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Draft COMMISSION STAFF WORKING DOCUMENT

Accompanying document to the

PROPOSAL FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT AND COUNCIL

for the inclusion of GHG emissions from maritime transport in the EU's reduction commitments

Impact Assessment

{COM(2013) 480 final}
{SWD(2013) 236 final}

Disclaimer:
This report commits only the Commission's services involved in its preparation and does not prejudge the final form of any decision to be taken by the Commission.

GLOSSARY

CDM	Clean Development Mechanism
CER	Certified Emissions Reductions
EEA	European Environment Agency
EEDI	Energy Efficiency Design Index
EEOI	Energy Efficiency Operational Index
EIB	European Investment Bank
EMSA	European Maritime Safety Agency
EUA	European Union Allowances
GT	Gross tonnage
GHG	Greenhouse gas
HFO	Heavy Fuel Oil
IMO	International Maritime Organization
IPCC	Intergovernmental Panel on Climate Change
MARPOL	International Convention on MARitime POLlution
MEPC	Maritime Environmental Protection Committee
MDO	Marine Diesel Oil
MGO	Marine Gasoil
MRV	Monitoring, reporting and verification of emissions
NGO	Non-governmental organisation
SEEMP	Ship Energy Efficiency Management Plan
SOLAS	International convention for Safety Of Life At Seas
toe	Tons of oil equivalents
UNCLOS	Untied Nation Convention on Law Of the Seas

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1. PROCEDURAL ISSUES AND CONSULTATION OF INTERESTED PARTIES

Lead DG: DG CLIMA in close cooperation with DG MOVE being in agreement with this impact assessment.
Agenda planning /WP reference: 2012/CLIMA/005

1.1. Impact assessment steering group (IASG)

Work on the impact assessment was carried out by a European Commission Inter-Service Steering Group (ISG) set up by DG CLIMA which met six times. The following Directorates-General (DGs) of the European Commission participated in the work of the group: DG ENV, DG ENTR, Secretariat-General (SG), Legal Service (SJ), DG TAXUD, DG MARKT, DG COMP, DG JRC, DG RTD, DG MOVE, DG TRADE, DG MARE, the European Maritime Safety Agency (EMSA) and the European Environment Agency (EEA).

1.2. Consultation of the IAB

Following the IAB's first opinion and its recommendations, the draft impact assessment has been substantially revised. These changes concern the section on problem definition which has been re-arranged describing the policy context, market failures as well as expected market dynamics until 2020 (e.g. ship overcapacity, the need to generate fuel savings, new technologies, slow steaming) more in detail. Furthermore, within the limits of a reasonable page volume for the Impact Assessment, the intervention logic has been re-enforced, the objectives more streamlined and the policy options have been described more in detail. Regarding the assessment and comparison of options, more elements have been added (e.g. a dedicated section on modelling, cost figures for all actors involved, administrative costs for Member States, a dedicated annex on SMEs and a dedicated annex describing costs for each individual option according to size of ships, type of competent authorities and type of recycling of revenues where relevant). Future monitoring and evaluation arrangements have been further clarified. Furthermore, more references to stakeholder views have been introduced all over the document including a dedicated section on "industry approaches" (section 2.6). The balance in the distribution of relevant information between the different annexes and the main text has only been partly modified as the draft Impact Assessment's main text already exceeded the recommended number of pages by around 50%.

In its second option, the IAB suggested providing more robust evidences on the magnitudes of the underlying market failures. Additional evidence based on the studies analysing these aspects has been added. Moreover, following the recommendation of the board, the results of the public consultation, instead of a synthesis of these results, have been added to the annex of the impact assessment to substantiate stakeholder views and to present them in a more differentiated way. Finally, following the IAB recommendation, the impact assessment also better explains the two stage approach. In particular, the fact that additional discussions are required once the MRV will be in place is now explicit.

1.3. Consultation and expertise

1.3.1. External support

The underlying econometric modelling and analysis was carried out by a consortium led by AEA Technology. The consortium consisted of senior experts consultants in the maritime sector: IHS Fairplay, AMEC and Marintek. The data on environmental, economic and social impacts used in this impact assessment have been provided by this study if not stated differently. A study on market barriers for the uptake of cost-efficient mitigation technologies carried out by Maddox consulting (particularly as regards the Monitoring, Reporting and Verification - MRV option) and a study carried out by IHS Fairplay on ships visiting EU ports, as well as industry expert consultations were also used to complement the analysis.

AEA Technology report, Maddox Consulting study and IHS Fairplay study are available on the Commission website[1].

1.3.2. Consultation of maritime experts and Member States

In order to review the policy options mentioned in the second International Maritime Organisation (IMO) greenhouse gas study 2009[2] and in the 2009 CE Delft study[3], a working group (WG6) was established under the European Climate Change Program II (ECCP). This group has also allowed for a formal technical stakeholder consultation and provided input for the external support, especially by narrowing down the policy options, by addressing the issue on regions heavily dependent on shipping and by understanding the positive and negative aspects of an EU proposal for delivering an IMO action.

A one-day and three two-day meetings were organized on 31 August 2010, 8-9 February, 22-23 June and 15-16 November 2011. They brought together more than 100 participants from national administrations, from the EU shipping organizations and associations, from international shipping organizations and from other associations and NGOs. Representatives from the European Maritime Safety Agency (EMSA), the European Environment Agency (EEA) and the European Parliament also attended. The minutes, the background papers and the presentations of these meetings are available on the Commission website for public information[4].

Furthermore, Commissioner Hedegaard and Vice-President Kallas met with high level experts in the maritime transport sector. These meetings took place on the 3 February 2011, 28 June 2011 and 7 November 2011.

1.3.3. Public on-line consultation

An online public consultation was held from 19 January to 12 April 2012, i.e. 12 weeks. A press release announced the launch of this public consultation. The public consultation was carried out using the "General principles and minimum standards for consultation of interested parties by the Commission". Results from the consultation are given in Annex III.

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[1] http://ec.europa.eu/clima/policies/transport/shipping/studies_en.htm

[2] The Second IMO Greenhouse gases study 2009 constitutes a significant scientific work undertaken at the global scale under the auspices of IMO. The Study identifies a significant potential for reduction of GHG emissions through technical and operational measures. The Study estimates that, if implemented, these measures could increase efficiency and reduce the emissions rate by 25% to 75% below the current level.

[3] In 2009, CE Delft provides the European Commission with Technical support for European action to reducing Greenhouse Gas Emissions from international maritime transport.

[4] http://ec.europa.eu/clima/policies/eccp/second/stakeholder/documentation_en.htm

The results of the consultation confirm that a global agreement in the IMO is perceived as the best long term option to achieve GHG emissions reduction of the shipping sector. The results show agreement that, in absence of a global measure, any European measure should be a level playing field for all ships using ports in the EU. It is also a generally shared view that any market-based measure, whether adopted at EU or IMO level, needs to be accompanied by transparent and robust monitoring of emissions. This monitoring should be established with the view of avoiding undue administrative burdens and ensure accurate reporting results.

In parallel to this internet public consultation, a technical workshop was organised on 6 March 2012 with relevant stakeholders in order to discuss in concrete terms how the possible EU measures could be implemented. The list of parties consulted and the main conclusions are given in Annex V.

In addition, a one-day broad consultation meeting with more than 120 participants was held on 5 December 2012 to discuss in more detail the monitoring and reporting of CO2 emissions in the shipping sector.

2. PROBLEM DEFINITION

2.1. EU related CO2 emissions from maritime transport are significant, leading to negative impacts on climate change

Emissions of the shipping sector have been recognised as a fast growing environmental problem as they affect climate, have direct impacts on human health, and they contribute to ocean acidification and eutrophication[5]. Background information on the shipping sector, especially regarding the various shipping segments and their energy efficiency, is given in Annex I.

EU related CO2 emissions from maritime transport reached 179.6Mt in 2010[6]. By a way of comparison these EU related maritime sector emissions are higher than the total 2009 emissions of 20 Member States, taken individually[7].

Greenhouse gas emissions from shipping, which are closely linked to the development of the world economy, have increased strongly in the past few years. Although, the EU has reduced its greenhouse gas (GHG) emissions by 379,8MtCO2eq between 1990 and 2007[8], during the same period, the CO2 emissions from international shipping related to the EU, i.e. emissions

[5] Corbett, J. 2003. New Directions: Designing ship emissions and impacts research to inform both science and policy. Atmospheric Environment, Vol 37 Issue 33: 4719–4721

[6] AEA Technology and others 2012

[7] Austria (82MtCO2), Belgium (152MtCO2), Bulgaria (61MtCO2), Czech Republic (134MtCO2, Denmark (64MtCO2), Estonia (18MtCO2), Ireland (65MtCO2), Greece (134 MtCO2), Cyprus (10MtCO2), Latvia (12MtCO2), Lithuania (22MtCO2), Luxembourg (13MtCO2), Hungary (67MtCO2), Malta (6MtCO2), Portugal (79MtCO2), Romania (132MtCO2), Slovenia (20MtCO2), Slovakia (44MtCO2), Finland (69MtCO2) and Sweden (69MtCO2)

[8] Eurostat, April 2012

related to intra-EU routes, incoming and outgoing voyages, have increased by 66MtCO2[9], undermining the EU efforts to tackle climate change.

International shipping is the only sector and transport mode not covered at the EU level by emission reduction target. All other transport modes, including domestic shipping[10], are covered by emission reduction targets in result of the revised directive 2003/87/EC which set the European emission trading scheme (EU-ETS) and the Decision (EC) n°406/2009 on the effort of Member States to reduce their greenhouse gas emissions to meet the Community's greenhouse gas emission reduction commitments up to 2020. Moreover, some specific measures are used to help the internalisation of the carbon cost, such as the regulation (EC) n°443/2009 and 510/2011 setting CO2 emissions standards for cars and vans, but none of them apply to international shipping.

Although the EU continues to consider global approaches central in developing its policy, in view of the significance of the problem it was agreed between the European Parliament and the Council of the EU in 2008 that in the absence of an international agreement, the Commission should make a proposal to include international maritime emissions into the Community reduction commitment[11].

The EU related maritime emissions have two distinct dimensions. Firstly, the emissions relating to intra-EU traffic by EU operators which are not expected to increase significantly by 2050, and secondly, those emissions relating to sea transport into and out of EU where significant growth is projected. Accordingly an appropriate regulatory measure should – in addition to addressing how EU does maritime business – contribute to how business is done in Europe and promote further action internationally.

Considering the importance of international progress on developing a global measure, this impact analysis covers a measure aimed at increasing availability of comparable and transparent emissions data through Monitoring, Reporting and Verification (MRV – option 2), which would allow for better informed decision making within sector, as well as a range of so called Market Based Measures (MBMs – options 3-5). For the purposes of this analysis it has been considered that although a robust MRV scheme is the foundation of most MBMs, it can in certain circumstances deliver significant results as an interim stand-alone measure.

Trade activity was the basis of the calculation of the projected CO2 emissions in the shipping sector used for this impact assessment. More precisely, variations of seaborne trade of more than 80 commodities between two EU regions (Northern EU and Southern EU) and 13 extra-EU regions[12] defined the maritime transport activity up to 2050. Such variations were calculated using the IHS Global Redesign Scenario[13]. It was therefore possible to estimate the future CO2 emissions on EU related routes considering a frozen technology scenario.

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[9] AEA Technology and others, 2012

[10] Domestic shipping means shipping within the territorial waters of a Member State. Intra-EU shipping is considered as international shipping. CO2 emissions from domestic shipping represent 22.3MtCO2 in 2010.

[11] Recital 2 of the decision n°406/2009/EC and recital 3 of the directive n°2009/29/EC

[12] Mediterranean non EU, Northern non EU, Middle East, North Africa, North America, Central America/Caribbean, South America East Coast, South America West Coast, Australia/Oceania, North East Asia, South East Asia, India, Southern Africa

[13] IHS Global Redesign Scenario is one out of a total of three scenarios that have been developed by IHS over the past two years.

Based on this frozen technology scenario and using IMO data and Marintek and IHS Fairplay expertise, emissions reductions, due to economies of scale related to the increase of ship size (which is a significant trend in the shipping sector), fuel switch (in particular due to low sulphur requirement) and mandatory improvement of the implementation of the EEDI[14], were integrated. This led to the projected EU related CO2 emissions under the baseline scenario.

The EU is strongly committed to achieve the climate objective of limiting global average temperature increase to less than 2 degrees Celsius above pre-industrial levels. To this end, the Europe 2020 Strategy for smart, sustainable and inclusive growth[15] includes five headline targets. One of the headline targets is to reduce GHG emissions by at least 20% compared to 1990 levels or by 30%, if the conditions are right[16]. In the view of contributing to the EU 2020 Strategy, the 2011 Commission White Paper on Transport[17] states that EU CO_2 emissions from maritime transport should be reduced by 40% (if feasible 50%) from 2005 levels by 2050. Therefore, the projected increase of CO2 emissions from shipping is not in line with the EU objectives, leading to negative impacts on climate change.

2.2. What are the drivers of the problem?

2.2.1. EU sea transport is experiencing growth , leading to an increase of its CO2 emissions

CO2 emissions in maritime transport are related to shipping activity, which is closely related to the growth of the word trade. It can be assumed that the relative weight of major economies outside the EU, such as China, India or Brazil in the global GDP will increase[18] resulting in an increase in the trade activity of the EU with these countries. More than 90% of EU trade is seaborne[19] and this share is expected to increase[20]. Although in absolute terms emissions from intra EU maritime transport are not expected to increase significantly and may even decrease from 78.5MtCO2 in 2005 to 70MtCO2 in 2030 (-11%)[21], EU related maritime transport activity is expected to increase as a result of increase in trade with third countries leading to an increase of CO2 emissions on EU related routes. Under a frozen technology scenario, the EU related CO2 emissions could reach 280MtCO2 by 2030 (+43% compared to 2005). The intra EU emissions from maritime transport will therefore drop from 40% of the total EU related CO2 emissions in 2005 to 26.6% in 2050.

These projections have been estimated according to a trade model, the IHS Global Redesign Scenario, integrating strong underlying assumptions related to interalia geopolitics, monetary issues, environmental issues or economical policies. However, projected CO2 emissions are sensitive to the variation of these assumptions. For example, a higher/lower GDP growth in

[14] Energy Efficiency Design Index, see section 2.3.1
[15] COM(2011) 21, see: http://ec.europa.eu/resource-efficient-europe
[16] COM(2010)2020, 3.3.2010
[17] COM(2011) 144 final
[18] IHS Fairplay, Global Redesign Scenario 2012
[19] http://ec.europa.eu/transport/modes/maritime/index_en.htm
[20] The Commission's White Paper on Transport mentions that "*30% of road freight over 300 km should shift to other modes such as rail or waterborne transport by 2030, and more than 50% by 2050, facilitated by efficient and green freight corridors.*"
[21] AEA Technology and others, 2012

major economies outside the EU may lead to higher/lower CO2 emissions on EU related routes. A quantification of the projected CO2 emissions different than the one used in this impact assessment would have required the use of another trade model. Further details, especially on the trade flows considered by the model, can be found in annex VI.

2.2.2. Market failures prevent the uptake of low carbon technologies

Greenhouse gas emissions (GHG) of maritime transport are directly related to fossil fuel consumption and fuel can be considered up to 33 to 63% of ship's operational costs. In theory, the increase of fuel prices (particularly due to global low-sulphur requirements[22]) should trigger the adoption of technological means to increase of the energy efficiency of ships and ultimately to a decrease of GHG emissions compared to a business as usual scenario.

However, recent research by the International Maritime Organisation (IMO), CE Delft, Det Norske Veritas (DNV) and others has identified CO_2 reduction measures in the maritime transport sector that are not being implemented on large scale, such as slow steaming, weather routing, contra-rotating propellers, propulsion efficiency devices, etc. The total cost of many of these measures is negative – i.e. they deliver more fuel savings than the investment required. These measures could deliver substantial reductions in fuel consumption and emissions. However, they are not implemented in part due to market barriers which have to be considered as a major problem driver. Three main market barriers can be underlined[23]:

1. lack of information: Ship-owners, ship operators and charterers may not be aware of the energy efficiency of a ship, may not be able to compare this energy efficiency amongst other ships or may not be aware of technologies delivering cost-effective emissions reductions;
2. split of incentives: Several entities are involved in the operation of ships. As a result of this, a coherent long-term strategy to improve of the energy efficiency is difficult to implement as neither owner nor operator or charter can expect full pay-back of their investments.
3. access to finance: Ship-owners or ship operators do not have adequate access to private finance to invest in low carbon technologies.

A detailed description of the market barriers is given in Annex X.

If all market barriers were removed, the EU related CO2 emissions from maritime transport could be stabilized 5% below 2005 levels up to 2030[24]. This means that, with the current fuel prices projection[25], the uptake of low carbon technology with negative costs could fully compensate the growth of the transport activity. Such results have been confirmed by recent study of Det Norske Veritas (DNV), which demonstrates that global maritime emissions can be stabilised at today's level up to 2050[26].

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[22] In 2008, the IMO requested the use of low-sulphur fuel in specific regions (North Sea, the Channel and the Baltic for the EU) from 2015 onwards. These requirements were introduced in the EU legislation through the review of Directive 1999/32/EC. The switch from heavy fuel oil (HFO) to marine diesel oil (MDO) will lead to an increase of fuel costs for the maritime sector.

[23] Maddox Consulting 2012

[24] AEA Technology and others, 2012

[25] See table VI.2 under annex VI for the fuel price projections.

[26] Pathways to Low Carbon Shipping - Abatement Potential Towards 2050, DNV, 2012

It can be stressed that the lack of information has to be solved before removing the other market barriers. For example, in order to ensure that a long-term strategy to improve the energy efficiency of a ship is set up, ship-owners or ship operators have to be aware of the energy efficiency of their ship. Moreover, providing reliable information on the economic and environmental effectiveness of technologies improving energy efficiency will reduce the risk taken by banks to finance such technologies.

Consequently, even if fuel price could in principle be a key driver to encourage emission reductions, it cannot deliver the full potential of emissions reductions in the shipping sector due to the above mentioned market barriers.

2.3. Who is affected, in what ways and to what extend?

2.3.1. The EU and its EU Member States

As mentioned in section 2.1, international maritime transport is the only mode of transport currently not covered by an EU or international regulation (see also section 2.5 on EU and international regulations). In the absence of a policy measure there is a risk of distortion of competition between modes of transport.

Aviation is included in the EU-ETS under a law agreed in 2008[27]. The introduction of non-discriminatory carbon pricing for incoming and outgoing flights via the EU ETS has raised at times misinformed but nevertheless strong objections by key international partners. These partners have called for prioritising a global agreement on a market based measures at the 2013 International Civil Aviation Organisation (ICAO) Assembly. In response to the progress made at the latest ICAO Council meeting (9 November) and the commitment to deliver tangible results to address international aviation emissions by the 2013 Assembly, the Commission has proposed a temporary, one year derogation of the EU ETS as regards air traffic into and out of Europe. This gesture is expected to provide momentum for the ICAO discussions in the run up to the 2013 Assembly.

