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Analysis of the impacts on GHG emissions

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EU policies to address maritime GHG emissions

Analysis of the impacts on GHG emissions

Discussion Paper

by

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Summary

The EU Commission committed itself to include emissions from shipping into the existing EU reduction commitment if no international agreement was achieved on a global level. To this aim the EU Commission is currently considering different regional policy options in an impact assessment. In this paper the impact of these policy options on GHG emissions has been analysed.

We conclude that a carefully designed emissions trading scheme (ETS) is the best option from an environmental point of view, mainly because of an overall emission cap.

A target-based compensation fund, which also has an overall emission cap, could be as effective as an ETS. However, funds would be allowed to choose how they meet the target and would presumably have a certain degree of freedom on the use of offsets. This makes it difficult to assess the instrument and raises the risk of the funds not meeting the target. A thorough design, especially a clear allocation of responsibilities between funds and its members, is therefore crucial.

An emission tax has the advantages of a market based measure and will incentivise emission reductions. However, overall emissions are not capped.

A contribution-based compensation fund could have the same environmental effect as an emission tax. If parts of the emissions were exempted, the environmental effectiveness would of course be less than for an emission tax.

The two options of the mandatory emission reduction per ship have the disadvantage that overall emissions are not capped. Moreover, they can be avoided by ship operators easier than the measures above.

Due to the high risk of avoidance, a bunker fuel tax, which is a very effective policy instrument in cutting GHG emissions if applied on a global scale, is not an effective instrument when applied on a regional scale.

For the instruments that allow for off-setting (other than ETS allowances) it is important to ensure the environmental integrity of the off-sets.

Zusammenfassung

Für den Fall, dass kein internationales Abkommen auf internationaler Ebene erzielt wird, hat sich die Europäische Kommission dazu verpflichtet, die Emissionen der Seeschifffahrt in ihr bestehendes Reduktionsziel aufzunehmen.

Zu diesem Zweck lässt die Europäische Kommission derzeit verschiedene regionale politische Instrumente auf ihre Auswirkungen hin untersuchen. Im vorliegenden Papier wird der Effekt dieser Instrumente auf die Treibhausgasemissionen untersucht.

Dabei kommen wir zu dem Ergebnis, dass in Bezug auf die Umweltauswirkungen ein sorgfältig entworfenes Handelssystem für Treibhausgasemissionsrechte die beste Option ist, dies hauptsächlich aufgrund dessen, dass eine Gesamtemissionsobergrenze gesetzt wird.

Target-based compensation funds, die sich auch durch eine Gesamtemissionsobergrenze auszeichnen, könnten genauso effektiv sein wie ein Handelssystem für Emissionsrechte. Die Fonds könnten jedoch selbst darüber entscheiden, wie sie ihr Emissionsziel erreichen. Dies macht eine Bewertung dieses Instrumentes schwierig und birgt das Risiko, dass die Fonds ihr gestecktes Ziel möglicherweise nicht erreichen. Eine sorgfältige Ausgestaltung des Instruments, insbesondere eine deutliche Zuordnung der Verantwortlichkeiten der Fonds und ihrer Mitglieder, ist hierbei essenziell.

Eine Emissionssteuer hat die Vorteile eines marktbasierten Instruments und gibt den Anreiz Emissionen zu reduzieren, eine Gesamtemissionsobergrenze wird jedoch nicht gesetzt.

Ein C*ontribution-based compensation fund* könnte den gleichen Umwelteffekt haben wie eine Emissionssteuer. Wäre ein Teil der Emissionen jedoch ausgenommen, so würde der Umwelteffekt natürlich weniger günstig ausfallen als bei einer Emissionssteuer.

Die zwei Varianten der *Mandatory emission reduction per ship* haben den Nachteil, dass keine Gesamtemissionsobergrenze gesetzt wird. Darüber hinaus können sie noch einfacher als die oben genannten Instrumente umgangen werden.

