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Options for the Integration of Ocean Transport in a Greenhouse Gas Regime post 2012

Part II – Position Paper

2. March 2007

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Table of Contents

List of Tables

List of Figures

List of Examples

Part 2

Position Paper

This report is split into two parts: Part I to provide background information and Part II to discuss options for integrating international shipping in a post 2012 greenhouse gas agreement.

This second part of the report aims to provide creative ideas and recommendations to aid the formulation of a sound European strategy for addressing greenhouse gas emissions from ocean transportation after 2012. The goal of this analysis is to identify different options for the integration of ships that are politically, methodologically, administratively and technically feasible within the framework of today's global economy. While this report explores the subject from a global perspective and has global solutions as a future target, regional options, their merits and barriers to their implementation are discussed as well.

One underlying goal for evaluating the options is their capability for adressing effectively reductions of CO_2 emissions from internatioanl ocean transport. Some of the options only provide relative emission reductions. Methodological ways for reducing emissions in absolute terms still need to be developed. One promising avenue is a system-wide consideration of the freight industry throughout all modes of transport, because it is a multi-modal system of logistics and transport.

In this part of the report existing models are first briefly evaluated (6.1). On the basis of these evaluations and with considerations of the findings from Part I of this report, options are investigated in more depth and new options are developed (6.2). Those options from 6.1 that are considered worth while are further discussed in section 6.2. Some newly developed ideas aim to take the global trade needs and the specific situations of countries of the global South into account.[1] This analysis is applicable to all internationally travelling freight ships, including roll-on roll-off vessels and ferries.

6 Integration of International Ocean Transport in a Greenhouse Gas Reduction Regime

6.1 Comments on existing greenhouse gas reduction options

The goal of this report is to constructively expand ideas for the negotiations addressing greenhouse gas emissions from international ocean shipping in a climate gas reduction

[1] This report uses the terms "North" and "global South" as well as countries in transition instead of the terms "developed" and "developing", "1st World" and "3rd World" or "industrialized" and "developing" countries. The use of the terms North and global South is less discriminating and sidesteps terminology that lacks a precise definition, such as "developed". Also, the frequently used terms 'advanced industrial countries', 'emerging markets' and 'heavily indebted poor countries' imply some typical development paths. The terms “1st World” and “3rd World” stem from a Cold War context in the middle of the 20th century and are no longer current. Countries of the North and countries of the global South also emphasizes the geographic relationship between the countries that are named "developed" and "developing" in the UNFCCC and underlines the global characteristic of the global economy.

regime and to develop innovative solutions. The negotiations have reached a grid-lock in terms of the different perspectives of the stakeholders. Eight different models for allocating the emissions from international bunker fuels have been developed in the context of the Kyoto negotiations and within SBSTA (SBSTA 1996). Current discussions remain trapped within these eight models. In anticipation that none of the eight models will garner a majority of supporters, this report presents new options as well as new variations of existing options.

The reasons for the gridlocked negotiations with regard to the greenhouse gas emissions from international bunker fuels, from international aviation and shipping transport, are diverse and closely linked with international law and the different jurisdictions. For example, flag states, including the German International Register (GIS), fear that they will be burdened with the bulk of the responsibility, which could threaten a sector that is important in many flag state countries. Furthermore, countries in transition and countries of the global South are in particular afraid that environmental measures on international transport could institute non-financial trade barriers (for example countries of the Group 77). Countries of the North fear that the potential increase in transport costs could negatively weigh on economies that are often dependent on imports. Individual regions with concentrations of transport infrastructure, in particular in countries of the North, additionally fear that national or regional initiatives might put their countries at a competitive disadvantage, which could lead to damages to the transport industry that are locally significant (e.g. California, the Netherlands). The transport sector and the ocean shipping industry fear in large that the maritime trade could diminish with a diminishing return on investment and negative effects on employment. This aspect is especially important for countries of the global South for which the ocean transport industry is often an important source of income and employment. As a consequence of those justified positions there is a need to develop solutions to the problem of increasing greenhouse gas emissions from ships that enable to bridge the different stakeholder interests. Against this economic background and the growing threat of climate change, solutions should ensure enironmental effectivness and fair competitive conditions, for example by treating every ship companies or ship operater equally on each covered route.

Methodological Approach of this Report:

This part of the report will first describe and generally discsuss existing options and potential options described elsewhere (see Table 1). Those general discussions in section 6.1 will be used to select options that provide realistic potentials in regards to the integration of international ocean shipping in a future greenhouse gas reduction regime. The selected options will be further developed in Section 6.2. Each option is indicated by reference letter. At the end of each subsection in 6.1 a reference letter indicates if this options is further considered in section 6.2. Conclusions in section 6.1 are interim conclusions and the reader is encouraged to continue the discussions in section 6.2 on select options for a complete analysis.

Table 1: *Options already discussed by other authors*

	Option	**Target group for policy measures and emission reductions**	**Legal jurisdictions**
A	Emission reduction through allocation of greenhouse gas emissions from international shipping to national inventories similar to the Kyoto option (CE Delft 2006)		
A-1	Allocation on the basis of the route; Start and end port	Nation states with emission reduction targets according to the current Kyoto Protocol	UNFCCC for CO_2 targets; IMO for guidance; Nation states for implementing reduction measures
A-2	Allocation on the basis of the origin or destination of the cargo	Nation states with emission reduction targets according to the current Kyoto Protocol	UNFCCC for CO_2 targets; IMO for guidance; Nation states for implementing reduction measures
A-3	Allocation according the UNCLOS sovereignty to flag states	Flag states	UNFCCC for CO_2 targets; IMO for guidance; Nation states for implementing reduction measures
B	Sectoral option, represented by the IMO, with emission limits (CE Delft 2006)	Industry sector represented by the IMO; IMO for setting technical standards and guiding policy measures	
C	Regional start with emission standards, emission limits or emission-dependent fees and taxes (CE Delft 2006)	Regional organization[2] for setting standards, limits and fees; Nation states for implementing policy measures	Nation states and multilateral conventions as long as they are not in conflict with international law, in particular UNCLOS and the world trade laws
C-1	Implementation of emission standards (CO_2, but also other air pollutants)	Regional organizations	Nation states and multilateral conventions as long as they are not in conflict with international law, in particular UNCLOS and the world trade laws
C-2	Introduction of taxes on marine bunker fuel sales	Ship owners and operators	Nation states and multilateral organizations; Nation states
C-3	Implementation of industry-wide emission caps with the potential for emissions trading	Ship industry; Flag states; Ship operators	IMO; Nation states in their Port State Control regime under UNCLOS
D	Integration of emission reduction measures in existing regimes; Consideration of the ocean shipping sector like an Annex I country and the introduction of reduction measures as CDM measures (Bode et. al. 2002; ECON 2003)	Flag states; Ship operators	UNFCCC

[2] A regional start may commence in supranational organizations such as the European Union. However, it may also be started by specific multilateral organizations that include for example countires such as Norway, Switzerland, Japan and Canada. One organization that could be taken into account is the UN European Commission for Europe and the Convention on Long-Range Transboundary Air Pollution.

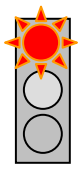
A Options to allocate emissions post occurance to national inventories

A-1) Allocation based on the distance of the voyage; Port of origin and port of destination

While this option may work with the bulk carrier industry, because bulk carriers mostly transport and discharge full cargo loads at one port, the characteristics of the liner ocean transport excludes this option. Furthermore, this option requires the commitment of both the state of origin and the state of destination.

- It is difficult to determine the port of origin and port of destination in the liner industry (at least 30% of the ship-related CO_2 emissions), because ships call on more than one port within a major trade lane. Usually they take on and discharge only partial cargo loads at each port.
- Dividing the greenhouse gases between the states of the port of origin and the port of destination is methodologically difficult and involves the danger of no agreement being reached with regard to the shares which each country will be responsible for. In particular countries of the global South that depend on the export of goods for their economies and OPEC countries who are interested in unrestricted oil trade might resist assuming shares of responsibility.
- The linkage between emissions from ocean transport with specific countries of origin and destination may be interpreted as discriminatory towards free trade from the exporting country. The country-specific basis for setting the measure would establish disadvantages for countries further away then others, by using the country as a determiner. Policy measures could be interpreted as import tariffs and non-financial trade barriers towards the imports from those countries and thus may be in conflict with the General Agreement on Terms and Tariffs (GATT) and other agreements of the World Trade Organization (WTO). This opens the opportunity to challenge such an option on the grounds of the international trade law. However, the amount of emissions to be allocated to the individual states under this option cannot be determined without such a linking of emissions and countries of origin and destination.

Conclusion:



- ➢ Methodologically difficult
- ➢ Impossible to implement politically within a reasonable time frame

A-2) Allocation on the basis of the origin or destination of the cargo

Under this model, the greenhouse gas responsibility will be pegged to the cargo itself compared to linking it to distances of the voyages under the former option. Thereby, the first criticism, the difficulty for partially loaded and unloaded cargo, disappears, because each cargo unit has only one port of origin and port of destination.

However, the other points of criticism on A-1 are similarly valid for the option to allocate emissions based on the cargo itself. This model may also evoke the resistance of export-oriented countries and may run the risk of being interpreted as discriminatory towards free trade. The question of trade discrimination becomes especially relevant when policy measures for the reduction of greenhouse gases apply to states that may not be party to the Kyoto protocol or comparable international agreements, while signatory countries can be expected to accept such measures. Considering the international nature of ocean shipping, the situation of extending measures to non-signatory countries is likely to arise.

Excurse: GATT article on trade discrimination

The two articles that prohibit the differentiated treatment of traded goods based on their countries of origin are Articles I and III of the General Agreement on Tariffs and Trade (GATT) of 1994. Article I prescribes that an importing country must treat each country according to the same rules and that no preferential treatment is permitted. Article III prescribes that imported products from one country are to be set as equal with like products of the importing country. Both articles form the basis of the prohibition of country-specific tariffs and fees that could hamper international trade.

However, Article XX of GATT allows exemptions on the grounds of environmental protection. Essential for any exemption is that the measures are not arbitrary, not unjustified and do not result in unequal treatment of export countries. They should also not constitute hidden attempts to interfere with trade as such. Moreover, the state that introduces policy measures under Article XX must prove that the measure is necessary for the protection of humans and the environment. As a consequence, states have up to now had to prove the necessity of the measure itself, the necessity that the measure interferes with international trade and that the measures which have the lowest effect on international trade has been chosen (IISD 2005).

