



TRANSPORT FOR A GLOBAL ECONOMY

*Challenges and Opportunities
in the Downturn*

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*Environmental Impacts of
International Transport*

*Making International Transport
Pay Its Climate Bill*

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MAKING INTERNATIONAL TRANSPORT PAY ITS CLIMATE BILL

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1. Introduction

Aviation and maritime transport are truly international in character. It is only in large countries that the two modes make up a significant share of domestic transport. At a global level, aviation accounts for about 2.5 per cent of CO₂ emissions as well as substantial emissions of other greenhouse gases and compounds. Shipping is believed to emit around 3 per cent of the anthropogenic emissions of CO₂. The total impact on global warming of emissions from aviation and shipping is not yet fully understood. Aircraft emit other GHG gases and compounds that are thought to have a positive warming impact and aircraft contrails are also thought to lead to cloud-induced warming. These impacts are especially important in the short-run. Engines of maritime ships also emit a number of gases and particles that have either positive or negative radiative forcing. This paper, however, is focused on CO₂ only. It covers market-based policy instruments and provides a few words on technical standards.

The idea behind market-based policy instruments is to make companies and citizens respond by choosing the least costly measures. What is most cost-efficient may vary over time as a result of changing price elasticities of demand and technological innovation. There is no way for national governments or international bodies to know with enough certainty what the future might bring. A technological breakthrough in shipping or aviation might, in combination with increasing marginal abatement costs in other sectors, change relative prices enough to make new abatement strategies economically viable. It is therefore essential that maritime shipping and aviation face the same marginal incentive to reduce CO₂ emissions as other modes of transport and land-based installations. This paper will discuss how to bring this about.

2. Emissions from international transport under the Kyoto Protocol

Greenhouse gas emissions from international shipping and aviation are not part of the emissions reported by individual countries under UN Framework Convention on Climate Change (UNFCCC). Similarly the commitments made by industrial nations under Annex 1 of the Kyoto Protocol apply to domestic flights and shipping only.

The Kyoto Protocol (Article 2.2) recommends that Annex 1 countries should develop measures to deal with greenhouse gas emissions through the International Civil Aviation Organization (ICAO) and the International Maritime Organization (IMO). However, the members of ICAO have been unable to reach agreement on the measures to be adopted. The IMO is under way to develop two different sets of indicators but has so far been unable to reach agreement with the parties on mandatory measures.

The UNFCCC is based on *the principle of common but differentiated responsibility* which means industrialized nations are expected to do a great deal more to abate greenhouse gases than could be expected from developing countries, at least in the short to medium term. However, this principle is problematic to reconcile with the international character of maritime shipping and aviation. The IMO and ICAO have in other policy areas developed rules and regulations that apply to all vessels and aircraft, regardless of nationality. An important principle of the UN Convention on the Law of the Sea (UNCLOS) is *no more favourable treatment of ships*.

Delegations to the IMO and ICAO representing developing countries claim that *the principle of common but differentiated responsibility* means that any mandatory regime aimed at reducing GHG emissions should be applicable to the Annex 1 countries only. Delegations representing Annex 1 countries, on the other hand, underline that the two organizations have a global mandate and should never discriminate among ships or aircraft as special treatment would distort trade and competition. A concern in this context is that about two thirds of all ships above 400 GT are registered in non-Annex 1 flag States, although most of this tonnage belongs to firms in the industrialised countries. Counted as GT or DW the share is even higher (74 and 77% respectively).

2.1 Unilateral action by the European Union

The European Union recently decided to include from 2012 emissions from international and domestic aviation in its existing Emissions Trading System, the EU ETS.

The EU has also presented the IMO with an ultimatum, threatening unilateral action directed at the emissions of international shipping, unless the IMO decides on the introduction of a regulatory framework by 2009. Both the Council of Ministers and the European Parliament have, in principle, given their support to the inclusion of CO₂ emissions from international shipping in the EU ETS. The European Commission, however, is currently investigating the feasibility of different legal measures, among them integrating shipping in the EU ETS, CO₂ taxation with hypothecated revenues, and a mandatory use of proposed IMO energy efficiency indices (see below).

3. Maritime shipping

According to an assessment by the IMO, global shipping in 2007 emitted approximately 843 million tons of CO₂. This figure represents the central consensus of an IMO-commissioned study team composed of the principal experts in fleet-wide emission modeling – however, the team also finds that possible 2007 emissions range from 685 Mt CO₂ to 1 039 Mt CO₂. Under normal economic circumstances international shipping is growing rapidly and demand for fuel would under business-as-usual double within 30 years.