Other modes of transports, such as road, rail and inland waterways, are covered by the Decision (EC) n°406/2009 on the effort of Member States to reduce their greenhouse gas emissions to meet the Community's greenhouse gas emission reduction commitments up to 2020. However, technical measures, such as regulation (EC) n°443/2009 setting emission performance standards for new passenger cars, have also been adopted to fit with the nature of the sector (e.g. the short life time of car, compared to other mode of transport, increases the accuracy of setting standards for new vehicles). Moreover, electric propulsion for railways and, increasingly, for cars, is also covered by the EU ETS.

There are also several international developments that will affect the level of emissions even in the absence of an EU measure. The work started in 2000 by the IMO led to finalising a report which represented, at the time, the most comprehensive overview and estimate of ships' emissions. On 15 July 2011 a new chapter was added on Regulations on energy efficiency for ships to make mandatory the Energy Efficiency Design Index (EEDI), for new ships and existing ships which have undergone a major conversion, progressively from 1st January 2013.

[27] http://ec.europa.eu/clima/policies/transport/aviation/index_en.htm

At the time of the adoption of the EEDI a further agreement was reached on all ships covered by the relevant IMO convention should carry a Ship Energy Efficiency Management Plan (SEEMP) on board. This SEEMP aims to record the operational measures taken to enhance the energy efficiency of the ship. However, the measures described in the SEEMP are not mandatory. Therefore, the impact of SEEMP remains uncertain.

Against this backdrop, and to maintain the consistency and positive impact of our environment and climate policy, a gradual approach which will still maintain maximum leverage on the international discussions on maritime emissions, will be in the interest of Europe.

2.3.2. EU ship-owners and ship-operators

In the shipping sector, the external cost of CO2 emissions has not been yet internalised. As a consequence, shipping competitiveness will not be affected in the absence of regulation on CO2 emissions from maritime transport. However, the penetration of low carbon technologies in the shipping sector, which would have reduced the shipping's dependency to fossil fuel, is currently low[28]. This leads to a strong exposure of the shipping sector to fuel price increase.

In parallel however, there is a growing demand from the shippers to improve the environmental footprint of their supply chain. For example, the Clean Cargo Working Group was established in 2003, brings together major shippers (such as IKEA, NIKE, Mark and Spencer, etc.) and major ship-operators, representing today 60% of the global container fleet by volume, to improve the environmental performance of marine container transport[29]. Despite the fact that maritime transport is still considered as the most efficient mode of transport, willingness to take action in this area is increasing among ship-operators to the extent that non-climate conscious ship-operators may face the risk of losing business opportunity.

2.3.3. Third countries

In absence of regulation of GHG emissions of shipping, the third countries will face similar negative impacts of climate change as the EU. Ship-owners and ship-operators from third countries will also continue to be exposed to fuel price increase, if no regulation at regional or international level unlocks the uptake of low carbon technologies. Consultation with third country partners shows increasing level of awareness as well as gradual but broad based willingness to eventually agree on a global measure. An appropriate EU level measure compatible with the maturity of the international discussions could contribute significantly to the analysis aimed at identifying a single global MBM.

2.4. How the problem would evolve, all things being equal? (baseline scenario)

The total CO_2 emissions related to European maritime transport activities (including intra EU routes, incoming journeys to the EU and outgoing journeys from the EU) are expected to

[28] Maddox Consulting, 2012
[29] http://www.bsr.org/en/our-work/working-groups/clean-cargo

reach 210 Mt CO_2 in 2020 (+8% compared to 2005), 223 Mt CO_2 in 2030 (+15% compared to 2005) and 271 Mt CO_2 in 2050 (+39% compared to 2005)[30].

These figures have been extrapolated according to the most reliable 2010 data[31]. However, it has to be stressed that there is a lack of accurate and consolidated monitoring, reporting and verification of CO_2 emissions in the maritime transport sector. To this end, it can be recalled that the market failures will not be removed by the market.

The evolution of the problem remains also highly dependent on action taken by foreign countries. The intra-EU emissions are indeed expected to be stable at around 72 Mt CO_2 up to 2050, i.e. -9% compared to 2005, although minor variations may occur (e.g. intra-EU emissions were 15% below 2005 levels in 2010 due to the economic crisis). On the contrary, the emissions from incoming (i.e. coming from ports outside the EU) and outgoing (i.e. going to ports outside the EU) journeys are expected to increase significantly (respectively +91% and +51% by 2050 compared to 2005).

The EEDI sets technical standards for improving the energy efficiency of certain categories of ships which will, in turn, lead to less CO2 emissions – approximately 23% reductions by 2030 compared to Business as Usual increase which would be 54% to 84% above 2007 levels on a global scale[32]. However, CO2 Emissions will increase globally at least by 235Mt above the 2007 levels by 2030 in the average scenario despite the implementation of the EEDI. The EEDI applies only to the new ships and there are no specific measures in place for existing ships.

Moreover, according to the impact assessment of the proposal for a directive of the European Parliament and of the Council amending Directive 1999/32/EC as regards the sulphur content of marine fuels[33], fuel prices will increase due to IMO regulation on sulphur emissions. In particular, the EMSA analysis concludes that under normal circumstances the price for Marine Gas Oil (MGO) will be in the range of €450 to €680 per tonne. Compared to Heavy Fuel Oil with a sulphur content of 1.5% (sulphur standard before MARPOL Annex VI was revised) it is predicted that MGO with a maximum sulphur content of 0.1% would on average become 65% more expensive under a fuel-based-only compliance scenario (i.e. whereby the less costly technology-based compliance is not used).

Finally, according to the stakeholders, the shipping sector is facing an overcapacity for at least a decade. It is not possible to have precise quantification of this overcapacity for each shipping segment. However, some estimates are given in annex I figure 1. In the short term, this overcapacity leads to operational responses, such as slow steaming[34], which can deliver emissions reductions. However, in the long term, due to the expected growth of the shipping sector, this overcapacity should no longer exist.

[30] AEA Technology and others, 2012
[31] Based on real time vessel tracking system in correlation with the IMO register of ship recording all ships technical specifications
[32] Second GHG IMO Study 2009
[33] SEC(2011) 918 final
[34] Regulated Slow Steaming in Maritime Transport: An Assessment of Options, Costs and Benefits, CE Delft, 2012

The CO2 emissions projections used in this impact assessment integrate all the elements mention above in the baseline. Further information on the baseline scenario can be found in annex VI, especially on the trade figures (section 2 of annex VI), fuel prices (table VI.2 of annex VI

2.5. International and EU policy approaches

2.5.1. International negotiations

In December 1997, Parties to the United Nation Framework Convention on Climate Change (UNFCCC) adopted the Kyoto Protocol. According to its article 2, paragraph 2, Parties included in Annex I of the Kyoto Protocol[35] shall pursue limitation or reduction of emissions of greenhouse gas emissions not controlled by the Montreal Protocol from aviation and marine bunker fuels, working through the International Civil Aviation Organisation (ICAO) and the International Maritime Organisation (IMO), respectively.

The IMO started working on the reduction of greenhouse gases in 1997 when the Conference of the Parties to the International Convention for the Prevention of Pollution from ships (MARPOL convention) agreed in its Resolution 8 that the IMO, in cooperation with the United Nation Framework Convention on Climate Change (UNFCCC), undertake a study on CO2 emissions from ships and therefore that the matter is on the agenda of the Marine Environment Protection Committee (MEPC). The progress made on the industry standard (EEDI) described above and the deliberations on technical measures to improve sector energy efficiency has been significant, however IMO recognises that further mechanisms are required to achieve the reductions of emissions from shipping sector at a meaningful scale.

Additional measures are under discussion at the IMO, but the progress in the discussion of such measures has been relatively unimpressive after a working group provided its initial report on market-based measures in July 2011. An EU level measure and an analysis of the impacts of MBMs could significantly contribute to the on-going reflections in this context.

2.5.2. EU approach

According to the Article 5 of decision n°1600/2002/EC of the European Parliament and of the Council of 22 July 2002 laying down the Sixth Community Environment Action Programme, the Commission was committed to "*identify and undertake specific actions to reduce greenhouse gas emissions from marine shipping if no such action is agreed within the International Maritime Organisation by 2003*".

On 5 December 2003, the IMO Assembly adopted Resolution A963(23) which urged the Marine Environment Protection Committee (MEPC) to identify and develop mechanism(s) needed to achieve limitation or reduction of GHG emissions from international shipping. The Commission postponed action.

[35] Annex I Parties include the industrialized countries that were members of the OECD (Organisation for Economic Co-operation and Development) in 1992, plus countries with economies in transition (the EIT Parties), including the Russian Federation, the Baltic States, and several Central and Eastern European States

The Council and the Parliament recalled this commitment in the Climate and Energy Package adopted on 23 April 2009 : *"in the event that no international agreement which includes international maritime emissions in its reduction targets through the International Maritime Organisation has been approved by Member States or no such agreement through the UNFCCC has been approved by the Community by 31 December 2011, the Commission should make a proposal to include international maritime emissions in the Community reduction commitment, with the aim of the proposed act entering into force by 2013. Such a proposal should minimise any negative impact on the Community's competitiveness while taking into account the potential environmental benefits."*[36]

In July 2011, the IMO decided on measures setting efficiency targets for certain category of new ships (see section 2.3.1 above). These measures, while expected to reduce global GHG emissions from international shipping from business as usual scenario, are not sufficient to ensure an appropriate contribution from this sector to global efforts to maintain global temperature growth below 2°C. Consequently, there is a clear mandate given to the Commission to act now.

The Climate change and energy package of 2008 and the EU ETS are considered major achievements of the EU. EU ETS remains a flagship policy has served as an example for actions by our third country partners (China, Korea, Australia, etc.). Since its launch in 2005 the EU ETS has delivered significant CO2 reductions. By generating a uniform carbon price across countries and sectors, it has created a level playing field and guaranteed a cost-effective approach. The EU ETS has functioned as foreseen but, due in large part to the wider economic situation, emissions have reduced to such an extent that many stakeholders consider that a stronger signal is needed to generate low-carbon investments. In the 2012 Carbon Market Report[37], the Commission analyses this issue in more detail. On the short term, the Commission has recently proposed the 'backloading' of 900 million allowances[38], i.e. the delay of planned auctions, in order to reduce surpluses on the market. It has also identified six structural measures which could tackle the structural supply-demand imbalance, and sought stakeholder feedback on these options. While monitoring aviation emissions in 2010 has taken place, the actual pricing of emissions from incoming and outgoing flights in ETS has been opposed by a number of third countries.

The Commission remains firmly committed to support the progress towards a global agreement in the IMO. Accordingly, although this analysis looks at a range of measures including MBMs, the Commission announced on 1st October 2012 a step-by-step approach. As mentioned in section 2.2.2, the removal of the market barriers related to lack of information is a prerequisite for the removal of any other market barrier. Therefore, the Commission will consider, in the interim, setting a strong monitoring, reporting and verification system first. Such monitoring and reporting system will be aligned with forthcoming international monitoring and reporting system, if available, and will be closely coordinated with the on-going discussion on the proposal for a regulation of the Council and the Parliament on a mechanism for monitoring and reporting greenhouse gas emissions and

[36] Recital 2 of the decision n°406/2009/EC and recital 3 of the directive n°2009/29/EC
[37] Report from the Commission to the European Parliament and the Council, The state of the European carbon market in 2012, COM(2012) 652 final
[38] http://ec.europa.eu/clima/policies/ets/auctioning/third/docs/20121112_com_en.pdf

for reporting other information at national and Union level relevant to climate change[39] (called Monitoring Mechanism Regulation). Therefore, it is expected that this approach will accelerate and support international process.

2.6. Industry approaches

Several existing initiatives seek to classify ships according to their environmental performance and other indicators, such as the Clean Shipping Index (CSI)[40], the Environmental Shipping Index (ESI)[41], Shippingefficiency[42], Rightship[43] or Green Award[44]. However, the variety of indicators might become an obstacle for their wider application.

Voluntary offsetting schemes have also been developped, such as Carbon Positive[45] or Yacht Carbon Offset[46], and an important mumber of major companies have taken action. For example, Maersk Line, the world leader in container transport, committed itself to reduce its GHG emissions per tonne nautical mile by 25% by 2020 compared to 2007. More precisely, the stakeholder consultations showed that the container vessel operators are at the forefront of tackling climate change. This can be explained by the fact that this shipping segment is significantly concentrated: the world top 10 containers operators represent approximately 60% of the global vessel capacity[47]. But containers represent only 31% of the 2010 EU related GHG emissions[48].

Some other liners (e.g. ferries, Ro/Ro) are also taking action. For example, Wallenius Wilhelmsen Logistics commits itself to be carbon neutral by 2050. Finaly, in tramp shipping (i.e. bulk carriers, tankers, general cargo, etc.), Norden, a Danish company, commits itself to reduce its CO2 emissions by 25% by 2020 compared to 2005, or Star Bulk, a Greek company, have joined a voluntary offseting scheme.

These examples show that numerous of EU ship operators have already taken actions. However, except in the container vessel segment, the sector is heavily fragmented (see annex II) and no general assumption on how shipping companies are reducing greenhouse gas emissions can be drawn regarding the size of operators or the type of ships operated. Therefore, the impacts of such action is difficult to quantify, in absence of common monitoring and reporting strandards.

[39] COM(2011)0789 final
[40] http://www.cleanshippingproject.se/
[41] http://esi.wpci.nl/Public/Home
[42] http://shippingefficiency.org/
[43] http://site.rightship.com/
[44] http://www.greenaward.org/
[45] http://www.carbonpositive.net/
[46] http://www.yachtcarbonoffset.com/
[47] http://www.bsr.org/en/our-work/working-groups/clean-cargo
[48] AEA Technology and others, 2012

2.7. The right of the EU to act

2.7.1. Legal basis

The legal basis for acting at the EU level is the environmental legal basis enshrined in Article 192 of the Treaty on the Functioning of the European Union, as the principal objective of the measure is the protection of the environment through the reduction of GHGs; this legal basis has already previously served as the legal basis to regulate GHG emissions.

2.7.2. Analysis of subsidiarity

The maritime sector is operated globally and a regulation at the international level remains the best way to address the reduction of CO_2 emissions of this sector. As previously mentioned, the IMO adopted technical and operational measures, which will only partially contribute to the necessary emission reduction of GHG from international shipping. Additional measures, such as MBMs, are under consideration in the IMO on the basis of a specific working group report on MBMs in July 2011.

Action at the EU level could significantly reduce CO_2 emissions from global maritime transport. CO_2 emissions related to journeys from and to EU ports represented 180 Mt CO_2 in 2010[49], i.e. around 1/5th of global maritime emissions[50]. This covers intra-EU journeys (including domestic traffic[51]), journeys from EU ports to the first port of call outside the EU and journeys from the last port of call outside the EU to the first EU-port. The total emissions of ships calling into EU ports are estimated to be significantly higher when taking into account the entire journey (e.g. a route from Melbourne to Rotterdam via Singapore) as the scope only covers the last leg of routes related to EU (e.g. only the route between Singapore and Rotterdam).

Acting at the EU level will be more efficient than acting at the Member State level. Indeed, the single market in maritime transport is a key goal for the EU, even though there is still some on-going work for its full achievement. On average, 90% of calls in EU Member State ports are from ships coming from or going to a port located in another EU Member State. Moreover, the hinterland of EU ports goes far beyond national borders. Furthermore, acting at the EU level could avoid competitive distortion in the internal market by ensuring equal environmental constraints on ships calling into EU ports.

Finally, acting at the EU level will ensure that the information provided on greenhouse gas emissions is harmonised at the EU level, contributing to the removal of the market barrier on lack of information.

[49] AEA Technology and others, 2012
[50] Based on 2007 figures.
[51] i.e. emissions within a Member State. Emissions between Member States are considered as international shipping.

2.7.3. Analysis of proportionality

According to the EU's climate and energy legislation[52], all sectors of the economy should contribute to achieving these emission reductions, including international maritime shipping. International shipping is the only sector and transport mode so far not covered at the EU level by the emission reduction target.

Article 191 of the UN Convention of the law of the seas (UNCLOS) encourages cooperating, as appropriate, at a regional basis, directly or through competent international organisations in the interests of protecting and preserving the marine environment by way of international rules, standards and recommended practices. GHG emissions from ships qualify as pollution of the marine environment[53]. No other international regulation prohibits regional action to address GHG emissions from ships, as long as any measure introduced respects international law, including IMO, WTO and UNFCCC rules.

As there is a clear mandate given to the Commission to act and as there exists no international rules prohibiting such action, an EU proposal is fully legitimate to take action on GHG emissions of the maritime transport sector.

The proportionality of a specific measure is also highly dependent on the categories and the size of ships concerned by the measures. About 19000 vessels above 300 Gross Tons (GT) have called in EU ports in 2010[54]. There is a significant diversity of types (at least 18 categories and size of ships. Therefore, the same measure may not be proportionate for small fishing vessels, whereas it will be for very large crude carriers. In order to reduce the administrative burden while ensuring a high environmental impact, the measure should aim at high coverage of emissions with a minimum number of ships covered. At least small ships below 400 GT should be excluded to ensure consistency with international regulation[55]. However, the threshold for small ships could also be set at a higher level) and/or certain ship types may be excluded. For example, setting a size threshold at 5000GT would reduce the number of ships covered by 44% while covering 90% of the EU related CO2 emissions (see Annex VIII). Such threshold could also exclude around 99% of maritime transport SMEs from the scope of the regulation (see annex II). Therefore, the administrative analysis was done for both thresholds 400GT and 5000GT.

Finally, CO_2 emissions due to fuel combustion represent about 98% of the GHG emissions of the shipping sector[56]. The possible measure should therefore focus on CO_2 emissions from fuel combustion, noting that a regulation on CO_2 emissions from fuel combustion may in any case trigger emission reduction of other climate forcers, such as black carbon[57] [58].

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[52] Recital 2 of the decision n°406/2009/EC and recital 3 of the directive n°2009/29/EC

[53] as recalled with amendment of Annex VI of MARPOL to include the EEDI.

[54] IHS Fairplay, 2011

[55] For example MARPOL Annex VI

[56] Excluding black carbon, as the global warming potential (GWP) of black carbon is highly uncertain.

[57] Black carbon is a climate forcing agent formed through the incomplete combustion of fossil fuels, biofuel, and biomass, and is emitted in both anthropogenic and naturally occurring soot. Black carbon warms the Earth by absorbing heat in the atmosphere and by reducing albedo, the ability to reflect sunlight, when deposited on snow and ice. Black carbon stays in the atmosphere for only several days to weeks, whereas CO_2 has an atmospheric lifetime of more than 100 years.

3. OBJECTIVES

EU action against climate change has been translated into a GHG reduction target as adopted in the Climate and Energy Package, and included in the headline target of the EU 2020 Strategy. The target set in the EU 2020 Strategy is to reduce GHG emissions by at least 20% by 2020 compared to 1990 levels, or by 30% in the context of a global deal[59].