Eine Bunkeröl- / Kraftstoffsteuer, die bei einer globalen Implementierung ein effektives Instrument ist, ist wegen des hohen Risikos einer Umgehung, ein kein effektives Instrument, wenn sie auf regionaler Ebene implementiert wird.

Bieten die Instrumente die Möglichkeit des *Off-settings* (mittels anderer Rechte als Emissionshandelsrechte), ist es wichtig, die Umweltwirkung dieser *Off-sets* sicherzustellen.

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1 Introduction

The EU commission has committed itself to include emissions from shipping into the existing EU reduction commitment if no international agreement is achieved on IMO/UNFCCC level. The IMO has agreed to introduce a global energy efficiency standard for ships, the so called EEDI (Energy Efficiency Design Index). However, this efficiency standard is only compulsory for new ships and only incentivises technical measures. DNV (Det Norske Veritas) and LR (Lloyd´s Register) have estimated that emissions will continue to increase after the EEDI comes into force, albeit at a slower pace. While global market based measures are still under discussion, the EU Commission is investigating possible measures on EU level. In November 2011, in the third meeting of the Working Group 6 of the ECCP (European Climate Change Programme; Reducing greenhouse gas emissions from ships), the main policy options that the EU Commission considers for impact assessment have been presented. The impact assessment of these policy options is currently being carried out. In addition, from 19 January – 12 April, the EU Commission has held an internet consultation to receive input from stakeholders regarding the following four main policy options:

1. A compensation fund;
2. An emission trading system (ETS);
3. A tax on fuel or on emissions;
4. A mandatory emission reduction per ship.

In this paper the impacts of these policy options on GHG emissions are analysed.

Ideally, the emission reduction that can be achieved by the different policy options could be determined and the options compared on these grounds. However, due to the limited information on the policy options available from the internet consultation and due to a lack of detailed data on the fleet that would be affected by the policy options, it is not possible for the authors to quantify the environmental impact of the policy options.

Therefore an alternative approach has been chosen for the assessment of the policy options with respect to their environmental impact:

First we identify the factors that determine the impact of the policy options on GHG emissions in general, such as the geographic scope, the possibilities for avoidance etc. Then we discuss the policy options considered by the EU Commission for impact assessment.

Prior to this analysis the policy options are exemplified briefly. Where possible, the rudimental description of the policy options in the internet consultation questionnaire is thereby complemented by a background document of the European Climate Change Programme (EU Commission, 2011a).

2 Policy options

2.1 Compensation fund

The first policy option proposed by the EU is a so called compensation fund. Two main approaches are thereby differentiated, the contribution-based approach and the target-based approach.

The common elements of the two approaches are as follows:

1. The geographical scope of the options is the same: the emissions of the ships on routes to and from the EU as well as on routes within the EU are covered.
2. Ships calling at an EU port have to be affiliated to a compensation fund; a penalty has to be paid otherwise.
3. The fund is not publicly administered.
4. Certain standards have to be fulfilled by a compensation fund to be recognized by the EU.
5. More than one compensation fund could be set up under both options.

The specific design elements of the two approaches are as follows:

1. Contribution-based approach:
    a. No emission reduction target is set ex-ante.
    b. A fee per ton CO_2 is levied by the compensation fund(s) from its members.
    c. Optional: the fee has to be paid not for all emissions but for a proportion of the emissions only.
    d. For a compensation fund to be recognized by the EU it has to levy the minimum CO_2 fee that is set by the EU.
    e. A mandatory contribution to international climate finance would be a criterion for approval of the fund(s) "in the event that revenues are needed for international climate finance".
2. Target-based approach:
    a. An overall target based on historical transport performance or emissions is set.
    b. The emission target is divided between individual compensation funds according to the emissions of the ships they cover.
    c. How the emission target is met is completely up to the compensation fund(s).
    d. An additional contribution to international climate finance is mentioned as a design option.