The policy measures aimed at reducing emissions from shipping that are currently under discussion include fuel or carbon taxes, CO₂ emissions trading, a levy on bunker fuel where the proceeds would be fed into an International Fund for Greenhouse Gas Emissions from Shipping, and mandatory use of the IMO's Energy Efficiency Design Index (EEDI)¹ or its Energy Efficiency Operational Indicator (EEOI)².

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1. Initially referred to as the IMO's CO₂ design index.
 2. Initially referred to as the IMO's operational CO₂ index.

The EEDI is aimed at the construction and design of new ships and will have limited impact on real emissions in the short to medium term. The unit for EEDI is gram of CO₂ per capacity mile, where capacity is an expression of the cargo-carrying capacity relevant to the cargo that the ship is designed to carry. The EEDI expresses the emission of CO₂ under specified conditions (engine load, draught, wind and waves etc). An adoption by the IMO of the EEDI would probably be supplementary to future measures aimed at influencing operational emissions from pre-existing and new ships.

The unit of the EEOI is also grams of CO₂ per capacity-mile. For most ships capacity will be expressed as tons of cargo moved but in some circumstances units such as TEUs, cars or passengers may be more relevant. A preliminary version of the EEOI has been used in extensive trials over the last five years. The IMO is now in the process of finalizing an up-dated version.

The EEOI is by most experts seen as a means of improving the understanding among ship owners, charters and crew members of how various parameters affect fuel consumption and CO₂ emissions. However, there have also been thoughts about using it as a mandatory baseline. This would, though, be problematic as ships vary in size and empty return-trips are impossible to avoid for some ships. Another issue is how empty containers should be accounted for. In general large ships would have an upper-hand on small ships and ships carrying high-density cargo would have an easier task than those dedicated to volume goods. Yet another problem is that the EEOI would be higher during years of high demand than under recessions. For these reasons using the EEOI as a basis for mandatory measures is extremely problematic.

In order to influence emissions, three different sets of market based instruments have been under discussion; CO₂ taxation, emissions trading, and a proposal for a universal levy. These policy instruments may all be designed to provide incentives to reduce operational emissions. This is important as the potential for operational measures is much larger than the prospective reductions from the design of new ships, particularly in the short to medium term.

In order to be able to reflect real³ emissions, the system for emissions trading, taxation or charging should be time-based rather than route-based. In a time-based regime the ship would have to submit CO₂ allowances or pay a tax or charge on fuel bought during a certain period of time. This means being liable for all emissions caused by the combustion of that fuel regardless of whether it was consumed at sea or at berth. The latter use of fuel is significant for some types of ship, for instance Ro-Ro vessels, large ferries and cruise ships. Fuel may also be used for loading and unloading cargo and for heating heavy bunker fuel or keeping cargo cool. In a route-based system it would be difficult to cover emissions at berth and the fuel purchased would often have to be split on different journeys or trip-legs as large vessels can store huge amounts of fuel. The proposal for a maritime emissions trading scheme, METS, (Kågeson, 2007) and the Danish proposal for a levy on bunker fuel are time-based (Denmark, 2009).

3.1 Gradual introduction

Global coverage is not likely to be achieved from start as it would require full support from developing countries (non-Annex 1 states). One can therefore envisage three possible stages of development:

3. As opposed to emissions that have been derived from a theoretical model based on assumptions on engine load, speed etc.

- A scheme endorsed by the IMO and UNFCCC that is open to voluntary participation by states and ports;
- An IMO/UNFCCC scheme covering all traffic on ports in Annex 1 countries;
- An IMO/UNFCCC scheme covering traffic in all parts of the world.

With universal coverage (the final stage) there would be no need to distinguish between fuels used on different voyages as the liability would cover emissions from traffic to all ports of the world. In this case it would be sufficient to rule that the ship must report its fuel consumption annually or, perhaps better, on a quarterly basis (to avoid extensive evasion just prior to the planned scrapping of old vessels) and surrender CO₂ allowances equalling its fuel purchases during the period in question.

In the probable absence of support for a global system, it would be natural in the first phase to build on ports of the Annex 1 countries⁴. However, the IMO and the UNFCCC could also invite other states to participate. The system could over the years be gradually extended to include ports in advanced developing countries. To facilitate the entry of new participants, it is essential to design the scheme in a way that makes it easy to include additional countries and ports. When this happens to a system for emissions trading it must be possible to adjust the cap accordingly and to allow the newcomers a proportional influence over the scheme.

One way for the Annex 1 countries to seek the support of developing nations for the first voluntary phase would be to grant each non-Annex 1 country that endorses the scheme part of the revenues from auctioning allowances or taxing the fuel. The developing countries would under such a regime accept that ships carrying cargo between their ports and ports of a Party to Annex 1 would be liable for emissions from that journey. Their export and import of goods to and from Annex 1 countries would thus be affected but neither domestic trade nor trade with other developing nations. As their participation would only be partial, the arrangement could be viewed as an implementation of the principle of common but differentiated responsibilities expressed in the Kyoto Protocol. If most of the proceeds from the scheme are directed to climate change mitigation and adaptation in developing countries these nations would receive a great deal more than they contribute.

