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**COMMISSION STAFF WORKING DOCUMENT**

**Impact Assessment - Part 3**

*Accompanying the document*

**Proposal for a Regulation of the European Parliament and of the Council  
on the monitoring, reporting and verification of carbon dioxide emissions from maritime  
transport and amending Regulation (EU) n° 525/2013**

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

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## ANNEX V - PARTICIPANTS AND CONCLUSIONS FROM THE TECHNICAL WORKSHOP HOLD BY AEA TECHNOLOGY IN LONDON ON 9 MARCH 2012

- **Delegates:** 17 participants attended:
  - Antoine Person, LDA (ferries)
  - Didier Vandeveld, MSC (containers)
  - Julien Topenot, CMA-CGM (containers)
  - Paul Altena, Speilthoff (bulkiers)
  - John Rogan, Shell (tankers)
  - Robert Ashdown, European Cruise Council, on the behalf of Tom Strang, Carnival (cruise)
  - Eija Kanto, Finnish shipowner association
  - Sara Skold, Clean Shipping Index
  - Fabien Becquelin, ShortSea on the behalf of Jean-Louis Cambon, Michelin (shippers)
  - Jorgen Clausen, DK Group (equipment manufacturer)
  - Ernst Karchhasrt, Siemens (equipment manufacturers)
  - Robert Derksen, Swiss Climate (service provider)
  - Herman-Josef Mannes, Meyer Werft (shipyard)
  - Jan Huebner, Germanisher Lloyds (verifier)
  - Didier Chaleat, Bureau Veritas (verifier)
  - Geir Hoybe, NOx Fund
  - Andreas Arvanitakis, Point Carbon (ETS expert)
  - Edmond Hughes, from the IMO
  
- **Summary of discussion on policy options**

### *Emissions trading*

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**Enforcement** Regarding enforcement measures, the escalation to detention of a ship was highlighted that this would incur a cost to Port Authorities, particularly if the owner chose to abandon the ship. Denial of entry is considered a strong measure. Delays to a ship would generate huge costs.

There is competition between ports and a need for a level playing field. In the case of an operator with a large fleet, it was asked whether it would be appropriate to detain any ship in that fleet.

**Level of the penalty** It was suggested that penalties should take several factors into account, including whether non-compliance was intentional, and the level of non-compliance. One suggestion was that port fees could be differentiated such that a discount is awarded to ships that are compliant.

**Conclusions** Maritime experts agreed that penalties should be scaled in proportion to the level of non-compliance. This could be enforced through differentiation of port fees. Additional consideration would need to be given to determine the level of underreporting that would trigger penalties.

Whatever the option, it was suggested that the compliance could be ensured thanks to a compliance certificate held on ships.

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### *Mandatory compensation fund*

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**Membership** It was felt that the fund should have open membership. Given the dynamic nature of the industry, it would be helpful to have some flexibility over membership. It was questioned as to whether the membership should be owner-specific or ship-specific. The length of membership was also discussed – from the point of view of the industry, a period of 5-8 years is considered to be long, but it was also recognised that periods of this length would be needed to produce meaningful emission reduction targets.

**Penalties** In terms of appropriate penalties, the system used in the Norwegian NOx fund was offered as a possible solution. Companies are obliged to pay a form of tax if they miss their targets by a certain threshold (e.g. 10%). However, it was suggested that the system currently proposed by the project team (in the background document, i.e. the payment of a refundable deposit) for the CO<sub>2</sub> regulation could be easier to manage, given the much larger number of ships that would be involved.

It would be important for tax/port authorities to police the systems, so it is not up to the Fund to enforce measures. This allows the Fund to concentrate on emission reductions. The money would go to industry but they would have to report to an authority. However, there would need to be an EU regulation to confer this power; at which point, it could be argued that it would not be an industry-only scheme.

**Payment into the Fund** The idea of a returnable deposit received some support – if the deposit were set lower than the obligations imposed on those outside of the system. It was felt that the level of membership fee should be low, although this would reduce the size of the fund. Another suggestion was for a basic rate of membership, but with optional incentives that could be selected, or a form of bonus/malus

**Conclusions** The Norwegian NOx fund was felt to be a good model; however, careful considerations would be needed if expanding to an EU-level measure, as the number of ships would be much greater.

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### *Industry managed compensation fund*

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**Discussion of competent authority** The idea of existing industry associations was suggested (e.g. BIMCO, INTERTANKO). However, these associations would not capture all vessels, so there would need to be a default fund for vessels that were not represented. Giving a mandate to EMSA to play the role of competent authority was also suggested.

The importance of good communication to stakeholders about the different options was highlighted.

It would be important to give Funds the right to evict members who are not complying.

**Conclusions** In general the idea of the industry-managed fund is considered to be the best option by many of the maritime experts.

The idea of funds by type of vessel was viewed positively by most experts. However, the way that targets would be set would have to be considered carefully.

Some calculations would be needed to work out the relative size of the Funds, and whether they would have large enough membership to generate significant revenues.

### *Mandatory emission reductions*

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**Indicator** Maritime experts pointed out that a good indicator would allow efficient ships to differentiate themselves and allow best practice sharing. This would only be possible through transparency.

A product called the “Eco toolbox” to manage all environmental aspects e.g. water ballast, cargo etc. was discussed. It has had positive effects on operational efficiency when used in the container sector. However, it could be very difficult for the existing world fleet to rely on these measures.

It was pointed out that the EEDI does not apply to all ships. The EEOI was not considered to be a feasible indicator as it would not work for tramp shipping because have no control over their EEOI. It was generally agreed that the EEOI cannot form a reliable indicator for the shipping sector.

**Conclusions** Maritime experts were of the opinion that there is no indicator that could be applicable to the shipping sector. They felt that this option would not be feasible.

### ➤ Administrative aspects

**Fuel measurement technologies** The only existing mandatory instrument to measure fuel supply is the bunker delivery note. Many schemes advocate the use of it, but over time other measures could be introduced. Even the bunker delivery note would be inaccurate as it wouldn't take into account measures onboard. Maritime experts pointed out that not every ship has a flow meter (even if, the largest the ship is, the most they have a flow meter), and they need to be calibrated accurately to the fuel type. This would impact the cost calculations. It would be possible to detect gross mis-reporting through use of several different measures.

There would need to be some back-up system for all circumstances – for example, if a ship's flow meter broke.

Monitoring using a particular recommended technology could be voluntary for an introductory period, during which incentives would be offered to ships that fit this technology. However, there is a risk that ships will have to pay twice if a global system comes into force that was to require a different technology.

Uncertainties would be smaller for big companies (<2%), whereas smaller operators would have lower accuracy. Manual measurements are not reliable either. There are no international standards.

The IMO cited some data on ship thresholds: ships >5,000 GT = 22,000 vessels, and would account for 99% of vessels. For ships >2,000 GT would account for 96%

**Administrative burden** It was suggested that it would be difficult to ask the crew to do additional tasks because they already have a high workload. In general, the view was that it was possible to monitor fuel consumption, and it would not place undue additional burdens on the crew. The regional scope would add some complexity. There was much discussion about sophisticated electronic monitoring that is currently in use of larger/modern ships. With respect to smaller ships, it could be possible to amend the oil record book to reflect how much fuel consumption occurred within the scope of the scheme. Every ship must have an oil record book and the data quality is very good. There are particular codes for different operations. Another line could be created with a new code that indicates when a ship enters the scope, and another line that records when it leaves. Based on this data it would be possible to calculate the amount of fuel consumed in the EU. However, there are still issues that would need further consideration, such as who would control its application and ensure correctness.

Some maritime experts felt that the public sector should pay for the verification, and the industry should not bear the cost of this.

**Verification** In terms of verification, it was felt that auditors should be able to certify the *processes* used to monitor fuel consumption, and that this could be done in the back offices. In some cases, it may be necessary to board the ship, but that would be possible as it is already done (e.g. low sulphur regulations). It was suggested that class societies would be able to approve monitoring plans. At a high level it would be possible to use AIS data to check consistency and plausibility of reported emissions.

**Monitoring guidelines** In terms of defining monitoring guidelines, it was recommended that a matrix should be created that identifies the pros and cons of each technology for each sector. It could be better to have a common methodology to ensure uniformity, otherwise ships would use the method that gives them the least emissions.

**Conclusions** The cost for larger vessels would be a much smaller percentage of overall costs. If the IMO figures are correct, then it makes sense to focus on larger ships, who would find compliance easier in any case.

Focussing on larger ships initially would also allow the rest of the sector to learn.

➤ **Other business**

- Freight rates are very sensitive to competition
- Stakeholders pointed out that the fuel prices presented by the project team are based on a very old source and that the figures for 2010 are not accurate.
- The prices of MDO/MGO will increase in the future.
- In general, it was felt that the fuel prices were rather low
- It is expected that the sulphur regulations are more likely to be realised in 2025, rather than 2020
- LNG as a retrofit was not considered to be a feasible option at present. If it does penetrate the fleet it would probably happen only gradually
- Prices of fuels are different in different regions of the world
- The elasticities also vary by region. It is very difficult to come up with reliable figures.

## ANNEX VI - METHODOLOGY FOR MODELLING

### 1. GENERAL ASSUMPTIONS

If bunker fuel sold in the EU was considered, there would be a gap between the volume of bunker fuel sold in the EU and the volume of bunker fuel consumed on EU routes. As the purpose of the measure is to address EU GHG emissions of ships, the environmental, social and economic impact assessment is based on bunker fuel consumed. Considering the bunker fuel sold in the EU will not lead to an exhaustive assessment of the impacts of GHG emissions of ships in the EU (e.g. a ship calling into the EU ports will have an impact on EU local air quality, even if it purchased its fuel outside of the EU), but it can trigger impacts outside of the EU. However, the administrative burden and the risk of avoidance of an internalisation of climate externalities based on bunker fuel sold in the EU are nevertheless duly assessed.

The assessment of the impacts has been estimated considering the compliance entity is the ship. The measure intends to have a direct effect on CO<sub>2</sub> emissions from ships. However, other compliance entities may be chosen triggering an indirect effect on CO<sub>2</sub> emissions from ships, which may mitigate the impacts mentioned hereafter.

### 2. GENERAL ASSUMPTIONS OF THE BASELINE SCENARIO<sup>1</sup>

The baseline scenario was established 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. In particular the global redesign scenario is considering:

- Strong, sustainable expansion in emerging markets.
- Monetary policy gradually adjusted in line with growth prospects. Asia starts tightening first, followed by the United States and Europe/Japan.
- Inflation is kept at bay.
- Large developed economies adopt measures to reduce budget deficits.
- After shrinking in 2009, US trade deficits widen again.
- As consumer demand expands in emerging markets a process of global rebalancing begins.
- Trade liberalization continues, but troubled by occasional disagreements and conflicts.
- US dollar depreciates mostly against emerging markets currencies, especially the renminbi.
- By 2030 China's economy accounts for a significant share of global trade, including key commodities and manufactured goods.
- The relative change in real GDP per capita is much quicker in the emerging markets than in the developed countries.

Figure 1 illustrates the compound annual growth rate (CAGR) of the developed world (US, W Europe, Japan) in the 20 years leading up to the great recession. The CAGR was 2.3%. In the Global Redesign scenario the CAGR for the years following the recession up to 2030 is forecasted to be lower, 2.1%.