2.2 An emissions trading system (ETS)

In the internet consultation the EU Commission describes the ETS system considered with: "the environmental outcome [of ETS] is guaranteed." This means that the EU Commission considers a cap-and-trade and not a baseline-and-credit ETS[1]. An overall emission target would thus be set

[1] A baseline-and-credit scheme is characterized by a ship specific standard that is combined with a trade mechanism. Ships that perform better than the standard receive credits which have to be purchased by ships that do not

under an ETS for maritime shipping. The cap would be determined on the basis of historical performance (EU Commission, 2011b).

The geographic scope of the intended emissions trading system would be the same as of the compensation fund: the emissions of the ships on routes to and from the EU as well as on routes within the EU are covered.

The other design elements of the ETS are not specified yet. The following design options are mentioned:

- The ETS for maritime shipping could be an independent system (a 'closed' ETS) or could be linked to the existing EU ETS (an 'open' ETS).
- Allowances could be allocated for free during a transitional period.
- There is a range of options for allocation (EU Commission, 2011b).
- There is a range of options for the use of the "allowance value", i.e. the revenue from auctioning of allowances (EU Commission, 2011b).

2.3 Tax

Two taxation schemes are considered by the EU Commission: a tax on bunker fuel and a tax on emissions.

2.3.1 Bunker fuel tax

The EU Commission considers a tax on bunker fuel for impact assessment. The tax rate would be based on the carbon content of the fuel. The tax would be levied on fuel sold in the EU. Fuel exported as cargo would be exempted. Like any national tax, Member States would receive the tax revenue.

2.3.2 Emissions tax

The geographical scope of the considered emissions tax would be the same as for the compensation fund and the emissions trading system: the emissions of the ships on routes to and from the EU as well as on routes within the EU are covered. For each ton of CO_2 emitted on these routes, a tax would have to be paid. According to EU Commission (2011a), "[r]evenues have to go to Member States."

2.4 Mandatory emission reduction per ship

Two options for a mandatory emission reduction per ship are given in the internet consultation document.

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comply with the standard. Under a baseline-and-credit scheme, overall emissions are not controllable since sector growth is not restricted. In contrast, total emissions are capped under a cap-and-trade mechanism. The amount of tradable emission allowances issued in a year corresponds with this cap and each unit emitted has to be covered by an allowance.

2.4.1 Option 1 ("target related to historic baseline")

Option 1 sets an emission cap per ship. The mandatory emission reduction target would thereby be relative to the historic baseline emissions of the ship. The geographical scope of the instrument would be the emissions of the ships on routes to and from the EU as well as on routes within the EU.

2.4.2 Option 2 ("target related to an index")

The internet consultation questionnaire states about the second option that per ship a "mandatory emission reduction target can be set in comparison with an index, such as the EEDI..." Our understanding of this option is that an efficiency target for ships is set, but that the index has to be decided upon.

3 Factors determining environmental impact of policy options

The four policy options that the EU Commission considers for the maritime sector can have an impact on the GHG emissions of the maritime shipping sector itself (in-sector emissions) as well as on the GHG emissions outside the maritime shipping sector.

The factors that can have an impact on the in-sector and/or the outside emissions are as follows:

1. The **geographical scope** of the policy instrument determines the amount of emissions that fall under the instrument and thus the reduction potential and the emission target of the instrument.
2. **Cap**: The emission reduction depends on whether or not overall emissions are capped/an absolute emission target is set. When the overall emissions are not capped/no absolute emission target is set, growth of activities in the sector might lead to an increase in overall emissions.
3. The emission reduction depends on the **stringency** of the policy instrument, e.g. the level of cap/target.
4. The more possibilities a policy option leaves for **avoidance**, the less its' environmental effectiveness.
5. **Incentives**: When an instrument rewards emission reduction beyond the emission target, overall GHG emission reduction may be higher.
6. If a policy instrument does not allow for offsetting (using ETS allowances and/or CDM/JI credits), then the CO_2 abatement options of the maritime shipping sector itself and their costs will, at least for market based measures, determine, next to the factors mentioned above, the in-sector emission reductions. If offsetting is (partially) allowed, then the share between in-sector emission reductions and emission reductions outside the sector will not only depend on the abatement options and abatement costs of the maritime shipping sector itself but also on the abatement options and costs in other sectors. If **offsetting is allowed** by **using** Certified Emission Reduction Credits (**CERs**) and Emission