In establishing a global scheme open for voluntary participation, the IMO would respect the right of innocent passage (UNCLOS Article 24). Ships travelling through the territorial waters and the Exclusive Economic Zones of the participating states on their way to ports in non-participating countries would not be covered by the scheme.

3.2 The responsible entity

In maritime law, a ship has a distinct legal personality and can be held responsible for illegal action carried out by anyone that made use of the vessel. It may be arrested and have legal proceedings brought against it separate from the legal owner or operator. Systems based on this principle already exist. Sweden enforces a national system of fairway dues on all ships regardless of flag. It requires all ships to submit electronically a declaration for fairway dues. According to the ordinance, “those who sign” declarations for fairway dues assume payment

4. Annex 1 countries are states that under the Kyoto Protocol are committed to specific reduction targets for 2008-2012.

liability for these dues. The ordinance does not specifically place the liability with any legal entity. It is understood to be the ship that needs to comply with the regulation.

Making the ship responsible for submitting allowances or paying the tax or charge would make it possible to rule that a non-complying ship would be denied the right of calling voluntarily at participating ports until its debt was paid. To maintain the ship's right to call it would make no difference whether the allowances (or the tax or levy) was submitted by the owner, the charterer, the ship's master or by someone else. Change of flag state or ownership would not alter the liability of the ship. To deny a non-compliant vessel the right of voluntary entrance would be the only power that a participating port State could exercise in the event of unilateral introduction of the scheme.

Making the owner or the charterer of the ship liable would potentially be less effective as several different charters may be involved over time and as vessel ownership may change. It may be difficult to deny a ship the right of entrance in a case where a former charterer or owner was legally responsible and had not submitted CO₂ allowances or paid the tax.

3.3 Administration and monitoring

Regardless of whether the scheme is aimed at taxing fuel or making maritime transport participate in emissions trading, ships that want to call at ports of participating states would have to open an account at the international authority in charge of the system and report its fuel purchases to that body by making use of the bunker delivery notes that are already obligatory for ships above 400 GT. Each ship would be registered by its IMO-number which remains the same through-out the life of the vessel.

A ship that has not surrendered CO₂ allowances matching its fuel purchases, or in the case of taxation has not paid the duty on all fuel bought, would be black-listed by the authority and denied the right of calling voluntarily at participating ports until its CO₂ account deficit was balanced or the debt paid.

3.4 Legal ground

According to United Nations Convention on the Law of the Sea (Art. 212), States, acting especially through competent international organisations or diplomatic conferences, shall endeavour to establish global and regional rules, standards and recommended practices and procedures to prevent, reduce and control pollution. The UNFCCC must be regarded as a competent international organisation with respect to emissions of greenhouse gases from ships. The IMO, which is normally seen as the competent international organisation with regard to any issues concerning international shipping, is also a body that can take a decision on a global regime for emissions trading in the shipping sector.

If the two relevant bodies under the United Nations fail to come up with a universal system for the abatement of greenhouse gases from international shipping, states can take unilateral action as long as they do not violate the "right of innocent passage". The way open to them is to act as Port States.

Port States have a wide discretion under UNCLOS and are allowed to make voluntary port calls conditional on unilaterally enforced standards if they consider this necessary for the protection of their environment. However, the requirements must be proportional to the subject pursued and non-discriminatory. They can be enforced on all vessels regardless of flag. Both

the United States and the European Union have on several occasions used this opportunity to enforce higher standards on ships calling at their ports.⁵

3.5 CO₂ emissions trading in an open system

CO₂ emissions trading would require a cap on emissions from international shipping. The advantage with applying a cap is that one can be sure to reach the target. The down-side is that the marginal cost would not necessarily be known in advance. Another potential drawback is that fluctuations in the market allowance price may make investors uncertain.

The fact that international shipping is growing fast and that its CO₂ emissions are currently estimated with some degree of uncertainty make it difficult to know exactly where to put the cap. One way of circumventing the problem would be to introduce a trial year during which ships would register their fuel consumption without any obligation to submit emission allowances.