The final policy measures that might be developed under a greenhouse gas reduction regime should be tested in regards to their conformity with international trade law. An avoidance of conflicts should be possible if the principles of equal treatment of countries are adhered to, especially given the need to interfere with transport processes in order to achieve greenhouse gas emission reductions from international freight transport. For example, the conformity with WTO rules might be achieved if the basis for establishing policy mesures are distance categories rather than countries and if the necessity of the measures for global climate protection is thoroughly argued. Those emission reductions are indeed necessary for the protection of human societies, the terrestrial and in particular the oceanic environment. One possible solution to avoid the label of trade discrimination is the use of distance categories, instead of real distances, for calculating the greenhouse gas emissions (Meyer-Ohlendorf 2005). Furthermore, as the German Advisory Council on Global Change noted, financial instruments are, even when

implemented nationally, not in conflict with the world trade law or the jurisdiction of the IMO. (WBGU 2002)

Critique within the countries themselves may come from industries, in particular multinational corporations that are greatly reliant on deliveries of raw materials and semi-products from third countries. However, a few characteristics should be recalled in relation to such criticisms:

- Marine transport is extremely cheap and even significant increases in its costs, as long as they affect the entire industry, will have only a minor impact on consumer prices.
- The purchaser of imported raw materials and goods are both clients and users of the manufacturing processes as well as of the transport services and are therefore to be seen as directly responsible for the transport activities. The supplier of manufacturing and transporting are in a sense service providers which are replaceable. Any greenhouse gas regime should thus reach in its final fiscal responsibility the buyers of transport services.

The allocation of emissions on the basis of import freight should be further investigated. There is likely little harm to the economy if transport costs were increased. Furthermore, transport purchasers are the stakeholders that can influence transport choices, including modal shifts, and thus pegging greenhouse gas responsiblities directly to freight might spur logistical measures with a positive net environmental effect.

Interim conclusion:

- ➢ Tying emission to freight is realistic and fair
- ➢ Worthwhile option with potentially positive economic effects
- ➢ A careful implementation in accordance with the international trade law is necessary

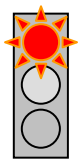
This option will be further studied under A-2 on page 16.

A-3) Allocation in accordance with UNCLOS to flag states

Flag states are the states which are primarily responsible for the implementation of the so-called construction, design, equipment and manning (CDEM) standards under UNCLOS. Based on this responsibility the logic is derived that flag states should take on the responsibility for ship-borne greenhouse gas emissions and reduction measures. However, a flag state option is not feasible for the following reasons:

- Flag states are providers of services and do not cause the transport directly. An allocation according to flag states would increase resistance from poor flag states in particular, who might find themselves and their economies over proportionally burdened with environmental measures. Some peripheral nations currently demand special treatment within the IMO greenhouse gas activities in reference to their special status under the Kyoto Protocol.

- The flag state connection between the ship and the state is relatively loose. A flag state allocation and the related emission reduction mandates would lead to the evasion of ships to other flag states. This would counter both the control and the implementation of environmental measures.



Conclusion:

- ➢ Cannot be implemented in a fair manner
- ➢ No differentiation according to national capacities exist

Similarly problematic, but less pronounced, are the allocation options whereby emissions are allocated to the countries in which the ship operators or ship owners are located. Those connections are also weak and are not in a direct causal relationship to the emissions.

B Sectoral option, administered through the IMO, with the setting of absolute emission limits

Sectoral options differ from national allocation options in that they allocate the emission limits and certificates to the industry sector as a whole. Nation states may play a role in enforcement but emissions are not included in national inventories. In the maritime industry, this enforcement is possible through the ability of every nation state to deny entry to their ports if specific conditions are not met. However, the emissions would not be added to the national inventories.

The sectoral option is particularly interesting when the difficulties of allocating greenhouse gas emissions from international shipping to individual nation states are taken into account. The International Maritime Organization (IMO) is the organization that claims responsibility for the global shipping industry, especially when it comes to setting valid CDEM standards. Many stakeholders in the shipping industry thus prefer to give the IMO the task of developing environmental measures. As described in part one of this report, the IMO has often been slow in setting standards, because of the blockade of negotiations based on conflicting national interests represented in the IMO. The IMO has also lagged behind expectations of the international community with regard to the adoption of measures for reducing greenhouse gas emissions from international shipping. Furthermore, the IMO must not necessarily be seen as the only competent international organization that can set standards for the shipping sector, as described in part one of this report.

The IMO, together with the UNFCCC could take a central role in the development of greenhouse gas reduction measures (UNFCCC 1998). The IMO could be in charge of methodological instruments and setting technical reduction measures, while the UNFCCC could set absolute emission reduction targets for the sector. The experiences of past years have shown that the IMO is not capable of solving conflicts of the parties in a reasonable time frame and of developing necessary measures. For example, the entry into force of the MARPOL Annex VI standards took more than eight years, de-

spite the fact that the Annex VI only has set the technical status quo for engine-based nitrogen oxides of the 1990s.

However, there are examples which prove that nation states and regional organizations can accelerate agreement within the IMO by acting on their own. The nation state and regional initiative can work as tests, or may set de facto standards, if for example countries act that cannot be ignored by the international shipping industry due to the size of their markets. Those countries with strong markets are in particular the states of the triad[3], which dominate the international trade.

Example 1: Acceleration of the introduction of double hulled tankers

The IMO agreed in 1992 on the mandatory implementation of double hull tankers. It was agreed that existing ships would start, as of 1995, to convert to double hulls in a time period up to 2026.

After the accident involving the "Erika" tanker off the coast of Spain in 1999, the European Union enacted several legislative "packages". In Erika II package, the European Union established its own accelerated introduction of double hull tankers in the waters of the Union (EC 2002).

The pushing ahead by the European Union, together with intensified international negotiations, led in 2001 to the revision of the IMO timetable and of the accelerated introduction of double hull tankers worldwide.

One major challenge of sectoral options is the allocation of emissions and determining the authorities to adopt mandatory emission reduction measures. The study commissioned by CE Delft (2006) develops two options to this problem: One that allocates the emissions to nation states and the other that allocates the emissions to the operators of the ships. The allocation to the nation states without a direct connection to the freight faces similar challenges as the direct national allocation by the UNFCCC. However, as described earlier, only the allocation connected to the import freight may create an efficient and fair option. The allocation to the ship operators and the juridical, fixed determination of emission reduction measures are also challenging, because of the complex legal situation in the maritime industry that operates in diverse patterns of ownership, charter, out-flagging etc. Furthermore, other challenging questions such as the basis of allocation, percentages or real tonnage and others, need to be answered in order for a satisfactory allocation scheme to be developed.

Based on this assessment, the sectoral option will be further investigated in respect of enabling the establishment of a long-term international emission limit.

Interim conclusion:

- An internationally administered sectoral option could be developed as long-term goal. It should be investigated whether regional options could support the development of an international option.

[3] States of the triad include North America, Europe and southeast Asia including Japan.

Options which mainly focus on sectors will be discussed in B (page 19), in the options B-a (page 19), B-b (page 25) and B-c (page 28).

C Regional Options

A regional start, as described by CE Delft (2006), has the potential to support the international community, represented by UNFCC and the IMO, in its search for appropriate global options to greenhouse gas emissions from international shipping. Regionally limited options can test ideas on the one hand. Regionally limited options can, on the other hand, put pressure on the international community to enact global options. Therefore, the idea of developing a regional option should be further investigated. It should also be investigated how other states could be linked to such a regional option. For example: If Europe would start with a regional option, and if the United States and Japan would follow this option, it would cover a significant part of the global international shipping activities and could realize a highly efficient option.

C-1) Setting Regional Emissions Limits

The setting of regional emission limits must be analyzed under the conditions of international law. As described in chapter 2, regional options run the risk of being interpreted in such a way that technical and operational standards for ships would be influenced beyond territorial borders. This is especially likely to be the case with regard to carbon dioxide (CO_2) because a standard that would only cover the passages in territorial waters would not lead to significant emission reductions since most of the fuel is burned outside of territorial waters. A standard that captures the entire voyage of ships or that is based on annual averages, de facto would influence shipping outside of the territorial waters. This may mean that such an option could be interpreted as illegal interference of nation states in the jurisdiction of the IMO and as setting de facto CDEM or GAIRAS standards.

However, in response to these challenges two facts provide the possibility of setting CO_2 focused emission standards by national or supranational entities:

1. As of today, there are no CDEM or GAIRAS standards, for example in the form of an MARPOL Annex, for CO_2 or other greenhouse gases. Therefore, no juridical authority of CDEM and GAIRAS standards would be infringed if regional standards were set. The international community in the IMO seems far away from setting CO_2-related CDEM or GAIRAS standards. Even the evaluation of different measures, as demanded by the IMO through the resolution A.963.(23) has not been conducted. Therefore, regional options should be legally implementable as long as the IMO does not act on behalf of the international community of states.
2. Emission efficiency standards for CO_2 per freight-distance unit do not pose specific technical standards, which would infringe with the IMO's jurisdiction. The reduction of CO_2 could be accomplished by, for example, the reduction of the

ship's speed and better utilization rates, thus without any technical change on-board the ships and regardless what final measures would be selected.

A more in-depth analysis of any model under a regional option is highly recommended.

Interim conclusion:

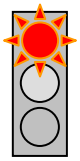
- As policy measure in principle possible

C-2) Levy of Taxes on the Sales of Bunker Fuels

The implementation of environmental policy measures through the sales of bunker fuels, discussed in Europe and in the United States, was rejected as impracticable (See LAO 2001 for example). Setting specific standards or levying taxes on bunker fuels in a non-global manner is likely to lead to the avoidance of bunkering in those countries with higher standards or taxes. Ships can, in contrast to aircrafts, carry large amounts of bunker fuel without losing too much of their freight capacity. Therefore, internationally travelling ships would fuel where such standards and taxes do not exist. The positive effect would thus be limited to ships that are bound, due to their operational patterns, to specific bunker locations.

The imposition of global taxes also seems highly unrealistic. The possibility that the international community of states would be able to agree on a global tax, and that no secondary loopholes for attracting investment capital would appear, is highly unlikely.

Conclusion:



- Not realistic and likely not effective

The practice of bunkering in international shipping also precludes the allocation of emissions to the countries where such bunkering takes place. Ships bunker where they find price advantages and may burn the fuel elsewhere. The national allocation based on bunker fuel sales would result in a distorted picture and would not match with the responsible stakeholder for the transport services.

C-3) Introduction of a regional, sector-wide emission limit with the option of emission trading in Europe

Emission trading in the international shipping sector can be approached in several ways and the study by CE Delft (2006) provides initial options. According to the study, an emission trading scheme for all ships that call at ports in the European Union would have the largest environmental effect. However, challenges occur when ships call at several ports on one string and only partially load or unload their freight (see A1 and A2). Furthermore, risks that ships would evade to other ports that are not part of the trading region exist. However, the risks are likely negligible and might only occuar at the boarders of the trading region, for example North Africa to Europe.The real risk

depends on the design of the select option and and its assessment requires an in-depth analysis.