Moreover, in order to keep climate change below 2ºC, the European Council reaffirmed in February 2011 the EU objective of reducing GHG emissions by 80-95% by 2050 compared to 1990, in the context of necessary reductions according to the Intergovernmental Panel on Climate Change by developed countries as a group[60].

Therefore, the general objective is:

General objective:

1. To contribute to reaching the relevant climate change and energy objective outlined in the EU 2020 Strategy and the 2020 flagship initiatives by taking action on international maritime emissions, as part of the ultimate goal of limiting global average temperature increase to less than 2 degrees Celsius above pre-industrial levels;

2. To contribute to the EU objective of reducing GHG emissions by 80-95% by 2050 compared to 1990.

In the context of the EU 2020 Strategy and its flagship initiatives, the Commission's Transport White Paper introduced a specific target of a reduction in EU CO_2 emissions from maritime bunker fuels by 40% (if feasible 50%) by 2050 compared to 2005 levels.

Under the EU 2020 objectives, the European Council[61] has identified that action against climate change will bring opportunities for growth and employment through building expertise in eco-efficient technologies. Currently, European shipbuilders are technology leaders in the passenger ship segment, for special purpose ships (e.g. dredgers) and in large parts of the equipment industry. Shipyards and equipment suppliers will play a vital role in providing the technical solutions to meet GHG reduction targets. It is important that Europe retains its expertise in this area. The policy objectives therefore promote technological development by supporting continued innovation in the EU maritime-related industries.

Furthermore, due to the global nature of the maritime sector, international regulation is always preferred. Therefore, another important specific objective for the EU is to develop

[58] AEA Technology and others, 2012
[59] COM(2010)2020, 3.3.2010
[60] Taking into account necessary efforts from developing countries, this will allow a global reduction of 50% in emissions by 2050 compared to 1990.
[61] Conclusion of the European Council (17 June 2010), EUCO 13/10

regional policies that can support the IMO process and that can take forward action to reduce maritime emissions within the EU and globally.

Specific objectives:

1. To reduce impact of EU shipping emissions on the climate by achieving reduction in CO_2 emissions from maritime transport by 40% (if feasible 50%) by 2050 compared to 2005 levels[62];

2. To promote technological improvement of ships, with respect of the flag neutrality[63] principle, and to improve the competiveness of maritime supply chains of the EU, by supporting continued innovation of the European shipbuilders, equipment manufacturers and service providers of the shipping sector

3. To stimulate actions by others, including by States in the IMO,

The above objectives can only be assessed through a precise understanding of the GHG emissions from the shipping sector. However, these emissions are not currently monitored. Therefore, introducing requirements for monitoring, reporting and verification of GHG emissions from the shipping sector is an operational objective that must be achieved by the policy options under consideration.

Furthermore, in order to give a clear signal and a clear incentive to achieve emission reductions in the maritime sector, internalising the external costs of climate change in the maritime sector is required. However, internalising the external costs of climate change may not be sufficient to remove all market barriers, but it could generate revenues that could also be used to contribute to the removal of market barriers.

Thus, the operational objectives of a proposal are:

Operational objectives:

1. To monitor, report and verify CO_2 emissions of the maritime sector related to the EU, thereby contributing to more informed decision making and climate consciousness by sector operators
2. To set a carbon constraint on ships for their CO_2 emissions to achieve emission reductions from maritime transport of 40% (if feasible 50%) by 2050 compared to 2005 levels.
3. To ensure adequate access to finance for the implementation of low carbon technologies.

[62] For the purpose of this impact assessment, an internal reduction scenario has been modelled with all impacts assessed according to this internal reduction scenario by 2030, due to the uncertainties of technological improvements of the maritime transport sector and of global economy on longer term.

[63] The flag of a vessel reflects the country of registration and thus the vessel's "nationality". The principle of flag neutrality calls for the equal treatment of all vessels, regardless to the vessel's nationality.

4. POLICY OPTIONS

4.1. Choice of policy options

For any EU measure that aims to support the development of an international regulation, it is important to build on policy options developed at international level[64]. However, as they have been designed from a global perspective, some may not be suitable for a regional measure. Therefore, the number of options proposed in the IMO has been narrowed down firstly by consulting the interested parties during the ECCP and the on-line public consultation mentioned earlier and secondly by refining them as described hereafter, based on the studies carried out by AEA Technology and others[65].

The policy options should not be prescriptive with respect to technological and operational solutions to be applied in the sector in order to maintain flexibility for the sector. In July 2009, IMO recognized that technical and operational measures would not be sufficient to satisfactorily reduce the amount of GHG emissions from international shipping in view of the growth projections of world trade[66]. It was therefore agreed by overwhelming majority that a Market-Based Measure (MBM) was needed as part of a comprehensive package of measure for the effective regulation of GHG emissions from international shipping. To this extent, the policy options assessed do not include technical and operational measures (such as hull coating or weather routing) that reduce GHG emissions. An emission reduction goal-based approach was preferred, as it will trigger the implementation of technical and operational measures which reduce emissions in a cost-efficient way.

A proposal which aims to set a fixed emission reduction target per ship was not considered to be a suitable policy option (although one of the option for public consultation). This proposal, submitted by the Bahamas[67], presented an interesting approach to a GHG reduction scheme at global level. However, if implemented at a regional level, there is a high risk of avoidance of the scheme by increasing the number of ships operating in the EU.

In this context, taking into account the work done in the IMO, the following MBMs are assessed: a levy on bunker fuel sales, a tax on emissions, a contribution based compensation fund, an ETS and a target based compensation fund. Aside from the MBM options, a measure that would provide a robust MRV regime for the maritime sector was also analysed.

In light of international developments and although this analysis looks at a range of measures including MBMs, Vice-President Kallas and Commissioner Hedegaard announced on 1st October 2012 a stepwise approach for the implementation of EU measures. This first step will be the monitoring and reporting of CO2 emissions from international maritime transport. Accordingly, the impact of the monitoring and reporting of CO2 emissions has been

[64] The Second IMO greenhouse gas study 2009, adopted and agreed by all parties, presented several policy options to ensure GHG emissions reduction in the maritime sector. Moreover, 10 proposals had been submitted by Parties. An overview of these policy options is given in Annex IX

[65] AEA Technology and others, 2012

[66] 59th session of the Marine Environmental Protection Committee – Agenda item 24

[67] The Bahamas submitted this proposal for the 63rd IMO's Marine Environment Protection Committee (MEPC 63) in March 2012. It has been withdrawn by the Bahamas in April 2012.

considered as an independent policy measure in this analysis. As robust MRV is a prerequisite for any MBM policy, MRV elements are included as an integral part of the impact analyses of the other options, with the exception of the levy on bunker fuel sales option where the quantities sold are the basis of the measure.

4.2. Consideration of the baseline and credit option

A baseline and credit scheme is a MBM, where ships that are more efficient than a benchmark can sell credits to ships that are less efficient than the benchmark. The benchmark expresses an amount of CO2 per transport work (tCO2 per tkm). It is an energy efficiency standard set per ship or per ship category and size. The benchmark and its evolution over time are set by the legislator, based on its policy objectives.

One option of designing such a system is to design the benchmark so as to ensure that the CO2 emissions do not fluctuate with the transport work (i.e. CO2 emissions are capped). In this case, the baseline and credit option is similar to a closed cap and trade system with free allocations of credits. A closed cap and trade system (also called closed ETS) is assessed hereafter. Therefore, for the purpose of this impact assessment, a baseline and credit option leading to a cap on emissions was not considered as a distinct option and, as a consequence, not further assessed.

By contrast, under a baseline and crediting system of the types currently in discussion at the IMO[68], no cap is established and therefore the overall CO2 emissions will fluctuate according to the transport work coming under scope of the future measure. This means that, while such baseline and crediting system is no doubt an appropriate measure for increasing the efficiency of the fleet, it is not an appropriate tool for meeting specific objective 1, outlined in section 3. Therefore, such a system represents a sub-optimal policy option in a European context, and has been disregarded from the in-depth assessment in this impact assessment.

The Commission notes, however, that the approach described in the preceding paragraph, if applied globally[69], would nevertheless deliver significant CO2 emission reductions beyond those achieved through a regional measure, primarily due to the sheer size of the fleet covered.

4.3. Enforcement of the policy options assessed

For all options, except the baseline scenario and the levy on bunker fuel sales, the enforcement of an EU measure will focus on actions taken by ships, even if the ship itself cannot perform the required activities for compliance due to the fact that the ship is not a legal entity. This approach is already used in other EU regulations.

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[68] The 63rd Marine Environment Protection Committee of the IMO in 2012 stressed that the EEDI cannot be used for existing ships and the use of Energy Efficiency Operational Index (EEOI) is currently not mandatory. Furthermore, ship types with high relevance in Europe such as cruise ships and ferries are not yet covered by the EEDI. Therefore, developing such a measure in an European context would require the EU to replace or supplement existing efficiency standards adopted at global level.

[69] such an approach is currently being discussed in the IMO context

The maritime sector is highly fluid and involves a range of ownership and commercial arrangements that can make it difficult to identify the party ultimately responsible for the shipping activities covered by an emissions reduction scheme. For this reason, the enforcement of IMO regulations is based on actions taken by ships. Ships can be identified through their IMO number, a permanent number that every ship has and is used for registration purposes[70]. Therefore, the enforcement of an EU measure should also focus on actions taken by ships.

So, ships will be considered as the compliance entity, even if for legal purposes the regulation will define the registered owner of a ship as the entity that will perform the required activities for compliance. This registered owner can in any case delegate this responsibility (e.g. to ship operators).

EU regulations in the maritime field already consider the issue of compliance of ships with EU and international standards. Inspections, compliance checks, expulsion from ports and denial of access to ports are done in accordance with the Flag State and Port State control rules. Existing databases (e.g. vessel tracking systems, such as Safe Sea Net[71] and Thetis[72] for Port State control regime, etc.) allow to tracking and targeting of individual ships. Provided that appropriate legal provisions are set, they could be used to check whether a ship has indeed reported its emissions and is thus in compliance with EU rules. Consequently, a list of non-compliant ships could be provided to the Member States for enforcement.

4.4. Description of the policy options assessed

4.4.1. Option 1: Baseline scenario

The baseline scenario does not address the market barriers mentioned in section 2.2.

A business as usual option is developed as a reference for the determination of impacts and the comparison of policy options. It only considers existing policies and legal instruments:

- CO_2 emissions from bunker fuel sales are monitored based on information provided by bunker fuel suppliers, in accordance with Decision 280/2004/EC[73]. All ships purchasing fuel in the EU are covered by the regulation.
- The verification of the emissions is done by the Member States and by the European Environment Agency.
- No internalisation of climate change externalities.
- The instruments adopted by the IMO in 2011 (EEDI, SEEMP), as well as the impact of the review of Directive 1999/32/EC on low-sulphur maritime fuel[74], are included in the baseline. No additional measures under discussion in the IMO have been considered due to the high uncertainties related to their adoption.

[70] IMO resolution A.600(15); SOLAS Chapter XI
[71] SafeSeaNet is a vessel traffic monitoring and information system
[72] Thetis is an information system, which aims to assist Member States with harmonization of Port State Control procedures and execution through centralized storage and distribution of reports
[73] Currently under revision
[74] See footnote 22

- The baseline also takes into account the improvement of the carbon footprint of ships, especially due to fuel switch and economy of scale[75].
- No policy to remove market barriers.

All stakeholders consulted during the ECCP and the on-line consultation considered that further action to address greenhouse gases of ships was needed. However, there are different views on the level of action. All stakeholders indicated their preference for a global scheme, but many Member States, industry associations and non-governmental associations considered that the EU action would help the IMO to move forward faster, especially by providing a strong base for a global action.

This option does not take into account the current possibility for the Member States to include activities or installations into the EU-ETS, according to Article 24 of Directive 2003/87/EC. To this end, Member States may decide to include ships or ports into the EU-ETS. However, so far, none of Member States decided to do so.

Table 1 - Summary of the main parameters of option 1

Compliance entity	Bunker fuel suppliers
Scope of emissions covered	Any CO2 emissions from maritime bunker fuel purchased in the EU
Requirements	Bunker fuel suppliers communicate to the Member States the amount of bunker fuel sold within a year for the calculation of the associated CO2 emission.
Enforcement	Decision 280/2004/EC
Market barriers addressed	None

4.4.2. Option 2: Monitoring, reporting and verification (MRV) of emissions based on fuel consumption

MRV of emissions based on fuel consumption will ensure accurate information of the CO2 emissions performance of a ship. Therefore, it will address the market barrier related to lack of information. However, it will not address the market failures associated with the split of incentives and the access to finance.

During the stakeholder meeting on 6 December 2012, most of industry representative have supported a strong MRV of emissions based on fuel consumed. Moreover, this approach is also foreseen by IMO submissions of our international partners. However, some industry representatives want to have a better clarity on the use of the data collected before having position of the monitoring scheme.

Under this option, the MRV of emissions is done by ships, based on their fuel consumption. The CO_2 emissions are made publicly available to incentivise the improvement of energy efficiency.

[75] Increasing fuel prices (particularly due to global low-sulphur requirements) will make alternative fuels such as LNG or biofuels more attractive and therefore some level of fuel switching can be expected. Moreover, there is already evidence of an industry-wide trend towards larger ships and additional economies of scale on transoceanic routes will be permitted by the opening of the new Panama Canal in 2015.

CO_2 emissions from ships relate to the emission factor associated (in CO_2 per tonnes of fuel) with the type of fuel consumed and the volume of fuel consumed (in tonnes). Specific elements on the determination of fuel consumption are given in annex XIV.

Verification of processes and standard compliance is also a common practice in the maritime transport sector. The verification of emissions reports can be done in principle by current existing independent verifiers, such as Recognised Organisations[76].
The annual compliance cycle for MRV and the tasks of authorities involved are further described in Annex XII.

Table 2 - Summary of the main parameters of option 2

Compliance entity	All ships above 400GT (or 5000GT)
Scope of emissions covered	Any CO2 emissions from the last port of call outside the EU to an EU port, between EU ports and from an EU port to its next port of call outside the EU.
Requirements	Ships communicate to the relevant Competent authority the amount and the type of fuel consumed on routes within the scope for the calculation of the associated CO2 emissions.
Enforcement	Existing Flag State and Port State control rules
Market barriers addressed	Lack of information

4.4.3. Option 3: Levy on emissions

This option is based on the payment of a contribution in euros per tonne of CO_2 emitted. Three sub-options were developed. The subjected compliance entity and the scope are different between the sub-options.

Under option 3a (levy on bunker fuel sales), the subjected compliance entity is the bunker fuel supplier and the scope is based on emissions from bunker fuel sold in the EU, whereas under option 3b (tax on emissions from fuel consumed) and 3c (contribution based compensation fund), the subjected compliance entity is the ship and the scope is based on emissions from fuel consumed on EU related routes. The difference between option 3b and 3c comes from the legal possibility to earmark revenues, which is subjected to national laws under option 3b, but not under 3c.

4.4.3.1. Sub-option 3a: Levy on bunker fuel sales

The levy is based on the existing MRV of emissions (i.e. based on the information on bunker fuel sales reported for taxation purpose by bunker fuel suppliers to the Member States and the European Environment Agency). The level of the levy depends on the contribution of the maritime transport sector as part of the transition to a low carbon economy. The carbon constraint is set through the payment of a contribution to a fund (in €/tCO_2). However, it could be suggested to recycle these revenues in an international fund, as proposed by Cyprus, Denmark, the Marshall Islands, Nigeria and IPTA in the IMO.

[76] Recognised organisations are organisations recognised in accordance with Regulation (EC) No 391/2009 of the European Parliament and of the Council on common rules and standards for ship inspection and survey organisations

Any recycling of revenues would be under the responsibility of the Member States collecting the levy. If revenues are recycled, these revenues could in theory be used to remove the market barrier related to access to finance, for example by providing financial incentives reducing the risk of investment (e.g. financial guarantee) or reducing the return on investment (e.g. low-interest loans or grants). Such instruments would be especially useful to apply to SME's, which would face greater difficulties in accessing finance. SME's could further profit from technical support for the implementation of new technologies or processes. This support could therefore be used for technological improvement of ships, with respect of the flag neutrality principle. It is however important to stress that, if the recycling of revenues takes place at Member States' level, it would be in the interest of overall consistency, if Member States apply the same principles as those applicable to state aid[77] for such spending. If Member States disagree on revenue recycling, it would therefore be desirable that this option is complemented with other instruments/interventions in order to remove the market barriers, especially where access to finance is concerned. Complementary instruments would in any case be useful: for instance, information campaigns could increase the speed at which mitigation technologies are taken up by the market.

Revenues could also be used for international climate finance.

During the on-line consultation, 71% of the respondents considered that the evasion risk regarding the implementation of a tax on fuel at a regional level cannot be avoided. The respondents in favour of a tax on fuel considered that it could be applied as a measure directed to the smallest ships, as a supplementary policy instrument of an ETS or a compensation fund.

For the purposes of this Impact Assessment, the level of the levy was set in line with the European Commission's proposal of 13 April 2011 to revise the Energy Taxation Directive (ETD)[78], which set energy taxation rules in the EU. This equates to a tax of €145.9 per tonne CO_2 (i.e. €456 per tonne of fuel sold) for bunker fuels (HFO and MDO) and €189.2 per tonne CO_2 (i.e. €536 per tonne of fuel sold) for LNG[79].

Any maritime bunker fuel purchased in the EU will be subjected to the levy. Fuel sold for export and offshore bunkering would not be covered by the regulation, as it is only possible to charge fuel for direct consumption[80]. As ships are able to undertake long voyages on a single bunkering and can carry additional fuel without significantly sacrificing their carrying capacity, it can be considered that the regulation will only address CO2 emissions from ships performing exclusively intra-EU routes (i.e. mainly ferries).

As the bunker fuel suppliers are fixed installations, the Member States would be in charge of ensuring the enforcement of the regulation, in line with their internal rules.

Table 3 - Summary of the main parameter of option 3a

Compliance entity	Bunker fuel suppliers
Scope of emissions covered	Any CO2 emissions from maritime bunker fuel purchased

[77] OJ C 82,01.04.2008, p.1.
[78] COM(2011) 169 final.
[79] The tax rates are based on the rates in the ETD proposal of EUR 20 per tonne of CO2 and EUR 9.6 per GJ.
[80] Article 4 of Directive 2003/96/EC

	and released for consumption in the EU
Requirements	Bunker fuel suppliers communicate to the Member States the amount of bunker fuel sold within a year for the calculation of the associated CO2 emission.
Enforcement	National enforcement rules
Market barriers addressed	(Access to finance could be addressed, if Member States agree on revenue recycling)

4.4.3.2. Sub-option 3b: Tax on emissions from fuel consumed

Under this option, the MRV of emissions is done by ships, based on its fuel consumption (as for option 2). The carbon constraint is set through the payment of a tax due for every tonne of CO_2 emitted to incentivise emissions reductions.