In a closed trading system the cap would have to be more generous, as there would be no “emergency exit” available if it proved to have been set too tight. An open trading system has the advantage of allowing trade with entities in other sectors and other parts of the world that may face a lower marginal abatement cost than the shipping sector. The volume of allowances and the number of potential participants would also be much greater in an open system, which should benefit market transparency and trade. Therefore an open system is preferred. Trade should be permitted with other sectors and cap-and-trade systems, and in addition the shipping industry should be able to use some project credits – Emission Reduction Units (ERUs) and Certified Emission Reductions (CERs) – from the Joint Implementation (JI) and Clean Development Mechanism (CDM) respectively.⁶

3.5.1 METS

Commissioned by the Federal German Environment Agency (UBA), Kågeson (2007) analyzed the feasibility of linking the CO₂ emissions from international shipping to the EU ETS. He proposes that responsibility for emission allowances within a Maritime Emission Trading Scheme (METS) should rest with the ship itself and be tied to the permission for a ship to call at a participating port. Ships would, according to this proposal, be liable for emissions from fuel bunkered since they last called at a participating port, albeit never for a period longer than a few months. This means that the return voyages of ships involved in intercontinental traffic would be covered and shipping operators would not gain anything by calling at ports in the vicinity of the European Union.

In such a system one would have to provide a refund to ships that were used only occasionally for a trip to a participating state. This could be done on the basis of a default value that is set as to not over-compensate such ships.

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5. Examples of this are the US Oil Pollution Act, the EU's early ban on single-hull tankers, the 1996 Stockholm agreement on stability requirements for Ro-Ro ferries, the US ballast water requirements, the EU's regulation on the highest permissible sulphur content in fuels used by ferries and its requirement on ships not to use fuel containing more than 0.1% sulphur while at berth.
 6. The extent to which purchases of emission credits from project-based mechanisms should be allowed is not discussed in this paper.

Domestic journeys by ships above 400 GT are proposed to be covered by METS as many carriers of this size are used both for domestic purposes and in international trade.

The report proposes that the initial allocation of emission allowances should be made by auction arranged by the EU or, if the system received global acceptance, by the IMO or the UNFCCC. Allocation free of charge based on the historic emissions of individual ships would mean having to decide on allowances for many different types of ship and for vessels of different size. In the shipping sector the problem with new entrants and the risk of rewarding companies that sell or scrap facilities is more pronounced than with land-based activities. Ships are by definition movable. The only good reason for “grandfathering” is to protect industries from losing market shares to competitors in non-participating countries. This problem will not occur in shipping when all vessels calling at participating ports, regardless of flag and port of departure, must surrender allowances equal to the fuel used. A second reason for auctioning is to avoid the generation of windfall profits, which may occur when allowances are given away free of charge.

Auctioning the allowances will also contribute to transparency and improved liquidity in the carbon market and thereby reduce the current market price volatility.

3.6 Fuel or CO₂ taxation

A fuel or carbon tax could potentially be labelled a levy when the proceeds are dedicated to a certain cause (and do not become general government revenue). Therefore the Danish proposal to the IMO for a common levy on bunker fuel could be regarded as an emissions tax with hypothecated revenues (see below). A positive effect of a carbon tax is that it makes the price of CO₂ emissions known which allows investors to consider it with a high degree of certainty. However, a potential risk is that tax resistance makes politicians set the levy too low so that the CO₂ target cannot be achieved. Contrary to emissions trading the price is known but not the outcome.

One way around this problem would be to allow the tax or levy to reflect the price on carbon that results from emissions trading in other sectors of society. The level of the tax could be adjusted every other year to coincide with the average price on CO₂ in the emissions market during that period of time. When the EU ETS is followed by national and regional cap-and-trade systems in other parts of the world, a global price on carbon will emerge if firms that are subject to these different schemes are allowed to trade allowances with each other. This could be achieved by allowing links between the various systems. However, if CO₂ taxation becomes the favoured option in most parts of the world, there will not be a global price on carbon to which such taxes could be tied.

A problem with tax- or levy-based schemes is that the rates must be subject to political agreement and that decisions on tax rates in the European Union require unanimity among the 27 member states. Some countries are very reluctant to giving away their right of deciding on tax and charge levels to a supra-national body of any kind.

3.6.1 A levy on CO₂

In 2007, Norway proposed that the IMO should introduce a system whereby a cap would be placed on the CO₂ emissions of international shipping at the same time as a charge would be levied on vessel emissions (Norway, 2007). According to the proposal, the revenue would be used for:

- grants to measures undertaken to reduce vessel emissions of CO₂;
- purchasing emission allowances on the international market in order to balance the total CO₂ emissions from international shipping against the cap;
- contributions to climate change mitigation in developing countries.

Norway appears to have reconsidered its proposal (in favor of emissions trading), but Denmark has taken the Norwegian idea a step further (Denmark, 2009). Denmark proposes a levy on bunker fuel that is set to reflect the fuel's content of fossil carbon, which is essentially the same as a carbon tax. The proceeds of this tax would be fed into an *International Fund for Greenhouse Gas Emissions from Ships* and be used for:

- offsetting CO₂ emissions above a baseline that is gradually lowered over the years;
- R&D projects;
- Technical cooperation within the existing IMO framework.