Reduction Units (**ERUs**)[2], then the quality of these offset options will play a crucial role in the actual emission reduction achieved outside the sector.

7. Good **enforceability** of a policy instrument is a necessary condition for the environmental effectiveness of an environmental policy instrument.
8. The policy instruments could indirectly lead to an increase of the emissions outside the maritime shipping sector: A **modal shift effect** could be induced, shifting GHGs emissions to other transport modes rather than reducing overall GHG emissions.
9. Long run GHG reductions will depend on
   i. whether an instrument can be **expanded to a global level**,
   ii. the **flexibility** of a policy instrument to adjust its stringency if necessary,
   iii. the instrument's **incentive** for **technological improvements**,
   iv. the amount of **revenues** available for additional GHG reduction: when under a policy instrument revenues are generated these could, next to buying offsets, be used to additionally stimulate GHG reductions, e.g. by subsidizing the adoption of CO_2 abatement measures.

4 Evaluation

4.1 Geographical scope

- The proposed geographical scope for the compensation fund, the ETS and the emission tax is the same: the emissions of the ships on routes to and from the EU as well as on routes within the EU are covered.
- For a bunker fuel tax, the geographical scope is the EU. Whether more or less emissions would be covered under a bunker fuel tax is unclear: ships that are sailing on routes that fall in the geographical scope of the other policy instruments may sail on fuel that they have bunkered outside the EU and ships that are sailing on routes that lay outside the scope of the other policy instruments may sail on fuel that was bunkered in the EU.

4.2 Overall emission cap

- Under an ETS overall (and not ship specific) emissions would be capped. If a separate maritime ETS was established the in-sector emissions would thereby be capped. If shipping were

[2] The **Clean Development Mechanism (CDM)** allows a country with an emission-reduction or emission-limitation commitment under the Kyoto Protocol (Annex B Party) to implement an emission-reduction project in developing countries. Such projects can earn saleable **certified emission reduction credits (CER)**, each equivalent to one tonne of CO_2, which can be counted towards meeting Kyoto targets.

The **Joint Implementation mechanism (JI)** allows a country with an emission reduction or limitation commitment under the Kyoto Protocol (Annex B Party) to purchase **emission reduction units (ERUs)** from an emission-reduction or emission removal project in another Annex B Party, each equivalent to one tonne of CO_2, which can be counted towards meeting its Kyoto target.

to join the existing ETS as a new sector, one cap would hold for the industry, the power sector, aviation and the maritime sector.
- Under a target-based compensation fund overall emissions would be capped if the emission target was based on *historical emissions*.
- The EU Commission states that the target of the target-based compensation fund could also be set on the grounds of historical *transport performance*. It is not clear for us how a target would be specified under this option. We thus cannot rule out that under this option overall emissions are not capped.
- Under a contribution-based compensation fund, under a fuel or emission tax, and under a mandatory emission reduction overall emissions are not capped.

4.3 Stringency

The stringency of a policy instrument, like the tax rate or the emission cap, naturally plays a key role in the environmental effectiveness of an environmental policy instrument.