MRV of emissions based on fuel consumption, which is a prerequisite for this option, will ensure accurate information of the CO2 emissions performance of a ship. Therefore, it will address the market barrier related to lack of information.

The payment of the contribution by the ship-owners will ensure that the entity in charge of implementing technical measures on board of a ship is fully responsible for the CO2 performance of this ship and therefore remove the market barrier related to the split of incentive.

The collection of the contribution will be a Member States' responsibility. For this reason, even if revenues can be generated to tackle market barriers, any eventual earmarking may be decided by national laws. If this is the case, these revenues could in theory be used to remove the market barrier related to access to finance, for example by providing financial incentives reducing the risk of investment (e.g. financial guarantee) or reducing the return on investment (e.g. low-interest loans or grants). Such instruments would be especially useful to apply to SME's, which would face greater difficulties in accessing finance. SME's could further profit from technical support for the implementation of new technologies or processes. This support could therefore be used for technological improvement of ships, with respect of the flag neutrality principle. It is however important to stress that, if the recycling of revenues takes place at Member States' level, it would be in the interest of overall consistency, if Member States apply the same principles as those applicable to state aid[81] for such spending. If Member States disagree on revenue recycling, it would therefore be desirable that this option is complemented with other instruments/interventions in order to remove the market barriers, especially where access to finance is concerned. Complementary instruments would in any case be useful: for instance, information campaigns could increase the speed at which mitigation technologies are taken up by the market.

Revenues could also be used for international climate finance.

During the on-line consultation, the tax on emission option was considered by only 10% of the respondents as being able to promote progress at the IMO. Moreover, 44% of the

[81] OJ C 82,01.04.2008, p.1.

respondents indicated that a tax on emissions could not achieve the emission reduction required effectively and efficiently.

For the purpose of this impact assessment, the level of the tax has been assumed to be set at the following level:

Table 4: Level of the tax used for the impact assessment, 2010 prices

	2020	2025	2030
Level of the tax (€/t CO_2)	9.13	21.37	35.55

This level corresponds to the carbon price with no additional action on climate change in the EU beyond policies already implemented and constitutes therefore the lower bound of the possible tax level. It is not a projection of the spot price of emission allowances under the EU ETS. A higher level may be set to deliver higher environmental output[82]. Detail on the methodology used for the assessment of impacts, especially the model used by AEA Technology, is explained in Annex VI.

Table 5 - Summary of the main parameter of option 3b

Compliance entity	All ships above 400GT (or 5000GT)
Scope of emissions covered	Any CO2 emissions from the last port of call outside the EU to an EU port, between EU ports and from an EU port to its next port of call outside the EU.
Requirements	Ships will communicate to the relevant Competent authority the amount of and the type of fuel consumed on routes within the scope for the calculation of the associated CO2 emissions. Ships will pay the tax on their CO2 emissions according to the CO2 emissions declared
Enforcement	Existing Flag State and Port State control rules
Market barriers addressed	Lack of information Split of incentives (Access to finance could be addressed, if Member States agree on revenue recycling)

4.4.3.3. Sub-option 3c: Contribution-based compensation fund[83]

Under this option, the MRV of emissions is done by ships, based on their fuel consumption (as for option 2). The carbon constraint is set through the payment of a fixed voluntary contribution (in €/tCO_2) to incentivise emissions reductions. A prerequisite is the setting up of a complementary instrument (e.g. speed limits, ETS, etc.) to ensure the participation in the contribution-based compensation fund as the more attractive instrument for ships[84]. Detail on

[82] For the purpose of this Impact Assessment, analyses have also been carried out using different tax levels, e.g. close to the expected price of EU allowances under a decarbonisation scenario with values of € 25.0 in 2020, € 34.2 in 2025 and € 50.9 in 2030. However, this does not significantly affect the results.

[83] The term "compensation fund" is associated with the idea that the growth of emissions in the maritime transport is compensated by the funding of in-sector or out-of-sector emissions reductions.

[84] This mechanism should be designed in such way that the contribution based compensation fund remains in practise the primary instrument. The Norwegian NOx fund is an example where a tax serves as such complementary instrument. The tax rate is higher than the contributions to the fund. So, it can be assumed that

the methodology used for the assessment of impacts, especially the model used by AEA Technology, is explained in Annex VI.

MRV of emissions based on fuel consumption will ensure accurate information of the CO2 emissions performance of a ship. Therefore, it will address the market barrier related to lack of information.

The payment of the contribution by the ship-owners will ensure that the entity in charge of implementing technical measures on board of a ship is fully responsible for the CO2 performance of this ship and therefore remove the market barrier related to the split of incentive.

The revenues collected by the fund could in theory be used to address the market barrier related to access to finance, for example by providing financial incentives reducing the risk of investment (e.g. financial guarantee) or reducing the return on investment (e.g. low-interest loans or grants). Such instruments would be especially useful to apply to SME's, which would face greater difficulties in accessing finance. SME's could further profit from technical support for the implementation of new technologies or processes. This support could be used for technological improvement of ships, with respect of the flag neutrality principle. It is also important to stress that, even if the recycling of revenues may not entail state aid elements, it would be in the interest of overall consistency, if Member States apply the same principles as those applicable to state aid[85] for such spending.

Revenues could also be used for international climate finance.

During the on-line consultation, the compensation fund option was considered by 53% of the respondents as the best to promote progress at the IMO. 68% of the respondents considered that any compensation fund should be managed by a public entity. Several respondents recommended the IMO or an EU public body. Many respondents also recommended management by the industry, but this option raised oppositions from the NGOs.

The level of the contribution is assumed to be similar as the level of the tax used for sub-option 3b (tax on emissions from fuel consumed).

The collection of the contribution and the recycling of revenues in the sector could be done by an EU wide fund. It is a practice in the maritime sector to set up funds to tackle environmental problems (e.g. International Oil Compensation Funds, Norwegian NOx Fund….). Similarly, such a pan-EU fund could be set up and be in charge of the collection of contributions and revenue recycling. This fund could be privately managed or publicly managed. If publicly managed, an existing body or a European Agency could serve as fund manager.

A fund should be managed in accordance with the full cost principle (non-profit), i.e. all the financial means which the fund receives will be utilised in accordance with its purpose of reducing emissions in a cost-effective manner with the exception of necessary administrative

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the use of alternative mechanisms will be marginal. For this reason, possible impacts of alternative mechanisms are not assessed.

[85] OJ C 82,01.04.2008, p.1.

costs. Under the supervision of the fund's board, the fund management would decide which measures shall receive support from the fund, and how (e.g. through inverse bidding processes).

Table 6 - Summary of the main parameter of option 3c

Compliance entity	All ships above 400GT (or 5000GT)
Scope of emissions covered	Any CO2 emissions from the last port of call outside the EU to an EU port, between EU ports and from an EU port to its next port of call outside the EU.
Requirements	Ships will communicate to the relevant Competent authority the amount and the type of fuel consumed on routes within the scope for the calculation of the associated CO2 emissions. Ships will pay the contribution to the fund according to the CO2 emissions declared, unless they opt to comply with a complementary instrument (e.g. speed limits, ETS, etc.)
Enforcement	Existing Flag State and Port State control rules
Market barriers addressed	Lack of information Split of incentives Access to finance

4.4.4. Option 4: Maritime emission trading scheme

Under this option, the monitoring, MRV of emissions is done by ships, based on its fuel consumption (as for options 2, and 3 b) and c)). The carbon constraint is set through the setting of a CO_2 emission reduction target.

MRV of emissions based on fuel consumption will ensure accurate information of the CO2 emissions performance of a ship. Therefore, it will address the market barrier related to lack of information.

The surrendering of allowances by the ship-owners will ensure that the entity in charge of implementing technical measures on board of a ship is fully responsible for the CO2 performance of this ship and therefore remove the market barrier related to the split of incentive.

Of the ETS options analysed, sub-option 4c generates revenues due to the auctioning of allowances. These revenues could in theory be used to remove market barriers relating to availability of adequate finance. This support could be used for technological improvement of ships, with respect of the flag neutrality principle. It is also important to stress that, if the recycling of revenues takes place at Member States' levelit would be in the interest of overall consistency, if Member States apply the same principles as those applicable to state aid[86] for such spending. If Member States disagree on revenue recycling, it would therefore be desirable that this option is complemented with other instruments/interventions in order to remove the market barriers, especially where access to finance is concerned. When the recycling of revenues may not entail state aid elements, it should still comply with the same principles as those applicable to state aid for environmental protection.

Revenues could also be used for international climate finance.

[86] OJ C 82,01.04.2008, p.1.

During the ECCP meetings, some industry associations considered the administrative burden as an issue for the ETS, whereas some Member States considered that it is mainly an issue for public authorities. The risk of evasion was raised by industry associations. The openness of an ETS was also discussed without firm conclusions. Industry associations and Member States considered that a closed ETS would be problematic in the shipping sector. However, several Member States and some non-governmental organizations supported an ETS. UK indicated that they preferred an ETS with 100% auctioning and no earmarking. One Member State expressed its opposition to an ETS.

For the purpose of this impact assessment, an internal target has been assumed to be set up at the following level based on an internal reduction scenario to achieve the reduction target for 2050 (-40%/ -50% if feasible) provided by the Commission's Transport White Paper:

Table 7: Estimated emissions reductions compared to 2005 to reach -40% by 2050 compared to 2005

	2020	2025	2030
CO_2 emissions reductions compared to 2005	0%	-6%	-10%

Source: AEA Technology and others, 2012

Detail on the methodology used for the assessment of impacts, especially the model used by AEA Technology, is explained in Annex VI.

Compliance is ensured by an obligation for each ship to surrender allowances to a competent authority according to its emissions reported for the previous year. If a ship-owner or a ship operator owns less allowances than the quantity it has to surrender, it will have to purchase allowances from other actors involved in the scheme.

The allowances surrendered can be existing units (EU allowances, Certified Emissions Reduction….) or new allowances created for the maritime sector. When the allowances authorized to be surrendered are only new allowances created for the maritime sector, the system is called a closed system. Otherwise, it is considered as an open system.

For the purpose of this impact assessment, three sub-options are considered, even if the final design of a maritime ETS will probably combine some elements of these sub-options (e.g. partial linking with other trading system, partial auctioning):

- Sub-option 4a: closed ETS (emission trading system without link to external carbon markets; free allocation of allowances to ships owners/ operators),
- Sub-option 4b: open ETS with free allocation (emission trading system with link to external carbon markets; free allocation of allowances to ships owners/ operators),
- Sub-option 4c: open ETS with full auctioning (emission trading system with link to external carbon markets; allowances are auctioned).

Details of this policy option are given in annex XV.

Table 8 - Summary of the main parameter of option 4

Compliance entity	All ships above 400GT (or 5000GT)
Scope of emissions covered	Any CO2 emissions from the last port of call outside the EU to an EU port, between EU ports and from an EU port to its next port of call outside the EU.
Requirements	Ships will communicate to the relevant Competent authority the amount of and the type of fuel consumed on routes within the scope for the calculation of the associated CO2 emissions. Ships will surrender to the Competent authority the number of allowances corresponding to the CO2 emissions declared
Enforcement	Existing Flag State and Port State control rules
Market barriers addressed	Lack of information Split of incentives (Access to finance could be addressed by sub-option 4c if Member States agree)

4.4.5. Option 5: Target based compensation fund[87]

Based on an emission reduction target defined by the legislator, a "target-based compensation fund" would be an entity which takes the responsibility for the emissions of all ships calling into EU ports. Each ship calling into an EU port would have to be member of this fund. Compliance of the fund is ensured by an obligation for the "compensation fund" to surrender offsets (for instance EU allowances or CER credits) to a competent authority in case the emissions of the maritime transport sector reported for the previous year exceed to emission target. For the emissions up to the target, it could also be required to surrender offsets. Detail on the methodology used for the assessment of impacts, especially the model used by AEA Technology, is explained in Annex VI.

The membership is defined by the payment of a membership fee. This membership fee is set per tonne of CO_2 emitted in the previous year and is set in accordance with internal rules of the fund, but it has to be sufficiently high to cover the management costs, the implementation of in-sector measures to reduce CO_2 emissions in line with the emission reduction target and the purchase of out-of sector allowances to be surrendered by the fund. The fee would be expected to depend on the achievement of in-sector emission reductions compared to the reduction target.

Under this option, the MRV of emissions is done by ships, based on its fuel consumption (as for option 2, 3 b) and c), and all sub-options 4). Therefore, it will address the market barrier related to lack of information.

The payment of the membership fee by the ship-owners will ensure that the entity in charge of implementing technical measures on board of a ship is fully responsible for the CO2 performance of this ship and therefore remove the market barrier related to the split of incentive.

[87] The term "compensation fund" is associated with the idea that the growth of emissions in the maritime transport is compensated by the funding of in-sector or out-of-sector emissions reductions

The revenues collected by the fund could in theory be used to remove the market barrier related to access to finance, for example by providing financial incentives reducing the risk of investment (e.g. financial guarantee) or reducing the return on investment (e.g. low-interest loans or grants). Such instruments would be especially useful to apply to SME's, which would face greater difficulties in accessing finance. SME's could further profit from technical support for the implementation of new technologies or processes. This support could be used for technological improvement of ships, with respect of the flag neutrality principle. It is also important to stress that, even if the recycling of revenues may not entail state aid elements, it would be in the interest of overall consistency, if Member States apply the same principles as those applicable to state aid[88] for such spending.

Revenues could also be used for international climate finance.

During the on-line consultation, the compensation fund option was considered by 53% of the respondents as the best option to promote progress at the IMO. 68% of the respondents considered that any compensation fund should be managed by a public entity. Several respondents recommended the IMO or an EU public body. Many respondents also recommended management by the industry, but this option raised oppositions from the NGOs. Moreover, the target based compensation fund was considered as more efficient and effective than a contribution based compensation fund to achieve the emission reductions required.

The carbon constraint is set through the setting of a CO_2 emissions target for the fund. For the purpose of this impact assessment, the target has been assumed to be set up at the same level of a maritime emission trading system (option 4).

The offsets surrendered are existing allowances (EU allowances, CER, etc.). The fund can be privately or publicly managed (by an existing body or a European Agency), in accordance with the same principles of full cost coverage and non-interference of Member States as in sub-option 3c.

Table 9 - Summary of the main parameter of option 5

Compliance entity	All ships above 400GT (or 5000GT)
Scope of emissions covered	Any CO2 emissions from the last port of call outside the EU to an EU port, between EU ports and from an EU port to its next port of call outside the EU.
Requirements	Ships will communicate to the relevant Competent authority the amount of and the type of fuel consumed on routes within the scope for the calculation of the associated CO2 emissions. Ships will have to pay a membership fee to the Fund corresponding to the CO2 emissions declared The fund will have to provide finance to the sector for the implementation of low carbon technologies and to purchase of out-of sector allowances to compensate the CO2 emissions of the sector (the part which will not be achieved by in-sector

[88] OJ C 82,01.04.2008, p.1.

	reductions)
Enforcement	Existing Flag State and Port State control rules
Market barriers addressed	Lack of information Split of incentives Access to finance

5. ASSESSMENT OF IMPACTS

In preamble, it can be recalled that the environmental, economic and social impacts of the emission reduction target set in the Commission's White Paper on transport (i.e. -40%, if feasible -50% by 2050 compared to 2005) was done in the impact assessment accompanying the Commission's White Paper[89], in particular regarding the general impacts on economic growth, household and transport-related sector.

For the purpose of this Impact Assessment, the economic, environmental and social assessment has been done up to 2030 due to the uncertainties of the global economy on longer term.

All impacts, except the administrative burden, have been estimated assuming that all ships above 400GT were covered by the regulation (see section 2.7.3). However, the administrative burden was calculated for both size threshold (400GT and 5000GT). Details of these calculations are given in annex XIII.

5.1. General elements on the model used

From a model perspective, the key points of interest relate to the costs of policy options, the emissions abatement profile over time, and the cost effectiveness (Euro per tonne CO_2 abated) of taking action in this area. Additional areas of interest include the extent to which shipping routes may change in response to policy action, the potential for modal shift as a policy response, and the extent of in-sector abatement versus out-of-sector abatement. AEA Technology, who provided support for the impact assessment, developed a model based on the TIMES model architecture. This model is built on three building blocks: (i) a representation of shipping activity, (ii) a representation of vessels and (iii) cost assumptions.

Regarding the representation of shipping activity, the model integrates the available routes into/out of Europe and available technological and logistical choices to 2050 for 313 commodities. For each origin/destination pair (e.g. “Demand of North African crude oil in EU South”), one or two types of movements are defined. One of them is direct movement, e.g. from supply to demand region. The other type of movement defined is one that assumes a stopover on the way to/from Europe. In this case, a ship is assumed to stop in Port Said or Casablanca on its way to/from Europe. The CO_2 emissions are split to represent the two journey legs. Only one movement type is defined for shorter routes, such as Intra-European trade. The TIMES model can allow for modal shift of cargo on intra-EU journeys. The costs are sourced from the DG Environment-funded project from 2010 entitled COMPetitiveness of EuropeAn Short-sea Shipping (COMPASS) report.

[89] SEC(2011) 358

Six vessel categories and up to 5 sub-categories according to vessel type and size were defined. For each of these categories and sub-categories of ships, several parameters, such as daily financial costs, daily operational costs, fuel consumption, CO_2 emissions per tnm, etc. were defined.

Finally, a range of possible emissions abatement options (technological and operational) have been identified and included in the modelling framework. The investment costs, operational costs and CO_2 reduction potentials of the abatement technologies were sourced from MEPC 61 INF. 18[90], an IMO-funded study on the reduction of GHG emissions from ships.

Detail on the methodology used for the assessment of impacts, especially the model used by AEA Technology, the underlying assumptions on fuel prices and a sensitivity analysis on the results provided by the model, is explained in Annex VI.

5.2. General considerations

5.2.1. Impacts on consumers and households

In general, due to its central role in enabling economic activity, a change in the cost of shipping may have effects on the whole spectrum of economic agents: raw material suppliers, manufacturers and service providers, the shipping industry, retailers and consumers. However, it was not possible to assess in detail the impact on all commodities traded by sea.

Therefore, for the analyses of such economic impacts as well as of possible modal shift, the impact of policy options on the costs of transport for eleven key commodities has been assessed. The results are summarised in table 10.

The commodities have been selected according to their relevance in terms of their importance for EU competitiveness (e.g. share of exports and imports, profit margins, transport costs) and according to the technical feasibility of the analysis, in terms of readily available data on historical and predicted trade flows, freight rates, freight rate elasticities, own price elasticities, costs pass-through rates, quantities sold and market shares of domestic and overseas producers. They were chosen as a representative sample on the basis of EU's collective trading profile and the inputs of experts. Competitiveness is understood at the EU-27 level, considering all Member States as a trading bloc vs. the rest of the world. These commodities represent 58% in value of EU imports and 26% in value of EU exports in 2010.