According to the proposal, offsetting CO₂ emissions above the baseline could be done by buying CO₂ credits in the international market or by supporting climate change adaptation.

The size of the levy is only indicated in the Danish proposal. Examples ranging from USD 7.5 to 45 per ton bunker are given. They correspond to USD 2.5 to 15 per ton CO₂, which fall well below the current carbon price in the EU ETS. The future price for CDM credits could be expected to reach EUR 30 (or more) when the European reduction target is minus 30 per cent. However, so long as real emissions from shipping only marginally exceed the baseline, a relatively low levy could buy all the credits needed to offset any excess emissions. Additional revenues would, on the other hand, be required for financing the other two measures mentioned above. The Danish submission to the IMO does not indicate how the total revenue would be split on the three objectives.

Some conclusions may anyway be drawn. The Danish model would achieve the same overall reduction of CO₂ as an emissions trading scheme provided that the baseline is identical to the cap and that the tax raises enough money to offset any emissions above the line. However, so long as the levy is set below the market price on carbon, the marginal cost to ship operators would fall below that which would result from emissions trading.⁷ If this happens less will be achieved in the shipping sector and more in other sectors compared to a case of emissions trading. It is only if the levy is set at a level that corresponds to the global market price on carbon that the two systems would deliver identical results. A charge at this level would also be needed to allow the scheme to make a contribution to the greenhouse gas fund that is similar to what can be provided by spending all revenues from auctioning CO₂ allowances on that purpose.

7. In a case where the baseline is exceeded by 25% a levy that corresponds to 20% of the price of carbon would raise the money needed for offsetting all excess emissions, as shipping would not have to pay anything for emissions below the baseline.

3.7 Effects on costs and intermodal competition

Assuming a future CO₂ price of €30 per ton CO₂, the cost of acquiring an allowance would be equivalent to a supplement on the cost of bunker of about 30 per cent when the market price of heavy fuel oil is USD 400.^{8,9} A higher price on bunker fuel would depress demand for oil as well as demand for emission allowances and credits. The effect on total fuel cost from emissions trading would in such circumstances percentage-wise be a smaller than in the above example. The uncertainty is large with regard to both bunker prices and the cost of CO₂ credits, but the increase on bunker prices from participating in emissions trading could be expected to fall in the range of 15-30 per cent.

In intercontinental freight transport there is usually no alternative to shipping and the incremental cost caused by emissions trading or CO₂ taxation would be small compared to the overall prices of manufactured goods. Shipping costs are approximately 1 per cent of the final consumer price of goods (European Commission, 2009). The price elasticity of demand for maritime transport is very low, so the risk that the emissions trading scheme would have a significant impact on world trade is small.

Some concerns have been raised in the shipping sector that taxes or requirements to submit emission allowances would make cargo owners substitute short-sea shipping by land-based modes. This risk is small for liquid bulk shipments but may be a concern where Ro-Ro and container traffic are concerned. But, on the other hand, rail and road transport will also see costs rise as an effect of climate change policies.

The price of the electricity consumed by trains in Europe is already affected by the cost to the trading sector of remaining within the cap. In a deregulated market, power generators try to pass on the marginal cost of production to all customers, and production in coal fired power stations is generally used to meet increased demand. A price of €30/ton CO₂ will raise the cost of electricity by up to 2.4 euro cents per kWh (US cents 3.2/kWh) compared to the situation before the cap was introduced.

A main reason for not wanting to extend emissions trading in Europe to CO₂ emitted from road vehicles has been a fear that the inclusion of the road transport sector would make the price of emission allowances rise to a much higher level than would otherwise have been the case. However, excluding trucks and cars from the EU ETS does not mean that they will not have to contribute towards the climate change objectives of the Community. Most Member States will have to raise their road fuel taxes significantly in order to keep emissions from the non-trading sectors below the targets that they have agreed on. Taking into consideration the high willingness to pay among motorists and hauliers that rise could in most cases be expected to be higher than the price on CO₂ in the trading sector (that would affect ships).

Finally, one should not forget that many other factors also affect the customers' choice of freight transport mode.

8. Combustion of 1 ton HFO results in an emission of approximately. 3 ton CO₂.

9. In this paper an exchange rate of 1.35 between the euro and the US dollar has been used.

4. Aviation

According to the IEA, global civil aviation emitted 729 million tons of CO₂ in 2006.¹⁰ The aviation industry is expected to grow at an annual rate of just under 5 per cent over the period to 2020, according to the ICAO (in forecasts made ahead of the economic crisis). Under current trends in technological development, larger aircraft, more direct air routes and improvements in flight control total fuel consumption in the commercial aviation sector is expected to increase by almost 3 per cent per annum. This would be equivalent to an approximate doubling of CO₂ emissions between 2005 and 2030.

