Technical Workshop on Bunker Fuel Emissions Bulletin

A summary report of the Technical Workshop on Emissions from Aviation and Maritime Transport

Published by the International Institute for Sustainable Development (IISD)

ONLINE AT HTTP://WWW.IISD.CA/YMB/SDOSL/
VOLUME 146, NO. 1, MONDAY, 8 OCTOBER 2007

TECHNICAL WORKSHOP ON EMISSIONS FROM AVIATION AND MARITIME TRANSPORT: 4-5 OCTOBER 2007

The Technical Workshop on Emissions from Aviation and Maritime Transport took place from 4-5 October 2007, at the Holmenkollen Park Hotel Rica, in Oslo, Norway. The workshop, which was organized by the Government of Norway in cooperation with the European Environment Agency (EEA), was attended by 90 participants representing governments, business, academia, the United Nations Framework Convention on Climate Change (UNFCCC), the International Civil Aviation Organization (ICAO) and the International Maritime Organization (IMO).

The main aims of the technical workshop were to: enhance reporting on emissions from fuels used for international aviation and maritime transport (bunker fuels); find commonalities among UNFCCC parties, the Intergovernmental Panel on Climate Change (IPCC), the IMO, and ICAO on methodological aspects related to reporting; encourage collaboration among parties on the future development of methodologies; serve as a mutual capacity building process; improve the availability and quality of data from all parties; and assist the UNFCCC Subsidiary Body for Scientific and Technological Advice (SBSTA) in the overall negotiation process.

This report provides a brief history of bunker fuels under the UNFCCC, the IMO, ICAO and the IPCC, followed by a summary of the Technical Workshop on Emissions from Aviation and Maritime Transport.

BRIEF HISTORY OF EMISSIONS FROM FUEL USED FOR INTERNATIONAL AVIATION AND MARITIME TRANSPORT

Emissions from fuels used for international aviation and maritime transport, commonly referred to as emissions from "bunker fuels," consist mainly of carbon dioxide. Bunker fuel emissions constitute a small, but fast-growing, percentage of global greenhouse gas emissions: in the period 1990-2004, emissions from international aviation and from international maritime transport have grown 34% and 43%, respectively.

Addressing bunker fuel emissions is being considered within the UNFCCC, ICAO and IMO processes, as well as by the IPCC. Some of the issues that add to the intricacies of bunker fuel negotiations are the significance of international transport to the global economy and countries' limited jurisdiction in controlling emissions from activities occurring outside their national borders.

UNFCCC

Bunker fuel emissions have been part of the UNFCCC process since before the UNFCCC entered into force.

INC 2 (1994): In Decision 9/2 on providing information on bunker fuel emissions, the Intergovernmental Negotiating Committee (INC) said that parties should include bunker fuels in a separate category in their emissions inventories on the basis of fuel sold, but should not include them in total national emissions.

COP 1 (1995): In Decision 4/CP.1, the Conference of the Parties (COP) mandated the SBSTA and the Subsidiary Body for Implementation (SBI) to address allocation and control of bunker fuel emissions, taking into consideration work by the IMO and ICAO.

SBSTA 4 (1996): At this meeting, SBSTA cited three separate issues regarding bunker fuel emissions: inventories; allocation of emissions; and control options. SBSTA considered eight "options" for allocation, including no allocation.

COP 3 (1997): In Decision 2/CP.3, the COP recalled that bunker fuel emissions should not be included in national totals according to the Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories.

KYOTO PROTOCOL: Article 2.2 the Kyoto Protocol states that Annex I parties (developed countries and countries with economies in transition) shall pursue the limitation or reduction of bunker fuel emissions working through ICAO and the IMO. However, bunker fuel emissions are not subject to the Kyoto Protocol targets.