The analysis of the 11 representative commodities is presented below. Following the public consultation and specific feedback from the pulp and paper industry, it was decided to carry out a complementary assessment on the pulp and paper sector. Due to sequencing constraints, it was not possible to include this sector in the scope of the main impact assessment. However, the preliminary findings of the specific assessment carried out by AEA Technology show similarly low impacts on cost of transport. The analysis will be available in full on the Commission's website early 2013.

[90] http://www.rina.org.uk/hres/mepc%2061_inf_18.pdf

Table 10: Additional variation of transport costs for key commodities by 2030 for all options, except 2 and 3a[91], in %

	3b Tax on emissions	3c Contribution based fund	4a Closed ETS	4b open ETS – free allocation	4c open ETS – auctioning	5 Target based fund
Crude oil	-0.8 to 7	-0.8 to 7	-0.8 to -0.2	-7 to -1	-0.4 to 8	-0.4 to 8
Refined petroleum products	-0.8 to 5.6	-0.8 to 5.6	-2.4 to -0.8	-7 to -2	-0.4 to 6	-0.4 to 6
Natural gas	6	6	-2 to -1.4	-1.5 to -1.4	6	6
Iron ores	2 to 11	2 to 11	-4.6 to 3.3	-5.3 to 2.8	2.6 to 12	2.6 to 12
Iron and steel	2 to 14	2 to 14	-5.5 to 5.5	-5.4 to 4.5	2 to 14	2 to 14
Steel products	4 to 14	4 to 14	-11 to 5.5	-11 to 4.5	-4 to 14	-4 to 14
Wearing apparels	-26 to -3	-26 to -3	-31 to 15	-33 to -11	-26 to -2	-26 to -2
Grain	-29 to -15	-29 to -15	-33 to -17	-34 to -22	-28 to -15	-28 to -15
Office and IT equipment	-2.9	-2.9	-15	-11	-2.3	-2.3
Motor vehicles	-13 to -3	-13 to -3	-15 to -6	-20 to -11	-12 to -2	-12 to -2
Organic chemicals	5 to 6	5 to 6	-2.6 to -1.2	-2.1 to -1.2	5 to 6	5 to 6

Source: AEA Technology and others, 2012

Freight rates to be paid by freight customers are in principle not expected to change in reaction to the changed transport costs with very limited exceptions. For the purpose of the analyses of economic impacts, it has been assumed that the few and limited transport cost increases of policy options (see table 10) are passed on by the ship operators to their customers whereas net cost savings are not passed-on due to the price building mechanism within the shipping sector.

Based on these considerations on the pass-through of costs and savings in maritime transport and on the price building mechanisms in different sectors (see Figure 1), measurable increases of commodity prices (with transport costs being only an insignificant element of the commodities' prices) are only expected for natural gas (only for policy options 3b, 3c, 4c and 5) of up to 0.1-0.5% and for iron ore (only for policy options 3b, 3c, 4c and 5) of up to 0.1-0.3%. Such price impacts are far below the usual price fluctuation for these products. In conclusion, no impacts deriving from possible increases of commodity prices are expected on the functioning of the internal market, on competitiveness and trade, on small and medium enterprises, consumers and households as well as third countries.

5.2.1. Transport modal split

Impacts on transport costs for shipping might have impacts on the modal split in case shipping is in competition with other transport modes. If shipping costs decrease under a

[91] Under option 2 (monitoring of fuel consumed), transport costs for all commodities are slightly decreasing. Under option 3a (levy on bunker fuel sales), very limited changes can be expected as only intra-EU routes are impacted but the transport costs related to these routes are increasing for all commodities.

policy option, shipping might attract new freight customers provided that shipping costs fall below the cost level of the other modes. Even if this can be expected to happen for several commodities, a quantification of this modal shift from road and rail to shipping is not feasible as the competition between transport modes is linked to specific routes. Furthermore, increased shipping costs for a commodity under a certain policy option could in principle lead to a modal shift from shipping to road and rail if shipping costs increase above the cost level of the other modes[92]. Again, route-specific assessments would be required to get reliable estimates. In the context of this impact assessment, the impact on changing maritime transport costs of the modal split cannot be quantified, even if the change in shipping costs could be used as proxy for a qualitative estimate of possible impacts of the modal split.

5.3. Option 1: Baseline scenario

5.3.1. Environmental impacts

For the baseline scenario, a further increase of CO_2 emissions is expected despite the effects of the EEDI introducing minimum efficiency standards for certain types of new ships as from 2015 (see table 11). The drivers behind this increase are described in section 2.2.

Table 11: Projected EU related CO_2 emissions

	Mt CO_2	Compared to 1990	Compared to 2005
2020	210	+45%	+8%
2030	223	+54%	+15%

Source: AEA Technology and others, 2012

The warming effect of CO_2 dominates the global warming impacts of shipping. However, black carbon[93] can have significant regional warming impacts. Atmospheric black carbon and surface deposition is considered to produce a warming effect due to accelerated melting of ice and snow. Even quantification of the impacts in terms of black carbon emissions or climate change impacts is not exact, evidence suggests that heavy fuel oil consumption is closely linked to the amount of black carbon emitted.

As there is a direct link between the fuel consumption and CO_2 emissions, the increase of CO_2 emissions of the maritime sector will lead to an increase of the negative effects of fuel combustion, especially on local air quality (see table 12). The main air pollutants from shipping include sulphur dioxide (SO_x), nitrogen oxides (NO_x) and particulate matter (PM). However, both NO_x and SO_x are controlled by international and European standards that will become significantly more stringent in the future leading to substantially lower emission levels in 2020. Sulphur regulations have an indirect impact on PM emissions. For 2030, emissions increases could be expected compared to 2020 due the likely increase of fuel consumption and unchanged emission standards.

[92] Less than 0.12% of the volume traded by ships is expected to shift to road or rail (which are covered by EU regulations on climate change), according to AEA Technology and others, 2012

[93] see footnote 55

Table 12: Emissions of NOx, SOx and PM in 2030, kt,

	2030 (kt)	Compared to 2010	Compared to 2020
NOx	4224	-5.4%	-1.7%
SOx	539	-79%	+12%
PM	75	-76%	+10%

Source: AEA Technology and others, 2012

The impacts of ship emissions on ecosystems and biodiversity are highly site-specific, but can cause damage through acidification and eutrophication. Increased acidification may affect certain organisms, particularly those with calcium carbonate skeletons and shells and the ecosystems that rely on them. Eutrophication is caused by high nutrient concentrations that stimulate the growth of algae and leads to several problems including: production of excess organic matter; increase in oxygen consumption; oxygen depletion and death of benthic organisms[94]. It has been suggested in studies of the impacts of emissions in Europe that including ecological impacts would make little difference given the magnitude of health effects. However, any increase in emissions of NO_x, SO_x and CO_2 could be expected to have negative impacts on ecosystems and biodiversity.

With continuing monitoring and reporting by Member States based on fuel sales, increased shipping activities will lead to an increase in fuel consumption (77.1Mtoe by 2030 for the EU scope, i.e. +30% compared to 2010). Beside the use of HFO and MGO[95], it can be expected that a number of ships switch to LNG (liquefied natural gas), mainly in response of the strengthened standards for sulphur emissions (LNG can be considered almost sulphur-free). In the baseline scenario, LNG is expected to represent about 9% of energy consumption in 2030. It can be noted that this expected fuel switch will also have a positive impact on CO_2 emissions (with LNG being less carbon-intensive than HFO and MGO), but this is outweighed by the growth of maritime transport.

Voluntary MRV already done today, e.g. by container vessels through the Clean Cargo Working Group, would continue to deliver emission reductions. However, due to its voluntary nature, it is not possible to estimate with sufficient accuracy the future benefits of such voluntary schemes.

Impacts on other environmental resources could be caused by an increase in dredging and infrastructure construction to accommodate larger vessels, leading to habitat fragmentation and disturbance. Construction of LNG infrastructure could also cause land use changes. It is not possible to get an accurate estimate of these impacts, although they are expected to be rather small. Moreover, if no policy is in place to require the contribution of the maritime sector to achieve the climate objective of limiting global average temperature increase to less than 2 degrees Celsius above pre-industrial levels, other sectors will have to compensate the growth of emissions in the international maritime transport. This contribution is estimated at up to 78MtCO_2 by 2030, i.e. almost the 2010 emissions of Austria. Consequently, impacts on other sectors may be significant. However, the nature of these impacts will depend on the way international maritime sector is included into the EU commitments.

[94] Helsinki Commission, 2010
[95] Heavy Fuel Oil and Marine Gas Oil

5.3.2. *Economic impacts*

The costs of the operation of ships within the EU scope related to the baseline scenario are given in the table below. The cost increase can be explained by the expected growth in maritime transport.

Table 13: Costs in the maritime sector in 2030, €bn, 2010 prices, undiscounted

	2030 (€bn)	Compared to 2010
Investment costs	49.4	+42%
Operational costs[96]	22.9	+23%
Fuel costs	60.0	+162%

Source: AEA Technology and others 2012

The increase of fuel costs will increase the costs per tonne of goods traded by 20% by 2030, which will either be passed through to the customers by increasing freight rates and/or be absorbed by the maritime sector reducing their profit margin. As this would impact all sectors and regions inside and outside the EU[97], no specific impacts are expected on average for the competitiveness of the EU economy, even if some specific regions or sectors particularly dependent on shipping are likely to face specific difficulties. Prices for end consumers on certain commodities will be affected.

Increasing freight rates in the shipping sector could in principle lead to modal shift from shipping to other modes of transport (such as rail or road). However, the expected increase in fuel price would also affect the other transport modes and therefore not undermine the competitiveness of shipping, in particular as in most cases, transport by ship is more energy efficient than by other modes.

5.3.3. *Social impacts*

The shipping sector also employs a significant number of people in various sub-sectors. Total maritime employment in the EU is approximately 250,000 people. In addition to seafarers, there are a number of sectors that are directly linked to the shipping industry, such as shipping services, port services, maritime works, shipbuilding, ship management and gas and wind energy industries. Banking and financial services, research and development, education and marine equipment are sectors that are indirectly linked to the maritime sector.

There might be some increase in employment in European ports and distribution hubs due to the expected growth in trade and shipping activities.

5.4. Option 2: Monitoring, reporting and verification (MRV) of emissions based on fuel consumption

It should be noted that an impact assessment on monitoring mechanisms for maritime emissions have already been carried out within the framework of the proposal for a regulation on mechanism for monitoring and reporting greenhouse gas emissions for reporting other

[96] Excluding fuel cost
[97] Assuming that no action is taken outside the EU.

information at national and Union level relevant to climate change[98]. A supporting study was also carried out in this context[99]. However, the impact assessment or the supporting study did not quantify the specific impact of a monitoring mechanism on shipping. The quantification is therefore provided hereafter.

5.4.1. Environmental impacts

Under this policy option, the EU CO_2 emissions are expected to be 2% lower than the baseline[100] (reaching 218.5 $MtCO_2$ by 2030), and deliver a cumulative emission reduction of 55.9 $MtCO_2$ up to 2030[101]. Lack of access to accurate and comparable information about fuel consumption in the maritime transport sector is one of the market barriers to cost effective GHG emission reductions in the maritime sector[102]. The 2% emission reduction has been confirmed during bilateral discussion with stakeholders. Some leading stakeholders, such as Maersk Maritime Technology for example, consider that this figure could even be higher.

More precisely, simply making fuel consumption information available can trigger an improvement of the fuel efficiency of ships. Ship operators that are directly responsible for fuel payments (i.e. they cannot pass the cost on) would already carefully monitor their fuel consumption and take adequate measures for the improvement of the energy efficiency in order to reduce fuel costs. However, other ship operators that are not responsible for fuel payments (i.e. they pass the cost on, for example via contract arrangements) would improve the energy efficiency of their ships only if the energy efficiency of the ship is taken into account in the charterer contracts.

This reduction in fuel consumption could also result in a reduction of other pollutants, such as sulphur dioxide (SO_x), nitrogen oxides (NO_x) and particulate matter (PM), as well as other climate forcing agents such as black carbon.

Additional environmental benefits may be triggered by the removal of this market barrier (e.g. the availability of information on fuel consumed at berth may increase the pressure for port electrification). However, these additional environmental benefits cannot be quantified, as they depend on other market barriers, such as split incentives (e.g. in case of port electrification, most of the investment is paid by ports, whereas the benefits are taken by the ship operators).

The improvement of ship efficiency may lead to the scrapping of less efficient vessels. However, limited impacts are expected on ship dismantling.

5.4.2. Economic impacts

As mentioned previously, the lack of accurate, comparable and standardised information about fuel consumption is one of the market barriers to cost effective GHG emission reductions in the maritime sector and therefore to a reduction of fuel cost. Removing this

[98] COM(2011)0789
[99] http://ec.europa.eu/clima/policies/g-gas/docs/monitoring_2011_en.pdf
[100] Maddox Consulting, 2012
[101] AEA Technology and others, 2012
[102] Maddox Consulting, 2012

market barrier can trigger an improvement in energy efficiency of the ships and therefore enhance innovation and research due to a better understanding of the fuel consumption.

Assuming that the improvement of the energy efficiency leads to a decrease of the fuel consumption of 2% compared to the baseline[103], the reduction of fuel cost can be estimated at up to €9.4 billion up to 2030. However, the operational costs will slightly increase due to the administrative requirements related to the monitoring of emissions.

In cases where ship-owners and ship operators do not yet apply fuel monitoring of their emissions, the total administrative burden for ships down to the level of 400GT may be estimated at €52.5 million per year[104], i.e. around €2900 per ship[105]. This represents 0.28% of the average 2010 operational costs (excluding fuel costs). However many ship-owners have already adopted highly sophisticated MRV standards and will have no difficulty complying. In addition evidence of consumption is already provided in fuel consumption log books on board for all ships. Log books contain data on fuel purchased and consumed, ports visited, cargo loaded and distances sailed. Accordingly, most of the additional costs are related to the familiarization of the obligation, the collection and formatting of existing data, verification and submission to the appropriate competent authority. If the EU monitoring scheme requires electronic reporting, the uptake of electronic data collection tools on board of ships may increase which could reduce the time spend by the crew on data collection and reporting and save money for the ship operator (according to some stakeholders, such as Norden, this would outweigh the initial investment). As a consequence, the administrative burden calculated for the impact assessment is probably a high estimate.

This total administrative burden is calculated for all ships above 400GT holding an IMO number. Using a higher threshold significantly reduces the total administrative burden for ships without significantly undermining the environmental effectiveness. The total administrative burden for all ships above 5000GT[106] are estimated at €26.1 million per year, leading to a reduction of 50% of the administrative burden while still capturing 90% of the emissions (and, as a consequence, to large proportion of the fuel savings previously mentioned, i.e. €11.6 billion up to 2030). Furthermore, the introduction of simplifications (see annex VIII) could further reduce the administrative burden although this has not been quantitatively assessed within this impact assessment. To conclude, the administrative burden for the monitoring and reporting requirements will be fully compensated by the fuel savings.

Further details of the calculation of the administrative burden are given in annex XIII.

[103] Maddox Consulting, 2012

[104] For 18400 vessels, this figures includes annual costs (e.g. for annual emission reports) as well as one-off costs (e.g. for monitoring plans) which are equally distributed over 10 years

[105] €4500 would be added if the private sector verification of the data reported as well as the processes is required.

[106] This threshold is used in SOLAS regulations

Table 14: Additional costs of policy option 2 compared to the baseline, up to 2030, private discount rate (10%)[107],

Additional costs compared to the baseline up to 2030	Investment costs	Operational costs (excluding fuel costs)	Fuel costs	Carbon costs	Total costs
Value (€bn)	-	+0.6	-9.4	-	-8.8
Percentage	-	+0.28%	-2%	-	-0.58%

Source: AEA Technology and others 2012

The pass through of these savings to the final consumers will rely on the elastic demand of maritime transport and on the elastic demand of commodities using maritime transport. If the demand of maritime transport is inelastic, ship operators should keep the savings, whereas, if the demand is elastic, the ship-operators should pass-through the savings to the shippers. If the savings are passed-through the shippers and if the demand of commodities using maritime transport is elastic, the savings should be passed through the final consumer. If the savings are passed-through the shippers and if the demand of commodities using maritime transport is inelastic, the savings should be kept by the shippers. Such mechanisms are explained in the figure below.

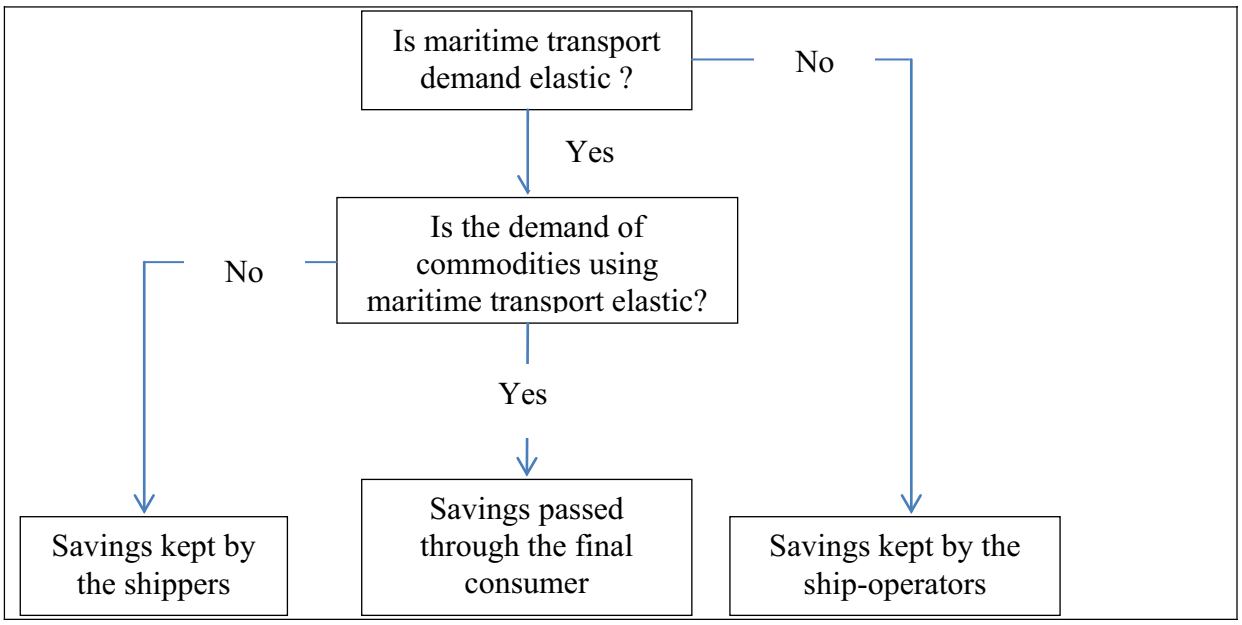

Figure 1 – Pass-through of savings in the shipping sector

The analysis shows that the impact of the measure on final consumer will be limited to commodities where the savings are passed through to the final consumers. However, freight costs represent only a share of the cost of a commodity (for example, up to 20% for natural gas, but only 0.03% for IT equipment). So, the pass-through of the savings to final consumers will have a limited impact (for example, -0.1% on natural gas prices up to 2030 and -

[107] As market barriers are key in the maritime transport sector, a private discount rate of 10% was used in this impact assessment (expect for the health benefits) instead a social discount rate of 4% recommended by the Impact Assessment guidelines.