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<sup>1</sup> Source: IHS Fairplay, 2012

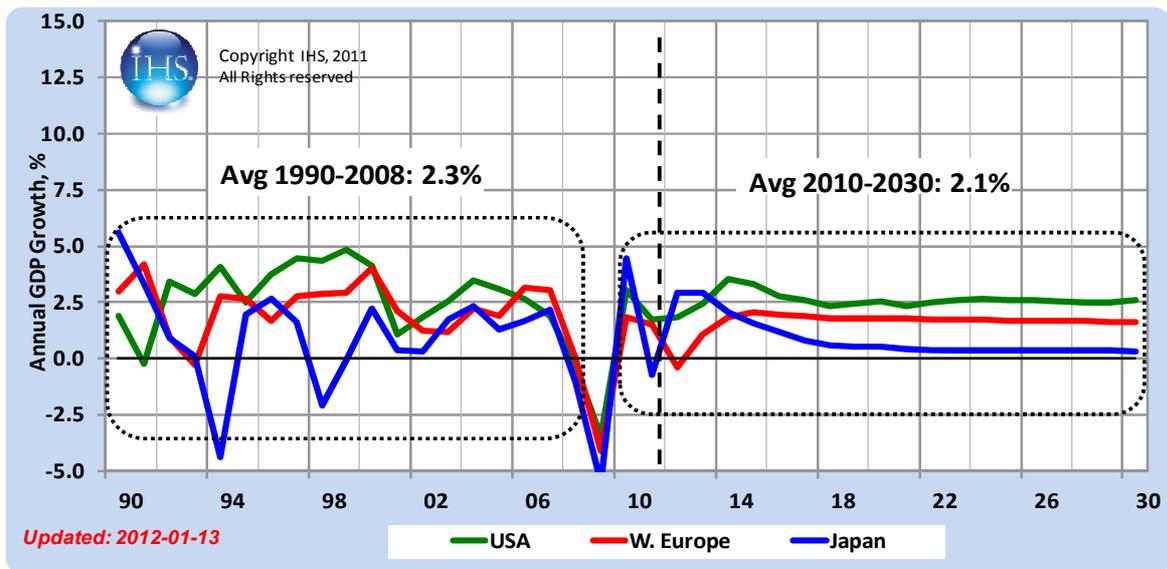


Figure 1: GDP growth in the developed regions

Figure 2 shows how the CAGR for three of the leading emerging market economies is expected to be lower in the forecast years compared to the two decades before the recession.

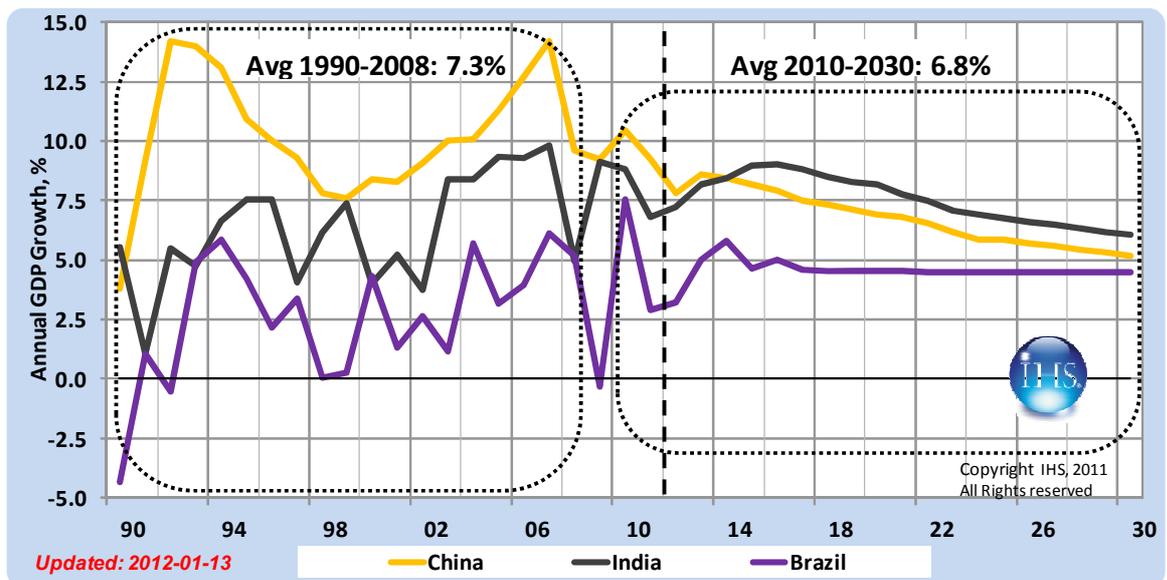


Figure 2: GDP growth in key emerging markets

As a result the world total CAGR for GDP increases as displayed in Figure 3. This is a consequence of the still higher growth in the emerging markets which gain market share each and every year and thereby lifts the world total. Figure 4 shows the absolute numbers behind the development, where the share of the world GDP of the Asian emerging markets continuously increases over the period on the expense of the developed regions' share.

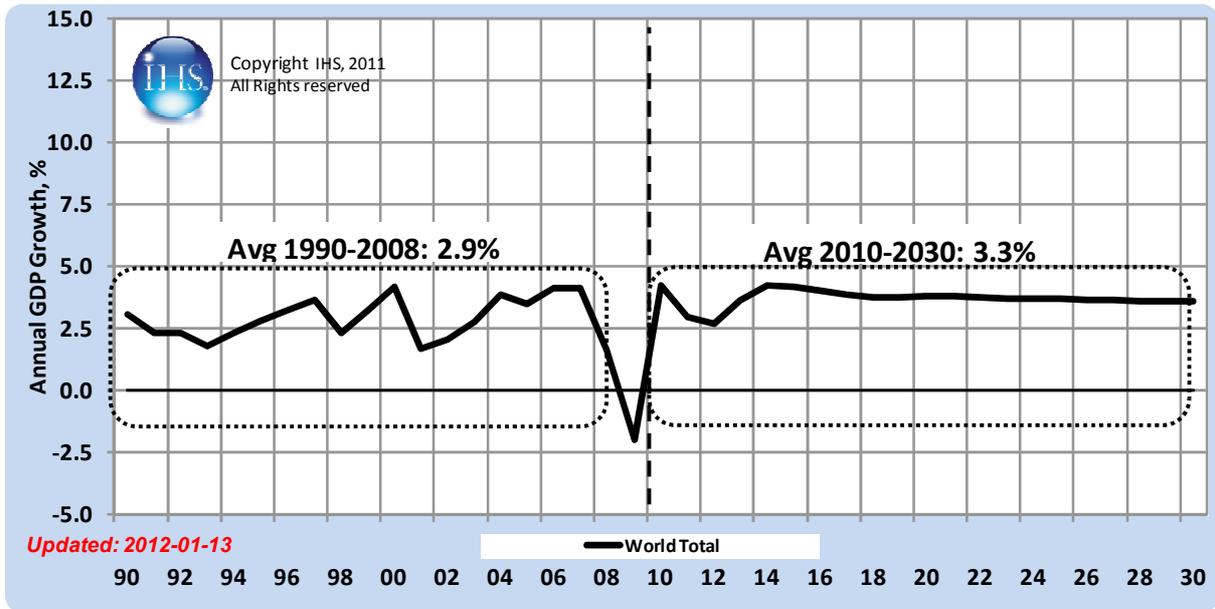


Figure 3: Global GDP growth

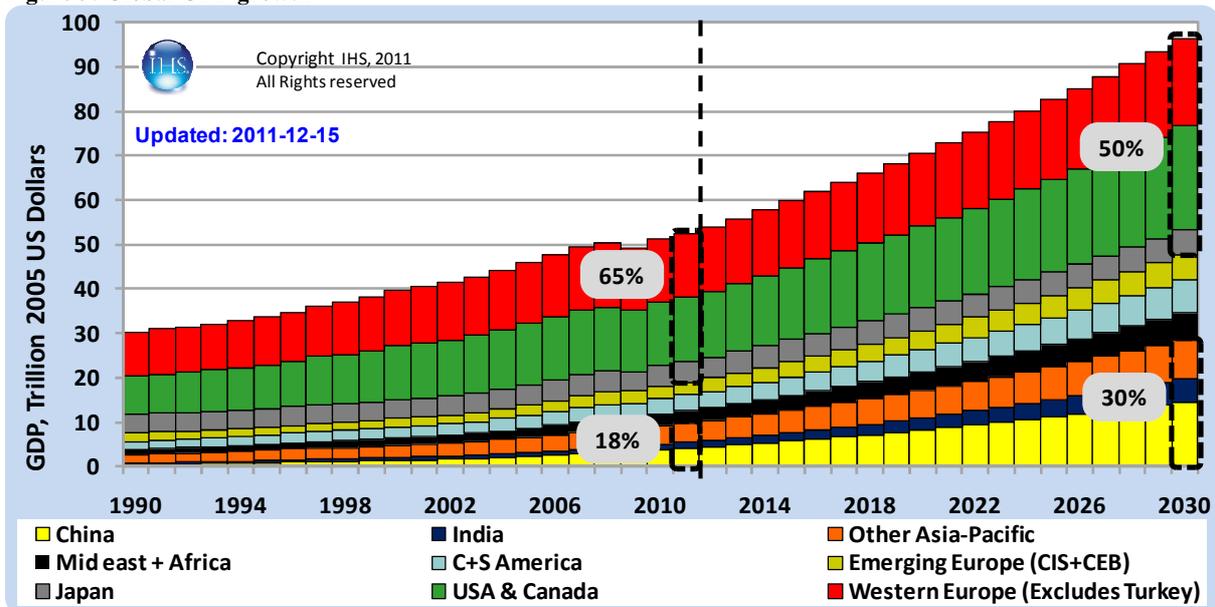


Figure 4: Global GDP, trillion 2005 US dollar

### 3. DESCRIPTION OF THE MODEL

#### 1. Overview

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<sub>2</sub> 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.

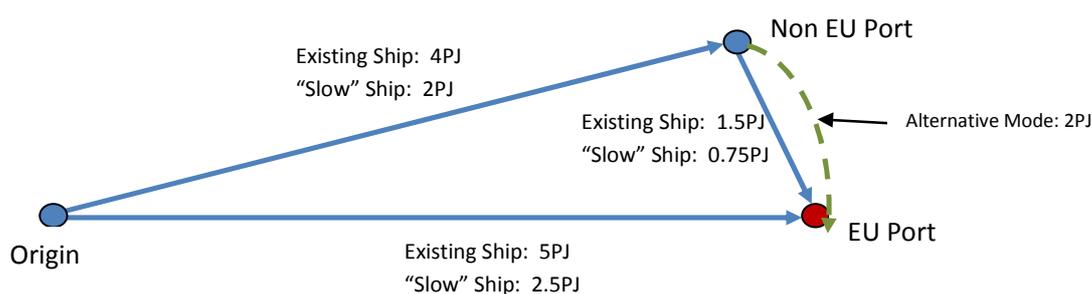
## 2. Representation of shipping activity

The model integrates the available routes into/out of Europe and available technological and logistical choices to 2050. Key amongst these are:

- the ability for ships to stop at a port just outside the EU,
- the ability to divert freight to alternative modes via a port just outside the EU, or for intra-EU trade,
- the possibility for technology change in the shipping fleet (i.e. new ships and/or efficiency measures).
- the option for ships to slow down and thus reduce emissions.
- the possibility for fuel switching in the shipping fleet.

Therefore, in addition to standard TIMES energy system model functionality, a network model is required depicting the various routes and modes for goods currently shipped into and out of Europe. The model includes the flexibility to switch between these routes and modes.

**Figure VI.5: Hypothetical Network & Technology Model Showing Routes of Fuel Consumption<sup>2</sup>**



Trade data for cargo categories, including historical data and projections up to 2050 were provided by IHS World Trade Service. Extra-EU data was available by the region of trade and commodity type.

The regions within the TIMES model were defined according to those used by the IHS World Trade Service to report the trade data. There are two EU regions: EU Northern/Baltic and EU South/Mediterranean, and 13 extra-EU regions. Distances between regions were defined in order to calculate fuel consumption on each route. For this purpose, a representative port was defined in each extra-EU region, and two ports for each EU region. The distances in nautical miles were calculated between these representative ports using <http://www.portworld.com/map/>.

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<sub>2</sub>

<sup>2</sup> Note: "Slow" ships require double the capacity of the existing fleet to serve an equivalent demand

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.