IN THIS ISSUE

The *Technical Workshop on Bunker Fuel Emissions Bulletin* is a publication of the International Institute for Sustainable Development (IISD) <info@iisd.ca>, publishers of the *Earth Negotiations Bulletin* © <enb@iisd.org>. This issue was written and edited by Miquel Muñoz, Ph.D., Jonathan Manley and Cecilia Vaverka. The Editor is Alexis Conrad <alexis@iisd.org>. The Director of IISD Reporting Services is Langston James "Kimo" Goree VI <kimo@iisd.org>. Funding for coverage of this meeting has been provided by the Norwegian Ministry of Environment, Department for Pollution Control. IISD can be contacted at 161 Portage Avenue East, 6th Floor, Winnipeg, Manitoba R3B 0Y4, Canada; tel: +1-204-958-7700; fax: +1-204-958-7710. The opinions expressed in the *Bulletin* are those of the authors and do not necessarily reflect the views of IISD. Excerpts from the *Bulletin* may be used in other publications with appropriate academic citation. Electronic versions of the *Bulletin* are sent to e-mail distribution lists (HTML and PDF format) and can be found on the Linkages WWW-server at <http://www.iisd.ca/>. For information on the *Bulletin*, including requests to provide reporting services, contact the Director of IISD Reporting Services at <kimo@iisd.org>, +1-646-536-7556 or 300 East 56th St. Apt 11A, New York, NY 10022, USA.

SBSTA 10-22: SBSTA 10 considered a report on bunker fuels prepared by the IPCC. From SBSTA 11 to SBSTA 22, discussions centered on methodological issues regarding reporting and calculating bunker fuel emissions. At SBSTA 22, there were presentations on different models to estimate bunker fuel emissions.

SBSTA 22-26: Since SBSTA 22, parties have been unable to agree on conclusions, meaning that no progress has been made on this issue.

COP 12 (2006): Noting a lack of progress on bunker fuels and the impossibility of doing so within the UNFCCC, Norway announced its intention to host a non-UNFCCC workshop on the issue. That workshop is the subject of this bulletin.

IMO

Emissions from maritime transport are addressed by the IMO's Marine Environment Protection Committee (MEPC).

IMO STUDY (2000): In March 2000, the IMO published a study on greenhouse gas emissions from ships. As a result of this study, in May 2000, the IMO decided to prohibit the use of perfluorocarbons on ships.

IMO ASSEMBLY (2003): At its 2003 Assembly, the IMO adopted Resolution A.963(23) on policies related to the reduction of greenhouse gas emissions from ships.

MEPC 53 (2005): MEPC 53 approved the IMO's interim guidelines for voluntary ship carbon dioxide emission indexing for use in trials (MEPC/Circ.471). The objective of the guidelines is to establish a common approach for trials on voluntary carbon dioxide emission indexing, which will enable ship owners to evaluate the performance of their fleet.

MEPC 55 (2006): MEPC 55 approved a work plan to identify and develop mechanisms needed to achieve the limitation or reduction of carbon dioxide emissions from international shipping, considered updating the 2000 IMO study on greenhouse gas emissions from ships, and agreed to continue and strengthen cooperation with the UNFCCC and ICAO in this area.

ICAO

Most work on greenhouse gas and other emissions from aviation is undertaken through the ICAO Council Committee on Aviation Environmental Protection, which consists of members and observers from states, intergovernmental organizations and non-governmental organizations representing the aviation industry and environmental interests.

35th ASSEMBLY (2004): In Assembly Resolution 35-5, ICAO endorsed the further development of an open emissions trading system for international civil aviation and requested that ICAO's Council provide further guidance for states in this matter, focusing on establishing the structural and legal basis for the aviation sector's participation in an open trading system. The Resolution included elements such as reporting, monitoring and compliance, while providing flexibility to the maximum extent possible, consistent with the UNFCCC process.

36th ASSEMBLY (2007): Climate change played a prominent role in ICAO's 36th Assembly. At this meeting, ICAO agreed to create the Group on International Aviation and Climate Change, which is made up of senior government officials. The Group's mandate is to recommend a vigorous ICAO Programme of Action on International Aviation and Climate Change.

IPCC

SPECIAL REPORT: In 1999, the IPCC approved the Special Report on Aviation and the Global Atmosphere, which, among other issues, considered how aviation affects climate and ozone, projected aviation emissions growth, looked at current and future impacts of aviation on radiative forcing, and discussed options for reducing emissions and impacts.

IPCC GUIDELINES: The IPCC Guidelines for National Greenhouse Gas Inventories, which are used for calculating and reporting national greenhouse gas emissions and removals, were first released in 1994; a revised set of guidelines was released in 1996. In 2000 and 2003, the IPCC approved additional good practice guidance reports that complement the Revised 1996 Guidelines. In 2006, the IPCC approved the Revised 2006 Guidelines.

REPORT OF THE MEETING

The Technical Workshop on Emissions from Aviation and Maritime Transport (the workshop) took place from 4-5 October 2007, at the Holmenkollen Park Hotel Rica, in Oslo, Norway.

