pursuant to the resolution on an open emission trading system, CAEP engaged the services of a consortium of consultants lead by ICF Consulting in 2003. The consulting consortium was tasked with providing an analytical basis and recommendations for a comprehensive set of design specifications for an open trading system for international aviation emissions. Three options were proposed:

- (i) an ETS integrated with the existing Kyoto Protocol cap and trade system where international aviation emissions would be merged with domestic emission systems;
- (ii) an aviation specific system based on a new ICAO legal instrument voluntarily joined through international agreement; and
- (iii) a voluntary emission trading system managed by ICAO where design issues and targets would be developed by participants.

Each alternative was assessed for its environmental benefits, administration, ICAO role, international aviation interests and ease of implementation. No approach was recommended by the report.

## 2.5 Voluntary Measures

2.5.1 Working Group 5 successfully completed a draft Template Agreement – Memorandum of Understanding and relevant accompanying guidance to potential users. The work was reviewed and adopted by CAEP. It was agreed by Members to recommend to the ICAO Council that the material be posted on the ICAO website for distribution purposes.

## 2.6 Summary

2.6.1 When the findings of CAEP/6 were compiled and discussed prior to the 2004 Assembly a wide range of views were expressed. Some CAEP Members believed further consideration of CO<sub>2</sub>-related emissions charges should be discontinued, since they were not a practicable or cost-efficient measure to achieve aircraft CO<sub>2</sub> reductions. Others disagreed. They felt the uncertainties were not sufficient reason for States to avoid their use. These States were of the view that neither further guidance nor further studies were needed since the existing ICAO policies on charges were deemed sufficient. They were ready to accept the development of further guidance if the Council made that request.

2.6.2 Developing countries believed the analysis provided by CAEP and the FESG indicated that the application of a CO<sub>2</sub> charge could increase operational costs and financial strains on developing countries' air carriers with potentially detrimental impacts on their long-term growth. They pointed out that developing country air carriers were not granted government subsidies and carried far less passenger and cargo volumes; this would lead to detrimental effects on the economic and social development of their countries.

2.6.3 The lack of consensus at the CAEP level regarding charges led to the development of voluntary options. It was proposed that Member States could agree to have their airlines subject to local taxes on a reciprocal basis. Alternatively, the options of a voluntary global scheme or bilateral and multilateral air transport agreements were discussed. However, it was not possible to develop a firm proposal for the Council within CAEP. As a result, decisions on next steps for emission levies were elevated to the Council and Assembly.

2.6.4 CAEP Members also debated emission trading options at length, including a number of variations on the ICF options. Members agreed that the option for a new instrument would be too complicated and time consuming. Agreement was reached to further study a Kyoto based option.

However, as some Members would not ratify the Protocol this option was seen as longer term. An option for a voluntary emission trading system garnered the most support; some felt this could be a first step to a more sophisticated model. The CAEP recommendation to the Council was:

“That further work by ICAO on emission trading should pursue the concepts of a voluntary system and of integrated trading systems.”<sup>12</sup>

### 3. BACKGROUND from 2004 to 2007

3.1 The 2004 Assembly Resolution A35 - 5 Appendix I is related to market-based measures regarding aircraft engine emissions. It recognizes that market-based measures are policy tools that are designed to achieve environmental goals at a lower cost and in a more flexible manner than traditional regulatory measures. It recalls an ICAO Council resolution recommending that any emission-related levies be in the form of charges rather than taxes, and that the funds collected should be applied in the first instance to mitigating the environmental effect of aircraft engine emissions.

3.2 The appendix addresses voluntary measures, emissions-related levies and emissions trading. It recognizes that ICAO is not ready for the implementation of greenhouse gas emissions charges internationally, but that such a charge is not precluded at a regional level, by mutual agreement of States and on operators of that region. The appendix endorses the further development of an open emissions trading system for international aviation and considers two approaches, one which would support the development of a voluntary trading system, and another which would provide guidance to incorporate emissions from international aviation in States' emissions trading schemes consistent with the UNFCCC process.