### 3. Representation of vessels

A summary of ship sizes/types is shown here. For each of these categories of ships, several parameters, such as daily financial costs, daily operational costs, fuel consumption, CO<sub>2</sub> emissions per tnm, etc. were defined

**Table VI.1: Summary of ship sizes and types**

Type	Size
Dry Bulk	Dry bulk Capesize 120'+
	Large Dry Bulk carrier (80' +)
	Medium Dry bulk carrier (35' - 85')
	Small Dry Bulk carrier (<35')
General Cargo	General Cargo 15'++
	RoRo 35'-++
	GEN long avg of GEN 15'++ and RoRo 35' ++
	RoRo 15' - 35'
	GEN short avg of GEN 0-15' and Reefer 0-15'
Container ships	Container 8500 TEU +
	Container 5500 - 8500 TEU
	Container 2000-5500TEU
	Containers 1000-2000TEU
	Container 0 - 1000 TEU
Oil (and product) tankers	Crude oil tanker 120'++
	Crude oil tanker 120' + , Product tanker 75' +
	Crude oil tanker 75-120', products 15-75'

Type	Size
	Crude oil tanker 0-75'and Products 0-15'
Liquid bulk (Chemical, LNG, LPG tankers)	Chemical 40'-++, LNG 60'++
	Chemical tanker 40' ++ and LPG 45'++
	Chemical tanker and LPG 15-40'
	LNG tanker 0'-15' and Chemical 0 - 15'
Passenger vessels	Ships carrying up to 1000 passengers

Source: size thresholds based on categories used in data provided by Marintek, IHS and IMO sources

#### 4. Cost assumptions

##### *Abatement technologies*

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<sub>2</sub> reduction potentials of the abatement technologies were sourced from MEPC 61 INF. 18<sup>3</sup>, an IMO-funded study on the reduction of GHG emissions from ships. These costs are variable depending on the ship size and type. Changes were made to the data sourced from MEPC 61 INF.18 in only three areas: speed reduction, optimisation of hull & superstructure (new ships), LNG costs (investment cost and operational cost), as updated data were available from Marintek.

##### *Fuel types and costs*

A generic maritime fuel was assumed to be used in existing cargo ships, rather than defining ships that run on residual fuel (HFO) and distillate marine fuel (MDO/MGO) separately. This assumption was used in order to keep the model compact and facilitate the interpretation of results. A new alternative technology is included in future years, i.e. ships that use liquefied natural gas (LNG) as fuel.

Wholesale fossil fuel price projections were sourced from the PRIMES model crude oil price and natural gas price projections developed for the Commission's 2011 Energy Roadmap (as obtained from the EC). There are three price scenarios: Reference, Current Policy Initiatives, and Decarbonisation. While the prices under the Reference Scenario and Current Policy Initiatives are similar in the years 2010 and 2015, the Decarbonisation Scenario projects significantly lower fossil fuel prices throughout the time horizon.

All three of the PRIMES crude oil price projections were used as the basis for developing price projections for maritime fuels. The impacts of sulphur regulations on prices were calculated using

<sup>3</sup> [http://www.rina.org.uk/hres/mepc%2061\\_inf\\_18.pdf](http://www.rina.org.uk/hres/mepc%2061_inf_18.pdf)

results from the Purvin & Gertz (2009) report to the Commission on the impacts of IMO fuel specification changes and included in the fuel price scenario.

**Table VI.2: Maritime bunker fuel price projections (EUR/tonne)**

	2010	2015	2020	2025	2030	2035	2040	2045	2050
Reference (Central prices)	328	375	606	710	755	808	861	909	977
Current policy initiatives (CPI)	386	418	636	745	791	847	903	954	1024
Decarbonisation	328	373	548	575	539	539	533	520	512

The CPI scenario was used as a reference for the impact assessment, as it reflects the current policy initiatives scenario.

#### *Administrative costs*

Additional administrative costs included in the model assume a minimum of five days investigation time (at €500 per day), with additional costs of 5% of the investment cost of the measure.

#### **4. IN-SECTOR REDUCTION TRAJECTORY**

It has been analysed how to achieve the objectives defined in the White Paper on Transport, namely a 40% reduction in GHG emissions by 2050 compared to 2005, through only action within the maritime sector. It has been assumed for this trajectory that the sector has no access to “flexibilities” such as the possibility to substitute in-sector emission reduction by purchasing offsets (carbon credits) or emission allowances (EUA). This trajectory could be achieved by setting up a closed ETS for the maritime sector only.

International fossil fuel price assumptions do not presuppose significant global climate action and thus follow global baseline projections, i.e. 791€/t by 2030 and 1024€/t by 2050.

The trajectory was set by trying to minimise cost subject to the constraint of the in-sector emission reduction of 40%. The results show emissions reduce from 2015 onwards, reaching -10% by 2030 compared to 2005.

**Table VI.3: In-sector reduction trajectory**

	2015	2020	2025	2030	2035	2040	2045	2050
Business as usual	199	210	217	223	233	244	255	271
Reference in-sector reduction trajectory for the Impact Assessment								
In-sector reduction trajectory	199	195	184	176	162	145	131	119

Reduction compared to 2005 emissions	2%	0%	-6%	-10%	-17%	-25%	-33%	-40%
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Source: AEA Technology 2012

It is worth to recall that if the domestic GHG reduction milestones of the Roadmap for Moving to a Competitive Low Carbon Economy in 2050<sup>4</sup> are achieved, demand for fossil fuels in the EU may be reduced significantly, reducing also the need for shipping these fossil fuels. To illustrate the possible impact of reduced demand for shipping, a sensitivity analysis was carried out assuming that the same in-sector reduction trajectory is applied. The reduction of transport activity due to decreasing shipping of fossil fuels necessarily leads to higher emissions reductions than the reference in-sector reduction scenario mentioned in table VI.3.

Table VI.4: Sensitivity analysis assuming a decarbonisation of the EU economy

	2015	2020	2025	2030	2035	2040	2045	2050
In-sector reduction trajectory	199	190	176	167	152	134	119	109
Reduction compared to 2005 emissions	2%	-2%	-10%	-14%	-22%	-31%	-39%	-44%

Source: AEA Technology 2012

Moreover, a sensitivity analysis was carried out assuming that administrative costs related to the uptake of technology were higher than 5% of the investment cost of the measures. A threshold of 10% was chosen. However, this increase did not lead to a significant change in the uptake of technology: the CO<sub>2</sub> emissions remain similar to the internal optimal reduction trajectories, even if the total costs increase by 0.04%.

A sensitivity analysis was also carried out assuming low bunker fuel prices, which is associated with a global decarbonisation scenario.

Table VI.5: Internal optimal reduction trajectories according to different fuel prices

		2015	2020	2025	2030	2035	2040	2045	2050
Emissions (MtCO <sub>2</sub> )	High fuel price	199	195	184	176	162	145	130	119
	Low fuel price	199	197	187	180	168	147	132	119
Reduction compared to 2005	High fuel price	2%	0%	-6%	-10%	-17%	-25%	-33%	-40%
	Low fuel price	2%	1%	-4%	-8%	-14%	-25%	-32%	-40%

Source: AEA Technology and others 2012

The in-sector reduction trajectory is not expected to vary significantly, even if the emission reduction may be delayed. Regarding the costs, even if there is a significant difference (around 7%) between the total costs of the in-sector reduction trajectory using high fuel prices and low fuel prices, this difference is mainly due to fuel costs. Indeed, others costs do not vary significantly (less than 1% difference for investment costs and even lower for operational costs). So, the impacts on policy options assessed should not significantly differ regarding fuel prices.

## 5. SCENARIO ASSESSED

The policy analysis only considers the time period up to 2030 to look at concrete policy proposals. Taking into account the in-sector reduction trajectory to achieve the long term goal of -40% by 2050, a reduction goal of -10% is set for 2030 to assess the different potential policy instruments to achieve such a goal.

The modelling simulates two types of policy instruments, i.e. a levy and an emission trading system (ETS). Any policy option assessed, except the option on monitoring and reporting based on fuel consumed (option 2), can be linked with these policy instruments. In particular, due to similar mechanisms, the contribution based compensation fund was assessed considering a levy with full recycling on revenues and the target based compensation fund was assessed based on an ETS with full auctioning and full recycling of revenues. The option on monitoring and reporting based on fuel consumed was assessed using academic studies, in particular the Maddox study, and stakeholder consultations.

The impacts associated with different levels of the levy are assessed. For the ETS the impact of a stand-alone system or a system linked to other trading systems is assessed, assuming different options for free allocation and auctioning.

The scenarios that look at impacts of different policy instruments up to 2030 apply a number of assumptions in order to allow results to be compared:

- The assessment of the impacts of the internalisation of climate externalities is based on the assumption of no evasion or avoidance of the system, as any regulation must be designed in such way to minimize avoidance.
- Private discount rates are applied and the model assumes efficient implementation of possible mitigation options, with no market barriers.
- Global oil prices are as listed in table VI.2
- Shipping of fossil fuels is not reduced due to climate action in the EU.

The model is a partial equilibrium model focused on the shipping sectors. Therefore macro-economic impacts, including potential double dividend benefits from raising revenue through auctioning or a levy are not estimated in this model.

The results focus on the impacts on the costs of shipping itself. For options that include a certain amount of free allocation, it is assumed that ship operators will not incorporate the opportunity costs of these free allowances in its price setting. This specific assumption therefore might underestimate the cost increasing impact on shipping prices and underestimate the windfall profits that might materialise for shipping operators if free allocation is applied.

### 5. Levy

Three scenarios were assessed based on the level of the levy:

- Internal reduction scenario: A level of levy that would ensure that emissions reduce by 10% by 2030 within the shipping sector
- Levy high ETS prices: A level of levy that corresponds to the carbon prices required to achieve the 2030 milestone from the 2050 Low Carbon Economy Roadmap<sup>5</sup>.
- Levy low ETS prices: A level of levy that corresponds to the carbon prices with no additional action on climate change in the EU beyond policies already implemented<sup>6</sup>.

The table below shows the level of the levy marginal abatement costs of achieving an emission reduction of 10% by 2030 compared to 2005.

**Table VI.6: Level of levy considered**

(2010 prices)	2020	2025	2030
Internal reduction scenario <sup>7</sup>	19.73	137.62	470.61
Levy high ETS prices	25.0	34.2	50.9
Levy low ETS prices	9.13	21.37	35.55

If all emissions are reduced internally, carbon prices would need to increase considerably, to levels above € 400 by 2030. It does not appear economically efficient for the level of the levy to be set at such level, as the marginal abatement costs of other sectors is likely to be lower (e.g. 50.9€/tCO<sub>2</sub> considering the EU ETS prices in case of a step up of ambition in line with the 2050 Roadmap). In other words, this demonstrates that the in-sector reductions in line with the cost-effective reduction trajectory of the economy as a whole (as shown in the Low Carbon Economy Roadmap) would be lower: at around 5% by 2030, as opposed to the 10% in-sector reduction in line with the reference trajectory mentioned in table VI.3.

**Table VI.7: Comparison between the level of the levy and the emissions**

		2020	2025	2030
Emissions (MtCO <sub>2</sub> )	Levy low ETS prices	194,2	185,9	186,7
	Levy high ETS prices	193,9	185,7	186,4

<sup>5</sup> The carbon prices used are those equivalent to the low carbon scenario in SEC(2011) 288 final (Table 31), achieving 80% reductions in the EU by 2050, using effective technologies with fragmented global action on climate and reference fossil fuel prices.

<sup>6</sup> The carbon prices used are those equivalent to the reference scenario in SEC(2011) 288 final, assuming policies at EU and national level already implemented, with fragmented global action on climate and reference fossil fuel prices. These carbon prices would see emission only reduce by 40% by 2050, well short of the -80% as projected in the 2050 low carbon Roadmap scenarios.

<sup>7</sup> AEA Technology and others, 2012

	Internal reduction scenario	194,8	180,8	176,1
Reduction compared to the baseline	Levy low ETS prices	-7%	-14%	-16%
	Levy high ETS prices	-7%	-15%	-17%
	Internal reduction scenario	-7%	-17%	-21%
Reduction compared to 2005	Levy low ETS prices	-1%	-5%	-5%
	Levy high ETS prices	-1%	-5%	-5%
	Internal reduction scenario	0%	-8%	-10%

*Source: AEA Technology and others, 2012*

The assessment of costs also shows that a scenario using a a levy set at low ETS prices (i.e. 35.55 €/tCO<sub>2</sub> in 2030) delivers significant net savings of 23.6 bn €. It should also be noted that applying a levy that corresponds to the carbon prices required achieve the 2030 milestone from the 2050 Low Carbon Economy Roadmap (i.e. 50.9 €/tCO<sub>2</sub> in 2030) achieve similar emissions reduction as the Levy low ETS price still at negative total costs for the sector.