On Thursday morning, participants attended the opening session and a plenary session setting the scene for emissions from fuels used for international aviation and maritime transport (bunker fuels). On Thursday afternoon and Friday morning, there were two parallel sessions: one on aviation and one on maritime transport. On Friday afternoon, the plenary session resumed for a closing session.

This report of the meeting is organized according to the agenda.

OPENING SESSION

In her introductory remarks, Henriette Westhrin, State Secretary, Ministry of the Environment, Norway, noted that increasing greenhouse gas emissions from international aviation and maritime transportation are a matter of concern. Underlining the lack of regulatory mechanisms that address international bunker fuel emissions, she said that it is vital to include the international aviation and maritime transport sectors in a post-2012 climate change regime. She also noted the need for the International Maritime Organization (IMO) and the International Civil Aviation Organization (ICAO) to contribute constructively to the formulation of this post-2012 regime.

Jeff Huntington, Head of Programme, European Environment Agency

Jeff Huntington, Head of Programme, European Environment Agency, outlined the aims and objectives of the workshop. He highlighted that technical barriers associated with bunker fuel emissions reporting, data access and methodological issues need to be resolved to pave the way for sound political decision-making. He also emphasized that capacity building is necessary to address institutional barriers to calculating greenhouse gas emissions. Noting the differences between the aviation and maritime transport sectors, he stressed the need to address each sector separately.

SETTING THE SCENE

Chaired by Lars Olsen Hasselager, Denmark, this plenary session included presentations from the United Nations Framework Convention on Climate Change (UNFCCC), IMO and ICAO Secretariats, as well as from academics.

UNFCCC and ICAO representatives highlighted existing collaboration on bunker fuels among international bodies, but noted a lack of coordination at the national level. Stelios Pesmajoglou, UNFCCC Secretariat, provided a historical overview of the treatment of bunker fuels under the UNFCCC.


Stelios Pesmajoglou, UNFCCC Secretariat

He noted that bunker fuel emissions are a small, but rapidly growing, percentage of global greenhouse gas emissions. He highlighted bunker fuels as one of the oldest items in the UNFCCC agenda, and said that the lack of progress since SBSTA 22 (2005) is because some countries link progress on bunker fuels to progress on other agenda items. He said that the main impediments to progress on this issue are the significance of transport to the global economy and the limited jurisdiction of countries outside of their own borders. Pesmajoglou noted that while Kyoto Protocol targets include domestic aviation, international aviation is not included, underlined methodological problems in discriminating between domestic and international fuel use, and stated that since 2002, emissions from international aviation have been larger than from domestic aviation. He said that some parties view bunker fuels as a key element to be included in a post-2012 UNFCCC regime.

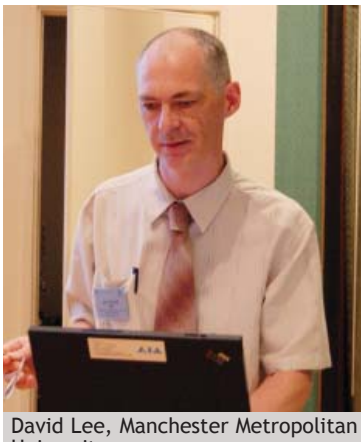
Eivind Vagslid, IMO, outlined the IMO's work on reducing greenhouse gas emissions from maritime transport, mentioning, *inter alia*, the 2000 IMO study on greenhouse gas emissions from ships, which the IMO is currently updating, and resolution A/.963(23), adopted in 2003, which urges the IMO to develop the mechanisms needed to achieve reductions of greenhouse gas emissions from international shipping by formulating a work plan, establishing a greenhouse gas baseline, and to develop a carbon dioxide indexing methodology. Noting the significant potential for technical efficiency improvements and reducing greenhouse gas emissions through operational measures, he stressed that it will be difficult to prevent total emissions growth in this sector given the increasing demand for international shipping. Vagslid pointed out that the IMO's work plan on greenhouse gas reductions will finish at MEPC 59 (2010), and that Member States will then have to decide if the IMO should establish a mandatory regime on the control of greenhouse gas emissions from shipping. He also noted that while 75% of the world's merchant fleet is registered in non-Annex I countries, it is mostly owned by interests in Annex-I countries.