0.0002% on IT equipment prices up to 2030). So, even for the commodities where the savings are passed through the final consumer, the impact should be marginal.

No specific administrative burden on small and medium enterprises[108] has been identified. However, as mentioned in annex II, small and medium enterprises in maritime transport may be more sensitive on getting accurate information on the abatement potential of low technology and their operational impacts. Such information should secure their uptake by companies that are operating only a few numbers of ships and which cannot afford to test technologies on board of their ships.

5.4.3. Social impacts

No significant impact on employment can be expected.

Setting requirements on monitoring will also trigger an increase of qualification of the crew. However, this increase is not considered as significant, as most of the tasks requested are already performed.

Moreover, the reduction of fuel consumption will lead to a decrease of emissions of sulphur dioxide (SOx), nitrogen oxides (NOx) and particulate matter (PM) and therefore have benefits for human health. This benefits are estimated between €1.0 to 2.9 billion up to 2030[109].

5.4.4. Administrative burden for public authorities

Detail calculation of the administrative burden for public authorities is given in annex XIII.

For the public authorities, the total administrative burden will be limited to the supervision of monitoring and reporting, and enforcement. The annual administrative burden can be estimated at around €4 million in case of national competent authorities and around €3 million in case of a central EU competent authority. This difference can be explained by aggregation of resources and economies of scale. These costs may be reduced by 40% if only ships above 5000GT are included. Furthermore, the introduction of simplifications (see annex VIII) could further reduce the administrative burden for public authorities. As a consequence, taking into account these simplifications, the minimal annual costs for a central EU competent authority could be estimated at € 0.6 million[110]

For a ship, there is no difference between reporting the emissions to a Member State competent authority or to a central EU competent authority, even if using a single EU competent authority may be simpler for non EU flagged ships. Moreover, using national or EU competent authorities makes no difference to the environmental, social or economic impacts of the policies. The main difference between national competent authorities and a central EU competent authority is the cost for public authorities.

[108] Pending on the scope, at least 99% of EU maritime transport SMEs could not subjected to the regulation. See annex II

[109] AEA Technology and other, 2012

[110] Estimate based on a minimum number of posts required, excluding one-off costs for setting up IT systems and excluding enforcement costs

5.4.5. Specific impacts outside the EU

The monitoring of fuel consumption can trigger environmental, social and economic benefits also outside the EU. There is little administrative burden to monitor the total emissions of a ship on all routes instead of only the ones related to EU routes. Therefore, the monitoring of emissions could become attractive also on non-EU routes, especially if the monitoring of emissions on EU routes delivers fuel savings, and progress should be made through the IMO on this respect.

As a consequence, the environmental, social and economic benefits mentioned previously for the MRV of the emissions of fuel consumed related to EU routes can also apply outside of the EU. However, it cannot be quantified with absolute accuracy, especially as the expansion of transparent monitoring depends on the willingness of the ship operators.

Moreover, it can be stressed that any market based measure adopted through the IMO would require robust monitoring and reporting of emissions. Strong monitoring and reporting requirements that can be used outside EU routes should therefore help the IMO to progress on this issue.

5.5. Option 3a: Levy on bunker fuel sales

5.5.1. Environmental impacts

The EU CO_2 emissions are expected to be 3% lower than the baseline (reaching 217.0 $MtCO_2$ by 2030), and deliver a cumulative emission reduction of 40.1$MtCO_2$ up to 2030. However, the environmental effectiveness may be less pronounced, if market barriers are not sufficiently addressed and reduced.

Emissions of black carbon are expected to decrease in the same order of magnitude as both, black carbon and CO_2 are closely linked to the fuel consumption.

Due to the link between CO_2 emissions, fuel consumption and emission of other pollutants, it is expected that the emissions of NO_x, SO_x and PM decrease. However, this decrease is not considered as significant. As results of the slightly decreased emissions of NO_x, SO_x and CO_2, limited positive impacts on ecosystems and biodiversity are expected.

Limited reduction of fuel consumption is expected: the cumulative reduction up to 2030 is expected to be 2.1 Mtoe. No major uptake of biofuels is expected by 2030.

Imposing a non-global levy on bunker fuel sales would trigger specific negative economic and environmental impacts due to an expected high level of avoidance. Most ships travelling on intra-EU routes could avoid taxation using offshore bunkering. This offshore bunker supply (i.e. beyond a 12 nautical mile zone) is already common practice to avoid paying port fees, agency fees or being constrained by loading limits in ports. However, offshore bunker supply has negative environmental effects as it increases the risk of oil spills.

5.5.2. *Economic impacts*

The tax of bunker fuel sales will only have an impact on ships performing exclusively intra-EU routes as others will purchase the fuel outside the Union. Large ships in particular are able to undertake long voyages on a single bunkering and can carry additional fuel without significantly sacrificing their carrying capacity (a process known as "tankering"). Therefore, if the purchase of fuel in the EU requires additional costs not required in third countries, the ships will purchase their fuel outside of the EU. As consequence, the EU maritime bunker fuel sales would drop by 55% to 90%, without significantly reducing the GHG emissions of ships. The range of this estimate is based on two assumptions: Only fuels for intra-EU shipping (related emissions account for 43% of the total GHG emissions of the maritime sector based on fuel sales) would be purchased within the EU or only fuels for intra-State shipping (representing 11% of the total) would be purchased within the EU.[111].

Table 15 presents the total and additional direct costs and savings for the operation of ships generated by this policy option up to 2030 compared to the baseline in terms of investment, operational, carbon and fuel costs as well as the net aggregated total.

Table 15: Additional costs of policy option 3a compared to the baseline, up to 2030, private discount rate (10%)[112],

Additional costs compared to the baseline up to 2030	Investment costs	Operational costs (excluding fuel costs)	Fuel costs	Carbon costs	Total costs
Value (€bn)	+2.5	+1.6	-4.8	+66.7	+66.0
Percentage	+0.4%	+0.5%	-0.8%	-	+4.5%

Source: AEA Technology and others 2012

A tax on bunker fuel would likely be passed on by suppliers to their customers i.e. ship operators, in turn creating an incentive for them to improve fuel efficiency. As a result, this policy option would incur additional investment costs as ship owners and ship operators operating on intra-EU routes would invest in new vessels and / or abatement technologies[113] to retrofit existing ships. A small rise in overall operational cost (excluding fuel cost) may also occur as a result of implementing these abatement measures. However, both these impacts would be small amounting to an increase of 0.4% in investment costs and 0.54% in operation costs compared to the baseline.

Total costs under this policy options are expected to be high, at € 66 billion compared with the baseline out of which the cost of the tax would be of approximately €67 billion.

[111] AEA Technology and others 2012, CE Delft and others 2009.

[112] As market barriers are key in the maritime transport sector, a private discount rate of 10% was used in this impact assessment (expect for the health benefits) instead a social discount rate of 4% recommended by the Impact Assessment guidelines.

[113] For example, hull coating (reduction of frictional resistance of a hull), waste heat recovery (using the heat of the engine for electricity production), wind engines (rotors placed on deck of a ship can generate thrust, taking advantage of the Magnus effect), solar energy, speed reduction, propeller upgrade, engine upgrade, weather routing (optimisation of routes according to current and weather conditions), etc.

Administrative burden is expected to be negligible for this policy option as the cost for monitoring the emissions from bunker fuel purchased is estimated at €0.6 per ton of fuel sold[114] and can be considered as small[115]. Detail calculation of the administrative burden is given in annex XIII.

The free movement of goods is unlikely to be affected as no change in volume of goods traded within and outside the EU has been identified. Moreover, no impacts are expected on extra-EU trade (as ships will bunker outside the EU to avoid the tax), as the costs will only be supported by ships performing intra-EU routes. As a consequence, no impacts on the general economy are expected on third countries, a part from an increase of fuel sales.

Regarding ships performing exclusively intra-EU routes, cargo ships may have the possibility to change their route to bunker outside EU territorial waters. Alteration of routes and/or modal shift could be expected, with specific concerns with regions heavily dependent on shipping. Ferries will not change their route. So, the impact will be limited to certain type of ships. These ships are mostly performing land-bridge routes, which are particularly sensitive for isolated regions and may face strong competition with other modes of transports.

The introduction of a levy on bunker fuel sales would not have any negative impacts on the competitiveness of the EU shipping operators compared to non EU shipping operators as any policy option will be flag-neutral. A competition distortion may be triggered between ships performing exclusively intra-EU routes and others, as ships performing exclusively intra-EU routes will have limited possibility to purchase their fuel outside the EU.

Small and medium enterprises will be affected in a similar manner as large enterprises. More precisely, a levy on bunker fuel sales does not allow distinguishing the impact regarding ship size. However, as mentioned in annex II, for small enterprises, the size of enterprises is related to the size of ships this enterprise is operating. As a consequence, the levy on bunker fuel sales prohibits possible implementations of SMEs related provisions.

The impacts on public authorities remain very limited for this policy option as for monitoring and reporting of emission, internalization of costs of emissions and enforcement, existing structure could in principle be used. The total administrative burden for public authorities are estimated around € 100 000 per year. Detail calculation of the administrative burden is given in annex XIII.

The major economic impact is related to the distortion of competition between ships performing exclusively intra-EU routes and others that can avoid the scheme. It appears that there are no options to reduce avoidance. This was demonstrated by California's 1991 decision to lift the fuel tax exemption and to tax interstate bunker fuel sales. Within a year, Californian bunker sales had collapsed as ships bunkered elsewhere especially in Panama.

[114] Assuming that the total administrative burden is €34 million per year and the fuel consumption is around 56Mtoe

[115] Fuel prices are expected to reach €745 per ton of fuel by 2030

5.5.3. Social impacts

A levy on bunker fuel sales in the EU would lead to increased expenditure on energy efficiency measures, new ships and/or engines and would contribute to the growth of the global market for these products with positive impacts on employment in Europe. Compared to the baseline, the expected additional investment in technical energy efficiency measures is expected to contribute to the creation of additional jobs.

Shipping activities are projected to remain constant for this policy option compared to baseline. The additional operating cost of €100 million due to speed reduction is expected to create a limited number of additional jobs on ships relative to the baseline.

The expected drop of bunker fuel sales under this policy option would lead to the loss of jobs in bunker facilities in ports. Other job loss may be expected in refineries in the EU. However, as this job loss is highly dependent on the strategies of the petroleum companies (producing bunker fuels in the EU and then exporting or producing directly outside the EU), it is not possible to get an accurate estimate on this potential job loss.

The impacts of the tax on bunker fuel sales option on emissions of SO_2, NO_X and PM emissions are estimated to be small. This translates to a small (but not negligible) benefit for human health and crop damage impacts. The total estimated cost to human health and crops due to decreases in SO_2, NO_X and PM emissions following the methodology set out for the other policy options is €0.1 to 0.4 billion.

5.6. Option 3b: Tax on emissions from fuel consumed

5.6.1. Environmental impacts

Under this policy option, EU CO_2 emissions are expected to be 16% lower than the baseline (reaching 186.8MtCO_2 by 2030) and deliver a cumulative emission reduction of 335.4MtCO_2 up to 2030. However, the environmental effectiveness may be less pronounced, if market barriers, especially related to access to finance, are not sufficiently addressed and reduced.

Emissions of black carbon are expected to decrease in the same order of magnitude as both, black carbon and CO_2 are closely linked to the fuel consumption. Due to the link between CO_2 emissions, fuel consumption and emission of other pollutants, it is expected that the emissions of SO_x and PM decrease by 3% and of NO_x by 8% up to 2030 compared to baseline[116]. As results of the slightly decreased emissions of NO_x, SO_x and CO_2, limited positive impacts on ecosystems and biodiversity are expected.

Fuel consumption is expected to be less than the baseline: the cumulative reduction up to 2030 is expected to be 113.8 Mtoe. More precisely, the consumption of fossil fuel (heavy fuel oil – HFO –, marine diesel oil – MDO – and liquefied natural gas - LNG) is expected to be less than the baseline, even if the share of LNG within these fossil fuels will be greater. This can be explained by the fact that up to 2030, it is less costly to reduce the fuel consumption

[116] AEA Technology and others, 2012, based on TIMES model output on fuel consumption

than to switch to low carbon fuel. There remains no commercial basis for major uptake of biofuels by 2030.

5.6.2. Economic impacts

5.6.2.1. Direct impacts on the ship owners and ship operators

The table below presents the total and additional direct costs and savings for the operation of ships generated by this policy option up to 2030 compared to the baseline in terms of investment, operational and fuel expenditure as well as the net aggregated total.

Table 16: Additional costs of policy option 3b compared to the baseline, up to 2030, private discount rate (10%),

Additional costs compared to the baseline up to 2030	Investment costs	Operational costs (excluding fuel costs)	Fuel costs	Carbon costs	Total costs
Value (€bn)	+2.9	+0.03	-55.9	+26.1	-26.9
Percentage	+0.5%	+0.01%	-9.6%	-	-1.8%

Source: AEA Technology and others 2012

Most of operational measures, such as slow steaming or weather routing, can be implemented immediately after the entry into force of the measure. The implementation of new technologies, such as engine or propeller upgrade, may require being in dry dock. Therefore, ship-owners and ship-operators will probably anticipate the entry into force of the measure by investing in low carbon technologies when they have planned dry dock repairs[117]. Finally, it can be assumed that technical and operational measures with negative abatement costs will be implemented first.

As a consequence, considering that the implementation of low carbon technology start 3 years before the entry into force of the tax on emissions, the carbon costs paid during the first year after the entry into force of the tax, i.e. 269M€, will be fully compensated by the fuel savings, i.e. 1473M€. Moreover, annual investment costs will increase progressively from 11M€ in 2016 to 297M€ in 2030.

The implementation of a tax on emissions from fuel consumed would encourage additional investment costs as, in order to reduce tax contribution, ship owners and ship operators would invest in new vessels and / or abatement technologies to retrofit existing ships. Furthermore, a small increase of the overall operational cost (excluding fuel cost) is expected. Indeed, some specific abatement measures may trigger additional operational costs (e.g. hull cleaning), whereas others can lead to a decrease of the operational costs (e.g. slowing down reduce engine maintenance costs) or are neutral (e.g. weather routing). Therefore, even if there is a limited increase of the costs for the entire fleet, a more significant increase of costs may be possible, especially for less efficient ship level, depending on the abatement strategy followed individually.

[117] For example, many ships are already retrofitted to comply with the IMO regulation on sulphur which will enter into force in 2015.

The most important decrease of costs comes from the fuel savings. In addition to the fuel savings directly related to ship journeys from and to EU ports, it can be expected that the policy options also trigger fuel cost savings outside this scope as ships becoming more efficient in reaction to the EU measure (spill-over effect). However, it has not been feasible to quantify these additional costs savings and the related emission reductions.

Overall, the additional costs are compensated by reduced fuel costs leading to significant net savings of around €27 billion until 2030 for the sector.

The total administrative burden for ship-owners and ship operators is estimated at €140 million per year, if all ships above 400GT are included in the scope. This means €7600 per ship per year and represents annually 0.75% of the average 2010 operational costs (excluding fuel costs). Detail calculation of the administrative burden is given in annex XIII.

5.6.2.2. Functioning of the internal market and competition

Free movement of goods is unlikely to be affected. Indeed, this policy option would not lead to a decrease of the volume of goods traded within and outside the EU as the assessment of key commodities shows that their prices are not affected by a tax on emissions (see preamble of section 5).

The issue of competition between the maritime sector and other transport modes may be raised in the event of changing shipping costs. Even if a detailed assessment of possible model shift is not feasible within the context of this impact assessment, some modal shift from road and rail to shipping cannot also be excluded due the significant cost reduction for shipping (see section 5.2.1).

5.6.2.3. Competitiveness and trade investment flows

This option is not expected to have negative impacts on the competitiveness of the EU shipping operators compared to non EU shipping operators. As any policy option will be flag-neutral, the policy will apply equally to all ships calling into EU ports. Ships calling more often into EU ports may have the advantage of shorter pay-back periods for investments into their efficiency leading to high fuel cost savings.

Regarding the competitiveness of the EU economy, the detailed analysis of eleven representative commodities shows that the prices of the commodities are not affected by the possible change of freight rates with the exceptions of natural gas (increase of up to 0.5%) and iron ore (up to +0.3%). Therefore, no significant impacts are expected on the EU economy.

5.6.2.4. Impacts on Small and Medium Enterprises

No specific administrative burden on small and medium enterprises[118] has been identified. However, as mentioned in annex II, small and medium enterprises in maritime transport may be more sensitive on getting accurate information on the abatement potential of low

[118] Pending on the scope, at least 99% of EU maritime transport SMEs could not subjected to the regulation. See annex II

technology and their operational impacts. Such information should secure their uptake by companies that are operating only a few numbers of ships and which cannot afford to test technologies on board of their ships.

Large companies account for half of the turnover in Water Transport, but for 1% only of number of companies. This suggests that large firms undertake higher added value tasks and have higher productivity than SMEs. This is likely to be the result of economies of scale which apply strongly in shipping with research showing that firm capacity and net profit are positively related. Therefore, facilitating access to finance is also a key issue to ensure that SMEs will be able to invest and take the benefits of cost savings. To this end, it has to be underlined that, under a tax option, the recycling of revenues would need to be decided by Member States.

5.6.2.5. Public authorities

Public authorities will be affected by the control of compliance (i.e. reporting of emissions, payment of the contribution, etc.) and the enforcement. Detail calculation of the administrative burden is given in annex XIII.

Enforcement is already carried out by Flag State and Port State control. So, the administrative burden related to the enforcement should be low. The total additional burden for the national public authorities in charge of enforcement are estimated around €100 000 per year.

The costs borne by the competent authority in charge of controlling the compliance will depend on the scope considered. The table below shows the total additional administrative burden according to the different options and according to the size of ships concerned.

Table 17: Annual additional administrative burden, in € million

	National Competent Authority		EU competent authority	
	All ships above 400GT	All ships above 5000GT	All ships above 400GT	All ships above 5000GT
Tax	5.4	3.5	4.6	3.0

Source: AEA Technology and others, 2012

5.6.2.6. Consumers and households

Consumers and households are most sensitive to 5 of the 11 commodities assessed: natural gas, refined petroleum products, wearing apparels, office and IT equipment and motor vehicles[119]. The introduction of a tax on emissions from fuel consumed would not lead to price changes for these commodities, except natural gas, and therefore, should have no negative impacts on consumers and households. The increase of prices of natural gas, up to 0.5% by 2030 cannot be regarded as significant impacts on households. The other commodities are not directly consumed by households and even in the event of an increase in their price, the low level of increase should not be sufficient to result in impacts on the final consumers.