**Table VI.8: Additional costs up to 2030 compared to the baseline, €bn**

	Internal reduction scenario	Levy high ETS prices	Levy low ETS prices
Costs <sup>8</sup> (excluding levy costs)	-47,6	-52,7	-52,7
Levy costs	203,5	47,8	29,1
Total costs	156,0	-1,8	-23,6

*Source: AEA Technology and others, 2012*

The level of a levy depends on the contribution requested from the maritime transport sector as part of the transition to the low carbon economy. As this contribution is not set yet for the short and medium term, only the impacts associated with a levy set at low ETS prices (i.e. 35.55 €/tCO<sub>2</sub> in 2030) is assessed further to analyse the environmental, economic and social impacts.

#### 6. Free allocation and auctioning

For the assessment of impacts under the ETS options, all scenarios assume an allocation to the sector equal to the emission profile as projected in section 3 to achieve the long term in-sector reduction trajectory, resulting in a 2030 target equal to -10% compared to 2005.

Two scenarios have been assessed: a free allocation scenario (i.e. all allowances up to the cap are given for free) and an auctioning scenario (i.e. each allowance has to be purchased).

<sup>8</sup> Including additional investment costs, additional operational costs and fuel savings.

It should be noted that the scenarios are stylised. No sensitivity was performed on allocating to the sector a cap higher than the target of -10% compared to 2005. But a tighter cap, in a system that is linked to a large external trading system, would be similar from the point of view of the sector, to a scenario with more auctioning. As such the extreme scenarios of full auctioning and full free allocation give a range of potential impact on the sector, also for more ambitious targets.

The ETS scenarios assume that there is a link to external carbon market mechanisms, resulting in an equalisation of prices. In the scenario it is assumed prices equalise to a level equal to the low and the high ETS prices as used in the Levy example. As such this assessment gives a potential range of impacts that strongly will be determined by the available supply of allowances from for instance the ETS or credits from CDM, sectoral trading mechanisms or other carbon market mechanisms. The assessment does not look into potential sources of this supply and the impact of the potential demand from the maritime sector on these sources of supply.

No closed ETS scenario has been specifically assessed but the closed ETS with full auctioning would largely correspond to a levy that achieves the reductions fully internally.

**Table VI.9: In-sector emissions under the open ETS option (MtCO<sub>2</sub>), Sources: AEA Technology and others 2012**

		2020	2025	2030
Emissions (MtCO <sub>2</sub> )	ETS link, high ETS prices	194.6	185.9	186.7
	ETS link, low ETS prices	194.6	185.7	186.4
Reduction compared to the baseline	ETS link, high ETS prices	-7%	-14%	-16%
	ETS link, low ETS prices	-7%	-15%	-17%
Reduction compared to 2005	ETS link, high ETS prices	-0,2%	-5%	-5%
	ETS link, low ETS prices	-0,2%	-5%	-5%

**Table VI.10: Comparison between the level of the levy and the emissions by 2030(MtCO<sub>2</sub>), Source: AEA Technology and others, 2012**

	Internal reduction scenario	Levy high ETS prices	Levy low ETS prices
ETS link, high ETS prices	10.6	0.3	0
ETS link, low ETS prices	10.3	0	0.3

This table shows that the difference in terms of in sector CO<sub>2</sub> emissions is not significant up to 2030.

#### 7. Impacts on the EU-ETS in case of a linking with the maritime ETS

In case of linking with the EU-ETS, the maritime sector would be expected to be a net buyer of up to 10 million of EUAs<sup>9</sup> by 2030. This represents less than 0.5% of the total EUAs by

<sup>9</sup> European Union Allowances

2030 and therefore, it can be assumed that the linking of a maritime ETS with the EU-ETS will have no significant impacts on the EU-ETS.

However, as mentioned previously, the impact assessment has been carried out assuming that there is no comprehensive global agreement on climate change and therefore no significant decrease of the trade of fossil fuels. In the event that there is a global decarbonisation of the economy, the maritime sector could be a net seller of 14 million of allowances. This represents around 0.5% of the total EUAs by 2030 and therefore it can be assumed that there is no major risk of disturbance of the EU-ETS in case of linking with a maritime ETS.

## ANNEX VII - IDENTIFIED REGIONS RELIANT ON SHIPPING

### 1. SPECIFIC REGIONS HEAVILY DEPENDENT ON FREIGHT ACTIVITY

The Member States most reliant<sup>10</sup> on shipping are Ireland, the Netherlands, Malta, the UK, Sweden and Finland. These countries are expected to be the most sensitive to an EU regulation that places price on emissions. Austria, Czech Republic, Hungary, Poland, Slovakia and Slovenia do not have a significant seaborne trade activity and, therefore, are not expected to be as sensitive to any policy.

Apart from these two groups of countries, the following groups can be considered:

- more than 50% of the port calls (excluding port calls from passenger vessels) in Bulgaria, Estonia, Latvia, Lithuania, Denmark and Romania are done by bulk carriers (excluding tankers) and general cargo; these categories of ships are carrying low added value goods and, therefore, according to the different policy options considered, the greatest the savings will be, the greatest the benefits will be for these Members States;
- almost 50% of the port calls (excluding port calls from passenger vessels) in Germany, Belgium, Cyprus, Spain and the EU overseas territories are done by container vessels; this category of ship is the most sensitive to avoidance and, therefore, this issue is a key issue for these Member States;
- the port calls in France, Italy, Portugal and Greece are balanced and the sensitivity to the EU regulation should be close to the EU average. Luxembourg can be considered as part of this group too.

At NUTS<sup>11</sup>2 level, the main regions reliant on shipping are heavily linked with the location of major EU ports. According to the share of freight activity by sea, these regions are: Zuid Holland (Rotterdam - NL), Antwerpen (BE), Hamburg (DE), Haute-Normandie (FR), Noord-Holland (NL), Andalucia (SP), Provence Alpes Cote d'Azur (FR), East Yorkshire and Northern Lincolnshire (UK), Liguria (IT), Sicily (IT), Västsverige (SE), Cataluna (SP), Comunidad Valenciana (SP), Etelä-Suomi (FI), Bremen (DE), Puglia (IT), Nord-Pas-de-Calais (FR) and Romania South East region (RO).

The impacts previously assessed should be more visible for these regions.

### 2. SPECIFIC REGIONS HEAVILY DEPENDENT ON PASSENGER ACTIVITY

In 2009, 403 million passengers embarked and disembarked in EU 27 ports from passenger vessels. Italy and Greece are the focus of this activity, together accounting for 44% of all passengers. This is followed, with significantly smaller numbers, by North Sea countries (Denmark, Sweden, Germany, UK and France).

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<sup>10</sup> The reliance on shipping is defined according to seven indicators: the export as % of GDP, the share of exports done by sea, the imports as % of GDP, the share of imports done by sea, the extra-EU exports as % of GDP, the share of extra-EU exports done by sea, the extra-EU imports as % of GDP, the share of extra-EU imports done by sea and the trade volume in tonnes per capita.

<sup>11</sup> Nomenclature of Territorial Units

Malta, Denmark, Greece, Estonia, Sweden, Finland and Italy have a share of passenger embarked/disembarked per inhabitant higher than the EU average. So, these countries, and especially Italy, Greece and Denmark, will be the most affected by any option addressing passenger ships.

At NUTS2 level, the most reliant regions are: Åland (FI), Ceuta (SP), Sjælland (DK), Sydsverige (SE), Notio Aigaio (GR), Malta, Nordjylland (DK), Sardinia (IT), Stockholm (SE), Calabria (IT), Hovedstaden (DK), Ionia Nisia (GR).

### **3. SPECIFIC ISSUE FOR REGIONS WITH SPECIAL WINTER CONDITIONS**

It can also be stressed that regions with special winter conditions, especially in the Baltic Sea, will be more sensitive to a regulation that address GHG emissions from fuel consumed. Indeed, ice-strengthened ships use more fuel oil in ice conditions and also in open water, due to their special design and engine power compared to ships designed only for open water conditions.

Ice-strengthened ships have more expensive investment costs than ships designed only for open water conditions, because ice-strengthening increases the steel weight of the ship hull and also the weight of the propulsion machinery. In addition to the cost of ice-strengthening of the hull, also the additional engine power increases the investment costs of ice-going ships.

Therefore, even if most policy options intend to reduce GHG emissions from ships effectively at negative costs, the investment costs and the fuel savings may be lower for ice-strengthened ships and, as a consequence, regions dependent on routes performed by ice-strengthened ships may be affected. As a consequence, this concern has to be addressed when implementing the policy option.

### **4. SPECIFIC ISSUE FOR REGIONS DEPENDENT ON SHIPBUILDING**

Although the EU's market share of shipbuilding in terms of volumes has declined over the years, the EU has succeeded in retaining a position by building more complex ships with a relatively higher value added, while the production of more standard mass production ships moved to other countries, especially in Asia. The EU also has a relatively strong position in the ship repair market and in the marine equipment sector which supplies ship construction. Indeed, it is a net exporter.

At the European level, while shipbuilding may be declining, it still remains an important source of jobs and economic activity in the regions where it does take place. The main concentrations of large ship yards are in Germany, Croatia and Romania, followed by Finland, the UK and Spain.

A measure to address GHG emissions of ships will lead to an increase of demand of retrofitting, as well as of high value marine equipment. Therefore, any policy option should lead to net benefits for regions dependent on shipbuilding. The highest net benefits would be provided by policy options with the highest in-sector emission reduction required.

## ANNEX VIII - ANALYSIS OF POSSIBLE TECHNICAL SCOPE OF AN EU MEASURE

All existing technical regulations for ships define a threshold for the size of ships covered. Main criteria for the definition of such threshold should be maximising of the amount of emissions covered by the measure (to ensure its environmental effectiveness) and the proportionality of the measure, in particular the minimisation of the administrative burden mainly for industry.

For the purpose of this Impact Assessment, two possible thresholds have been analysed:

1. 400 GT: this size limit is commonly applied under MARPOL and has been used for proposals in the IMO
2. 5000 GT: SOLAS uses 5000 GT as a threshold for certain technical equipment requirements. In addition, the 1992 International Convention on Civil Liability for Oil Pollution Damage uses 5000 GT as the floor for Article V liability.

As the absolute administrative burden of a market-based measure (including monitoring, reporting and verification and internalisation of climate externalities) seems to be to a large extent independent of the size or type of ship (in the order of 7000 – 8000 € per ship and year, see Annex XIII and AEA study), this burden is expected to be insignificant for large ships, but relatively high for smaller vessels.

Overall, the total annual administrative costs for industry in case of a 5000 GT threshold have been estimated at 148 M€ and at 82 M€ for a 400 GT threshold (see Annex XIII for detailed results). Costs for public authorities are also lower in case of a 5000 GT threshold (see annex XIII for different scenarios).

Furthermore, the size threshold impacts on the coverage of the MRV system regarding SMEs in the shipping sector: A 400 GT threshold would exclude 87% of the SMEs whereas a 5000 GT threshold would exclude 99% of the SMEs (see Annex II for more information).

It can be concluded that a 5000 GT threshold has to be regarded as more proportional than a lower threshold as both the total administrative costs for the sector and the coverage of SMEs can be minimised.

To ensure the effectiveness of the measure, the effect of the exclusion of certain vessel types and smaller ship categories on the amount of emissions covered has been analysed. This analysis could support a decision on the technical scope of a measure addressing maritime GHG emissions.

For the analysis, 2010 emission data from the AEA study have been used. Overall, almost 20,000 vessels equipped with Automatic Identification System (AIS) transponders and with EU port calls in 2010 are covered.