Jane Hupe, ICAO

Jane Hupe, ICAO, said that climate change was the main issue addressed at the recent ICAO 36th Assembly. She said ICAO favors an emissions trading scheme if all parties participate on equal terms, as ICAO does not distinguish between Annex-I and non-Annex I parties. She said that the EU ETS initiative deserves praise as an important step in moving the agenda on emissions trading forward. Hupe then elaborated on ICAO's strategies on guidelines and standards and on operational and market-based measures, and highlighted the importance of appropriate indicators and parameters to measure performance. She said that ICAO is exploring use of the Kyoto Protocol's Clean Development Mechanism (CDM), drew attention to an ICAO publication on guidance for emissions trading, noted that ICAO's large amount of data could help with inventory activities, and stated that progress on this issue had been hindered by lack of mandate from SBSTA.


Kristin Rypdal, CICERO, during her presentation in Thursday's plenary

Kristin Rypdal, CICERO, presented on reporting principles and methods to estimate greenhouse gas emissions from aviation and shipping contained in the 1996 IPCC Guidelines, the 2000 IPCC Good Practice Guidance and the 2006 IPCC Guidelines. She noted that national inventories include only greenhouse gas emissions taking place within national territory, while international aviation and shipping are reported separately as so called "memo items" by the fuel-selling country. She mentioned the different inventory methodologies, including: Tier 1 (the simplest method, requiring least amount of data); Tier 2 (based on technology-specific emission factors); and Tier 3 (requires more detailed, country-specific data). Rypdal said that the choice between Tier 1 and Tier 2 methods depended on preference, as both rely on fuel statistics. Noting that only Tier 3 methods can provide independent activity data from fuel statistics, she underscored that methods for estimating fuel consumption need refinement. She also said that it is more difficult to apply definitions and methods in the shipping sector than in the aviation sector.


David Lee, Manchester Metropolitan University

David Lee, Manchester Metropolitan University, spoke on historical and future scenarios and their radiative impacts. He said that emissions from international aviation currently account for about 2% of global emissions, but that their radiative forcing effect is larger. He said that if growth continues along current trends, emissions from shipping and aviation could account for up to 15% of global emissions by 2050. He explained that the cooling effects of sulphate (SO4) emissions from maritime

transport do not compensate for the warming effect of carbon dioxide emissions, said that modeling work shows the level of effort required to mitigate climate change, and stressed that policies are required to achieve these goals.

PARALLEL SESSION: AVIATION

The parallel session on aviation was co-chaired by Sara Aagesen, Spain, and Manuel Estrada, Mexico, and consisted of presentations by parties, on issues in monitoring and reporting, on different models for calculations of emissions, and on possible future data requirements. The session concluded with a discussion session moderated by Falk Heinen, Germany.

Co-chairs Sara Aagesen, Spain, and Manuel Estrada, Mexico

PRESENTATIONS BY PARTIES: J-P Chang, France, explained the methodology used in France for calculating air traffic emissions, noting the use of a fuel balance approach to separate domestic and international flights. He said that the difference between theoretical consumption from the model and actual fuel sold in France is less than 5%. He also said that 22% of France's international emissions come from EU flights and that using theoretical distances in models systematically underestimates actual distances flown.

Scott McKibbon, Canada, spoke about Canada's work in developing a Tier 3 accounting system for aviation emissions. He explained that the new accounting system would use origin-destination data from the Department of Transport Canada and the Official Airline Guide (OAG), and added that the system was aggregated at a provincial level so that responsibility for emissions could be identified for individual provinces.

José Romero, Switzerland, described Switzerland's bottom-up approach to international aviation emissions, noting that Switzerland has detailed movement statistics of all aircraft operating at Swiss airports, including a database with information on 16 000 individual aircraft and 400 different types of engines. He said that Switzerland knows the exact split between domestic and international aviation emissions.

Leonidas Osvaldo, Argentina, described the information sources, methodology and steps followed to estimate aviation emissions in Argentina, and noted that almost all flights in Argentina depart or land in one of Buenos Aires's two airports. He said that Argentina's energy statistics do not differentiate between fuel used for exports or bunkers, and that further information is needed for this categorization.

Jo Jun-haeng, Republic of Korea, explained the organizational arrangements for estimating emissions in his country, stating that Korea uses Tier 1 and 2 methodologies and utilizes IPCC emission factors. He said that data from airlines and fuel suppliers is used, noting a discrepancy between the two sources. He also stressed the need to clarify whether airlines or airports should be responsible for collecting data and the desirability of cross-checking data to improve accuracy.