[119] AEA Technology and others 2012

5.6.2.7. Specific regions heavily dependent on shipping

As the introduction of a tax on emissions from fuel consumed would in general lead to net benefits for the shipping sector, in principle, more intensive impacts in terms of job creation and cost savings impact could be expected for regions dependent on shipping. No general economic impacts on these regions can be expected (see preamble of section 5).

5.6.2.8. Third countries

As mentioned previously, this policy option is not expected to lead to significant changes of freight rates. As a consequence, major international partners should not be economically affected by an EU regulation.

5.6.2.9. Risk of avoidance

If there were no barriers to the addition of port calls, then for certain types of ships, the effect of the alteration of routes could be significant. The CO_2 emissions could be up to 6% higher than the expected emission reduction by 2030. However, there are significant additional costs related to the addition of a port call (e.g. financial interests related to longer journeys, additional charter, logistic and administrative costs, etc.). Moreover, the impacts of route shifting due to the addition of a port call (which are higher than the risk of modal shift) could be significantly less pronounced if the regulation provides for an adequate definition of a port call. Indeed, such definition could ensure that additional port calls are not calls of convenience. The risk of avoidance could therefore be significantly mitigated.

5.6.3. Social impacts

The tax on emissions from fuel consumed would lead to increased expenditure on energy efficiency measures, new ships and/or engines and would contribute to the growth of the global market for these products with positive impacts on employment in Europe. The expected additional investment in technical energy efficiency measures which could lead to the creation of new jobs in shipyards and equipment manufacturers globally. The additional operating cost of €300 million due to speed reduction is expected to create a limited number of additional jobs on ships relative to the baseline.

Due to reduced emissions of NO_X, SO_2 and PM, monetised benefits for public health for the period until 2030 in the order of magnitude of €6 – 18 billion can be expected for this policy option[120].

5.7. Option 3c: Contribution based compensation fund

The impacts of this policy option are in principle similar to the ones for the tax on emissions from fuel consumed (option 3b) (see section 5.6) as a membership fee based on emissions could be assimilated as a tax on emissions, except for the administrative burden and the impacts of the recycling of revenues. However, the reduction of emissions and fuel costs are higher for option 3c, if the recycling of revenues would be done in an efficient manner and

[120] These estimates are based on the damage cost function developed under the Clean Air For Europe (CAFE) program.

would succeed in removing the market barriers, given that it is an integral part of the compensation fund approach.

Detail calculation of the administrative burden is given in annex XIII.

In the event of a privately managed fund, the total administrative burden for ship-owners and ship operators is estimated at €149.5 million per year, if all ships above 400GT are included in the scope. This means €8100 per ship per year and represents annually 0.80% of the average 2010 operational costs (excluding fuel costs). For the public authorities, the administrative burden will be limited to the control of monitoring and reporting and the enforcement (see table 18).

Table 18: Annual additional administrative burden for the public authorities in the event of a privately managed fund, in € million

	National Competent Authority		EU competent authority	
	All ships above 400GT	All ships above 5000GT	All ships above 400GT	All ships above 5000GT
	5.4	3.5	4.6	3.0

Source: AEA Technology and others 2012

In the event of a publicly managed fund, the administrative burden for ship owners and ship operators will be similar to the tax on emissions from fuel consumed (option 3b) (see section 5.6), but the administrative burden for the public authority will differ due to the setting of a fund (see table 19).

Table 19: Annual additional administrative burden for the public authorities in the event of a publicly managed fund, in € million

National Competent Authority		EU competent authority	
All ships above 400GT	All ships above 5000GT	All ships above 400GT	All ships above 5000GT
19.1	11.9	18.1	11.3

Source: AEA Technology and others 2012

A contribution based compensation fund would allow the generation of €26.1 billion up to 2030. So, this option generates sufficient revenues to incentivise the removal of market barriers, especially considering that the additional investment costs requested to improve the energy efficiency of ships is estimated at around €3 billion up to 2030.

5.8. Option 4: Maritime emission trading scheme (ETS)

5.8.1. Environmental impacts

Under this policy option, the in-sector emissions reduction will depend principally on the linking of the system and on the use of free allowances. Under open ETS options, ship-owners and ship operators could purchase out-of sector emissions reductions (offsets) to comply with the target. If these offsets are supplied from an emission trading system where the emissions are capped, the environmental effectiveness can be considered as similar to an in-sector contribution.

Table 20: In-sector emissions by 2030 and cumulative emissions, $MtCO_2$.

	Emissions by 2030 ($MtCO_2$)	Compared to the baseline	Cumulative emissions reductions up to 2030
Closed ETS[121]	175.7	-21%[122]	377.1
Open ETS with free allocation	186.7	-16%	333.8
Open ETS with full auctioning	186.8	-16%	336.3

Source: AEA Technology and others 2012

Emissions of black carbon are expected to decrease in the same order of magnitude as both, black carbon and CO_2, are closely linked to the fuel consumption. Due to the link between CO_2 emissions, fuel consumption and emission of other pollutants, emissions of SO_x and PM decrease by about 3% and of NO_x by 8% up to 2030 compared to baseline. As results of the slightly decreased emissions of NO_x, SO_x and CO_2, limited positive impacts on ecosystems and biodiversity are expected.

For all ETS options, the fuel consumption is expected to be smaller than the baseline: the cumulative reduction up to 2030 is expected to be 116.13 Mtoe under the closed ETS, 113.51 Mtoe under the open ETS with free allocation and 113.97 Mtoe under the open ETS with auctioning. More precisely, the consumption of fossil fuel (heavy fuel oil – HFO –, marine diesel oil – MDO – and liquefied natural gas - LNG) is expected to be smaller than the baseline, even if the share of LNG within these fossil fuels will be greater (up to 11.1% in 2030 under the closed ETS versus 9.4% in 2030 under the baseline). This can be explained by the fact that up to 2030, it is less costly to reduce the fuel consumption than switching to low carbon fuel. There is no commercial basis for major uptake of biofuels by 2030.

5.8.2. Economic impacts

5.8.2.1. Direct impacts on the ship owners and ship operators

The table below presents the total and additional direct costs and savings for the operation of ships generated by this policy option up to 2030 compared to the baseline in terms of investment, operational and fuel expenditure as well as the net aggregated total.

Table 21: Additional costs of a maritime ETS compared to the baseline, up to 2030 (€bn), private discount rate (10%),

		Closed ETS	Open ETS with free allocation	Open ETS with full auctioning
Investment costs	€bn	+8.4	+2.8	+3.0
	%	*+1.4%*	*+0.4%*	*+0.5%*
Operational costs (excluding fuel costs)	€bn	+0.07	+0.12	+0.01
	%	*+0.02%*	*+0.04%*	*+0.003%*
Fuel costs	€bn	-55.8	-55.6	-56.0
	%	*-9.6%*	*-9.5%*	*-9.6%*

[121] Closed ETS with full auctioning is not assessed

[122] This is equivalent to -10% compared to 2005 in accordance with the internal reduction scenario for the 2050 target modeled for the purpose of this impact assessment.

Carbon costs	€bn	0.0	+0.7	+30.4
Total costs	€bn	-47.3	-52.0	-22.6
	%	*-3.3%*	*-3.6%*	*-1.5%*

Source: AEA Technology and others 2012

For the reasons explained in section 5.6.2.1, for all ETS options, any annual increase of investment, operational or carbon costs will be compensated by fuel savings. More precisely, considering that the implementation of low carbon technology start 3 years before the entry into force of the ETS, the carbon costs paid during the first year after the entry into force of an open ETS with full auctioning, i.e. 486M€, will be fully compensated by the fuel savings, i.e. 1491M€. Moreover, annual investment costs under an ETS with full auctioning will increase progressively from 17M€ in 2016 to 295M€ in 2030.

The implementation of a maritime ETS would encourage additional investment costs and operational cost (excluding fuel cost). If these increases are moderate at the sector level, a significant increase at the ship level may be possible, especially for less efficient ships, depending on the abatement strategy followed individually.

The most important decrease of costs is coming from the fuel savings. In addition to the fuel savings directly related to ship journeys from and to EU ports, it can be expected that the policy options also trigger fuel cost savings outside this scope as ships become more efficient in reaction to the EU measure (spill-over effect, see section 5.6.2.1).

Overall, significant net savings of up to €52 billion until 2030 for the sector are expected as additional costs are more than compensated by the reduced fuel costs. The savings correspond to average annual savings of €1.57 billion (for a closed ETS), €1.73 billion (for an open ETS with free allocations) and €0.75 billion (for an open ETS with full auctioning).

If all ships above 400GT are included in the scope, the total administrative burden for ship-owners and ship operators is estimated at €149.0 million per year for ETS with full auctioning and at €178.6 million per year for open or closed ETS with free allocations. This means between €8100 and €9700 per ship per year and represents annually between 0.80% and 0.96% of the average 2010 operational costs (excluding fuel costs). Detail calculation of the administrative burden is given in annex XIII.

5.8.2.2. Functioning of the internal market and competition

Free movement of goods is unlikely to be affected. This policy option would not lead to a decrease of the volume of goods traded within and outside the EU as the assessment of key commodities shows that the prices of the commodities are not affected by the surrendering of allowances (see preamble of section 5).

The issue of competition between the maritime sector and the other transport modes may be raised in the event of changing shipping costs. Even if a detailed assessment of possible model shift is not feasible within the context of this Impact Assessment, due to the significant cost reduction for shipping, some modal shift from road and rail to shipping may occur.

5.8.2.3. Competitiveness and trade investment flows

The maritime ETS is not expected to have negative impacts on the competitiveness of EU shipping operators compared to non EU shipping operators. Indeed, as any policy option will be flag-neutral, the policy will apply equally to all ships calling into EU ports. However, ships calling more often into EU ports may have the advantage of shorter pay-back periods for investments into their efficiency leading to high fuel cost savings.

Regarding the competitiveness of the EU economy, the detailed analysis of eleven representative commodities shows that the prices of the commodities are not affected by the possible increase of freight rates with the exceptions of natural gas (increase of up to 0.5% under the open ETS with full auctioning) and iron ore (up to +0.3% under the open ETS with full auctioning). Therefore, no significant impacts are expected on the EU economy[123].

5.8.2.4. Impacts on Small and Medium Enterprises

No specific administrative burden on small and medium enterprises[124] has been identified. However, as mentioned in annex II, small and medium enterprises in maritime transport may be more sensitive on getting accurate information on the abatement potential of low technology and their operational impacts. Such information should secure their uptake by companies that are operating only a few numbers of ships and which cannot afford to test technologies on board of their ships.

Large companies account for half of the turnover in Water Transport, but for 1% only of number of companies. This suggests that large firms undertake higher added value tasks and have higher productivity than SMEs. This is likely to be the result of economies of scale which apply strongly in shipping with research showing that firm capacity and net profit are positively related. Therefore, facilitating access to finance is also a key issue to ensure that SMEs will be able to invest and take the benefits of cost savings. To this end, it is noted that revenues are generated under the ETS options with auctioning (see section 5.8.2.10).

5.8.2.5. Public authorities

Public authorities will be affected by the control of compliance (i.e. reporting of emissions, control of the surrendering, etc.) and the enforcement. Detail calculation of the administrative burden is given in annex XIII.

Enforcement is already carried out by Flag State and Port State control. So, the administrative burden related to the enforcement should be very low. The total additional costs for the national public authorities in charge of enforcement are estimated around € 100 000 per year.

The costs borne by the competent authority in charge of controlling the compliance will depend on the option considered. The table below shows the total additional administrative burden according to the different policy options and according to the size of ships concerned

[123] Bearing in mind that these commodities are mostly looked at in isolation and are a small sample of the whole economy, the cumulative impacts of the option may be important.
[124] Pending on the scope, at least 99% of EU maritime transport SMEs could not subjected to the regulation. See annex II

Table 22: Annual additional administrative burden, in € million

	National Competent Authority		EU competent authority	
	All ships above 400GT	All ships above 5000GT	All ships above 400GT	All ships above 5000GT
Closed / Open ETS with free allocation	4.7	3.0	2.9	1.9
Open ETS with full auctioning	5.7	4.3	3.2	2.5

Source: AEA Technology and others 2012

5.8.2.6. Consumers and households

Consumers and households are most sensitive to 5 of 11 commodities assessed: natural gas, refined petroleum products, wearing apparels, office and IT equipment and motor vehicles[125]. The introduction of a maritime ETS would lead to a decrease of the freight rates of these commodities, except natural gas, and therefore, should have no negative impacts on consumers and household. The increase of prices of natural gas, up to 0.5% by 2030 is not sufficient to trigger significant impacts on households. The other commodities are not directly consumed by households. In the event of an increase in their price, the low level of increase should not be sufficient to result in impacts on the final consumers.

5.8.2.7. Specific regions heavily dependent on shipping

As the introduction of a maritime ETS would in general lead to net benefits for the shipping sector, in principle, more intensive impacts in terms of job creation and cost savings could be expected for regions dependent on shipping. No general economic impacts on these regions can be expected (see preamble of section 5 and annex VII).

5.8.2.8. Third countries

As mentioned previously, this policy option is not expected to lead to significant changes of freight rates. As a consequence, major international partners should not be economically affected by an EU regulation.

5.8.2.9. Risk of avoidance

The risk of avoidance for this policy option is similar to the one for option 3b (see section 5.6.2.9).

5.8.2.10. Recycling of revenues

A maritime ETS with auctioning would generate important financial flows, some of which could be recycled back into the sector. Similar mechanism is already foreseen under the

[125] AEA Technology and others 2012

current EU-ETS at the EU level under the NER 300[126]. A maritime ETS with full auctioning would generate around €30 billion up to 2030. So, this option could generate sufficient revenues to incentivise the potential removal of market barriers, especially considering that the additional investment costs requested to improve the energy efficiency of ships is estimated at €3 billion up to 2030.

5.8.3. Social impacts

A maritime ETS would lead to increased expenditure on energy efficiency measures, new ships and/or engines and would contribute to the growth of the global market for these products with positive impacts on employment in Europe. The expected additional investment in technical energy efficiency measures could lead to the creation of up to 21 600 new jobs (for a closed ETS) and 5800 (for an open ETS) in shipyards and equipment manufacturers globally[127]. The additional operating cost of €300 to €400 million due to speed reduction is expected to create a limited number of additional jobs on ships relative to the baseline.

As shown in the table below, the emission reductions of NOx, SO2 and PM due to the reduction of the fuel consumption will lead to substantial benefits for public health[128].

Table 23: Total estimated benefits (health and crop damage) due to reductions in emissions of NOx, SO2 and PM (€ billion) under each scenario for the period 2010-2030, 2010 prices, discounted using a discount rate of 4%

	Benefits: low – high (mean) (€bn)
Closed ETS	6.5 - 18.3 (11.3)
Open ETS – free allocation	6.2 - 17.6 (10.9)
Open ETS – auctioning	6.4 - 18.0 (11.1)

Source: AEA Technology and others 2012

5.9. Option 5: Target based compensation fund

The purpose of a target based compensation is to mutualise the achievement of the target set for the sector. The achievement of the target can be done through in-sector investments or through the purchase of offsets. These actions (in-sector investments or purchasing of offsets) are similar as the one a ship has to perform under an ETS. Therefore, from a modelling point of view, a target based compensation fund can be seen as a single entity under an ETS.

[126] The NER 300 – so-called because it is funded from the sale of 300 million emission allowances held in the New Entrants Reserve (NER) of the EU Emissions Trading System (ETS) - aims to contribute to investments in demonstration and deployment of innovative technologies, including 34 types of renewables.
[127] AEA Technology and others, 2012
[128] These estimates are based on the damage cost function developed under the Clean Air For Europe (CAFE) program.

Assuming that the compensation fund functions as intended, ship-owners and ship-operators will not pay a membership fee to a target based compensation higher than the price of allowances they would have paid if they were directly involved in an ETS.

A target based compensation fund can require a membership fee covering all CO2 emissions in the shipping sector or only CO2 emissions above the target.

If the membership fee is set to cover all CO2 emissions, considering that the level of membership fee will not be higher than the price of allowances ships would have paid if they were directly involved in an ETS, the impact of a target based compensation fund can be considered as similar as an open ETS with full auctioning (see section 5.8).

If the membership fee is set to cover only CO2 emissions above the target, considering that the level of membership fee will not be higher than the price of allowances ships would have paid if they were directly involved in an ETS, the impact of a target based compensation fund can be considered as similar as an open ETS with free allocation (see section 5.8).

The only difference with an open ETS with full auctioning or with free allocation is related to the administrative burden, as investments are required to setup and manage the fund. The administrative burden are in principle similar to option 3c (contribution based compensation fund). Detail calculation of the administrative burden is given in annex XIII.

6. COMPARISON OF OPTIONS

6.1. Introduction

A set of specific criteria to select the most suitable policy option was developed based upon the general criteria set in the IA guidelines. They aim to assess the achievement of the specific objective of the policy option, while considering the 9 IMO principles for the design of market-based measures[129]

These criteria were submitted to stakeholders during the online consultation carried out from January until April 2012 (see section 1.3.3). The consultation results showed that the environmental effectiveness of a possible EU measure is considered most relevant by 65% of the respondents. Other criteria to determine the choice of the policy option considered to be most relevant or relevant by a majority of respondents are the vulnerability of the legislation, its enforceability and the competitiveness of the EU. The other proposed criteria (timeliness, competitiveness of the EU maritime sector and consistency with the related EU measures) are regarded as less important for the choice of the policy option. However, the consistency with EU related policies and shipping competitiveness are nevertheless regarded as relevant for the evaluation and should be maintained as criteria. The timeliness was not considered as

[129] 1 / Effective in contributing to the reduction of global GHG emissions; 2/ Binding and equally applicable to all flag States in order to avoid evasion; 3 /Cost-effective; 4/Able to limit – or at least – effectively minimize competitive distortion; 5/ Based on sustainable environmental development without restricting global trade and growth; 6 /Goal-based approach that is not prescriptive in nature; 7/ Supportive of promoting and facilitating technical innovation and R&D in the entire shipping sector; 8/ Facilitates new technologies in the field of energy efficiency; 9/ Practical, transparent, fraud free, and easy to administer

relevant for the evaluation, as any policy option can be adopted in consistency with its interaction with policy progress in international fora.

General criteria	Specific criteria for this Impact Assessment
Effectiveness	Environmental effectiveness (To reduce impact of EU shipping emissions on the climate by achieving reduction in CO_2 emissions from maritime transport by 40% (if feasible 50%) by 2050 compared to 2005 levels – Specific objective 1)
	Vulnerability: Exposure to/Risk of evasion
	Enforceability (Ensure appropriate monitoring, reporting and verification while keeping administrative burden to the minimum)
Efficiency	Shipping competitiveness (Promote technological improvement of ships, with respect of flag neutrality principle, and improve the competiveness of maritime supply chains of the EU, by supporting continued innovation of the European shipbuilders, equipment manufacturers and service providers of the shipping sector – Specific objective 2)
	Maintaining and enhancing competiveness of the EU
Consistency	Stimulating actions by others, including the IMO (Specific objective 3)
	Consistency with the related EU policies
	Timeliness (Consistency with timing of application of measures and interaction with policy progress in international fora)

In addition to these criteria, the policy options were also assessed considering their ability to remove market barriers, which are the key driver of the increase of CO2 emissions in the shipping sector, as mentioned in section 2.