- For some policy instruments (e.g. ETS) baseline emissions may have to be determined in order to determine the stringency of the instrument (e.g. the ETS cap). The period for which the baseline emissions are determined is thereby crucial. If the baseline period is a "boom" period, the sector may not need to take any action at all to comply with the instrument.
- Note that if a separate, closed ETS system was introduced for the maritime shipping sector alone, there could be a tendency not to work with a stringent cap in fear of a relatively high allowance price. On the other hand, a loose cap would result in low allowance prices in a closed system. The sector would not be able to buy allowances from other sectors which may have cheaper abatement options.
- Note also with respect to the contribution-based compensation fund that the EU Commission gives the option that "the contribution may be required in respect of only a portion of the emissions only." The extent to which an exemption is granted is of course crucial for the environmental effectiveness of the instrument.

4.4 Avoidance

- Under a compensation fund, an ETS, an emission tax, as well as a mandatory emission reduction per ship two `avoidance` strategies are conceivable:
  1. An extra port call outside the EU or the shift from transhipment to ports outside the EU can reduce the emissions that are captured by a policy instrument.
  2. A redistribution of the geographical deployment of ships: ships that are relatively efficient could be deployed on routes that are covered by the instrument, whereas ships that are relatively inefficient are deployed on routes outside the geographical scope of the instrument.
- For ship-specific absolute emission targets (option 1 of mandatory emission reduction per ship) a strategy could be to use the ships on routes covered by the instrument until the target is reached and switch subsequently to routes not covered by the instrument.
- None of these `avoidance` strategies are relevant under a bunker fuel tax, but as the EU Commission puts itself in the questionnaire for the internet consultation: "... applying a tax

purely on bunker fuel sold in the EU could lead to a significant risk of evasion and, may, as a result, undermine the environmental effectiveness ... of the fuel tax."

Ships that fully or partly operate on non-intra EU routes can be expected to avoid an EU bunker fuel tax by bunkering outside the EU. This is, at least in the long run, likely to be the case since the ships that operate on these routes generally have a high cruising radius. A drop in bunker fuel sales in the ports of California after the exemption of bunker fuel from the sales and use tax had temporally been abolished in the early 90s shows that this fear is not unfounded (OECD, 1997).

For ships that normally sail on intra-EU routes only, the risk for evasion by bunkering outside the EU will naturally be lower. Depending on the net bunker fuel price and the level of the tax rate, some ships may have an incentive to make a detour for bunkering outside the EU. However, clearing formalities regarding the ships' freight will be an obstacle for this kind of evasion.

4.5 Incentive to reduce emissions beyond target

Most instruments result in an incentive to reduce carbon, regardless of the level of emissions. In contrast, a mandatory emissions reduction per ship results in an incentive to reduce emissions up to the point where the mandatory level has been achieved. There is no incentive to reduce emissions beyond that level. When an instrument rewards the emission reduction beyond a ship-specific emission target, overall GHG emission reduction may be higher.

Hence, on the basis of this analysis the following instruments result in higher emissions reductions:

- A contribution-based compensation fund;
- An ETS system;
- A bunker fuel tax;
- An emission tax.

4.6 Quality of offsets

Under some of the considered policy options the use of offsets (other than ETS allowances) may be allowed/be mandatory:

- Under an ETS offsets may be allowed (e.g. if the ETS for the shipping sector would be integrated in the existing EU ETS)
- Under the considered target-based compensation fund, the funds are free in the way that they meet the target. Whether the target is an in-sector target or whether the target can also be met by the use of offsets is not clear from EU Commission (2011a).

Assumedly, these offsets will be CER Credits and/or ERUs (see footnote 2). The quality of the CER Credits and the ERUs will then play a crucial role in the actual emission reduction that is achieved outside the sector. Doubts have been raised as to the quality of the offsets (see e.g. Sepibus, 2009) The EU Commission states itself that "the European Union is calling for its [CDM]

reform to improve its environmental integrity, effectiveness, efficiency and governance." (EU Commission, 2011b).

4.7 Enforceability

Good enforceability of a policy instrument is a necessary condition for the environmental effectiveness of an environmental policy instrument.