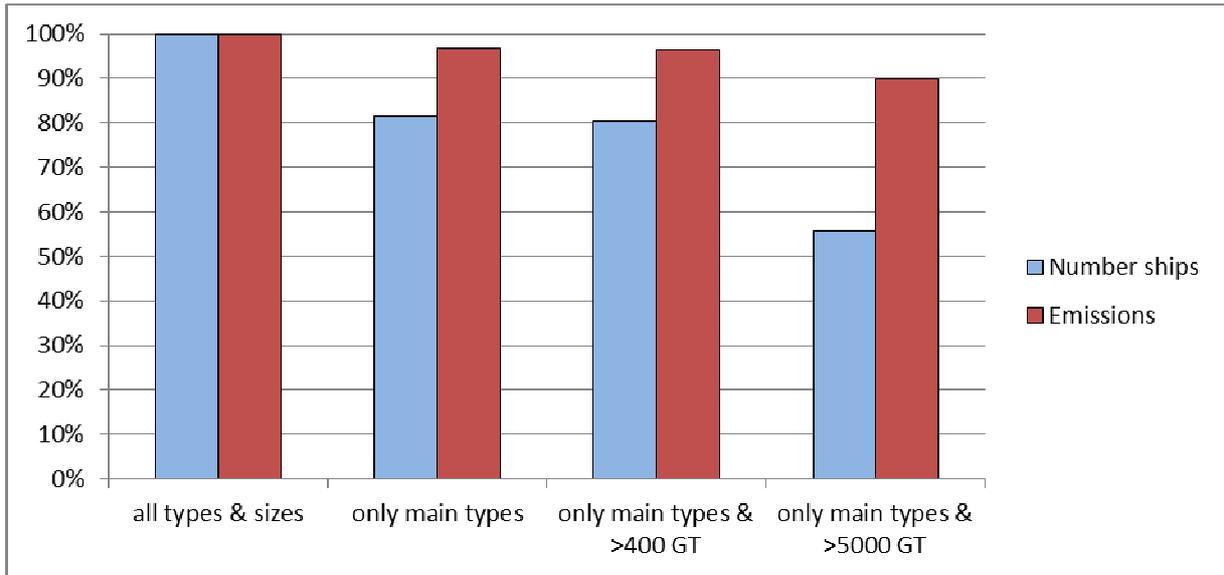
Table VIII.1: Number of ships and CO2 emissions in 2010 for EU scope per ship type and size

VesselType	VesselSize/Group	Vessels	CO2 emissions [t]
01 Oil tanker	A - GT < 300	11	<b>1.930</b>
01 Oil tanker	B - 300 <= GT < 400	20	<b>6.169</b>
01 Oil tanker	C - 400 <= GT < 500	19	<b>5.826</b>
01 Oil tanker	D - 500 <= GT < 5000	239	<b>315.429</b>
01 Oil tanker	E - 5000 <= GT	1208	<b>15.404.869</b>
02 Chemical tanker	C - 400 <= GT < 500	6	<b>2.485</b>
02 Chemical tanker	D - 500 <= GT < 5000	513	<b>1.839.139</b>
02 Chemical tanker	E - 5000 <= GT	1577	<b>13.971.459</b>
03 LPG	A - GT < 300	1	<b>414</b>
03 LPG	C - 400 <= GT < 500	1	<b>780</b>
03 LPG	D - 500 <= GT < 5000	130	<b>570.398</b>
03 LPG	E - 5000 <= GT	210	<b>1.668.018</b>
04 LNG	E - 5000 <= GT	163	<b>5.220.857</b>
05 Other tanker	B - 300 <= GT < 400	3	<b>893</b>
05 Other tanker	C - 400 <= GT < 500	2	<b>643</b>
05 Other tanker	D - 500 <= GT < 5000	45	<b>100.519</b>
05 Other tanker	E - 5000 <= GT	19	<b>322.459</b>
06 Bulker	A - GT < 300	1	<b>277</b>
06 Bulker	C - 400 <= GT < 500	1	<b>669</b>
06 Bulker	D - 500 <= GT < 5000	126	<b>295.112</b>
06 Bulker	E - 5000 <= GT	2732	<b>21.940.872</b>
07 General cargo	A - GT < 300	9	<b>767</b>
07 General cargo	B - 300 <= GT < 400	16	<b>2.393</b>
07 General cargo	C - 400 <= GT < 500	25	<b>4.841</b>
07 General cargo	D - 500 <= GT < 5000	3158	<b>5.876.285</b>
07 General cargo	E - 5000 <= GT	1349	<b>7.583.619</b>

<b>VesselType</b>	<b>VesselSize/Group</b>	<b>Vessels</b>	<b>CO2 emissions [t]</b>
08 Other dry	B - 300 <= GT < 400	1	<b>462</b>
08 Other dry	C - 400 <= GT < 500	3	<b>1.156</b>
08 Other dry	D - 500 <= GT < 5000	145	<b>290.648</b>
08 Other dry	E - 5000 <= GT	394	<b>4.277.142</b>
09 Container	D - 500 <= GT < 5000	64	<b>285.627</b>
09 Container	E - 5000 <= GT	1964	<b>54.565.733</b>
10 Vehicle	D - 500 <= GT < 5000	2	<b>10.692</b>
10 Vehicle	E - 5000 <= GT	438	<b>5.591.435</b>
11 Roro	D - 500 <= GT < 5000	34	<b>68.615</b>
11 Roro	E - 5000 <= GT	356	<b>6.137.373</b>
12 Ferry	A - GT < 300	155	<b>320.221</b>
12 Ferry	B - 300 <= GT < 400	49	<b>152.251</b>
12 Ferry	C - 400 <= GT < 500	82	<b>246.061</b>
12 Ferry	D - 500 <= GT < 5000	311	<b>2.217.155</b>
12 Ferry	E - 5000 <= GT	488	<b>16.888.627</b>
13 Cruise	A - GT < 300	5	<b>1.177</b>
13 Cruise	B - 300 <= GT < 400	4	<b>2.215</b>
13 Cruise	C - 400 <= GT < 500	3	<b>1.761</b>
13 Cruise	D - 500 <= GT < 5000	33	<b>66.249</b>
13 Cruise	E - 5000 <= GT	173	<b>6.209.402</b>
14 Yacht	A - GT < 300	74	<b>27.102</b>
14 Yacht	B - 300 <= GT < 400	81	<b>47.167</b>
14 Yacht	C - 400 <= GT < 500	147	<b>130.178</b>
14 Yacht	D - 500 <= GT < 5000	265	<b>540.787</b>
14 Yacht	E - 5000 <= GT	13	<b>123.603</b>
15 Offshore	A - GT < 300	49	<b>23.155</b>
15 Offshore	B - 300 <= GT < 400	23	<b>14.008</b>

<b>VesselType</b>	<b>VesselSize/Group</b>	<b>Vessels</b>	<b>CO2 emissions [t]</b>
15 Offshore	C - 400 <= GT < 500	25	<b>24.482</b>
15 Offshore	D - 500 <= GT < 5000	618	<b>1.122.327</b>
15 Offshore	E - 5000 <= GT	145	<b>701.982</b>
16 Service	A - GT < 300	483	<b>285.312</b>
16 Service	B - 300 <= GT < 400	356	<b>288.537</b>
16 Service	C - 400 <= GT < 500	210	<b>201.886</b>
16 Service	D - 500 <= GT < 5000	474	<b>878.640</b>
16 Service	E - 5000 <= GT	93	<b>572.357</b>
17 Fishing	A - GT < 300	55	<b>11.026</b>
17 Fishing	B - 300 <= GT < 400	27	<b>8.582</b>
17 Fishing	C - 400 <= GT < 500	35	<b>15.574</b>
17 Fishing	D - 500 <= GT < 5000	248	<b>276.232</b>
17 Fishing	E - 5000 <= GT	25	<b>110.212</b>
18 Miscellaneous	A - GT < 300	13	<b>2.508</b>
18 Miscellaneous	B - 300 <= GT < 400	2	<b>551</b>
18 Miscellaneous	C - 400 <= GT < 500	6	<b>1.633</b>
18 Miscellaneous	D - 500 <= GT < 5000	45	<b>28.637</b>
18 Miscellaneous	E - 5000 <= GT	44	<b>140.280</b>
<b>Total</b>		<b>19.844</b>	<b>178.047.885</b>

The ships covered by the analysis emitted around 180 Mt CO<sub>2</sub> in the EU scope (journeys from and to EU ports). The results are summarised in the following figure:



COVERAGE OF NUMBER OF SHIPS AND CO<sub>2</sub> EMISSIONS DEPENDING ON THE COVERAGE OF SHIP TYPES AND SIZES, 2010 DATA FOR EU SCOPE

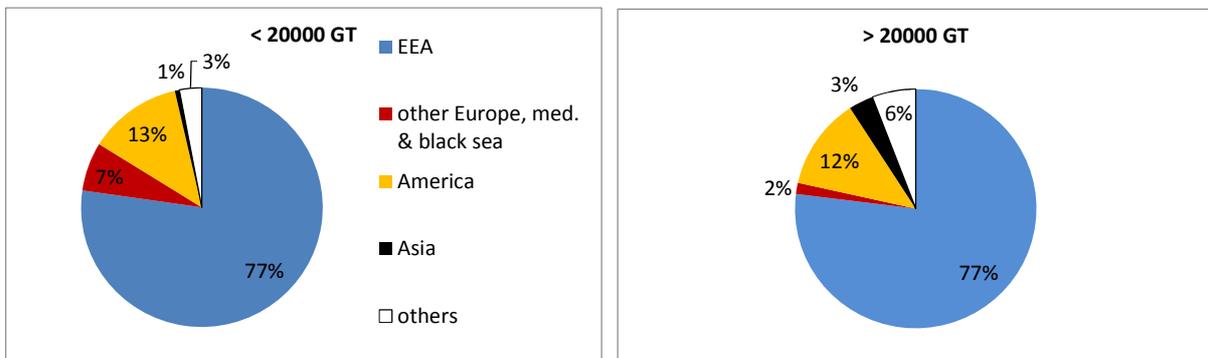
If for the 13 main ship types, only vessels with at least 400 GT are considered. As result, the number of ships is reduced to 81% of the total still covering 97% of the total emissions.

If only the 13 main ship types and vessels of at least 5000 GT are covered by a measure, the number of ships goes down to about 11,000 (56% of the total number) representing 160 Mt CO<sub>2</sub> emitted (90% of the total amount).

A size threshold higher than 5000 GT would not lead to such high level of emissions covered and would therefore not ensure the environmental effectiveness of the measure.

People could also argue that the introduction of a size threshold may create a distortion of trade competition, as short sea shipping would not be covered by the measures as much as deep sea shipping. However, short sea shipping and deep sea shipping are not serving the same market.

Another analysis has been carried out to identify a possible correlation between the size and the flag of ships calling into EU ports. In case of a strong correlation, a size threshold might lead to different relative coverage of ships flying different flags.



SHARE OF EU PORT CALLS BY FLAG, SOURCE: IHS FAIRPLAY 2011

Available data only allow differentiating between ships smaller and larger than 20000 GT. The analysis shows that the share of port calls by EEA flagged ships is 77% for both groups. Out of the remaining 23% port calls, the second largest groups are port calls by ships flying American flags (mainly Panama and Bahamas) with 13% respectively 12% of the port calls (smaller/ larger than 20000 GT). This analysis provides no evidence of correlation between size and European/ non-European flags. As a consequence, the size threshold should not lead to a significant different coverage of EU/ EEA flagged ships.

In conclusion, the number of ships covered by a measure to reduce maritime GHG emissions can be reduced significantly if certain categories and in particular smaller vessels are excluded. A higher threshold of 5000 GT as used under SOLAS would reduce the estimated administrative costs for the shipping sector from 148 to 82 M€ per year while covering 90% of the total emissions. No impacts have been identified on the coverage of different flags.