Arthur Rolle, Bahamas, explained the key institutions, sources of data, models, calculations and verification procedures used in the Bahamas. He noted problems in reporting and in accessing aviation traffic data. Citing the IPCC 2006 guidelines, he said that countries will need more capacity to respond to greater reporting requirements, but that such increased capacity is not yet available.

ISSUES TO ADDRESS WHEN MONITORING AND REPORTING EMISSIONS FROM AVIATION: Odette Deuber, Öko-Institut, presented on approaches for separating domestic and international aviation emissions, noting that methods are country-specific. She said that approaches can be top-down or bottom-up, with top-down approaches based on the assumption that carbon dioxide emissions are proportional to fuel consumption, while bottom-up approaches draw on carrier and airport records and other data. She suggested using tonne-kilometer or carbon dioxide intensity indicators to verify the quality of the calculated split between domestic and international aviation emissions.

Odette Deuber, Öko-Institut

Leif Hockstad, US Environmental Protection Agency, presented on monitoring military aviation activities. He explained the US national system for reporting under the UNFCCC, the status of coordination among different US government departments, and the methodologies used by US Department of Defense to determine their bunker fuel emissions. Hockstad also highlighted the accuracy of the data from the military.

DIFFERENT MODELS FOR CALCULATION OF EMISSIONS: Gregg Fleming, US Department of Transport, presented on the System for Assessing Aviation Global Emissions (SAGE). He said that SAGE is a Tier 3 methodology and is a comprehensive database that includes detailed data on approximately 35 million flights and one billion flight segments per year. He explained that this data is apportioned to airports, noting that 300 airports account for 90% of the world's traffic. He said that radar archives were available for North and Central America and Europe. Fleming also showed a high resolution world map plotting fuel burn from aviation, and said that all of the information is publicly available.

David Lee, Manchester Metropolitan University, described an aviation modeling tool called FAST that was developed for the UK Department of Trade and Industry. He explained that FAST uses OAG data and an aircraft design model dataset as the base, and uses great circle distances instead of route information to determine emissions. Lee then spoke about climate applications for FAST modeling data combined with contrail images and cirrus cloud data, described policy analysis applications for the FAST tool, including a study to identify, for different potential UNFCCC regimes, countries' responsibilities for aviation emissions, and said that the inclusion and availability of passenger and load data represent the greatest source of variations in modeling results.

Ted Eliff and Stefano Mancini, Eurocontrol, presented on the Advanced Emission Model (AEM) and Pagoda aviation greenhouse gas emission calculation tools developed by Eurocontrol. Eliff described the software architecture of AEM and noted that using the Base of Aircraft Data database allowed for the accounting of 99.14% of European air traffic. Mancini presented applications of the Pagoda modeling tool, and


Stefano Mancini, Eurocontrol

highlighted the development of a statistical portal, which provides a user-friendly interface to access Pagoda fleet and emission data. Mancini said that the interface and database would become available in 2008.

Jakob Graichen, European Topic Centre, outlined the results of a comparative study of two independent datasets: Pagoda estimates and Eurocontrol data. He emphasized that fuel-sale and fuel-burn approaches can have different results due to left-over fuel after the flight. He suggested that countries using the Tier 3 approach have better datasets and energy statistics. He noted that countries tend to overestimate domestic emissions in comparison to international emissions and that in many cases bottom-up approaches provide a more accurate international/national emissions split than top-down approaches.

POSSIBLE FUTURE DATA REQUIREMENTS: Andy Kershaw, British Airways, explained his company's experience with the UK Emissions Trading Scheme (ETS), noting that it demonstrated that airlines can comply with the monitoring, verification and reporting requirements of an emissions trading scheme. Stressing that aircraft operators have access to accurate fuel and operational data, Kershaw explained the methodology used by British Airways to comply with its voluntary commitments under the UK ETS, and said that airlines should propose future methodologies for complying with trading schemes.

Jakob Graichen, speaking in an individual capacity, presented on data needs under future possible greenhouse gas emission control regimes. He said that many options for future regimes are being considered, such as relative targets, a sectoral approach and multi-stage differentiation among countries, and said that the feasibility of those options needs to be considered from a reporting point of view. He noted that Annex I parties plus the 15 largest non-Annex I parties account for around 90% of global aviation emissions. Graichen also stated that the SBSTA "options" for bunker fuels are not relevant under a sectoral approach. He affirmed that development of policies for aviation is a political problem rather than a reporting or methodological problem.