Many detailed questions related to this option remain open. They include for example methodological questions (how would emissions be calculated?), questions of the jurisdiction (who would be emissions trading partner?), questions of setting boundaries (trading within the industry or across sectors?), as well as questions on the roles and responsibilities of a trading scheme (who carries the responsibility of reducing emissions?). Those questions and the regional options will be further discussed under C-3-a (p. 29), C-3-b (p. 32) and C-3-c (p. 34).

Interim conclusion:

- A detailed analysis is necessary, in particular on the questions how the emission limits would be set and how would those be distributed to the stakeholders.

A regional coalition of states could also implement differentiated port and fairway dues as policy measure, instead of an emission trading system of allowances. The same principle challenges however would exist.

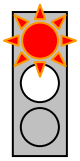
D Integration of CO_2 reduction measures in the shipping industry as CDM measure in existing trading systems

The suggestion of treating ocean ships in a similar way to Kyoto non-Annex I countries and of allowing CDM measures to be implemented with regard to ships. (Bode et. al. 2002; ECON 2003) On the basis of this suggestion emission reduction measures could be implemented cost-effectively in the marintime transport sector, while (partly) paid by other industries or tax payers in Annex I countries.

An extension of CDM measures to specific industry sector would bear the risk to undermine the original role of the CDM. CDM measures are meant to promote sustainable economic development and technology transfer in countries of the global South and reduce the cost of mitigation for Annex I countries. Extending this mechanism to the shipping sector would not fulfil those criteria.

Other problems of CDM measures, in particular the sound setting of the baseline emissions as well as strict monitoring of the reduction measures also would apply to this approach. Those tasks would put a high administrative burden on nation states under the Port State Control that are likely to equal the administrative burden for any direct emission control regime. The anticipated emission reductions however, are likely to be much lower due to the participation of the international shipping industry being only partial.

Conclusion:



- This option would undermine the goals of CDM measures as instruments to promote sustainable economic development in countries of the global South.

- CDM emission offsets in the maritime industry would furthermore not be far reaching, especially in comparison to setting direct mandatory emission reduction instruments. It does therefore not fulfill the precautionary principle.

6.2 Further development of greenhouse gas reduction options and development of new options for the international shipping industry

This section will develop greenhouse gas reduction options further as well as develop new ones, based on the discussed existing options, the international legal background, the technical and the operative opportunities and the structure of the global trade patterns. The guidance provided by the UNFCCC should thereby serve as central criteria for evaluating those options (UNFCCC 1992). Thus, the main assessment criteria are:

i. Politically realizable because economically and technically feasible.

ii. Fair; supportive of a just system.

iii. Differentiated according to the economic and technical capabilities.

iv. Following the 'precautionary principle', meaning that it will efficiently achieve far reaching emission reductions.

v. In support of the technology transfer to countries of the global South, in particular in the field of the transport industry.

vi. Supportive of an open global trade system that promotes sustainability and economic development goals.

vii. Not unreasonably or arbitrarily discriminating against international trade.

The following ideas are rooted in the results and assessments developed in part one of this report. In summary they are:

- UNCLOS yields a clear mandate to protect the maritime environment.
- The ecosystems of the oceans and coasts are in extreme danger due to the global climate change.
- According to UNCLOS, internationally applicable standards must be established by "competent international organization(s)". The IMO, but also other international organizations such as the UNFCCC, as well as international conferences of the parties could set internationally binding standards according to UNCLOS, particularly in the field of air emissions.
- There is currently no sign that states within the IMO will be able to develop solutions in regards to ocean shipping and greenhouse gas reductions in a timely manner.
- There is currently no international regime that would set standards for greenhouse gases from internationally travelling ships.

- Coastal states and port-owning states can adopt emission standards and financial instruments that aim to protect the oceans and the coasts.
- The greenhouse gas emissions from international shipping generally equal the fossil fuel consumption from ships.
- The bulk amount of greenhouse gases from ships originates in the trade with goods and not in travel of people.
- Global trade has overpropotionally increased, especially since the 1990s, compared to the increase of the global economic output.
- The expansion of global trade is to a large extent an expansion of intra- and inter-corporate trade to achieve cost optimization (externalization), which rarely contributes to sustainability and the economic development of countries of the global South.
- Countries that dominate and profit mostly from international trade are countries of the triad (North America, Europe and southeast Asia with Japan)
- Transport is cheap. The share of transport on final consumer prices is negligible and tends to decrease.
- The transport sector, including ships, causes other negative environmental effects. Measures to reduce greenhouse gases must be synergetic or at least not be in contradiction to other measures that target other negative environmental effects.
- Technical measures in the transport sector at best provide long-term solutions for reducing greenhouse gas emissions by utilizing innovative and alternative energies and designs.
- Operative measures in logistics and ship operations have short-term potentials to reduce emissions.
- Companies in the shipping sector are not opposed to rules and regulations as long as they apply to all shipping companies equally. The implementation of standards for all ships creates a level playing field in a similar way.

On the basis of these findings, the following sequence of measures has been developed that can deliver a specific contribution to reduce greenhouse gas emissions from ships. Several variations are based on model A-2). The integration in a trading scheme with reference to C-3) will be discussed. Furthermore, one focus will be on sectoral options in reference to model B).

The following sections will develop a step-by-step approach for each idea. Some examples will highlight the potentials and the limitations of individual options. All of the following options will only focus on carbon dioxide (CO_2) as the main greenhouse gas from ocean shipping. The integration of other Kyoto gases (methane, nitrous oxide, perfluorocarbons, hydrofluorocarbons, and sulphur hexafluoride) shall be discussed sepa-

rately. We recognize that ships have other negative environmetnal effects. However, in-depth inclusion of those is outside of the scope of this study.

All options rely in one way or the other on the collection of data from ships. Thoughts on the current status of data gathering and how necessary data collection may look like is provided in the box below.

6.2.1 Greenhouse gas reporting from international ocean transport

Parties to the UNFCCC and its Kyoto Protocol need to prepare greenhouse gas inventories as part of their reporting obligations. Annex I countries need to prepare annual national inventory reports on their emissions of the six Kyoto gases since 1990. Non-Annex I countries prepare National Communications approximately every five years which contain inventory information as well. Emissions from international ocean transport are not part of the national inventories but shall be reported by Parties as memo items. The default approach for calculating emissions is the use of fuel specific emission factors and fuel sale statistics. If a jouney of a ship starts and terminates in the same country emissions are considered domestic and form part of national totals. All fuel bunkered by a ship that heads for another country is included under international emissions independent of the flag of the ship or nationality of its owner. Only national totals for domestic and international maritime transport have to be reported by Parties, no differentiation between types of ships or routes for international ocean transport is required.

The IMO started in 2005 to test its Greenhouse Gas Index (GHG Index) through several member states. Goal of the GHG Index is to assist the IMO in achieving the "limitation or reduction of greenhouse gas emissions from shipping". Basis of the proposal is each individual ship and the fuel consumption per transport work. "For existing ships, the CO_2 index should represent an average value of the energy efficiency of the ship operation over a period of one-year. For newly built ships the CO_2 index should represent an average value of the energy efficiency of the ship operation over a period of not less than six months." (IMO 2005, MEPC 53/WP 11, Annex 1 page 5) The reporting includes the real cargo and distance travelled as well as the amount of fuel consumed, split by voyage or days. (IMO 2005)

The GHG Index in its draft guideline therefore provides a ship-based index of performance that is "intended (…) as guidance on monitoring of the efficiency of ship operations". (IMO 2005, Annex 1, page 3) Implemented in the manner of the draft guidelines, the GHG Index could deliver the following data to port states, coastal states and the UNFCCC and for each ship:

- Amount of fuel consumed over 12 or 6 months.
- Distance sailed for the last months but also for the last voyages.
- Cargo loaded in tons or other cargo units for the past months but also for the last voyages.

- Transport efficiency in units of [kg CO_2/t-mile] or other cargo unit normalizations.

However, the recent focus on setting average values for greenhouse gas performance per ship category is unlikely to provide meaningful measurements or baselines. The virtue that the proposed GHG Index includes real cargo leads to a wide spread of efficiency indices within ship categories. The differences between ship categories are obvious and correlated to their different service characteristics. Furthermore, smaller ships tend to employ more engine power per cargo tonnage than larger ships and thus perform less in terms of greenhouse gas efficiency. Thus only the indexing per ship makes sense.

The inclusion of real transport work as proposed by the GHG Index is an absolute positive necessity in order to establish the potential to reduce greenhouse gas emissions effectively. One, most technical measures are, due to the longevity of ships, a long-term proposition. Second, the potential of greenhouse gas reductions through logistics improvements, better utilization, transport mode shifts etc. can only be realized if the greenhouse gas performance per transport work is documented.

In the following document the desired and referred to reporting scheme is named GHG Reporting. This GHG Reporting may be based on the currently proposed GHG Index or may be introduced differently if the GHG Index fails. Regardless, it must be fulfil the following conditions:

- It must be based on, filled-out by and reported from each individual ship to the authorities.
- It must include distances, fuel consumed and real cargo loaded.
- It must provide information on the type of fuels consumed per day or voyage.
- It should provide an average over a period of time as well as detailed information on the last days or voyages.
- It should provide a mean to track performance improvement of each ship over time based on the amount of cargo transported and the distance travelled.

Information of this type is readily available. Ships that travel only short distances, such as ferries or feeder vessels, may have difficulties to determine the fuel consumed per voyage sufficiently exact. With those types of ships averages over a period of time need to be used. Other ships should have no problem reporting accurately.

The GHG Reporting data will then allow to build regional or global accumulative greenhouse gas balances from ocean shipping. Some of the new electronic surveillance technologies, such as the automatic identification system (AIS), might support the collection of spatial data. However, it is not currently established to submit emission-related data. A GHG Reporting as described will also allow to build efficiency parameters per cargo unit and other emission units that could be used for emission trading schemes or other policy measures.

A GHG Reporting scheme can be legally implemented nationally or regionally if the IMO GHG Index would not provide the necessary coverage and angel of information in

a timely manner. The legal authority for setting a regional GHG Reporting scheme stems from the UNCLOS mandate to protect maritime environment. A GHG Reporting scheme will not establish or necessitate technical standards and thus will not infringe any IMO authority. There are other examples, for example for ballast water reporting (Example 2), where individual states and ports had set mandatory reporting duties, which were superseded by an IMO mandate at a later point in time.

Example 2: *Precedence of a local reporting requirement*

In the 1990s, the United States Coast Guard and the Smithonian Environmental Research Centre established the National Ballast Information Clearinghouse (NBIC) in order to address the task of managing the introduction of invasive species with the ship's ballast water. Since 2004 the United States has a ballast water reporting mandate, which demands exact data on ballast water amounts, exchange, discharges and all related locations of those activities, as well as other information. Prior to the national mandate was an attempt by the Port of Oakland to bind a ballast water reporting mandate to the tariff agreements. While the compliance was good, the full enforcement capabilities exist since the US Coast Guard can enforce the national system together with the Port State Control. This case may serve as precedence for a regional mandatory reporting requirement.