- Comparing the considered policy options, enforcement of a bunker fuel tax is clearly the easiest.
- The geographic scope of most of the instruments considered, not only comprises the emissions on routes to the EU and on intra-EU routes but also on routes from the EU. Enforcement could turn out difficult for the routes from the EU, especially for ships that only occasionally sail to EU ports.
- Under a compensation fund assignment of responsibilities has to be clearly defined. Does the responsibility lie with the fund or its members? This will especially be crucial for the target-based compensation fund under which the funds themselves can decide on how they meet the target.

4.8 Modal shift

In CE Delft et al. (2009) the impact of climate policy for shipping on modal shift is analysed. The findings are as follows:

- Modal shift is confined to transport routes where alternatives via other modes exist. If at all, it will most likely occur in unitised short sea shipping, including Roll-on/roll-off and Lift-on/Lift-off. For intercontinental shipping other modes of transport hardly exist and elasticity estimates of short sea bulk transport suggest that these are not very price sensitive.
- Modal shift may result in higher CO_2-emissions as well as in lower emissions. Small vessels (up to approximately 1,800 DWT) have emissions that are comparable to road transport and higher than emissions of rail transport. So modal shift only results in higher emissions on routes where relatively large ships compete with road transport.
- On routes where unitised cargo is transported and relatively large vessels compete with road transport, modal shift may occur if road and rail transport are not subjected to cost increasing climate policies or if the cost increase per unit of transport is lower than in maritime transport. If the cost increase in road and rail transport is higher than in maritime transport, modal shift may occur in a way that increases the share of maritime transport.

The cost increases arising from a policy instrument have an impact on the probability of modal shift: the larger the increase, the higher the probability of a modal shift. Cost increases will differ between the instruments. A ranking of the instruments with respect to their cost increases is however not possible at this stage, since the design of the options is not specific enough yet.

4.9 Long term GHG reductions

The long run GHG reductions will depend on

1. whether and how easily the policy instrument is expandable to other regions,
2. the flexibility of a policy instrument to adjust its stringency if necessary,
3. the instrument's incentive for technological improvements in the sector, and
4. the amount of revenues available for additional GHG reduction.

4.9.1 Possibility of implementation on a global level

Most of the options are theoretically also implementable on a global level. Only option 2 ("target related to an index") of the mandatory emission reduction per ship might, depending on its design, not be implementable on IMO level. MEPC has decided that the EEDI cannot be the basis for a mandatory policy instrument. The challenge would then be, not to work with the EEDI but to find another commonly agreed ship efficiency index.

4.9.2 Flexibility in stringency

The possibility to adjust the stringency seems to be comparably for all the policy options, except for the contribution-based compensation fund. To be recognized as a compensation fund, a fund has to levy the minimum CO_2 fee. Raising this minimum fee at a later stage could thus pose a problem.

4.9.3 Incentive for technological improvements in the sector

The long-run GHG reductions will depend on, among other things, the incentive that the instruments give for the adoption of abatement technologies and therefore also for the development of new technologies. All instruments incentivise the adoption of technological abatement technologies, market based mechanisms (MBM) however provide a higher incentive than non-MBM.

4.9.4 Revenue for additional GHG reduction

If revenue is generated by a policy instrument, this revenue may be used for financing additional GHG emission reductions (other than offsets), e.g. by subsidizing the adoption of in-sector CO_2 abatement measures.

- Under a contribution-based compensation fund, revenues are generated. Funds could be obliged to use (parts of) this revenue for additional GHG reductions.
- Under a target-based compensation fund, funds are free to choose their compliance strategy. Even if the funds would be obliged to use offsets and thus would have to generate some revenue it is not realistic to assume that more than the revenue needed to buy offsets would be raised.
- When allowances are auctioned under an ETS, revenues would be generated. To oblige Member States to use these revenues for financing additional GHG emission reductions is politically probably not feasible. Some Member States however may decide to spend (some of) the revenue to finance additional GHG emission reductions.
- Revenues of a bunker fuel tax and an emission tax has to go to the Member States (EU Commission, 2011a). Not only the implementation of the taxes but also hypothecation of

their revenues requires unanimity amongst Member States (CE Delft, 2009). Hypothecation of the revenues to finance additional GHG reductions may therefore be difficult to implement.