## ANNEX IX - LIST OF IMO PROPOSALS (24 MAY 2011)

Proposed market-based measures	Proponent(s)	Mechanism for GHG reduction	
		In-sector emission reductions	Out-of-sector emission reductions
An International Fund for Greenhouse Gas emissions from ships (GHG Fund)	Cyprus, Denmark, the Marshall Islands, Nigeria and IPTA (MEPC 60/4/8, GHG-WG 3/2/1 GHG WG 3/3/4)	Price incentive on fuel use	Prescribed purchase of out-of-sector project offset credits by a fund;  Potential for supplementary reductions from use of remaining proceeds
Consolidated proposal of the Efficiency Incentive Scheme (EIS) based on the Leverage Incentive Scheme (LIS) and the Vessel Efficiency System (VES)	Japan & World Shipping Council (MEPC 60/4/37 MEPC 60/4/39 GHG-WG 3/3/2)	Mandatory EEDI;  Existing ship standard with fuel-based charge  Leveraged refund incentive	Potential for supplementary reductions from use of remaining proceeds
Port State arrangements utilizing the ship traffic, energy and environment model, STEEM (PSL)	Jamaica (MEPC 60/4/40)	Price incentive on fuel use	Potential for supplementary reductions from use of remaining proceeds
Ship Efficiency and Credit Trading (SECT)	US (MEPC 60/4/12 MEPC 61/5/16 MEPC 61/INF.24)	Mandatory EEDI;  Efficiency trading	
Global Emission Trading System (ETS)	Norway, United Kingdom, France & Germany (MEPC 60/4/22 MEPC 60/4/26 MEPC 60/4/41 MEPC 60/4/54 GHG-WG 3/3/5 GHG-WG 3/3/6 GHG-WG 3/3/8)	Price incentive on fuel use	Purchase out-of-sector project offset credits by shipping sector;  Potential for supplementary reductions from use of remaining proceeds
How technical and operational measures are the only direct and effective means to deliver cuts in CO <sub>2</sub> emissions	Bahamas (MEPC 60/4/10, GHG-EG 3/2)	Mandatory emission reduction target	
A Rebate Mechanism (RM) for a market-based instrument for international shipping	IUCN (MEPC 60/4/55 MEPC 61/5/33)	Price incentive on fuel use	Prescribed purchase of out-of-sector project offset credits by a fund;  Potential for supplementary reductions from use of remaining proceeds



## ANNEX X - DESCRIPTION OF MARKET BARRIERS

Work by the International Maritime Organisation (IMO) and other organisations<sup>12</sup> have indicated that there are significant negative or low marginal abatement cost opportunities to reduce GHG emissions in the maritime transport sector, i.e. the fuel cost savings would almost or entirely exceed the cost of the measures. The use of such opportunities would lead to reductions in GHG emissions and in transport costs. However, a number of market barriers are contributing to prevent their implementation.

Three main categories of market barriers exist. As these categories sometimes overlap, it can be difficult to distinguish between different types of barriers. Moreover, the different categories are not mutually exclusive, in other words several categories of barriers may impact the adoption of one solution. Market failure barriers are the most widespread.

### 1. Market failures barriers

#### *a. Split of incentives*

This market failure occurs when the commercial shipping market does not have the ability to implement a cost effective solution because the maritime transport actor (e.g., the ship owner) making the investment in a solution does not realise the benefit (e.g., fuel saving) of the investment.

In other words, the people benefiting from energy efficiency are not the people paying for it.<sup>13</sup> In the shipping industry, it occurs when there is a disconnect between the vessel owner, who controls investment spending and energy conservation efforts, and the operator, who is responsible for fuel cost. This primarily occurs when vessels – especially bulk carriers, tankers, and containerships – are hired under contract for a time charter or bare boat charter.<sup>14</sup> In such cases, it is the charterer who pays for fuel but the ship owner who is responsible for any investment in energy-efficiency equipment. Another “split incentive” issue is that shipowners do not typically expect to own a vessel for its entire life, or are uncertain of how long they want to own the vessel. It is not guaranteed that shipowners can obtain a premium for a ship in a second hand sale that has better than expected fuel efficiency.<sup>15</sup>

Moreover, commercial practises in the maritime industry hinder the implementation of a cost effective solution. For example, in a spot charter, a ship will be compensated through demurrage if the terminal is not ready to take the vessel when it arrives. However, if the ship

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<sup>12</sup> CE Delft Study "Technical support for European action to reducing Greenhouse Gas Emissions from international maritime transport"; European Commission Joint Research Centre Reference Report "Regulating Air Emissions from Ships", the "Second IMO GHG Study 2009", the submission to the IMO "Marginal abatement costs and cost effectiveness of energy-efficiency measures" (MEPC 61/INF.18) and the master thesis "Unlocking the potential for CO<sub>2</sub> abatement in ships arriving and departing from UK ports" by Jenny Hill of Imperial

<sup>13</sup>Jaff et al, 1994

<sup>14</sup>Wijnolst et al, 1997

<sup>15</sup>Brealey et al, 2005

slows down (thereby reducing GHG emissions) to arrive at a later time when the terminal is available, the ship is not compensated for the extra voyage time incurred.

Furthermore, shipping cycles also prevent the uptake of efficient technology. Large changes in vessel charter rates over different shipping cycles mean that when rates are high, vessel owners are unwilling to take any time out of service (e.g. to install an energy efficiency solution). When charter rates are low, vessel owners may not have the funds required to make an investment in an energy efficiency improvement.

#### *b. Lack of information*

This market failure relates to the lack of accurate information on the energy efficiency of existing vessels, specifically the lack of accurate fuel consumption information.

It also generates technological barriers. For a specific technology, a lack of confidence in the technology because of a lack of operational data/experience can prevent the adoption of efficient technologies. For example, there are concerns regarding the ability of marine diesel engines to efficiently and safely operate for extended periods at low speeds. This can hinder implementation of the speed reduction solution.

Furthermore, small shipping companies may lack the staff to analyse, make the decision, and oversee the implementation of a solution. The marine industry is extremely diverse and has a large number of small companies that may not have the management time or expertise needed to evaluate and implement GHG solutions. This may be further complicated by the use of third-party ship managers that serves to remove the ship owner – from whom the impetus for energy efficiency improvements is typically expected – from day-to-day operational issues involving their ships.

#### *c. Access to finance*

Even when an investment is profitable, it may not be possible for an owner or operator to get access to finance for this investment. This can occur for various reasons:

- Uncertainty over future fuel prices represents an economic barrier to virtually all solutions involving an installation cost (e.g., waste heat recovery). Uncertainty over the magnitude of fuel reductions for a given solution can also adversely impact the investment decision.
- Furthermore, shipping business cycles also prevent the uptake of efficient technology. Large changes in vessel charter rates over different shipping cycles mean that when rates are high, vessel owners are unwilling to take any time out of service (e.g. to install an energy efficiency solution). When charter rates are low, vessel owners may not have the funds required to make an investment in an energy efficiency improvement, as the risks become higher for financiers.
- When solution is only marginally economic at the current fuel price, the expected rate of return can be too low to compensate for the investment risk taken.

Moreover, a cost effective solution may not implemented due to management issues, such lack of staffing or time to implement a technology. However, the ability of shipping company to increase their staff is highly dependent on the freight rates variations.

## **2. Operational or Physical Barriers**

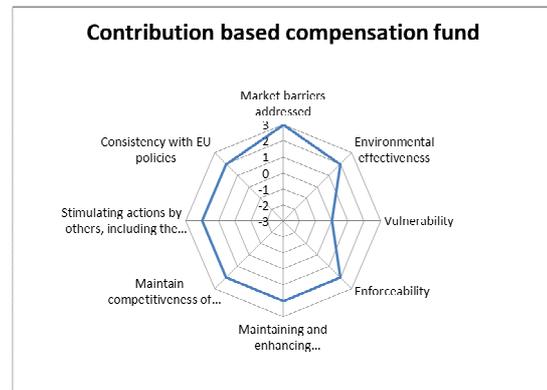
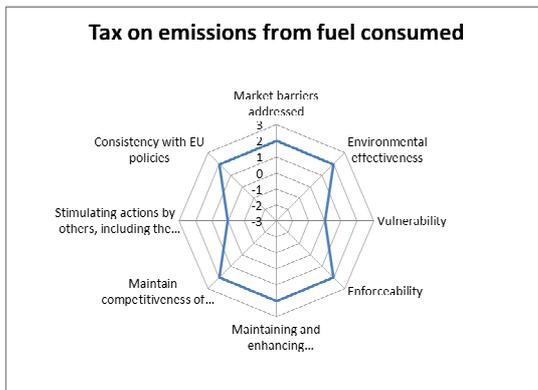
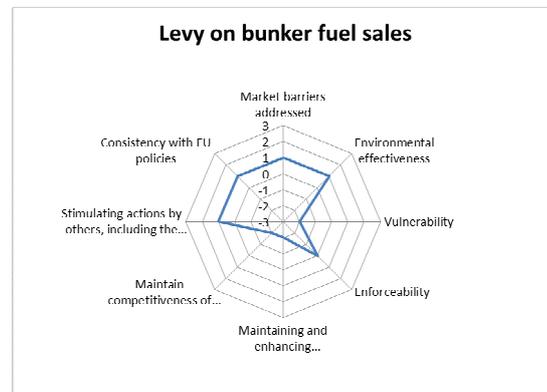
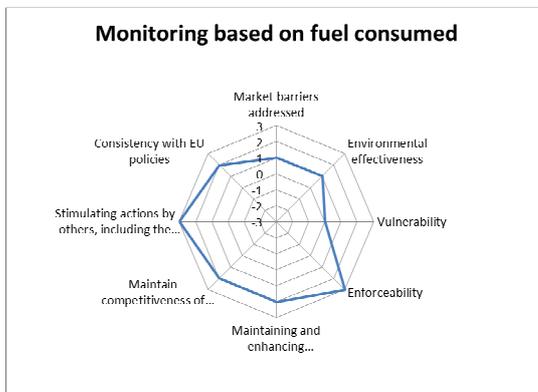
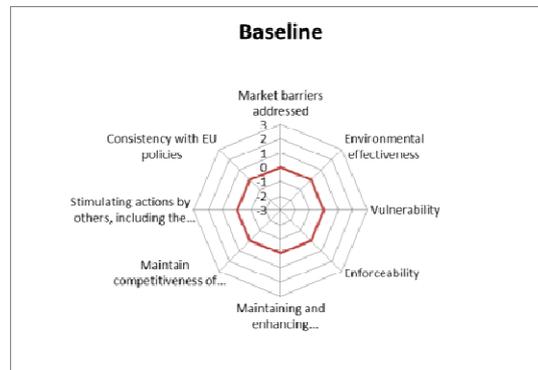
Operational or physical barriers occur when a solution cannot be utilised on a specific vessel due to physical space constraints or other matters that impact vessel operations. Examples of this include:

- Waste heat recovery on a small vessel. The vessel may not have the physical room to install the waste heat recovery heat exchanger in the funnel.
- Solar cells: On a container ship, the ability to put a large array of solar cells is problematic given the use of deck space for container stowage. Similarly, bulk carriers require removable hatch covers that would complicate the use of deck mounted solar arrays.
- Proposals to install and deploy sails may be problematic on vessels with limited deck space such as bulkers and containerships.

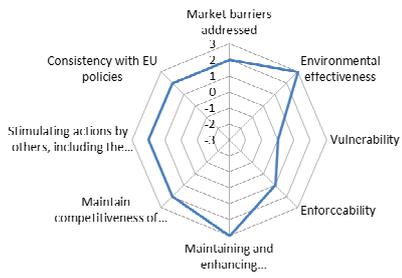
## **3. Regulatory Barriers**

Regulatory barriers are based on concerns over (existing and potential future) regulations that impact the implementation of a given solution. There is a range of different types of regulatory barriers, such as competition regulation; domestic, regional or international law prohibiting certain activities or limitations in the legislative authority and legislative processes. For example some abatement solutions such as hull cleaning and propeller polishing are prohibited in certain ports due to local regulations that prohibit the release of the cleaning residues in local waters.