6.2.2 In-depth discussion of options for integrating ocean transport into a greenhouse gas regime

A Options to allocate emissions post occurance to national inventories

A-2: National Allocation on the Basis of Freight

In section 6.1 A) the national allocation based on origin or destination of the vessel, based on flag states and ownership was discussed and deemed impracticable. This section will investigate whether the emissions from maritime transport could be allocated to the national inventories based on the amount of import freight of each state.

The fair allocation of emissions to nation states prior to their occurrence is only possible on the basis of import freight, as described earlier. This option simplifies the allocation to nation states. Furthermore, the purchaser of transport services and user of the goods are ultimately responsible for the negative effects of the transport. Institutionally, the national allocation based on import freight would require the following principle elements:

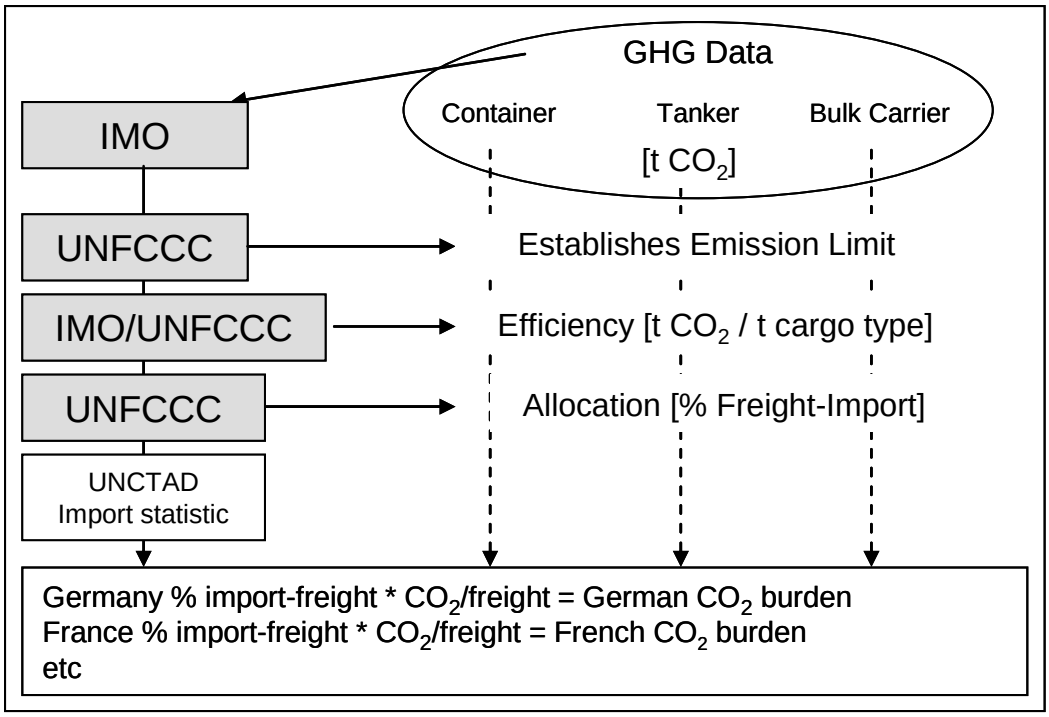
a) The establishment of a global sector-wide emission inventory

b) The allocation by the UNFCCC to the national inventories.

Step-by-step analysis:

- The IMO or UNFCCC establishes a global balance of greenhouse gases from international shipping. The global balance can be derived from the fuel consumption data that would be available after mandatory implementation of GHG Reporting.
- The IMO or UNFCCC establishes a global amount of greenhouse gases from international shipping.
- The IMO or UNFCCC also sets transport-related CO_2 emissions for major ship categories. (For example tanker, container ships, dry bulk carriers, general cargo carriers etc.)

Figure 1 Model of the national allocation on the basis of import freight



Source: Own Depiction

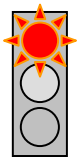
- The global amount of CO_2 emissions from ocean transport could be distributed by the UNFCCC to individual nation states based on the international trade statistics. This could be based on the percentage of imported goods according to weight or value of the imported goods. The international trade data are fairly well known and thus the allocation of emissions is possible on this basis.
- The emissions would become part of the national inventories and targets. Reduction commitments would be implemented according to the Kyoto-Protocol scheme. Countries of the North would either need to reduce their overall emissions or purchase emission allowances beyond their budgets. Countries in transition could be targeted with efficiency goals and countries of the global South could be excluded from reduction measures.

- The target could be the freezing of CO_2 emissions from international shipping, which de facto could mean a reduction of emissions, provided that the trade volume continues to increase as forecasted and if transport of freight would shift from other modes to ocean shipping as the most fuel efficient mode per cargo-distance.

Deficits:

- The IMO would need to mandaroty implement a functioning GHG Reporting scheme.The modelling of greenhouse gas emissions is complex and scientists publish significantly different figures on global emissions (Corbett und Koehler 2003; Endersen 2003; Eyring et.al. 2005).
- The ex-post allocation greenhouse gases does not permit a distance-differentiated allocation, because the basis for the allocation would be past emissions and trade data and would not be bound to the real movement of the ships. This means that the allocation process would result in a politically controversial process. The currently differentiated status of nation states under the Kyoto would present challenges.
- States that have reduction obligations, particularly many importing nations, are often not equal with states that have the jurisdiction over internationally travelling ships.
- Technical standards would need to be established by the IMO, meaning by the international community of states. The more stringent standards would create financial burdens for flag states, who did not necessarily agree to emission reductions based on the national allocation of emissions.
- One obvious mitigation measure that states might consider in order to fulfil their reduction obligation as regards the transport sector would be the limitation of international transport itself. This, however, is contrary to the principles of promoting an open world trade system and is thus in conflict with the international trade law and the principles of the UNFCCC.

Conclusion:



- ➢ Due to the heavily negotiation based approach, this option lacks transparency and a palpable connection between emission and emission reduction responsibility.
- ➢ National allocation contains to be mainly a political process, supported by trade data. This process is likely to be slow
- ➢ A differentiated option in accordance with the polluter pays principle and the capacities of states are barely achievable.
- ➢ The scheme of national allocation can be potentially lead to protectionist measures and is thus contrary to an open trade system.

- The necessary implementation of emission reduction measures by flag states could lead to a limited transfer of environmental technologies to countries of the global South.

B Sectoral Options

In section 6.1 B the option of a global sector-wide approach was discussed with some thoughts on regional implementation. Different options will be further developed in the following paragraphs.

There are in principle two variations of sectoral options: a) the setting sectoral emission limits ("caps") and b) the setting of sector-wide performance standards ("baselines"). The sectoral option with emission limits and national distribution of CO_2 loads operates in a parallel fashion to the option of national allocation. The only difference is that the IMO would take on the task of distributing the emission allowances to nation states, for example on the basis of ship operators, flag states or based on trade data as described above. All these allocations are problematic for the same reasons described in the section above. This option will not be examined further.

One variation of these sectoral options is an IMO-administered emission trading scheme with an overall CO_2 emission cap, set by the UNFCCC (B-a). The responsibility could hereby be based, sector-wide, on the vessel activity itself. Emission responsibility would be realized at the unloading port. This would ensure a correlation between importing states and the obligation to reduce emissions and would therefore present quasi a national allocation of emissions. This option will be discussed in detail under B-a.

Performance options (B-b and B-c), connected to greenhouse gas efficiency and the transport of the freight itself, form a basis for states to develop emission reduction measures and to burden those stakeholders who are responsible for the transport in the first place. The greenhouse gas burden would travel with the freight, for example the tonne of steel or the container, until it reaches its final destination. Policy measures could include emission limits, port dues, or emission trading. Direct binding technical standards that travel with the ship cannot be introduced by nation states due to international law.

In addition, the performance option has the advantage that the switch from less energy efficient modes of transport, such as air freight, to more energy efficient modes of transport, including ocean shipping, could be promoted. Mechanisms for how this could be implemented are discussed under C-3-b (page 32).

B-a Setting global, sectoral emission limits and their integration in a emission trading scheme

Building upon the proposal of an emission trading scheme in the aviation sector by the European Commission, this option aims to integrate the international shipping sector in an open emission trading scheme. The proposal of the European Commission “to in-

clude aviation activities in the scheme for greenhouse gas emission allowance trading within the Community" (EC 2006) is rooted in the attempt at finding global solutions for the aviation sector and intends to constitute a point of reference for other nations who would like to promote similar systems (EC 2006). Similarly, a regional trading system could integrate international shipping activities and be a point of reference for other regions as well as an example of how an international regime could ultimately be developed.

Therefore, this report will first evaluate the possibility of developing a "cap and trade" system that is administered internationally by the UNFCCC. The IMO would provide data support. The goal would be to absolutely reduce the amount of greenhouse gas emissions from international shipping. It is important, however, that options with absolute "caps" would not hamper international trade itself or discriminate against individual states. Thus the presented option aims to de-couple the trading volumes from the emission caps. Other options based on efficiencies often only provide relative emission reductions.

- The IMO gathers the global greenhouse gas emissions from international shipping for a baseline year (e.g. 2008). This information will be used to distribute emission allowances to ship operators.