4.9.5 Use of revenues

Some policy options raise revenues. These could in principle be used to promote improvements in fuel efficiency. The feasibility depends on who collects the revenues, as it could require hypothecation of fiscal revenues, which some countries oppose. A use of revenues in the sector could increase the acceptance of a policy instrument.

4.10 Overview

In the following table an overview is given on the policy options and the main factors that determine the environmental impact of the instruments.

	ETS	Compensation fund		Bunker fuel tax	Emission tax	Mandatory reduction target per ship	
		Contribution-based	Target-based			Option 1: target related to historic emissions	Option 2: target related to an index
Geographical scope	Emissions of the ships on routes to and from the EU as well as on routes within the EU are covered.	Same as ETS.	Same as ETS.	EU; unclear whether more or less emissions are covered compared to other instru-ments.	Same as ETS.	Same as ETS.	Same as ETS.
Overall emis-sion cap	Yes.	No.	Historic emissions baseline: Yes. Transport per-formance baseline: this policy option is unclear to us.	No.	No.	No.	No.
Stringency	If free allocation: baseline emissions to be determined carefully. Separate, closed system: risk of too lax cap.		Baseline emissions to be determined carefully.			Baseline emissions to be determined carefully. Ship-specific base-line difficult to determine.	
Risk of avoid-ance	Yes.	Yes.	Yes.	Yes; very high.	Yes.	Yes; easy.	Yes; easy.

	ETS	Compensation fund		Bunker fuel tax	Emission tax	Mandatory reduction target per ship	
		Contribution-based	Target-based			Option 1: target related to historic emissions	Option 2: target related to an index
Incentive to go beyond target	Yes.	Yes.	Unclear.	Yes.	Yes.	No.	No.
Offsetting (other than ETS allowances) is allowed	Maybe.	May be mandatory.	Unclear.	No.	No.	No.	No.
Enforceability	Enforcement of routes from EU difficult	Enforcement of routes from EU difficult Not clear: Fund or member of fund responsible?	Enforcement of routes from EU difficult Not clear: Fund or member of fund responsible?	Easiest.	Enforcement of routes from EU difficult	Enforcement of routes from EU difficult	Enforcement of routes from EU difficult
Risk of modal shift	Yes.	Yes; expectedly less than for MBM if there are emissions exempted.	Yes; depends on instrument choice of fund.	Yes.	Yes.	Yes; expectedly less than for MBM.	Yes; expectedly less than for MBM.
Implementable on global level?	Yes.	Yes.	Yes.	Yes.	Yes.	Yes.	Not if EEDI is used.
Flexibility in stringency	Average.	Could be more problematic.	Average.	Average.	Average.	Average.	Average.

	ETS	Compensation fund		Bunker fuel tax	Emission tax	Mandatory reduction target per ship	
		Contribution-based	Target-based			Option 1: target related to historic emissions	Option 2: target related to an index
Incentive for technological improvement	Yes.	Yes; maybe lowered by emission exemption.	Yes.	Yes.	Yes.	Yes; lower than for MBM.	Yes; lower than for MBM.
Revenue available for additional GHG reduction	Yes, but earmarking politically probably not feasible.	Maybe.	Unlikely.	Yes, but earmarking politically probably not feasible.	Yes, but earmarking politically probably not feasible.	No.	No.