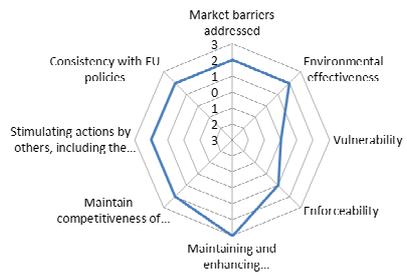
## ANNEX XI - GRAPHICAL REPRESENTATION OF THE COMPARISON OF THE POLICY OPTIONS



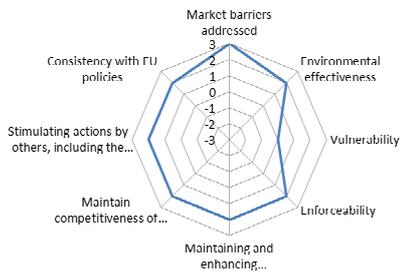
### Closed ETS with free allocation



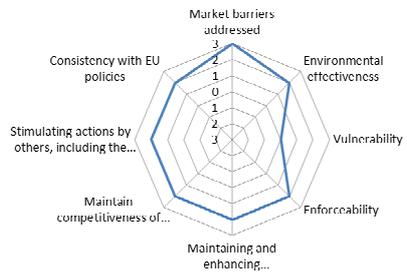
### Open ETS with free allocation



### Open ETS with full auctioning



### Target based compensation fund



## ANNEX XII - ANNUAL COMPLIANCE CYCLE FOR MONITORING, REPORTING AND VERIFICATION OF EMISSIONS

### 1. General remarks

As regards the geographical scope, the following routes will in principle be covered in a non-discriminatory manner for all ships regardless their flag:

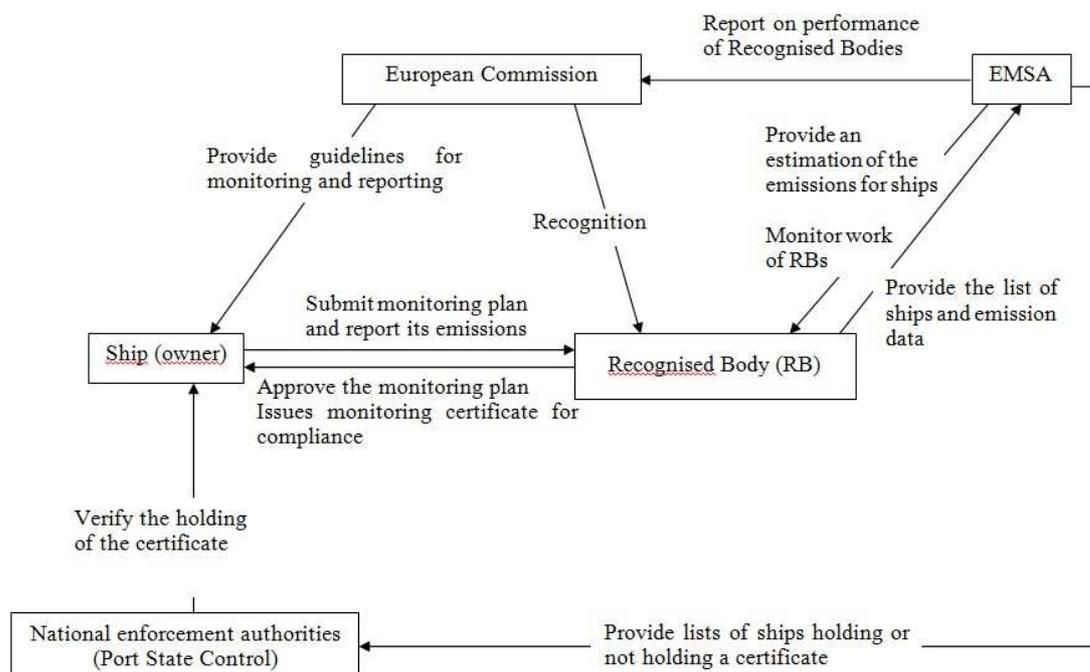
- intra-EU journeys
- journeys from the last non-EU port to the first EU port of call (incoming journeys)
- journeys from an EU port to the next non-EU port of call (outgoing journeys)

Tasks related to the check of monitoring plans, emission reports, communication with ship owners and operators and the issuance of certificates would be ensured by recognised bodies or other accredited independent third parties. Such bodies, in particular Recognised Organisations, already have extensive experience and play an important role for maritime safety.

Enforcement of the MRV obligations would be ensured by Member States, more concretely by Port Authorities under the existing Port State Control regime.

The proposed MRV measure should take the form of a Regulation. For the implementation of the proposed MRV system, delegated acts would be needed to determine the necessary technical details. Guidance documents will be developed to facilitate the implementation.

### 2. Compliance cycle



**ANNEX XIII - ADMINISTRATIVE COSTS AND ADMINISTRATIVE BURDEN**

Source: AEA Technology and others, 2012

**1. ENFORCEMENT BY NATIONAL COMPETENT AUTHORITIES (FOR ALL OPTIONS EXCEPT OPTION 3A - LEVY ON BUNKER FUEL)**

If all ships above 400GT are included:

Actions required	Tariff (per hour)	Time per CA (man-days)	Time per competent authority (hours)	Price (per CA)	Frequency (per year)	Price (per CA & per year)	Equipment costs (per entity & per year)	Outsourcing costs (per CA & per year)	Business as usual costs (% of administrative costs)	Total administrative costs (per CA & per year)	Total administrative burden (per CA & per year)	Total administrative costs (per year)	Total administrative burdens (per year)
Familiarizing with the information obligation	€41,50	5	40	€1.660,00	0,1	€166,00	€0,00	€0,00	0	€166	€166	€4.482	€4.482
Verification		11	86	€3.569,00	1	€3.569,00	€0,00	€0,00	0	€3.569	€3.569	€96.363	€96.363
<b>Total</b>						<b>€3.735,00</b>	<b>€0,00</b>			<b>€3.735</b>	<b>€3.735</b>	<b>€100.845</b>	<b>€100.845</b>

If all ships above 5000GT are included:

Actions required	Tariff (per hour)	Time per CA (man-days)	Time per competent authority (hours)	Price (per CA)	Frequency (per year)	Price (per CA & per year)	Equipment costs (per entity & per year)	Outsourcing costs (per CA & per year)	Business as usual costs (% of administrative costs)	Total administrative costs (per CA & per year)	Total administrative burden (per CA & per year)	Total administrative costs (per year)	Total administrative burdens (per year)
Familiarizing with the information obligation	€41,50	5	40	€1.660,00	0,1	€166,00	€0,00	€0,00	0	€166	€166	€4.482	€4.482
Verification		7	53	€2.199,50	1	€2.199,50	€0,00	€0,00	0	€2.200	€2.200	€59.387	€59.387
<b>Total</b>						<b>€2.365,50</b>	<b>€0,00</b>			<b>€2.366</b>	<b>€2.366</b>	<b>€63.869</b>	<b>€63.869</b>

For option 3a, the enforcement is considered as part of the compliance check done by the national competent authorities in charge of compliance.

**2. MONITORING BASED ON FUEL CONSUMED (OPTION 2)**

- For ship owners and ship operators

If all ships above 400GT are included:

Actions required	Tariff (per hour)	Time per vessel (man-days)	Time per vessel (hours)	Price (per vessel)	Frequency (per year)	Price (per vessel & per year)	Outsourcing costs (per vessel & per year)	Business as usual costs (% of administrative costs)	Total administrative costs (per vessel & per year)	Total administrative burden (per vessel & per year)	Number of entities concerned	Total administrative costs (per year)	Total administrative burdens (per year)
Familiarizing with the information obligation	€41,50	24	192	€7.968,00	0,1	€796,80	€0	0	€797	€797	18400	€14.661.120	€14.661.120
Preparation of the monitoring plan		6	48	€1.992,00	0,1	€199,20	€0	0	€199	€199	18400	€3.665.280	€3.665.280
Retrieving relevant information from existing data		3	24	€996,00	1	€996,00	€0	80	€996	€199	18400	€18.326.400	€3.665.280
Adjusting existing data		3	24	€996,00	1	€996,00	€0	0	€996	€996	18400	€18.326.400	€18.326.400
Filling in forms and tables, including recordkeeping		1	8	€332,00	1	€332,00	€0	0	€332	€332	18400	€6.108.800	€6.108.800
Verification		2	16	€664,00	1	€664,00	€3.750	0	€4.414	€4.414	18400	€81.217.600	€81.217.600
Submitting the information		1	8	€332,00	1	€332,00	€0	0	€332	€332	18400	€6.108.800	€6.108.800
<b>Total</b>							<b>€4.316,00</b>	<b>€3.750,00</b>		<b>€8.066</b>	<b>€7.269</b>		<b>€148.414.400</b>

If all ships above 5000GT are included:

Actions required	Tariff (per hour)	Time per vessel (man-days)	Time per vessel (hours)	Price (per vessel)	Frequency (per year)	Price (per vessel & per year)	Outsourcing costs (per vessel & per year)	Business as usual costs (% of administrative costs)	Total administrative costs (per vessel & per year)	Total administrative burden (per vessel & per year)	Number of entities concerned	Total administrative costs (per year)	Total administrative burdens (per year)
Familiarizing with the information obligation	€41,50	20	160	€6.640,00	0,1	€664,00	€0	0	€664	€664	11400	€7.569.600	€7.569.600
Preparation of the monitoring plan		5	40	€1.660,00	0,1	€166,00	€0	0	€166	€166	11400	€1.892.400	€1.892.400
Retrieving relevant information from existing data		2	16	€664,00	1	€664,00	€0	80	€664	€133	11400	€7.569.600	€1.513.920
Adjusting existing data		2	16	€664,00	1	€664,00	€0	0	€664	€664	11400	€7.569.600	€7.569.600
Filling in forms and tables, including recordkeeping		1	8	€332,00	1	€332,00	€0	0	€332	€332	11400	€3.784.800	€3.784.800
Verification		2	16	€664,00	1	€664,00	€3.750	0	€4.414	€4.414	11400	€50.319.600	€50.319.600
Submitting the information		1	8	€332,00	1	€332,00	€0	0	€332	€332	11400	€3.784.800	€3.784.800
<b>Total</b>							<b>€3.486,00</b>	<b>€3.750,00</b>		<b>€7.236</b>	<b>€6.705</b>		<b>€82.490.400</b>

- For public authorities

- For national competent authorities controlling the compliance

If all ships above 400GT are included:

Actions required	Tariff (per hour)	Time per CA (man-days)	Time per competent authority (hours)	Price (per CA)	Frequency (per year)	Price (per CA & per year)	Equipment costs (per entity & per year)	Outsourcing costs (per CA & per year)	Business as usual costs (% of administrative costs)	Total administrative costs (per CA & per year)	Total administrative burden (per CA & per year)	Number of entities concerned	Total administrative costs (per year)	Total administrative burdens (per year)
Familiarizing with the information obligation	€41,50	50	400	€16.600,00	0,1	€1.660,00	€0,00	€0,00	0	€1.660	€1.660	27	€44.820	€44.820
Designing information material		200	1600	€66.400,00	0,1	€6.640,00	€200.000	€0,00	0	€7.653	€7.653	1	€206.640	€206.640
Informing the subjected entities		680	5440	€225.760,00	0,1	€22.576,00	€0,00	€0,00	0	€22.576	€22.576	27	€609.552	€609.552
Verification of the information submitted		340	2720	€112.880,00	1	€112.880,00	€0,00	€0,00	0	€112.880	€112.880	27	€3.047.760	€3.047.760
<b>Total</b>							<b>€143.756,00</b>	<b>€200.000,00</b>	<b>€0,00</b>		<b>€144.769</b>	<b>€144.769</b>		<b>€3.908.772</b>

If all ships above 5000GT are included:

Actions required	Tariff (per hour)	Time per CA (man-days)	Time per competent authority (hours)	Price (per CA)	Frequency (per year)	Price (per CA & per year)	Equipment costs (per entity & per year)	Outsourcing costs (per CA & per year)	Business as usual costs (% of administrative costs)	Total administrative costs (per CA & per year)	Total administrative burden (per CA & per year)	Number of entities concerned	Total administrative costs (per year)	Total administrative burdens (per year)
Familiarizing with the information obligation	€41,50	50	400	€16.600,00	0,1	€1.660,00	€0,00	€0,00	0	€1.660	€1.660	27	€44.820	€44.820
Designing information material		200	1600	€66.400,00	0,1	€6.640,00	€200.000	€0,00	0	-	-	1	€206.640	€206.640
Informing the subjected entities		420	3360	€139.440,00	0,1	€13.944,00	€0,00	€0,00	0	€13.944	€13.944	27	€376.488	€376.488
Verification of the information submitted		210	1680	€69.720,00	1	€69.720,00	€0,00	€0,00	0	€69.720	€69.720	27	€1.882.440	€1.882.440
<b>Total</b>							<b>€91.964,00</b>	<b>€200.000,00</b>	<b>€0,00</b>		<b>€85.324</b>	<b>€85.324</b>		<b>€2.510.388</b>

- For EU competent authority controlling the compliance

If all ships above 400GT are included:

Actions required	Tariff (per hour)	Time per CA (man-days)	Time per competent authority (hours)	Price (per CA)	Frequency (per year)	Price (per CA & per year)	Equipment costs (per entity & per year)	Outsourcing costs (per CA & per year)	Business as usual costs (% of administrative costs)	Total administrative costs (per CA & per year)	Total administrative burden (per CA & per year)	Total administrative costs (per year)	Total administrative burdens (per year)
Familiarizing with the information obligation	€67,00	50	400	€26.800,00	0,1	€2.680,00	€0	€0,00	0	€2.680	€2.680	€2.680	€2.680
Designing information material		200	1600	€107.200,00	0,1	€10.720,00	€200.000	€0,00	0	€210.720	€210.720	€210.720	€210.720
Informing the subjected entities		13800	110400	€7.396.800,00	0,1	€739.680,00	€0	€0,00	0	€739.680	€739.680	€739.680	€739.680
Verification of the information submitted		4600	36800	€2.465.600,00	1	€2.465.600,00	€0	€0,00	0	€2.465.600	€2.465.600	€2.465.600	€2.465.600
<b>Total</b>							<b>€3.218.680,00</b>	<b>€200.000,00</b>			<b>€3.418.680</b>	<b>€3.418.680</b>	<b>€3.418.680</b>