Suggestion: *Global Ship CO_2 2008 = Σ all Ship CO_2 Index-Values [t/y]*

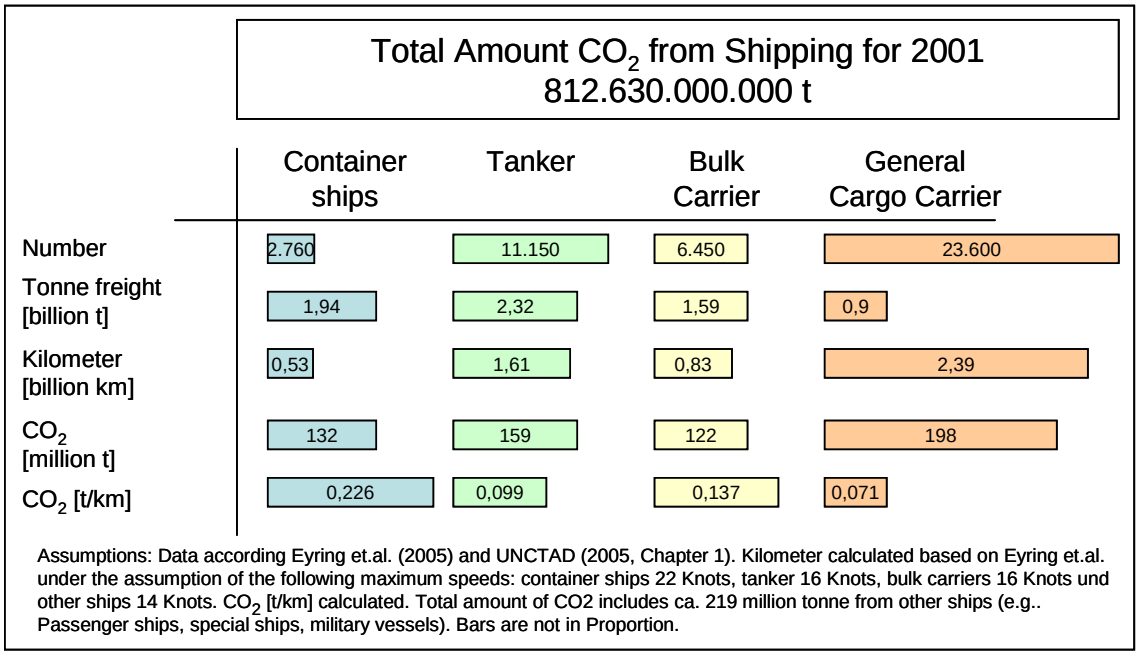
- The IMO could also establishe realistic ship efficiency values for each ship category on the basis of the GHG Reporting. This enables the allocation of allowances according to distances of the transport services. The option is an essential step in order to de-couple trade from the final emission responsibility.

Illustration:
$[t_{CO2}/y]_{2008}$ container ship ≡ *$[km]_{2008}$ distance container ships*
$[t_{CO2}/y]_{2008}$ tanker ≡ *$[km]_{2008}$ distance tanker*
$[t_{CO2}/y]_{2008}$ bulk carrier ≡ *$[km]_{2008}$ distance bulk carrier.*
…

- From this calculation the distance-bound emission units are derived per ship category that would be used in an emissions trading scheme. These emission units or allowances would be independent from the freight itself and are thus not influenced by the freight transport volume, but are rather only distance-based.
- Those allowances reflect that ships of specific categories had used a specific amount of fuel for distances travelled. However, those distances correlate with the amount of freight in the baseline year. It also equates to a specific amount of CO_2.

Illustration:
container ships = *226 $[kg_{CO2}/km]$*
tanker = *99 $[kg_{CO2}/km]$*
bulk carriers = *137 $[kg_{CO2}/km]$*
…

Figure 2 Example calculation based on literature data



Source: Own calculation and deciption based on data from Eyring et.al. (2005) and UNCTAD (2005)

- The UNFCCC could determine the number of allowances that would be handed out to shipping companies and ship operators. The allowances would be determined by dividing the global CO_2 amount by the ship category distance that is travelled. In order to determine free allowances, the UNFCCC sets a specific percentage of the baseline year, for example 80%. The remaining number of allowances would be auctioned off to the shipping companies and ship operators. The shipping companies and ship operators would pass on those costs to their customers. The entire number of allowances poses the emission limit in the system.

Sample calculation on literature data:
for the year 2001 + 2 the allowances for container ships are:

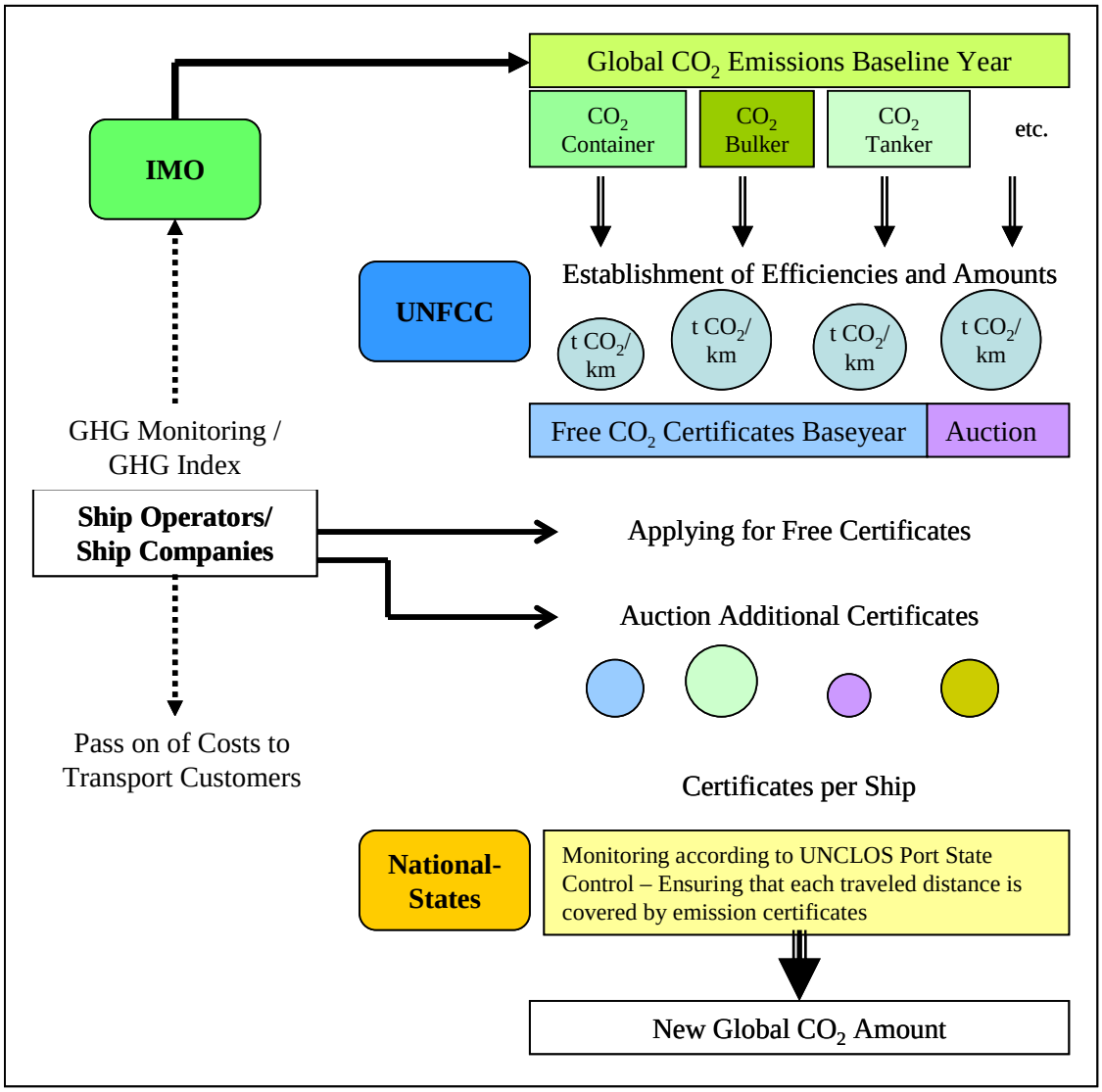
*(80% * 530 mil. allowances) = 424 mil allowances of 0.226 t CO_2/km for no charge (20% * 530 mil.) = 106 Mil. * 0.226 t CO_2/km = 23,956,000 t CO_2 to be auctioned off*

At €25 per allowance, the auctioned allowances would cost €599 million euros.

Shipping companies and ship operators would be encouraged to transport more freight per allowance. Examples of how their obligations could be reduced and at the same time increase transport services are provided in Appendix 1.

- Shipping companies and ship operators apply at a certain fixed date for a particular quantity of allowances for the upcoming trading period. The UNFCCC distributes the free allowances and auctions off the remaining ones.
- In addition, a mechanism should assure credits for those shipping companies and ship operators that can show significant improvement of their CO_2 emissions per distance, for example through the introduction of shaft generators or alternative energies. Shipping companies and ship operators would need to verify a quantifiable reduction in comparison to the performance of the same ship in the years earlier. Emission allowances in a related number should be credited to these shipping companies and ship operators.
- Each port-owning state assures that every distance travelled by ships calling at their port, is covered by emission allowances. The control authority is provided under the UNCLOS.
- Ship operators are only allowed to emit the amount of CO_2 equivalent to the number of allowances they have. This means that the industry may grow only by increasing the amount of cargo transported under the same emissions, for example through a better utilization of freight space on ships.
- The connection of CO_2 volume and distance unit limits the total amount of CO_2 that can be emitted, but not the amount of freight that can be transported. This means that shipping companies will aim to transport more freight under their allowance and distance units. This can lead to a change to larger ships, the consolidation of freight, more direct routes and better ship utilization. The benefit of this option is that it cannot be interpreted as a de facto tax on fuels, nor does it unreasonably limit international trade.
- The roles of the IMO, UNFCCC, nation states and shipping companies or rather ship operators are schematically shown in Figure 3.
- The baseline years could travel with the target years. This would result in a continuous improvement, if one assumes that shipping companies and ship operators would aim to transport the same amount of cargo with as few allowances as possible because of the costs associated with these allowances.

Figure 3 *Roles and flow diagram of the international sectoral "cap and trade" option*



Source: *Own depiction*

The assumption of this option is that shipping companies and ship operators would pass on the additional cost of the transport to their customers, who are the final users of transport services. Based on the statistics of unloaded freight, this burden would be mostly carried by "developed market economies".

Table 2 *Unloaded freight in 2004 (UNCTAD 2005) and calculated CO_2 burden sharing according to the example above*

Unloaded freight	DMEC	DC	hereby: Africa	Americas	Asia
in percent	58.9 %	30.5 %	3.1 %	5.6 %	21.3 %
in million Euro	353	183	18,6	33,6	128

DMEC = Developed Market Economy Countries; DC = Developing Countries

- One option might be to allow shipping companies and ship operators to purchase allowances from other industries, in order to allow the growth of transport and trade as well as the switch from less energy efficient transport modes to ships. These credits could be emission reduction units (ERU) and certified emission reductions (CER) from Joint Implementation and Clean Development Mechanism (JI, CDM) projects, or they could be country assigned units (AAUs). It is important, if credits should be integrated, that the absolute cap of the system not be weakened.
- The UNFCCC could also reduce the allowances over a specific time horizon, besides freezing the number of allowances to the baseline year. This reduction might be necessary in order to achieve an absolute emission reduction from international shipping in the long term.

Suggestion: *2010 = 2008 baseline year*
2012 = 90% von 2008
2015 = 80% von 2008
2020 = 60% von 2008
…

Deficits:

- This option might only be politically feasible on a long-term basis, considering the blockade within the IMO and the need to have reliably global data. While in principle desirable, this option could serve as a target and orientation for setting-up interim solutions.
- The emission allowances should decrease from time to time in order to achieve an absolute reduction of greenhouse gas emissions.
- The technology transfer in countries of the global South is not directly addressed.