5 Conclusions

The EU commission has committed itself to include emissions from shipping into the existing EU reduction commitment if no international agreement is achieved on IMO/UNFCCC level. The IMO has agreed to introduce a global energy efficiency standard for ships, the so called EEDI (Energy Efficiency Design Index). However, this efficiency standard is only compulsory for new ships and only incentivises technical measures. DNV and LR have estimated that emissions will continue to increase after the EEDI comes into force, albeit at a slower pace. While global market based measures are still under discussion, the EU Commission is investigating possible measures on EU level. In November 2011, in the third meeting of the Working Group 6 of the European Climate Change Programme (Reducing greenhouse gas emissions from ships), the main policy options that the EU Commission considers for an impact assessment have been presented. The impact assessment of these policy options is currently being carried out. In addition, from 19 January – 12 April, the EU Commission has held an internet consultation to receive input from stakeholders regarding the following four main policy options:

1. A compensation fund;
2. An emission trading system (ETS);
3. A tax on fuel or on emissions;
4. A mandatory emission reduction per ship.

In this paper the impact of these policy options on GHG emissions has been compared by looking at the different factors that determine the impact of the policy options on GHG emissions. From this analysis we conclude the following:

A carefully designed **Emission Trading System (ETS)** seems to be the best instrument from an environmental point of view. Under an ETS, and this is the main advantage, overall emissions are capped. The emissions baseline/cap has thereby to be chosen carefully. If a closed ETS for the shipping sector was introduced, the emission cap should not be chosen too lax in fear of high allowance prices. Just as the other MBMs, ETS gives an incentive to reduce emissions beyond the target. If CER/ERU offsets are included in the measure, their environmental integrity has to be ensured. The use of CER/ERU offsets could be limited. Disadvantages of an ETS are that the hypothecation of revenues from auctioning is restricted and thus also their use for additional GHG emissions and that the modal shift effect is probably higher than for non-MBMs.

A **target-based compensation fund** could be set up comparable to an ETS and could thus induce a similar impact on reduction of GHG emissions. However, funds are free to choose how they meet the target which makes it difficult to assess this instrument. What can be assessed is that the instrument has the advantage of an overall emission cap if the target is set on the basis of historical emissions. Disadvantages are that it cannot be expected that there are revenues which can be used for additional GHG emission reduction. But more important is that the funds have a high responsibility in choosing their own instruments. This raises the risk that the funds may not meet their target: approaches that ex ante seem plausible could turn out to be ineffective; conflicts between members of a fund could arise etc. This makes a clear allocation of the responsibility between fund and members very important.

An **emission tax** has the advantages of a MBM, however has no overall emission cap. An advantage compared to ETS is that no CER/ERU offsets are used of which the environmental integrity has to be ensured. Revenues could be used for additional GHG reduction; implementation of hypothecation may however be difficult.

A **contribution-based compensation fund** could induce the same environmental effect as an emission tax. An advantage compared to the emission tax is that the revenues could be used easier to finance additional GHG reduction. The disadvantage compared to emission tax is that the adjustment of the stringency could be a problem. If mandatory offsets are used, then the environmental integrity has to be guaranteed. If parts of the emissions were exempted, the environmental effectiveness would of course be less than of an emission tax.

The two options of the **mandatory emission reduction per ship** have the disadvantage that no overall emission cap is set, that avoidance is easier under a ship-specific regulation and, on top, that the options have the disadvantages of non-MBMs that no incentive is given to reduce emissions beyond the target and that a lower incentive for technological innovation is given. The modal shift effect however is probably lower than under MBMs.

With regards to option 2 ("target related to an index") of the mandatory emission reduction, it has to be pointed out that if the measure was based on the EEDI, it would not be implementable on a global level, since MEPC has decided not to use the EEDI for a mandatory instrument.

The least effective policy instrument in terms of the environmental effect is probably the **bunker fuel tax**. A bunker fuel tax, which is a very effective policy instrument in cutting GHG emissions if applied on a global scale, is not an effective instrument for cutting GHG emissions when applied on a regional scale due to the high risk of avoidance.

Note finally, that for all the instruments except fuel tax it holds that enforcement with respect to emissions on the routes from EU may be problematic.

6 References

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