Using these criteria, the comparison of options is based on the results of the quantitative and qualitative assessments of the economic, environmental and social impacts (see section 5).

6.2. Effectiveness

6.2.1. Removal of market barriers

All market barriers are addressed by just two of the options analysed: the contribution based compensation fund (option 3c) and the target based compensation fund (option 5).

In theory two further options could address all market barriers, including the market barrier relating to access to financing, notably the tax on emissions (option 3b) and an open ETS with full auctioning (option 4c). However, this would only be the case if Member States would agree on the recycling of national revenues or if alternative instruments/interventions are setup.

Other ETS options (4a – closed ETS) and (4b – open ETS with free allocation) are not generating revenues and therefore no revenues can be recycled in the sector to address the market barriers related to access to finance. However, these options do not prevent the implementation of alternative instruments/interventions to address the market barrier related to access to finance. These alternative instruments will be in any case independent of the policy options and cannot therefore be considered as part of the evaluation of these options.

The monitoring based on fuel consumed (option 2) will only address the market barriers related to the lack of information. At the same time robust MRV regime should contribute to increasing awareness of the environmental consequences and economic opportunities of efficiency measures within the sector thereby stimulating early action and investment.

The levy on bunker fuel sales (option 3a) could only address the market barrier related to access to finance if Member States agree on the recycling of national revenues or if alternative instruments/interventions are setup to address this market barrier.

Finally, the baseline (option 1) is not expecting to address any market barrier.

Table 24: Key market barriers addressed,

Options	Key market barriers		
	Lack of information	Split incentives	Access to finance
Option 1 – Baseline			
Option 2 – Monitoring based on fuel consumed	✓		
Option 3 – Levy on emissions			
3a - Levy on bunker fuel sales			✓*
3b - Tax on emissions from fuel consumed	✓	✓	✓*
3c - Contribution based compensation fund	✓	✓	✓
Option 4 – Maritime ETS			
4a - Closed ETS	✓	✓	
4b - Open ETS with free allocation	✓	✓	
4c - Open ETS with full auctioning	✓	✓	✓*
Option 5 – Target based compensation fund	✓	✓	✓

**if Member States agree or if other instruments/interventions are established*

6.2.2. Environmental effectiveness

A closed ETS (option 4a) delivers the highest in-sector emission reductions followed by the tax on emissions from fuel consumed (option 3b), the contribution based compensation fund (option 3c), the open ETS with free allocation (option 4b), the open ETS with full auctioning (option 4c) and the target based compensation fund (option 5) which have similar positive results. However, for options the contribution based compensation fund (option 3c), the open ETS with full auctioning (option 4c) and the target based compensation fund (option 5), the in-sector CO_2 reduction is more certain than for the tax on emissions from fuel consumed (option 3b)and the open ETS with free allocation (option 4b) as revenues could be used to remove market barriers. The monitoring based on fuel consumed (option 2) and the levy on bunker fuel sales (option 3a) deliver the lowest in-sector emission reduction compared to the baseline, both with a rather high level of uncertainty.

Table 25: In-sector emission reduction by 2030,

	In-sector emissions by 2030 ($MtCO_2$)	Compared to the baseline	Cumulative in-sector emissions reductions up to 2030 (Mt CO_2)
Option 1 – Baseline	223	-	-
Option 2 – Monitoring based on fuel consumed	218.5	-2%	55.9
Option 3 – Levy on emissions			
3a - Levy on bunker fuel sales	217.0	-3%	40.1
3b - Tax on emissions from fuel consumed	186.8	-16%	335.4
3c - Contribution based compensation fund	186.8	-16%	335.4
Option 4 – Maritime ETS			
4a - Closed ETS	175.7	-21%	377.1
4b - Open ETS with free allocation	186.7	-16%	333.8
4c - Open ETS with full auctioning	186.8	-16%	336.3
Option 5 – Target based compensation fund	186.8	-16%	336.3

Source: AEA Technology and others, 2012

The emission reduction delivered by the closed ETS (option 4a) is in line with the Commission's White Paper on Transport target, i.e. to reduce impact of EU shipping emissions on the climate by achieving reduction in CO_2 emissions from maritime transport by 40% (if feasible 50%) by 2050 compared to 2005 levels, as the reduction achieved by 2030 is in accordance with the internal reduction scenario for the 2050 target (-40%/ -50% if feasible compared to 2005) modeled for the purpose of this impact assessment.

The emission reductions delivered by the contribution based compensation fund (option 3b), open ETS options (4b and 4c) and the target based compensation fund (option 5) could also be in line with Commission's White Paper on Transport target, if ship-owners and ship operators are purchasing out-of sector emission reductions that are supplied from an emission trading system where the emissions are capped in addition to the in-sector emissions reductions of -16% compared to the baseline.

All other options – baseline (option 1), monitoring based on fuel consumed (option 2) and levy on bunker fuel sales (option3a) – fall short of delivering emissions reductions in line with Commission's White Paper on Transport target.

The other environmental impacts are proportional to the reduction of CO_2 emissions, especially air quality.

6.2.3. Vulnerability

Except for the levy on bunker fuel sales (option 3a), where the risk of avoidance is estimated around 55% to 90% of the scope, no policy option is expected to trigger significant risk of avoidance or evasion. The alteration of routes and a switching of ship size of type are very unlikely. Furthermore, no modal shift to road or rail can be expected as the net savings for the shipping sector are more likely to trigger a shift towards shipping.

6.2.4. Enforceability

All policy options consider appropriate and robust MRV of emissions is ensured as an integral part of the measure with the exception of the levy on bunker fuel sales (option 3a) which is based on fuel sales not delivering complete emission figures of shipping activities related to the EU[130].

Table 26: Annual administrative burden for ship owners and ship operators, € million

	Total annual administrative burden	
	All ships above 400GT	All ships above 5000GT
Option 1 – Baseline	0	0
Option 2 – Monitoring based on fuel consumed	52.5	26.1
Option 3 – Levy on emissions		
3a – Levy on bunker fuel sales	Negligible	Negligible
3b - Tax on emissions from fuel consumed	139.9	80.2
3c - Contribution based compensation fund	149.5[131]/ 139.0[133]	86.2[132]/ 80.2[133]
Option 4 – Maritime ETS		
4a - Closed ETS	178.6	105.2
4b - Open ETS with free allocation	178.6	105.2
4c - Open ETS with full auctioning	149.0	87.4
Option 5 – Target based compensation fund	149.5[132]/ 139.0[132]	86.2[132]/ 80.2[133]

Source: AEA Technology and others 2012

The administrative burden is very low for all policy options compared to the net savings for the sector of around € 25 -50 billion up to 2030 for most policy options (see section 6.3.1). Apart the baseline scenario (option 1), the administrative burden is lower for the levy on emissions (option 3) and the monitoring based on fuel consumed (option 2) than other options. For the other options, the administrative burden for ships and ship operators is in the same order of magnitude.

Administrative burden for public authorities for all policy options are very low, in particular compared to other costs and benefits related to the policy options.

Overall, the enforceability considering appropriate monitoring, reporting and verification while keeping the administrative burden to a minimum can be considered best for monitoring based on fuel consumed (option 2) as MRV is ensured at lowest cost. The costs of setting benchmarks for an ETS with free allocation (options 4a and 4b) would make administrative burden the highest. The baseline (option 1) and to a lesser extent the levy on bunker fuel sales (option 3a) cannot be considered as effective regarding the criterion enforceability.

[130] Under this policy option, to large extent, fuel is expected to be purchased outside the EU. Therefore, fuel sales could not be used as basis to determine the total CO_2 emissions of voyages from and to EU ports.
[131] In case of a privately managed fund
[132] In case of a publicly managed fund

6.3. Efficiency

6.3.1. Shipping competitiveness

All policy options except the baseline (option 1), monitoring based on fuel consumed (option 2) and the levy on bunker fuel sales (option 3a) would deliver substantial net savings to the shipping sector serving the EU. ETS types with free allocation (4a and 4b) are expected to deliver the highest absolute benefits for the maritime sector (around €50 billion up to 2030) followed by the contribution based compensation fund (option 3c), the open ETS with full auctioning (option 4c) and the target based compensation fund (option 5), each of them delivering around € 23 to 27 billion up to 2030. The tax on emissions from fuel consumed (option 3b) could in principle deliver similar reduction, but no revenues might be available to incentivise the removal of market barriers as they go to the general budgets of Member States. The monitoring based on fuel consumed (option 2) leads to significantly less savings whereas the levy on bunker fuel sales (option 3a) is the only policy options leading to net costs for the sector.

Table 27: Cost and savings up to 2030, € billion, private discount rate (10%),

	Additional investment, operational and carbon costs (€ bn)	Fuel savings (€ bn)	Net costs (€ bn)	**Ratio savings/ costs**
Option 1 – Baseline	0	0	0	**-**
Option 2 – Monitoring based on fuel consumed	0.6	9.4	-8.8	**15.6**
Option 3 – Levy on emissions				
3a - Levy on bunker fuel sales	70.8	4.8	66.0	**0.07**
3b - Tax on emissions from fuel consumed	29.0	55.9	-26.9	**1.9**
3c - Contribution based compensation fund	29.0	55.9	-26.9	**1.9**
Option 4 – Maritime ETS				
4a - Closed ETS	8.5	55.8	-47.3	**6.5**
4b - Open ETS with free allocation	3.5	55.6	-52.0	**15.8**
4c - Open ETS with full auctioning	33.5	56.0	-22.6	**1.7**
Option 5 – Target based compensation fund	33.5	56.0	-22.6	**1.7**[133]

Source: AEA Technology 2012

In relative terms, the open ETS with free allocation (option 4b) delivers the highest savings/costs ratio for the maritime sector. However, it has to be stressed that an open ETS with entirely free allocation does not bring revenues that could be used inter alia to remove market barriers. So, this ratio would be lower in case of partial free allocation. The

[133] If the target based compensation fund is assimilated as an open ETS with free allocation, this ratio should be equivalent to option 4b.

monitoring based on fuel consumed (option 2) is also an option that delivers absolute savings compared to the additional costs requested.

Moreover, the contribution based compensation fund (option 3c) and the target based compensation fund (option 5) generate revenues that can be rechanneled in the maritime sector to improve the competitiveness of the EU maritime supply chain. For the open ETS with full auctioning (option 4c), revenues could be rechanneled as well whereas for the levy on bunker fuel sales (option 3a) and the tax on emissions from fuel consumed (option 3b),such use in the maritime sector would be subjected to the initiative of the Member States.

Overall, shipping competitiveness could be best ensured by the closed ETS (option 4a) and the open ETS with free allocation (option 4b) with the highest net savings for the sector. In this context, the monitoring based on fuel consumed (option 2 with very good savings/costs ratio, but limited absolute savings) as well as the tax on emissions from fuel consumed (option 3b), the contribution based compensation fund (option 3c), the open ETS with full auctioning (option 4c) and the target based compensation fund (option 5) could be regarded as positive with – for the four latter policy options – substantial net savings in the order of magnitude of € 22-26 billion up to 2030 and a good savings/costs ratio. The baseline (option 1 with no savings) and the levy on bunker fuel sales (option 3a with high additional costs) are not expected to be able to contribute to shipping competitiveness.

6.3.2. Maintaining and enhancing competiveness

The policy options are not expected to generate major general economic and social impacts, except the levy on bunker fuel sales (option 3a) which could lead to a closure of some bunker fuel suppliers in Europe. Furthermore, no significant negative impacts on SMEs have been identified.

6.4. Consistency

6.4.1. Stimulating actions by others, including through the IMO

Any IMO agreement will require a strong monitoring and reporting of emissions. Therefore, the monitoring of emissions from fuel consumed (option 2) could serve as a catalyst for global measure without prejudging what kind of market based measure will be implemented. All options that generate revenues (contribution based compensation fund (option 3c), target based compensation fund (option 5), open ETS with full auctioning (option 4c)) could also be used to pool financing in support of international climate action (e.g. Green Climate Fund) or to facilitate technical assistance and cooperation in view of efficient shipping.

6.4.2. Consistency with EU related policies

As under the baseline (option 1), maritime transport would remain the only transport mode or industrial sector not covered by the EU's GHG reduction commitment, this option cannot be regarded as consistent with EU related policy. All other options could in principle be used to set a carbon constraint on CO_2 emissions from maritime transport (although the monitoring of emissions from fuel consumed (option 2) is only the first step in this direction that does not set a carbon constraint by itself), in line with the respective operational objective defined in section 3.

6.5. Concluding remarks

Table 28 summarises the comparison of policy options based on the explanations given in the previous sections 6.2 – 6.4.

Table 28: Overview of assessment of policy options

		Options								
General criteria	**Specific criteria**	1	2	3a	3b	3c	4a	4b	4c	5
		Baseline	Monitoring fuel	Levy fuel sales	Tax emissions	Contribution-based fund	Closed ETS	Open ETS allocation	Open ETS auctioning	Target-based fund
Effectiveness	Market barriers addressed	o	(+)	(+)	+	++	+	+	++	++
	Environmental effectiveness	o	(+)	(+)	+	+	++	+	+	+
	Vulnerability	o	o	--	o	o	o	o	o	o
	Enforceability	o	++	o	+	+	(+)	(+)	+	+
Efficiency	Shipping competiveness	o	+	--	+	+	++	++	+	+
	Maintaining and enhancing competitiveness	o	+	--	+	+	+	+	+	+
Consistency	Stimulating actions by others, including the IMO	o	++	+	o	+	+	+	+	+
	Consistency with the related EU policies	o	+	+	+	+	+	+	+	+

++: very positive +: positive (+): slightly positive o: neutral -: negative --: very negative

A graphical representation of this table is given in Annex XI.

Considering the market barriers addressed, the contribution based compensation fund (option 3c), the open ETS with full auctioning (option 4c) and the target based compensation fund (option 5) could be regarded as the best options as they could address all three main barriers (lack of information, split incentive and lack of access to finance). However, as discussed earlier the open ETS with full auctioning could be considered to address the lack of access to finance, only if there is an agreement on revenue spending. The tax on emissions (option 3b) could also address all market barriers, if Member States would set up instruments removing the market barrier related to access to finance.

Concerning environmental effectiveness, the closed ETS (option 4a), followed by the tax on emissions from fuel consumed (option 3b), the contribution based compensation fund (option 3c), the open ETS with free allocation (option 4b), the open ETS with full auctioning (option 4c) and the target based compensation fund (option 5) could be regarded as the best. However, for the tax on emissions (option 3b) no out-of sector emission reductions can be expected.

Regarding efficiency, the monitoring of fuel consumed (option 2) the open ETS with free allocation (option 4b) deliver the highest benefit/cost ratio for the sector, but the contribution based compensation fund (option 3c), the open ETS with full auctioning (option 4c) and the target based compensation (option 5) generate revenues that could be used for removing market barriers. However, all the highly environmental effective policy options deliver similar benefit/cost ratio for society.

A non-global levy on bunker fuel sales (option 3a) is not suitable, as it will trigger evasion that will undermine the environmental effectiveness of the measure. Moreover, this option brings very high additional costs, without providing significant savings. The baseline option is not a suitable option, as any action will trigger environmental, social and economic benefits for the maritime sector.

It is also clear that all policy options based on fuel consumed will require a strong monitoring and reporting of CO_2 emissions from fuel consumed. So, even if the contribution based compensation fund (option 3c), all three ETS types (options 4a, 4b, 4c) and the target based compensation fund (option 5) can be considered as the most suitable options, the implementation of the monitoring of fuel consumed (option 2) will be a prerequisite for all policy options.

Finally, reducing the scope of the measure to ships above 5000 GT will have significant impacts on the administrative burden of all policy options based on CO_2 emissions from fuel consumed, while not significantly undermining the environmental benefits of these measures. It could also limit the impacts on SMEs. For these reason, only ships above 5000 GT should be included in a measure for a first step. This would reduce the administrative burden by around 40% under all options while still capturing 90% of the emissions.

As a conclusion and in accordance with the stepwise approach proposed by Vice-President Kallas and Commissioner Hedegaard, the monitoring of fuel consumed (option 2) should be considered as the option that would be the necessary first step for other policy options leading to more substantial benefits in terms of economic, environmental and social impacts. It would also trigger some emission reductions and other benefits.

For the next steps following the implementation of the monitoring and reporting, it is clear that the levy on bunker fuel sales (option 3a) is not suitable for a regional measure. The other policy options address problem drivers and achieve the environmental objective (although to different degree) with economic and social impact discussed above. Any eventual decision regarding market based measures should be aligned with the option emerging from the relevant deliberations at the IMO.

7. MONITORING AND EVALUATION

In order to monitor and evaluate the progress made towards the reduction of GHG emissions from maritime transport in view of a possible Commission proposal to included maritime GHG emissions into the EU's reduction commitment, the following indicators are proposed:

1. Annual CO_2 emissions from maritime transport within the EU scope measures on ship and fuel consumption basis

2. Annual CO_2 emissions from maritime transport compared to the annual maritime transport activity of the EU (in tonnes-nautical miles);
3. Annual turnover of European shipbuilders, equipment manufacturers and services providers of the shipping sector;
4. Achievement of milestones in IMO process: IMO expert group on monitoring and reporting established, IMO expert group on market based measures pursued, IMO impact assessment on global market based measures launched and measures in place in third countries
5. Number and percentage of ships that are monitoring and reporting their emissions in line with the regulation compared to the number of ships calling into EU ports;

These indicators should be calculated on an annual basis from relevant European Agencies based on data provided by the Competent Authorities. The functioning of measures for monitoring and reporting of emissions as well as for internalisation of climate externalities and any potential revenue recycling should be reviewed periodically.

The first and second indicators are data collected as part of the monitoring and reporting requirements necessary for any policy options, except the tax on bunker fuel sales (option 3a), which was discarded by the impact assessment. They aim to ensure that the first specific objective mentioned in section 3 is fulfilled.

The third indicator is already collected by Eurostat. It aims to ensure that the second specific objective mentioned in section 3 is fulfilled.

The fourth indicator aims to assess the progress made by the IMO and by others to address GHG emissions in the shipping sector. It therefore ensures that the third specific objective mentioned in section 3 is fulfilled.

Regarding the fifth indicator, the number of ships that are monitoring and reporting their emissions will be part of the monitoring and reporting requirements necessary for any viable policy options. The number of ships calling into EU ports can be provided by EMSA using their existing database mentioned in section 4.3. This indicator aims to address the acceptance of the EU regulation by the shipping sector.