4.1 Fuel taxation or emissions trading?

The Chicago Convention, which established ICAO, prohibits the taxing on arrival of fuel already onboard an aircraft. This prohibition has since been extended by governments to a general tax exemption for fuel on international flights and further enshrined in a large number of bilateral service agreements. Therefore, according to some experts and some governments, the Chicago Convention prevents the Parties of the convention from enforcing taxes or charges on international air traffic for any other purpose than making airlines pay for services rendered. Therefore making international aviation subject to a cap-and-trade scheme appears to be the only way forward.

In 1996, the ICAO Council adopted a Resolution that recommended that any environmental levies on air transport, which States may introduce, should be in the form of charges rather than taxes. This resolution, which was endorsed by ICAO's Assembly in 2001, effectively killed the possibility of developing a kerosene tax. Today only a few countries maintain taxes on domestic aviation fuel.

In 2001, the ICAO's Committee on Aviation Environmental Protection, CAEP, approved an open emissions trading system as a cost-effective solution for reduction of CO₂ emissions in the long term. The ICAO Assembly in September 2004 endorsed "voluntary trading systems that interested Contracting States and international organizations might propose" and said that ICAO would provide guidance to Contracting States. This statement was the basis for the European Commissions' proposal in 2006 to include aviation in the EU ETS.

Some countries, including the United States, insisted that foreign carriers could only be included by mutual agreement, which would necessitate new bilateral agreements with all states affected by a scheme. The EU, on the other hand, decided to allow itself to mandate participation of foreign carriers in the absence of mutual agreement.

The ICAO's 37th Assembly decided to form a new group of experts, the Group on International Aviation Climate Change (GIACC), with a mandate to draw up a plan of action for ICAO to address climate change. The proposal is due to be delivered by mid 2009 and will be put before a High Level Group meeting of ICAO and the Council to be endorsed as ICAO's climate change plan to be submitted to COP 15¹¹ in Copenhagen.

10. International Energy Agency CO₂ Emissions from Fossil Fuel Combustion 2008.

11. The 15th Conference of the Parties.

In February 2009, the Aviation Global Deal Group, consisting of several large airlines, called for a global sectoral deal on aviation, which would include a cap on carbon emissions and the use of market-based measures such as emissions trading.

4.2 Emissions trading, the European example

When the European Commission presented its proposal for a directive (COM(2006) 818 final) on the inclusion of aviation in the ETS it found a route-based approach, defined on the basis of country of departure and/or destination, to be most simple and workable. The scheme will cover all flights arriving or departing from an airport in the Community as of 1 January 2012. This means that emissions from domestic flights, that have hitherto been part of the national commitments, will fall under the cap.

According to the directive, emissions trading will be limited to aircraft having a maximum departure weight of 5.7 tons or more. The flights covered by the scheme will be allocated emission allowances equivalent to 97 per cent of the average sectoral emissions between 2004 and 2006 which will serve as the legal cap and is expected to be reduced to 95 per cent for the period between 2013 and 2020. The majority of aviation allowances will be allocated to the sector free of charge and based on benchmarking and historic operations. During the first period, auctioning will only be used for 15 per cent of the allowances allocated to the industry. In the longer term a growing share will probably be distributed by auction.

As noted already above, the only good reason for “grandfathering” is to protect industries from losing market shares to competitors in non-participating countries. This problem will not occur in aviation when all aircraft calling at participating airports, regardless of flag and point of departure, must surrender allowances equal to the fuel used. A strong reason for auctioning is to avoid the generation of windfall profits, distortion of the market and creation of new barriers to entry that may occur when allowances are given away free of charge. This has been the experience with the allocation of airport landing rights. If the EU is only to gradually introduce auctioning it faces the difficulty of distributing emissions permits free of charge in a way that minimises these potential impediments to efficiency in aviation.

Airlines will be granted limited opportunities to make use of emission credits (CER and ERU) from the project-based flexible mechanisms (CDM and JI). JI and CDM are project-based emission reduction activities that take place in respectively other industrialized countries (listed in Annex 1 of the Kyoto Protocol) and developing countries. In view of the expected growth of the aviation industry and the difficulties of replacing fossil fuels in air transport, the aviation industry is expected to become a net purchaser of emission allowances. Assuming an annual growth in fuel consumption of the order of 3 per cent, the industry’s demand for emission allowances could be expected to be at least 20 per cent higher than the 2005 emission level as early as 2012.

Operators will be liable for submitting allowances equal to the emissions caused by their aircraft. In order to avoid duplication and an excessive administrative burden on aircraft operators, each operator, including those based in countries outside the EU, will be administered by one Member State only.