Jakob Graichen, European Topic Centre

DISCUSSION SESSION: The discussion session was moderated by Falk Heinen, who outlined key areas for discussion, including data availability, use of data, future data requirements and interdependencies between reporting and the process for limiting emissions. Heinen also posed questions regarding the main obstacles for obtaining data, the need for legislation, data quality and regional differences.

One participant noted, and many agreed, that the quality of data in the aviation inventories is superior to that in Land Use, Land-Use Change and Forestry, methane or nitrous oxide (N2O) emissions under the UNFCCC. Some participants said that it would be useful for many countries if a centralized model provided emission estimates to complement national data, while others noted the importance of having many models to be able to compare results and cautioned about different assumptions in different models. Participants also highlighted harmonization of databases and assumptions in models as well as inclusion of NOx in considered emissions. On the sectoral approach, one participant cautioned about the difficulties for company-based reporting, while another said that sectoral reporting could be done on country-basis or company-basis. Some participants highlighted adaptation, additional reporting requirements, and changes in tourism (and thus aviation) patterns.

PARALLEL SESSION: MARITIME TRANSPORT

The parallel session on maritime transport was co-chaired by Sveinung Oftedal, Norway, and Bert Borst, the Netherlands, and consisted of presentations by parties, on issues in monitoring and reporting, on different models for calculations of emissions, and on possible future data requirements. The session concluded with a discussion session moderated by Mark Major, European Commission.

PRESENTATIONS BY PARTIES: Shinichi Hanayama, Japan, stressed feasibility and effectiveness when dealing with methods to reduce greenhouse gas emissions from international shipping, and expressed concern about the impact of greenhouse gas reductions on shipping industry growth. He advocated the development of one single regulatory framework for all parties to the UNFCCC, and said that an external verification scheme for the IMO CO2 index should be provided.

Outlining methods for calculating greenhouse gas emissions from shipping, Eilev Gjerald, Norway, referred to challenges, including: improving sale statistics; follow-up on the domestic shipping definition; achieving the correct split of bunker fuel sales between domestic and international shipping; and attaining the accurate distribution of bunker fuels among vessel categories.

Lee Sung-won, Republic of Korea noted the estimation of greenhouse gas emissions in the Korean shipping sector, and cited difficulties such as a lack of detailed fuel consumption data and activities data, as well as lack of specific emissions factor data for Tier 2 methods.

ISSUES TO ADDRESS WHEN MONITORING AND REPORTING EMISSIONS FROM MARITIME TRANSPORT: Miecke Reece, International Energy Agency (IEA), presented on the reporting of domestic and international maritime transport and implications for greenhouse gas emissions inventories. Noting difficulties in the reporting process, she emphasized the need to harmonize the IEA's reporting definitions with the 2006 IPCC Guidelines and to enhance transparency. She also stressed that accurate information on energy use in domestic and international shipping would improve the quality of greenhouse gas inventories.


Miecke Reece, International Energy Agency (IEA)

Reidar Grundström, Swedish Maritime Administration, spoke on monitoring emissions from leisure boats, emphasizing that leisure boats account for more than 13% of total Swedish carbon dioxide shipping emissions. He described using a bottom-up approach to estimate the number of boats and gasoline consumed given the lack of fuel sales statistics, and noted that the results have since been used for climate reporting.

PRESENTATIONS OF DIFFERENT MODELS FOR CALCULATION OF EMISSIONS: Øyvind Endresen, Det Norske Veritas (DNV), presented on modeling past and present maritime transport emissions and on modeling future emission scenarios. He said that DNV was increasing the level of detail for activity-based models and that new models categorized vessels according to type and size. He said that this was important as the activity, engine loads and days at sea varied significantly between vessel type and size. He noted that using IPCC GDP growth scenarios, carbon dioxide emissions from maritime transport are projected to more than double by 2050.

Veronika Eyring, German Aerospace Center, outlined estimates of past, present and future emissions from international shipping, highlighting that carbon dioxide emissions will grow in all future emission scenarios if emissions stay unregulated. She described the principal approaches for producing spatially-resolved ship inventories, including the bottom-up and top-down approaches. She also highlighted validating emission inventories through satellite and in-situ measurements, and emphasized that better input data on ship activity and improved means of allocating activity spatially will reduce current differences among inventories.

Tim Gunner, Intertanko, presented a recent assessment of world bunker consumption from international shipping that was commissioned by the IMO's expert group and which used a bottom-up approach based on ship owners' data. He stressed that a switch from residual fuel to marine diesel oil (a blend of heavy fuel and gas oil) would result in long-term reductions of air pollution from ships, and would annually save up to 31 million tonnes of carbon dioxide emissions.