Conclusion:

- The system would be economically feasible because it would increase the cost of transport slowly with the introduction of emission certificates. The increased cost would hit all transport service providers to a similar degree.
- Connecting the allowances to shipping companies and ship operators would ensure that the costs would be passed on to the persons responsible for the transport in the first place.
- The option takes political differences into account by pegging the allowances on import volume
- The global setting and successive reduction of free allowances would realize far reaching emission reductions and adheres to the precautionary principle.
- The option would not hamper open international trading system and would promote energy efficiency.

- The differentiation according to ship category and distance for the baseline year creates transparency.
- Due to the deficits, especially the blockade by some states within the IMO, this option may only be implemented in the long term.
- The option is desirable as a long-term goal and should be promoted through regional measures.

B-b Setting global, sector-wide relative emission limits (efficiency standards or performance standards)

Against the background of a "cap and trade" option potentially triggering resistance in the industry, this report also investigates efficiency-based options. The goal must be, however, that even these options achieve far reaching emissions reductions in order to respond adequately to the risks that are associated with global climate change.

- The IMO sets greenhouse gas target-efficiency-values per carried transport distance unit (tonne-mile), ship category and cargo type ("best practice"). This best practice target-efficiency should be based on a realistically high utilization (for example 85%) and industry-wide best efficiencies. The data would originate in the GHG Reporting. Those target-efficiency-values would represent one emission allowance.

Illustration: *1 Tonne bulk freight* *= 9 g CO_2/ t-km*
1 Tonne petroleum product *= 7 g CO_2/t-km*
1 Container unit (TEU) *= 98 g CO_2/TEU-km*

- The real-time performance of ships would then be evaluated against those target-efficiency-values. The IMO GHG Reporting would deliver the necessary ship and cargo data. The benefit of this option is that the real utilization of each ship per voyage would be recognized.
- Each ship would receive an annual greenhouse gas index value based on last year's ship performance data. The responsible party for measuring and reporting the performance data would be the ship operators. The index values would travel with the ship.
- Each ship would document their real-time performance under the same methodology.
- Each tonne of freight and each container could then be connected with one CO_2 burden which may lie above or below the target efficiency value.

Illustration: *real tanker performance* *= 10 g CO_2/t-km*
target-efficiency for tanker *= 7g CO_2/t-km*

- The CO_2 burden would be accounted for at the port-state where the freight finally is being unloaded, or rather where the cargo passes customs. The cargo papers would indicate all necessary information, including country of origin etc.

The jurisdiction to monitor and estimate the burden would lie with the nation states under the Ports State Control regime.

- The calculation of the CO_2 burden could be conducted as follows:

*(IMO efficiency value - ship CO_2-factor) * Freight unit * distance category = CO_2-burden ([4])*

Sample calculation: 20,000 t steel from Sydney to New York:

*(7 g - 10 g CO_2/t-km real value transpacific) * 20,000 t * distance category 19,600 km =*

1,176 t CO_2 burden

The CO_2 burden would then be connected with a fee. For example, at a price of €25 per tonne of CO_2, the freight of steel would be charged at €29,400. This equals €1.47 per imported tonne of steel. This would create significant incentives to reduce the emissions at approximate transport costs of €10 per this distance.

Sample calculation: 10 containers from Hong Kong to Hamburg:

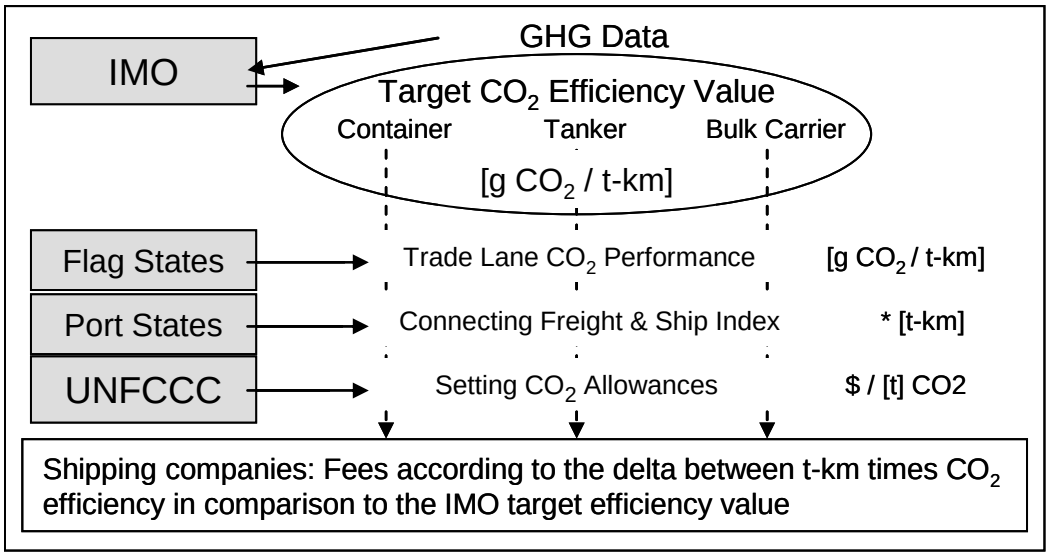
*(98 g – 160 g CO_2 / TEU-km real value Asia-Europe) * 10 * distance category 18,500 km = 29.6 t CO_2 burden*

At a cost of €25 per tonne of CO_2, this container would be charged with €74. If we assume a mean freight rate of €1,400 per container on this trade (UNCTAD 2005, Table 36), this fee represents a 5% increase in cost. If we assume the off-loading of 3,000 TEUs, a ship may pay €222,000 in this case.

- The responsible parties for those fees, which could take the form of harbour fees or emission trading allowances, would be the shipping companies or ship operators, who obtain a direct link to the purchaser of the transport services. Those fees would then be passed onto the customers of the shipping companies.
- The fees may be also offset by ships which perform better than the target-efficiency-values.

[4] Whether the real distance or a categorized distance would be applied depends on the interpretation of international trade law. The direct connection of emission limits with the real distance might be prohibited under world trade law. (Meyer-Ohlendorf 2005).

Figure 4 Model for establishing efficiency standards



Source. Own depiction

- The target efficiency values could be successively reduced or the fees successively increased in order to incentives measures to reduce emissions.

Options:

- One option to ease the burden of individual ships may be to allow the monitoring and reporting of real-time efficiencies as averages per shipping company or per alliances on specific trades. Shipping companies would then focus on the most cost efficient ways to reduce the average performances. The burdens on individual ships would be smaller.
- Another option may be the integration of other transport modes in this ocean shipping scheme. This option will be discussed in more detail under C-3-b (p. 32).

Deficits:

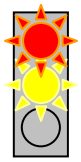
- A negative point might be that countries with high foreign trade deficits would face higher burdens than countries with balanced trade if the IMO target efficiency is based on a standard utilization. This might result in resistance - for example from the United States - when implementing such an option within the IMO. Also countries that export to the United States might oppose such an option.
- Any performance improvement might be offset by growth of the industry and of international trade. The emissions are not capped in absolute terms with this option.
- Furthermore, there is a risk to fixing today's efficiency values as target efficiency values and that no agreement can be reached on reducing those target ef-

ficiency values. The development of far reaching emission reductions is not embedded in the option.

- There are only limited incentives for switching from less energy efficient ship categories, for example container ships, to more energy efficient categories. However, this is probably only possible for very limited types of cargo.

Conclusion:

- A connection to the global CO_2 emissions can be assured by linking the IMO target efficiency values with the GHG Reporting.
- The acknowledgement of efficiencies when distributing CO_2 burdens enables shipping companies and ship operators to decouple transport services and CO_2 emissions. Thus, this option would not constitute a discrimination of trade volume and transport.
- The option could be designed to offer sufficient incentives, even under today's prices for carbon offsets.
- The deficits above, however, create massive hurdles that are not likely to be resolved, taking the controversial positions of states in the IMO into account.



Alternative to B-b: B-c Establishment of a spatially specific relative efficiency limit (geographic efficiency standard)

- In light of the potential resistance of countries with large trade deficits and their trading partners, the IMO could develop an efficiency standard that takes spatial characteristics into account. The IMO could develop a system that differentiates with regard to major trade lanes. This would recognize different efficiencies on major trade lanes.
- The IMO would establish target-efficiency-values for each freight-distance unit, cargo type and trade lane, considering both directions on those trade lanes. The data would come from the GHG Reporting
- Those trade lane-specific efficiency values would then become the CO_2 allowances.
- The CO_2 allowance that includes geographic differences by integrating real data would then be trade lane-specific. This means that importers from the pacific region to the United States would receive higher allowances per imported goods then the importers in the Asia-Europe trade. [5]

[5] The "Environmental Performance Survey" by the Clean Cargo Working Group, a multi-industry working group, uses the emission monitoring specific for each trade lane. Trade lanes could be, for example, transpacific, transatlantic, Asia-Suez-Europe, Latinamericatrade; Africatrade; Australia/Oceaniatrades; Intra-Asia, Intra-Europe, and Intra-Americas trades. They can therefore be grouped in a manageable number.

- The financial burden for ships, shipping companies and alliances above the target efficiency values would need to be more pronounced then any credits for undercutting the mean values in order to create significant incentives to improve the performance.
- Furthermore, the IMO should lower the target efficiency standards from time to time in order to work towards an optimized utilization of the ships.

Deficits:

- This option provides only limited emission reduction incentives.
- An absolute reduction of CO_2 emissions should be embedded in the methodology.

Conclusion:

- Realistic and country specific.
- Maybe at risk of only fixing today's status quo and failing to bring about far reaching emission reductions.
- Agreement on this option within the IMO might be difficult to achieve. This option may be only feasible in more moderate forms due to the controversy country positions within IMO. The option could potentially be implemented on a long-term basis.

C-3-a Regional setting of emission limits and their integration in an open trading scheme

In Section B-a, the internationally administered "cap and trade" system was introduced, which may function as a goal for the international community. However, because states in the IMO might not be able to agree on such a system in an acceptable timeframe, it is important to assess whether such a system could also be implemented regionally. Regional may mean in Europe, including some non-EU countries such as Norway; regional may also mean the extension of an option to other regions such as Japan and California.

Today's monitoring and reporting system in the international ocean transport sector does not deliver data that is very accurate. The IMO greenhouse gas index as proposed would provide such data if implemented quickly and mandatory, which remains highly uncertain (IMO 2005b). However, there is no legal hindrance to implement a mandatory GHG Reporting requirement regionally or nationally. Electronic surveillance systems are also available to track spatial movements. One state or a multi-state organization could therefore implement a regional monitoring system as well as a regional emissions trading scheme, similar to the proposal for the aviation industry in Europe. A trading system could be designed as a point of reference for expanding a comparable system globally at some point of time in the future.