4.3 The Civil Aviation Emissions Trading Scheme (CAETS)

A global scheme for emissions trading in the aviation sector could build on the European model. It makes sense to include not only international flights but also domestic journeys by

planes of the agreed minimum weight as the same aircraft is sometimes used for both types of routes. A purely route-based approach is less problematic in aviation than in shipping as aircraft cannot load fuel for several trips and as no or little fuel is used when planes are parked at airport terminals. The regional air control organizations can be used for monitoring the planes, which buy their fuel from a limited number of depots located near to airports. It should be possible to develop a system for civil aviation which is similar to the bunker delivery notes that are already mandatory in the shipping sector. Airlines would in the case of a global scheme report and submit CO₂ allowances to a common authority under the ICAO.

4.4 Technical standards

There are as yet no fuel efficiency standards for civil aviation whereas there are limits on other emissions and impacts, e.g. NO_x and noise. It would be a good idea to supplement emissions trading by fuel efficiency standards.

5. A gradual introduction?

There exists a large potential for efficiency improvement in both shipping and aviation. If identified measures were implemented across the whole fleet of ships, they could, according to the European Commission (2009), deliver a 28 per cent reduction by 2020 compared to BAU. However, all measures may not be cost-effective at the carbon price of the 2010s. In aviation less can be achieved in the short term as the opportunities for improving operations are fewer than in shipping. Given the fast increase in demand for shipping and aviation both sectors are expected to have to offset part of their emissions by becoming net-buyers of allowances or credits.

Both emissions trading and the levy-system proposed by Denmark can thus be expected to generate a large and growing demand for emission credits. If emissions trading were to be extended to CO₂ emitted from both aviation and maritime transport, it would in the context of a broad geographical coverage be necessary to analyse whether the supply of emission credits from projects in developing countries will be able to match demand in the 2010s. Emission credits will also increasingly be demanded by firms subject to the regional and national emission caps already existing or on their way to be established in the industrialised world.

If the analysis shows that the global supply of emission credits cannot be expected to reach a sufficient level in the short term, this may be a reason for contemplating a gradual introduction of full responsibility in the shipping and aviation sectors. A step-wise introduction would then create conditions for the two modes that are similar to those enforced on most land-based emitters in the EU ETS. It may also be necessary in the context of climate change policy-making to consider the short-term effects of the current economic crises on the aviation and shipping industries.

A gradual introduction could be achieved by ruling that ships and aircraft initially only have to surrender allowances equal to a certain portion of their emissions which would then over a few years be raised gradually to full liability. In its first stage this design would of course suffer from the same disadvantage as the scheme proposed by Denmark of providing only a partial incentive to become more fuel-efficient. However, if a decision is taken to gradually raise the liability to 100 per cent by 2020, companies ordering new ships or aircraft would presumably consider the long-term effect rather than the short-term conditions when deciding on the design and operational speed of their vessels.

6. Revenues

The annual revenues from auctioning allowances to the aviation and shipping sectors will depend on the geographical scope of the systems and the carbon price.

If all traffic to and from ports of the developed countries are covered by the Maritime Emissions Trading Scheme (METS), and if in addition all domestic traffic in those countries performed by ships larger than 400 GT is included, and the cap is set to correspond to the 2005 emission level, around 630 million allowances would annually be sold on auction.

If all flights, international as well as domestic, by civil aircraft above 5.7 ton to and from airports in Annex 1 countries are covered by the Civil Aviation Emissions Trading Scheme (CAETS) about 550 million allowances would be auctioned based on a cap that equals the emissions caused by such traffic in 2005.

In total this would result in revenues from selling around 1 180 million allowances per year.¹² It is difficult to forecast the price of emissions allowances, but at a price of €30 per ton CO₂, the proceeds would in the short term amount to €35.4 billion (USD 47.8 bn).

If by 2020, METS and CAETS expand to cover 85 per cent of global emissions from aviation and shipping, the cap is reduced to 80 per cent of the level of these emissions in 2005 and the market price has risen to €40 per ton CO₂, the resulting resource stream would be €42.8 billion (USD 57.8 bn). In the longer term the proceeds would eventually decline when global coverage is reached and the caps are gradually lowered.

Taking into consideration the uncertainty of the above assumptions, the average annual revenue from the METS and the CAETS might be expected to be in the order of €30-40 billion (USD 40-54 bn) over the next two or three decades.

7. Proposal for a fair deal

A way of reconciling the *principle of common but differentiated responsibility* with the *principle of no more favourable treatment* would be for the IMO and the ICAO to design and endorse two schemes for emissions trading, METS and CAETS, that are open to voluntary participation by states and for the UNFCCC to reach an agreement at COP15 in Copenhagen to make all Annex 1 countries join the systems. Developing nations could be encouraged to allow emissions from flights and shipments between their ports and sea ports and airports in participating countries to be covered by the schemes. Those who agree to such partial coverage would share the proceeds from the system and get back a great deal more than they contribute.