Øyvind Buhaug, Norwegian Marine Technology Research Institute, spoke on assessing the emissions performance of individual ships and the IMO CO2 index, noting that this index is currently undergoing trials, is voluntary and will be further discussed in 2008. He said that a reference level on ship performance needs to be established for optimal use of the index, and that the difference between the reference level and actual performance may be used to generate emission trade credits. Highlighting that more data is necessary to support development, he underscored the need for ship owners to cooperate and to provide data.

POSSIBLE FUTURE DATA REQUIREMENTS: Andre Stochniol, International Maritime Emission Reduction Scheme, presented on data requirements and reporting under a novel hybrid instrument combining carbon trade and taxing, and noted that such an instrument avoids the problem of emissions allocation and allowance distribution to countries, flags, routes or ships. He also said that annual emissions growth is used rather than an emissions baseline. He noted that this approach delivers on the common but differentiated responsibilities principle, and combines mitigation and adaptation issues.


Andre Stochniol, International Maritime Emission Reduction Scheme

Jasper Faber, CE Delft, outlined possible future data requirements under different allocation options, and noted the importance of finding effective combinations of allocations and policy instruments. He underscored that allocating shipping emissions based on route of ship or cargo is the most favorable option, as the scope for evasion is limited and the financial burden is aligned with responsibility for emissions.

Stefan Seum, Stefan Seum Consulting, spoke on reporting greenhouse gas emissions from international shipping, focusing on data needs and other challenges in greenhouse gas emissions control regimes. He stressed that a sectoral allocation option based on ship activity is preferable to national allocation. Asserting that international shipping can be successfully included in a post-2012 climate change regime, and noting each institution's organizational strengths, he suggested that the IMO develop reporting methodologies and the UNFCCC set emission limits.

DISCUSSION SESSION: The discussion session was moderated by Mark Major, who listed key issues for participants to focus on, including: data accessibility; models for improving data; regional issues; improving inventories; and different levels of data verification. Some participants stressed the need for an IMO statistical office, while one speaker noted that the IMO has established a long range tracking system, which has information on shipping movements. There was general agreement that both top-down and bottom-up approaches are needed and that statistics must be in-line with methodologies being used. Several participants said that accurate data is available, but that the problem is how to compile and report it, as many flag states are not parties to the International Convention for the Prevention of Pollution from Ships and thus not required to report. Some suggested that port states and the UN Convention on the Law of the Sea collect data, and also noted the possibility that port states could establish their own mandatory schemes. While some participants maintained that charges on freight would give non-Annex I countries trade incentives, others said a freight-based regime would be challenging for developing countries. One participant said that it is difficult to put an absolute cap on marine transport, suggesting that the responsibility to report emissions should be placed on port states. One participant noted that a post-2012 regime must not be voluntary given the seriousness of the climate change issue. Some participants argued that a technical mandatory regime is less contentious than a market-based approach, which would entail taxes and charges. Many participants agreed that while regional solutions are suboptimal, if the global community currently cannot deliver, regional solutions would be steps in the right direction. Several participants also stressed that the IMO needs to move forward if it is to continue to be a relevant actor in this area. Several participants noted that there seem to be more institutional and resource-based barriers to the monitoring and reporting of bunker fuel emissions from international shipping than there are technical barriers.

CLOSING SESSION

In the closing session, the two parallel sessions reported back to the plenary. This was followed by a report of conclusions from the workshop presented by Jan Karlsson, and then by closing remarks.

On international aviation emissions, session co-chair Sara Aagesen said that the main conclusion from the session was that data, modeling tools and methods to solve the emissions reporting

Marit Viktoria Pettersen thanked Jan Karlsson and Jakob Graichen for their contributions in organizing the workshop

shortcomings exist. She noted the challenges that non-Annex I countries face regarding data collection and highlighted features of the various emission models that had been presented. Falk Heinen reported that the main issues raised in the discussion session included: the availability of aviation emissions data; applications for modeling data and harmonizing assumptions among different models; future data requirements under possible climate regimes; and technical requirements for emissions reporting and mitigation measures. He noted that policy measures are needed to implement technical requirements.