The problem with a regional system is the political definition of boundaries for establishing absolute emission limits ("caps"), because it would include a decision as to how far the responsibility of European importers for example reach out into international waters. For instance: Who takes responsibility for return trips and partial voyages, which might only be marginally utilized? Limitation to territorial waters would not provide sufficient CO_2 emission reductions. The responsibility for transport emissions must extend to international waters. The monitoring and reporting of emission data, without a direct link to the setting of technical standards, can certainly be introduced by nation states. In addition, the amended Safety of Life at Sea Convention (SOLAS) requires ships to be fitted with Automatic Identification System (AIS) that delivers data on ship type, position, speed, course and other navigational data. Thus AIS can be used to determine entry and exit of geographic zones considered in a regional trading scheme.

The regional implementation of a cap and trade system might take place as follows:

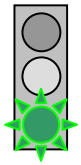
- A regional community of states implements a mandatory GHG Reporting scheme for shipping companies and ship operators. Each ship that calls at a port of those countries would be obliged to report greenhouse gas efficiencies, including fuel consumption, distance and real freight loads. The data should be collected from the last departure of that port or for one year. This would ensure that the utilization of the ship on return voyages would be captured. Spatial information may come from AIS.

Proposal: Σ *fuel consumption* / Σ *(freight * distance)*$_{baseline\ year}$

- The countries could then calculate from the greenhouse gas data for a baseline year those greenhouse gas emissions that correspond with the import of goods and that could be used for the distribution of emission certificates to ship operators. The distribution of allowances to shipping companies and ship operators would follow the same procedure as in the international option on the basis of the distance that was necessary to transport the goods for importing.
- In order to set the system boundaries, the same rationale would need to be applied for monitoring system boundaries as for emission trading system boundaries. For example, emissions from ships in liner shipping might include all emissions since the last departure from a port of the community of states, while ships in the tramp service might use the last cumulative distance in one direction.
- The definition of system boundaries will be easier in certain geographic settings compared to others. For example, if the regional trading boundary is Europe, then the system boundaries could be set to capture intercontinental traffic, for example on prominent marine coordinates (e.g. the entrance of the Asia-Europe trade into the Red Sea, etc.). If the monitoring and reporting mandate would then be linked to the freight, meaning that each imported freight would report for the same distance, regardless of whether it was transported by multiple ships.In this way, the re-loading of ships prior to entering the emissions trading region could be avoided.

- The following treatment of shipping companies and ship operators would follow the same pattern as in the international option, only that multi-national organizations instead of IMO and UNFCCC would administer the program (Compare Figure 3, p.17). These states would identify total emissions for the base year, ship category specific efficiency values per distances and would define emission allowances.
- A portion of the allowances (e.g. 80%) would be handed out for free; the remaining number of allowances would be auctioned off.

Conclusion:



- The setting of system boundaries is methodologically not easy, but resolvable. The effects of the boundary setting are relative, if the CO_2 reporting to identify the "cap" and for the definition of the numbers of allowances are identical.
- The regional scheme can be implemented politically in a foreseeable time frame.
- The regional option may increase the price of imported goods in those countries that participate in a regional scheme compared to countries that abstain. However, a region such as Europe is large enough so that any risk of evasion to other regions would be minimal.
- The costs of transport would differentiate globally according to the route and may create an imbalance. However, this effect is negligible due to the low cost portion of freight transport in the final consumer prices.
- The participating countries would take on their responsibility from the import of goods.
- The technology transfer to countries of the global South is not directly addressed.
- The regional implementation could accelerate the introduction of an international system, if the architecture would take a potential international system into account at the start.

Both options - regional and international cap and trading systems - can potentially be successful. In the first case - the internationally administered option - the hurdles are in the agreement of states within the IMO and UNFCCC which may take a long time. In the second case, the methodological option is weaker and the setting of the system boundaries may be a point of friction. However, the international community can set conventions that could be adopted by an international system if this were to be put online. A regional community of states is better suited to mandatory implement reporting requirements for ships calling at their ports and to the distribution of allowances for those trades. The evasion of ships to other regions is rather unlikely, because of the importance of the European market and the small fraction that transport costs constitute in final product costs. With regard to other important import markets such as Japan and

California, the case is likely to be similar. This may indicate that such a system could be extended to other regions through bi-lateral agreements.

C-3-b Multi-Modal Freight Transport Option based on emission efficiencies per import freight

The two presented efficiency options B-b and B-c propose to bind the CO_2 burden to a specific freight unit, for example tonne or container etc. One could treat air freight in a similar fashion and connect both through a trading scheme. The obligations would then travel with the freight until it reaches its final destination regardless of the mode of transport.

- Greenhouse gas reporting would be established for other modes of transport, for example international air freight, rail and truck traffic, similarly to ocean transport.
- This could, in a similar manner to the marine shipping option, be based on assumed globally high utilization and best practices, or it could be established specifically for each major trade lane.
- An allowance could be a best practice efficiency value from ocean freight transport as a reference point. The UNFCCC could be the organization for determining the target values and distribute allowances.
- Each freight unit would then have a CO_2 burden from its transport that would need to be reported by the shipping companies and ship or aircraft operators together with the customs formalities. The difference between the real value and the target value would determine the amount of allowances needed or the level of fees to be paid.
- Air freight would exceed the target values more substantially than ocean freight. Shipping companies, air freight and logistics companies would need to purchase corresponding amounts of allowances or would need to offset their emissions elsewhere. If we assume a cost per tonne of CO_2 of €25, the freight in the example where transport occurs by containership would require a €4 value, whereas the freight carried by air would require a €77 value.

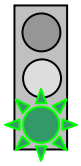
Sample calculation*: Comparison of air and ocean freight*

1 Tonne air freight – long distance = 82 g CO_2 / t-km
target efficiency value = 9.8 g CO_2 / t-km

Comparison air freight – container ship:
*(9.8 – 82 g CO_2 / t-km) * 5 t air freight * 8,500 km = 3.07 t CO_2 burden*
*(98 – 125 g CO_2 / TEU-km) * 0.5 TEU * 12,000 km = 0.16 t CO_2 burden*

- The CO_2 burden could be reduced drastically by switching from air freight to ocean freight (or rail cargo as well).
- International rail and truck cargo might be integrated in similar ways in such a system. The only downside is that no international organization comparable to the ICAO or IMO exists for rail and truck freight services.

Conclusion:



- The consideration of the entire freight transport would improve the transport efficiency of the entire transport system.
- Incentives for switching to more fuel efficient modes of transport would increase. This means that an efficiency-based option is constructive if the efficiency improvements of the entire transport system are at the target. The positive effect of switching from air and truck to rail and water borne freights is potentially great. However, a critical review after an initial period of time is highly recommended because the amount of freight that may switch mode de facto might be rather small.
- The multi-modal option has the advantage of being economically sound, even if ship emission reduction measures may create additional costs. The cost savings from switching modes are likely to be significantly higher than any additional cost that would result from a stringent ocean shipping standard.
- The likely passing-on of costs to the final purchaser of transport services makes this system fair.
- The focus on efficiency may not allow for the reduction of greenhouse gas emissions in absolute terms in the long run. This may not satisfy the precautionary principle.
- Technology transfer is not directly included.
- There would continue to be an open trading system, particularly since CO_2 emissions would not be limited absolutely.

C3-c Closed emissions trading system with CDM measures only in the freight transport sector

Economic development, transport infrastructure in countries of the global South (developing countries) and the access to trade and transport, domestic as well as international transport, are tightly interwoven aspects. The UNFCCC and other international conferences and organizations have been demanding a stronger technology and know-how transfer from countries of the North to countries of the global South for years. This transfer of technology along with associated opportunities for sustained economic development is lacking behind expectations, while economic GDP growth has been positive in many regions of the world.

The examples described above engage transport service providers in CO_2 reduction obligations, which can accumulate to several hundred billion euros per year. Besides options to offset the obligations on the free market between industries, one proposal is to allow only the offsetting of maritime transport emissions by investing in transport-related technologies and infrastructures in countries of the global South. The goal of such an option would be to garner the support of the latter countries for a bunker fuel post Kyoto regime, while promoting sustainability and an open global trade economy.

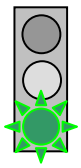
Using this option, transport infrastructure would improve and technology would be exported to countries of the global South, due to investment in transport infrastructure in those countries. The transport industry is a local industry in many parts of the world that creates direct employment and is supported by a network of small support business (for example for maintaining machinery, packaging etc.).

Some examples of offset projects are:

- The electrification of a container terminal including the installation of alternative energy.
- Expansion of a railway connection.
- Integration of computer technology for efficiency improvement in the transport logistics.

The CO_2 burdens from the transport industry could be offset with such projects as a closed industry-wide trading system. Particularly countries of the global South and countries in transition might find such an option appealing, because a direct re-investment in the international transport sector to their benefit would take place.

Conlusion:



- A just option that may garner the support of countries of the global South. Studying its effects is certainly worthwhile.

7 Recommendations of the Authors

The optimum method to guarantee an efficient and global reduction of greenhouse gases from ocean transport is to create a global, sectoral "cap and trade" system administered by the International Maritime Organization (IMO), the United Nations Framework Convention on Climate Change (UNFCCC) or both. This "cap and trade" system would have absolute emission limits and would tie the emissions allowances to ship distances travelled, as described under option B-a. However, short-term implementation of this option within the IMO is not realistic due to contention among IMO member states. Therefore, two variations are recommended in order to move the issue forward:

1) Establish regional emissions limits and a system of allowances that are integrated into an open regional trading scheme, as described under C-3-a. This option reproduces the global-sectoral "cap and trade" system on a regional scale. Able to be implemented immediately, this regional plan will stimulate the expansion of the model to a global scale in the long term.

An important, but nevertheless surmountable, challenge is to avoid conflicts with international law if ship emissions that originate in international waters are incorporated under the regional emission limit option. Shipping activities in international waters need to be incorporated in emission caps and allowances in order to achieve far reaching effects. Consideration of only the 12 nautical miles of territorial waters, or even the 200 nautical miles of Exclusive Economic Zones, would not offer sufficient potentials for greenhouse gases reductions, as these distances represent only a fraction of the overall transport mileage of often several tens of thousands of miles. The Automated Identification System data offer the necessary geographic information for all vessels.

Legally, the authors believe that the incorporation of shipping activities that originate in international waters in a manner that harmonizes with the International Law of the Sea is feasible, for the following reasons:

- Monitoring and reporting, as well as any other measures that do not set specific technical standards, could be implemented nationally or regionally.
- According to the German Advisory Council on Global Change (2002), national or regional financial instruments pegged to caps and allowances are permissible under the UNCLOS mandate to protect the oceans and the coasts.
- Shipping companies and ship operators would respond to the caps and financial instruments according to their preferred – and likely most cost efficient – methods.