The best way of allocating responsibility for the trading schemes might be to entrust the UNFCCC (or a subsidiary body) with auctioning the allowances and the IMO and the ICAO with the administration of registers and the CO₂ emission accounts for individual ships and/or shipping companies and airlines. A small part of the money would have to be set aside to cover the administrative costs. The rest could be fed into one or several funds under the auspices of the United Nations to be used for climate change mitigation and adaptation in developing countries. The UN will in future need large funds for dealing with problems directly or indirectly

12. The figures should be seen as an illustration of the effect when 75% of global air and sea traffic are subject to the schemes. The author does not have access to the disaggregated data on traffic and fuel consumption needed for making a detailed analysis.

caused by climate change such as scarcity of food due to draughts and floods (and competition with biofuels). Halting deforestation and encouraging reforestation is another important UN task. One fifth of the emissions of greenhouse gases are currently caused by changes in the use of land. Social unrest and military conflict may also follow climate change and require additional efforts by the UN. Part of the proceeds could be ear-marked for use in developing countries that endorse the system and accept its partial effect on them.

China and the G77 group have called for commitments from developed countries to spend at least 0.5 per cent of their GDP on climate change, on top of existing development aid (which amounts to less than 0.3%). The annual gross-revenue of the two trading schemes of €30-40 billion (USD 40-54 bn) represents a sum equal to about 0.13 per cent of the current GDP of the OECD countries. This is money without an owner, a resource that could be seen as belonging to mankind.

Many of the OECD countries will face growing, and in some cases very large, budget deficits in the aftermath of the current economic crises. Dedicating the proceeds from auctioning allowances to aviation and maritime transport to climate change mitigation and adaptation in developing countries would be a way for them to limit the additional burden of climate change mitigation on their national budgets. It is difficult to see how they would alternatively be able to raise all resources required.

Demand for transport by sea and air are closely connected to GDP per capita and the environmental pressure caused by economic growth. One should in this context remember that developing nations in some cases are home to large groups of middle class people who enjoy a standard of living that comes close to that of their Annex 1 counterparts. These citizens will see prices on air tickets for international travel and manufactured goods imported from the industrialised countries rise somewhat. However, their poor compatriots will not be affected as they cannot currently afford such luxury.¹³ So what could better reflect the responsibility for contributing to climate change mitigation at a global level than our individual shares of global trade and international transport?

In short summary

The Maritime Emissions Trading Scheme (METS) and the Civil Aviation Emissions Trading Scheme (CAETS), covering emissions from traffic to, from and within the industrialised countries, would allow the shipping and aviation industries to contribute to climate change mitigation by:

- Taking technical and operational measures in response to the carbon market price;
- Becoming a net-buyer of emission allowances and emission credits, thereby contributing to reductions in other sectors and in developing countries;

13. The only risk for poor people being affected concerns shipment of grain from exporting Annex 1 countries (such as Australia, Canada and the United States). One may therefore contemplate to allow carriers of grain a refund for journeys to developing countries.

- Providing large funds (in the order of €30-40 bn/year) for climate change related missions and tasks carried out by the United Nations and its relevant subsidiary organisations (USD 40-54 bn).

The revenues from these cap-and-trade schemes will allow the UNFCCC to compensate developing nations that accept that there will be a small affect on their economies by the inclusion of flights and shipments from their ports to airports and seaports in Annex 1 countries.

More advanced technologies may be needed for meeting longer-term commitments in a cost-efficient way. Given the long expected life of vessels, incentives are needed now for adjusting the fleets to the likely CO₂ prices related to future more stringent climate change commitments. Therefore fuel efficiency standards for new vessels and aircraft should supplement emissions trading.

REFERENCES

Denmark (2009), *An International Fund for Greenhouse Gas Emissions from Ships*, submitted 1 April 2009 to the IMO's MEPC 59.

European Commission (2009), *Towards a comprehensive climate change agreement in Copenhagen*. Commission staff working document (COM(2009) 39 final).

ICAO (2007), Report on voluntary emissions trading for aviation.

IMO MEPC (2008), Legal Aspects of the Organization's Work on Greenhouse Gas Emissions in the Context of the Kyoto Protocol, Note by the Secretariat. 1 August 2008.

Kågeson, P. (2007), *Linking CO₂ Emissions from International Shipping to the EU ETS*. A report commissioned by the Federal Environment Agency, Germany, 2 July 2007.

Norway (2007), *IMPERS: A new market-based CO₂ emission reduction scheme*, submitted 29 April 2007 to the IMO's MEPC 56.