On marine transport emissions, session co-chair Sveinung Oftedal said that statistics on emissions from international shipping have recently improved, as more research is being undertaken. Underlining that the activity-based approach gives more precise data than marine bunker sales, he said that the IMO's long range tracking system would provide for a more accurate activity-based approach. Oftedal emphasized the importance of free-of-charge data for research, and noted that mandatory reporting on bunker fuels is needed, highlighting that ship owners already have accurate data on bunker fuel volumes used and that there are no technical barriers to using this data. He also said that said that states face difficulties reporting domestic versus international fuel sales.

Jan Karlsson, EEA, presented the main conclusions of the entire workshop, highlighting: that as the maritime and aviation sectors were more different than similar, future discussions should be separate; even though climate change is high up on the ICAO and IMO agendas, aviation and maritime emissions will continue to rise significantly in the near future due to strong sectoral growth; IPCC guidelines provide comprehensive details on emissions reporting; and institutional barriers are greater than technical barriers for emission inventory reporting. He noted that ICAO and the IMO do not differentiate between non-Annex I and Annex I countries, and that difficulties still exist in separating international and national emissions. For the aviation sector, he concluded that data collection and modelling are well developed and can contribute to emissions allocation models and that the inclusion of aviation in future climate change regimes is technically feasible and requires institutional acceptance. He said that conclusions from the maritime session included that: maritime emission data exist, but are less available than aviation data; improvements to emissions models are needed to inform policy discussions; and that uncertainties exist in bunker fuel statistics due to the lack of reporting from offshore refuelling activities. He noted that 75% of ships are registered in non-Annex I countries but are owned by Annex I countries, and said that this could be problematic if non-Annex I registered ships were exempt from future climate regimes.

Marit Viktoria Pettersen, Ministry of the Environment, Norway, concluded the workshop by thanking participants for sharing their ideas, experiences and expertise, and drawing attention to a side-event that Norway will organize to present the conclusions from this workshop at UNFCCC COP-13 in Bali, Indonesia, in December 2007. She closed the meeting at 2:50 pm.

Marit Viktoria Pettersen, Ministry of the Environment, Norway

UPCOMING MEETINGS

8TH ANNUAL GLOBAL ENVIRONMENTAL TAXATION CONFERENCE: This conference will take place from 18-20 October 2007, in Munich, Germany. The meeting will focus on "Innovation, Technology and Employment: Impacts of Environmental Fiscal Reforms and Other Market-Based Instruments." For more information contact: Green Budget Germany; tel: +49-89-520-113-13; e-mail: foes@foes.de; Internet: http://www.worldecotax.org/

27TH SESSION OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE: IPCC-27 will convene from 12-16 November 2007, in Valencia, Spain, and will focus on the adoption of the IPCC's Fourth Assessment Report. For more information contact: Rudie Bourgeois, IPCC Secretariat; tel: +41-22-730-8208; fax: +41-22-730-8025; e-mail: IPCCSec@wmo.int; Internet: http://www.ipcc.ch/

TOURISM MINISTERIAL SUMMIT ON CLIMATE CHANGE: This summit will be held on 13 November 2007, in London, United Kingdom. The meeting will consider the results of the Second International Conference on Tourism and Climate Change (1-3 October 2007, Davos, Switzerland). For more information contact: UNWTO - World Tourism Organization; tel: +34-91-567-81 00; fax: +34-91-571 37 33; e-mail: climate@unwto.org; Internet: http://www.unwto.org/climate/davos/en/davos.php?op=1

25TH INTERNATIONAL MARITIME ORGANIZATION ASSEMBLY: This meeting will take place from 19-30 November 2007, in London, United Kingdom. The Assembly will consider, among others, the reports and recommendations from the Marine Environment Protection Committee (MEPC). For more information contact: IMO Secretariat: Tel +44 (0)20 7735 7611; Fax +44 (0)20 7587 3210; e-mail: info@imo.org; Internet: http://www.imo.org

THIRTEENTH CONFERENCE OF THE PARTIES TO THE UNFCCC AND THIRD MEETING OF THE PARTIES TO THE KYOTO PROTOCOL: The thirteenth Conference of the Parties to the UNFCCC and third Meeting of the Parties to the Kyoto Protocol will take place in Bali, Indonesia, from 3-14 December 2007. These meetings will coincide with the 27th meetings of the UNFCCC's Subsidiary Bodies with the *Ad Hoc* Working Group on Further Commitments from Annex I Parties under the Kyoto Protocol. For more information contact: UNFCCC Secretariat; tel: +49-228-815-1000; fax: +49-228-815-1999; e-mail: secretariat@unfccc.int; Internet: http://www.unfccc.int