Therefore, the first recommendation is to create a regional but far-reaching emissions monitoring and trading system with an absolute emission cap. This system works through the shipping companies to make transport purchasers directly responsible for the additional environmental costs incurred by long-distance transport. This regional system also functions as a test case, aiming at a global UNFCCC and / or IMO "cap and trade" system.

2) An alternative to the regional "cap and trade" system is the multi-modal efficiency option, as described in C-3-b. Under the multi-modal efficiency option, the real-time efficiency of each mode of transport per cargo unit would be evaluated against a 'best practice' target-efficiency-value. This target-efficiency-value represents one allowance. Whenever cargo is imported, values exceeding the allowances would need to be offset by the importers or carriers. In comparison to an efficiency option that only applies to ocean shipping, a multi-modal option may achieve more far-reaching greenhouse gas emission reductions because it incentivizes shifts to more efficient transport modes, for example from aircraft to ship. In this model, emission reductions are possible without absolute emission caps, as long as the financial incentives for modal shifts are significant. The addition of absolute emission caps should be evaluated as a second step in order to secure long-term emission reductions from the transport industry. This option could be introduced regionally and, if connected to an absolute cap, it could be extended globally by organizations such as the IMO, the ICAO and the UNFCCC.

List of Abbreviations

AIS	Automatic Identification System
CDEM	Construction, Design, Equipment and Manning (Standard)
CDM	Clean Development Mechanism
CO_2	Carbon dioxid
CSC	Coastal State Control
DC	Developing countries (countries of the global South)
DIS	Danish International Ship registry
DMEC	Developed market economy countries
DWT	Dead weight tonne
EEZ	Exclusive Economic Zone
FSC	Flag state control
GAIRAS	Generally accepted international rules and standards
GATT	General Agreement on Tariffs and Trade of 1947 and 1994
GDP	Gross domestic product
GIS	German International Ship registry
GT	Gross tonnage
IMO	International Maritime Organization
IPCC	Intergovernmental Panel on Climate Change
LNG	Liquified natural gas
MARPOL	Protocol of 1978 Relating to the International Convention for the Prevention of Pollution from Ships from 1973 – MARPOL 73/78
MEPC	Maritime Environmental Protection Committee
NIS	Norwegian International Ship registry
PSC	Port State Control
SOLAS	Safety of Life at Sea Convention
UNCLOS	United Nations Convention on the Law of the Sea
UNCTAD	United Nations Conference on Trade and Development
UNFCCC	United Nations Framework Convention on Climate Change
WTO	World Trade Organization

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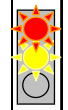
Appendix I

Summarizing Table

Table 3 Summary assessment of the presented options

	Activity	Target Group for Reduction Measures	Jurisdiction, Responsibility	Economically and methodologically feasible	Politically feasible	Fair and just	Differentiated according to the economic and technical capabilities	The precautionary principle following	Promoting the technology transfer, including within the transport industry	In support of an open global economy that promotes sustainability and development	Not without reason and unjustified hampering with international trade	Summarizing Assessment
A. & B. Sectoral approach with national allocation												
A2/B.	**National allocation on the basis of freight / sectoral Approach with national allocation**											
	- Establishment of a global CO2 balance	Nation states	IMO	+ distance-based allocation difficult	- -	- - in-sufficient trans-parency in the	-	-	o	- -	- -	
	- Determining CO2 emissions per trade category and ship type		IMO, UNFCCC									
	- Allocation of the total CO2 emissions to nation states according to trade statisitc data		UNFCCC (UNCTAD)									
	- Setting of national emission limits		UNFCCC									
B. Sectoral approach with GHG allocation bound to freight												
B-a	**Setting global, sectoral emission limits with the integration into a emission trading scheme**											
	- Record global emissions from international shipping for a base line year	Shipping companies, Ship operators, Logistics firms Nation states	IMO, GHG Index	+ +	+ long-term	+ indirect passing on to custo-mers of shipping compa-nies	+ differentia-ted, but not specifi-cally supportive of peripheral countries	+ + in particu-lar through the reduct-ion of cer-tificates over time	o	+ +	+ +	
	- Setting of distance-base emission units (certificates) per ship category and cargo type.		IMO, GHG Index									
	- Establishment of a portion of the certificates to be handed out for free and a portion to be auctioned off		IMO, UNFCCC									
	- Shipping companies and ship operators apply for certificates in anticipation of their activities; They may earn credits for measurable performance improvements		Shipping companies, ship operators									
	- Monitoring of the coverage of all distances travelled with emission certificates		Port-owning states under the Port State Control regime of UNCLOS									
	- Possible successive reduction of emission certificates for absolute emission reductions		UNFCCC									
	- Potentially allowance to trade emission certificates (AAU, ERU, CERs) from other industries		JI, CDM etc.									

	Activity	Target Group for Reduction Measures	Jurisdiction, Responsibility	Economically and methodologically feasible	Politically feasible	Fair and just	Differentiated according to the economic and technical capabilities	The precautionary principle following	Promoting the technology transfer, including within the transport industry	In support of an open global economy that promotes sustainability and development	Not without reason and unjustified hampering with international trade	Summarizing Assessment
B-b	**Setting global, sector-wide relative emission limits (efficiency standards or performance standards)**											
	- Estabhishment of global efficiency standards per t-km, cargo and ship type on the basis of target efficiency and best industry practices	Shipping companies, ship operators, logistics firms	IMO	+ +	o global efficiency standards make agreement more difficult	+ + because of direct costs to the purchaser of transport	+ +	- no anchored absolute reduction goals	+ if the CO2 sharing within companies and alliances would be permitted	+ +	+ +	
	- Establishment of ship-category-specific efficiency values		IMO									
	- Calculation of freight related CO2 burdens based on the delta of target and real efficiency values		IMO, UNFCCC									
	- Setting of fees for CO2 burdens		UNFCCC									
	- Payment of CO2 burden fees when freight enters final destination country		Customs offices; Nation states under the PCS regime									
B-c	**Alternative to B-b: B-c Establishment of a spatially specific relative efficiency limit (geographic efficiency standard)**											
	- Setting international efficiency values per t-km, cargo and ship type, and specifically for each major trade lane (e.g. trans-atlantic)	Like B-a	Like B-a	+ Agree-ment on major trade lanes necess.	+ +	+ +	+ +	- no anchored absolute reduction goals	+	+ +	+ +	
	Further like B-a											

	Activity	Target Group for Reduction Measures	Jurisdiction, Responsibility	Economically and methodologically feasible	Politically feasible	Fair and just	Differentiated according to the economic and technical capabilities	The precautionary principle following	Promoting the technology transfer, including within the transport industry	In support of an open global economy that promotes sustainability and development	Not without reason and unjustified hampering with international trade	Summarizing Assessment
C. Sectoral approaches with integration in trading schemes												
C-3-a	**Regional setting of emission limits with the integration in an open trading scheme**											
	- Establishment of a regional CO2 monitoring and reporting obligation; Convention on setting system boundaries for CO2 responsibilities	Shipping companies, ship operators, logistics firms Nation states	Regional, multi-national organization; CO2 reporting obligation under port states control	+ Setting system boundaries is difficult	+ +	+ Regions must be large enough to avoid evasion, e.g. Europa, US West-Coast and Japan	+ differentiated but not specifically promoting peripheral countries	+ +	+ not specifically targeted	+ +	+ +	
	- Setting of distance-related emission units (certificates) per ship and freight category		Regional, multi-national organization									
	- Setting of percentage of the baseline year certificatesto be handed off for free and to be autioned off		Regional, multi-national organization, UNFCCC									
	- Shipping companies and ship operators apply for certificates in anticipation of their activity. Ability to earn credits for measurable performance improvments		Shipping companies, ship operators									
	- Monitoring that all transport activites (distances) are coverend with certificates		Nation states under PCS of UNCLOS									
	- Possible successive reduction of amount of certificates for absolute CO2 emissions reduction		Regional, multi-national organization, UNFCCC									
C-3-b	**Multi-Modal Freight Transport Approach based on Emission-Efficiencies per Import Freight**											
	- Marine borne imports charged with a CO2 burden, as under B-b and B-c	Shipping companies, ship operators, logistics firms, air freight carriers Passing on of the costs to the customers of transport services	IMO; UNFCCC	+ +	+ complicated because many organizations are envolved	+ +	+ +	– no anchored absolute reduction targets	+ not specifically targeted	+ +	+ +	
	- Similar treatment of airborne freight		ICAO, UNFCCC									
	- Establishment of target efficiencies per freight unit and distance		UNFCCC									
	- Integration of cross-boundary lorry and rail cargo		Multi-nationale Organisation									
	- Calculation of CO2 burdens pegged to each unit of imported goods (tonne, container etc.)		Nation states under the PCS of UNCLOS									
	- Trade with emission certificates as under C-3-a		Multi-nationale Organisation									

	Activity	Target Group for Reduction Measures	Jurisdiction, Responsibility	Economically and methodologically feasible	Politically feasible	Fair and just	Differentiated according to the economic and technical capabilities	The precautionary principle following	Promoting the technology transfer, including within the transport industry	In support of an open global economy that promotes sustainability and development	Not without reason and unjustified hampering with international trade	Summarizing Assessment
C-3-c	**Closed emissions trading system with CDM measures only in the freight transport sector**											
	Like C-3-b, but with emission certificates trading as CDM only within the transport sector with the goal to improve transport infrastrucutre in peripheral countries. For example: - Expansion and electrification of a container terminal - Construction of a rail connection	Shipping companies, ship operators, logistics firms, air freight carriers	UNFCCC	+ +	+	+ +	+ +	-	+ +	+ +	+ +	
6.4 Framing Measures for Monitoring, Transparency and Public Awareness												
6.4.1	**Greenhouse Gas Efficiency Reporting/ IMO Greenhouse Gas Index**											
	Greenhouse gas efficiency reporting:	International transport sector, marine freight, but also other modes	Long-term: IMO: GHG Index; Short-term: national, regional, through multi-nationale cooperation, i.e. Europe, California, Japan; Authourity and jurisdiction under UNCLOS, Port State Control	+ +	+ +	N/A	N/A	N/A	N/A	N/A	N/A	
	Monitoring of CO2 per real transport distance performance for:											
	- Ship											
	- Shipping companies per ship and trade lanes											
	- Aircrafts per trade lanes											
	- Logistics companies per freight unit and trade lanes											
6.4.2	**Law for publishing transport-related greenhouse gas emissions**											
	- Reporting requirement of CO2 for each cargo unit, based on modal choice and major trade lanes	International logistics firms, freight carriers	International ISO Standard; Dissemination in countries of the triade; promotion of eco labeling such as the European flower	+ +	+ +	+ + promotes transparency	N/A	N/A	N/A	N/A	N/A	
	- Implementation of all modes of transport											