#### 3.3 Legal Issues

3.3.1 To address the outstanding legal issues related to whether emission related levies or emissions trading were consistent with the Chicago Convention and ICAO policies, the ICAO Council convened a Special Group on Legal Aspects of Emissions Charges in September 2005. This group reviewed *inter alia* compatibility of emissions charges with the Chicago Convention and the ability to exempt operators of some States from a charge.

3.3.2 The conclusions of the Special Group were divided. One group of States believed that if charges were linked to the quantity of emissions they would not be in contravention of Article 15 which deals only with charges for the use of airports and air navigational services. A separate group of States believed that emission charges would be in contravention of Article 15 because there was no link to facilities, services or remediation costs. The first group of States held the view that where charges were related to fuel consumption they would not be contrary to the Article 24 exemption of fees on fuel. The second group disagreed, finding that charges based on the quantity of fuel *per se* would constitute a fuel-based tax which would be incompatible with Article 24.

3.3.3 On the issue of linking charges to the damage caused by emissions, both sides agreed that such a charge would be compatible with the Chicago Convention.

3.3.4 The Group concluded that an exemption of a particular State from emissions related charges would be a contravention of the Chicago Convention Article 15 non-discrimination clause. However, they found that this may or may not preclude the possibility of exemption or waiver based on technical criteria, a transitional approach or a phased implementation of the levying of charges.

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<sup>12</sup> Report of CAEP Working Group 5 to CAEP 6: <http://www.icao.int/icao/en/env/EmissionsTrading.htm> Rather than providing a website link that may become not functional with time, you should add the complete reference: Ref. [CAEP/6-WP/XX ] “title of the document”. Working paper submitted at the CAEP/6 meeting held in Montreal (Canada) on February 2-12, 2004.

#### 4. BACKGROUND from 2007 to 2008

4.1 The Assembly in 2007 created GIACC with a mandate to address both UNFCCC negotiations for post-Kyoto targets and the use of market based mechanisms in international aviation emission reductions. Five new appendixes related to aviation and the environment were adopted by the Assembly Resolution A36-22 including aviation and local air quality, aviation impact on global climate-scientific understanding, aviation impact on global climate – Cooperation with UN and other bodies, ICAO Program of Action on international aviation and climate change (appendix K), and market-based measures including emissions trading (Appendix L).

#### 4.2 A36 - 22 Appendix L

4.2.1 This appendix addresses market-based measures, including emissions trading. In addition to repeating policy elements of A35 – 5 Appendix I, it acknowledges the principles of non-discrimination and equal and fair opportunities to develop international civil aviation set forth in the Chicago Convention, as well as the principles of common but differentiated responsibilities and respective capabilities under the UNFCCC and the Kyoto Protocol.

4.2.2 It recognizes that a majority of States endorses the application of emissions trading for international aviation only on the basis of mutual agreement, but that other States consider that any open emissions trading system should be established in accordance of the principle of non-discrimination.

4.2.3 On emissions-related charges and taxes, the appendix repeats the policy elements of A35 – 5 Appendix I. On emissions trading, it urges States not to implement an emissions trading system on other States except on the basis of mutual agreement. ECAC States entered a formal reservation against that element of the policy. On carbon offsets, studies are requested to examine the potential for carbon offset mechanisms as a further means of mitigating the effect of aviation emissions.

4.3 The work on emissions trading undertaken by CAEP Working Groups was published as guidance Document 9885 “*Guidance on the Use of Emissions Trading on Aviation*” in 2008, after having been reviewed by the Council after the 36<sup>th</sup> Assembly. It provides advice and practical information that States might be able to use when incorporating emissions from international aviation into emissions trading schemes, with a particular emphasis on those aspects that need specific consideration due to the inherent mobility of aviation activities as compared to emissions from fixed installations. The guidelines address elements such as accountable entities, emissions to be covered, trading units, base year and targets, allowance distribution, monitoring and reporting, and geographic distribution.

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