If all ships above 5000GT are included:

Actions required	Tariff (per hour)	Time per CA (man-days)	Time per competent authority (hours)	Price (per CA)	Frequency (per year)	Price (per CA & per year)	Equipment costs (per entity & per year)	Outsourcing costs (per CA & per year)	Business as usual costs (% of administrative costs)	Total administrative costs (per CA & per year)	Total administrative burden (per CA & per year)	Total administrative costs (per year)	Total administrative burdens (per year)
Familiarizing with the information obligation	€67,00	50	400	€26.800,00	0,1	€2.680,00	€0	€0,00	0	€2.680	€2.680	€2.680	€2.680
Designing information material		200	1600	€107.200,00	0,1	€10.720,00	€200.000	€0,00	0	€210.720	€210.720	€210.720	€210.720
Informing the subjected entities		8550	68400	€4.582.800,00	0,1	€458.280,00	€0	€0,00	0	€458.280	€458.280	€458.280	€458.280
Verification of the information submitted		2850	22800	€1.527.600,00	1	€1.527.600,00	€0	€0,00	0	€1.527.600	€1.527.600	€1.527.600	€1.527.600
<b>Total</b>							<b>€1.999.280,00</b>	<b>€200.000,00</b>			<b>€2.199.280</b>	<b>€2.199.280</b>	<b>€2.199.280</b>

### 3. LEVY ON BUNKER FUEL SALES (OPTION 3A)

- For bunker fuel suppliers

Actions required	Tariff (per hour)	Time per fuel supplier (man-days)	Time per fuel supplier (hours)	Price (per fuel supplier)	Frequency (per year)	Price (per fuel supplier & per year)	Outsourcing costs (per fuel supplier & per year)	Business as usual costs (% of administrative costs)	Total administrative costs (per fuel supplier & per year)	Total administrative burden (per fuel supplier & per year)	Number of entities concerned	Total administrative costs (per year)	Total administrative burdens (per year)	
Familiarizing with the information obligation	€41,50	10	80	€3.320,00	0,1	€332,00	€0,00	0	€332	€332	1200	€398.400	€398.400	
Designing information material		20	160	€6.640,00	0,1	€664,00	€0,00	100	€664	€0	1200	€796.800	€0	
Retrieving relevant information from existing data		30	240	€9.960,00	1	€9.960,00	€0,00	100	€9.960	€0	1200	€11.952.000	€0	
Adjusting existing data		30	240	€9.960,00	1	€9.960,00	€0,00	100	€9.960	€0	1200	€11.952.000	€0	
Filling in forms and tables, including recordkeeping		5	40	€1.660,00	1	€1.660,00	€0,00	100	€1.660	€0	1200	€1.992.000	€0	
Verification		4	32	€1.328,00	1	€1.328,00	€4.000,00	100	€5.328	€0	1200	€6.393.600	€0	
Submitting the information		1	8	€332,00	1	€332,00	€0,00	100	€332	€0	1200	€398.400	€0	
Paying the tax		1	8	€332,00	1	€332,00	€0,00	0	€332	€332	1200	€398.400	€398.400	
<b>Total</b>							<b>€24.568,00</b>	<b>€4.000,00</b>		<b>€28.568</b>	<b>€664</b>		<b>€34.281.600</b>	<b>€796.800</b>

- For national competent authorities

Actions required	Tariff (per hour)	Time per CA (man-days)	Time per competent authority (hours)	Price (per CA)	Frequency (per year)	Price (per CA & per year)	Outsourcing costs (per CA & per year)	Business as usual costs (% of administrative costs)	Total administrative costs (per CA & per year)	Total administrative burden (per CA & per year)	Number of entities concerned	Total administrative costs (per year)	Total administrative burdens (per year)
Familiarizing with the information obligation	€41,50	10	80	€3.320,00	0,1	€332,00	€0,00	0	€332	€332	27	€8.964	€8.964
Controlling the payment of the contribution		11	88	€3.652,00	1	€3.652,00	€0,00	0	€3.652	€3.652	27	€98.604	€98.604
<b>Total</b>						<b>€3.984,00</b>	<b>€0,00</b>		<b>€3.984</b>	<b>€3.984</b>		<b>€107.568</b>	<b>€107.568</b>

#### 4. TAX ON EMISSIONS FROM FUEL CONSUMED (OPTION 3B)

- For ship owners and ship operators

If all ships above 400GT are included:

Actions required	Tariff (per hour)	Time per vessel (man-days)	Time per vessel (hours)	Price (per vessel)	Frequency (per year)	Price (per vessel & per year)	Outsourcing costs (per vessel & per year)	Business as usual costs (% of administrative costs)	Total administrative costs (per vessel & per year)	Total administrative burden (per vessel & per year)	Number of entities concerned	Total administrative costs (per year)	Total administrative burdens (per year)
Familiarizing with the information obligation	€41,50	24	192	€7.968,00	0,1	€796,80	€0	0	€797	€797	18400	€14.661.120	€14.661.120
Preparation of the monitoring plan		6	48	€1.992,00	0,1	€199,20	€0	0	€199	€199	18400	€3.665.280	€3.665.280
Retrieving relevant information from existing data		3	24	€996,00	1	€996,00	€0	80	€996	€199	18400	€18.326.400	€3.665.280
Adjusting existing data		3	24	€996,00	1	€996,00	€0	0	€996	€996	18400	€18.326.400	€18.326.400
Filling in forms and tables, including recordkeeping		1	8	€332,00	1	€332,00	€0	0	€332	€332	18400	€6.108.800	€6.108.800
Verification		2	16	€664,00	1	€664,00	€3.750	0	€4.414	€4.414	18400	€81.217.600	€81.217.600
Submitting the information		1	8	€332,00	1	€332,00	€0	0	€332	€332	18400	€6.108.800	€6.108.800
Paying the tax		1	8	€332	1	€332,00	€0,00	0	€332	€332	18400	€6.108.800	€6.108.800
<b>Total</b>							<b>€4.648,00</b>	<b>€3.750,00</b>		<b>€8.398</b>	<b>€7.601</b>		<b>€154.523.200</b>

If all ships above 5000GT are included:

Actions required	Tariff (per hour)	Time per vessel (man-days)	Time per vessel (hours)	Price (per vessel)	Frequency (per year)	Price (per vessel & per year)	Outsourcing costs (per vessel & per year)	Business as usual costs (% of administrative costs)	Total administrative costs (per vessel & per year)	Total administrative burden (per vessel & per year)	Number of entities concerned	Total administrative costs (per year)	Total administrative burdens (per year)
Familiarizing with the information obligation	€41,50	20	160	€6.640,00	0,1	€664,00	€0	0	€664	€664	11400	€7.569.600	€7.569.600
Preparation of the monitoring plan		5	40	€1.660,00	0,1	€166,00	€0	0	€166	€166	11400	€1.892.400	€1.892.400
Retrieving relevant information from existing data		2	16	€664,00	1	€664,00	€0	80	€664	€133	11400	€7.569.600	€1.513.920
Adjusting existing data		2	16	€664,00	1	€664,00	€0	0	€664	€664	11400	€7.569.600	€7.569.600
Filling in forms and tables, including recordkeeping		1	8	€332,00	1	€332,00	€0	0	€332	€332	11400	€3.784.800	€3.784.800
Verification		2	16	€664,00	1	€664,00	€3.750	0	€4.414	€4.414	11400	€50.319.600	€50.319.600
Submitting the information		1	8	€332,00	1	€332,00	€0	0	€332	€332	11400	€3.784.800	€3.784.800
Paying the tax		1	8	€332	1	€332,00	€0,00	0	€332	€332	11400	€3.784.800	€3.784.800
<b>Total</b>							<b>€3.818</b>	<b>€3.750</b>		<b>€7.568</b>	<b>€7.037</b>		<b>€86.275.200</b>

- For public authorities
  - For national competent authorities

If all ships above 400GT are included:

Actions required	Tariff (per hour)	Time per CA (man-days)	Time per competent authority (hours)	Price (per CA)	Frequency (per year)	Price (per CA & per year)	Equipment costs (per entity & per year)	Outsourcing costs (per CA & per year)	Business as usual costs (% of administrative costs)	Total administrative costs (per CA & per year)	Total administrative burden (per CA & per year)	Number of entities concerned	Total administrative costs (per year)	Total administrative burdens (per year)
Familiarizing with the information obligation	€41,50	60	480	€19.920,00	0,1	€1.992,00	€0,00	€0,00	0	€1.992	€1.992	27	€53.784	€53.784
Designing information material		200	1600	€66.400,00	0,1	€6.640,00	€200.000	€0,00	0	€7.653	€7.653	1	€206.640	€206.640
Informing the subjected entities		680	5440	€225.760,00	0,1	€22.576,00	€0,00	€0,00	0	€22.576	€22.576	27	€609.552	€609.552
Verification of the information submitted		340	2720	€112.880,00	1	€112.880,00	€0,00	€0,00	0	€112.880	€112.880	27	€3.047.760	€3.047.760
Controlling the payment		170	1360	€56.440,00	1	€56.440,00	€0,00	€0,00	0	€56.440	€56.440	27	€1.523.880	€1.523.880
<b>Total</b>						<b>€200.528,00</b>	<b>€200.000,00</b>	<b>€0,00</b>		<b>€201.541</b>	<b>€201.541</b>		<b>€5.441.616</b>	<b>€5.441.616</b>

If all ships above 400GT are included:

Actions required	Tariff (per hour)	Time per CA (man-days)	Time per competent authority (hours)	Price (per CA)	Frequency (per year)	Price (per CA & per year)	Equipment costs (per entity & per year)	Outsourcing costs (per CA & per year)	Business as usual costs (% of administrative costs)	Total administrative costs (per CA & per year)	Total administrative burden (per CA & per year)	Number of entities concerned	Total administrative costs (per year)	Total administrative burdens (per year)
Familiarizing with the information obligation	€41,50	60	480	€19.920,00	0,1	€1.992,00	€0,00	€0,00	0	€1.992	€1.992	27	€53.784	€53.784
Designing information material		200	1600	€66.400,00	0,1	€6.640,00	€200.000	€0,00	0	€7.653	€7.653	1	€206.640	€206.640
Informing the subjected entities		420	3360	€139.440,00	0,1	€13.944,00	€0,00	€0,00	0	€13.944	€13.944	27	€376.488	€376.488
Verification of the information submitted		210	1680	€69.720,00	1	€69.720,00	€0,00	€0,00	0	€69.720	€69.720	27	€1.882.440	€1.882.440
Controlling the payment		105	840	€34.860,00	1	€34.860,00	€0,00	€0,00	0	€34.860	€34.860	27	€941.220	€941.220
<b>Total</b>						<b>€127.156,00</b>	<b>€200.000,00</b>	<b>€0,00</b>		<b>€128.169</b>	<b>€128.169</b>		<b>€3.460.572</b>	<b>€3.460.572</b>

○ For EU competent authority

If all ships above 400GT are included:

Actions required	Tariff (per hour)	Time per CA (man-days)	Time per competent authority (hours)	Price (per CA)	Frequency (per year)	Price (per CA & per year)	Equipment costs (per entity & per year)	Outsourcing costs (per CA & per year)	Business as usual costs (% of administrative costs)	Total administrative costs (per CA & per year)	Total administrative burden (per CA & per year)	Total administrative costs (per year)	Total administrative burdens (per year)	
Familiarizing with the information obligation	€67,00	55	440	€29.480,00	0,1	€2.948,00	€0	€0,00	0	€2.948	€2.948	27	€79.596	€79.596
Designing information material		200	1600	€107.200,00	0,1	€10.720,00	€200.000	€0,00	0	€210.720	€210.720	1	€210.720	€210.720
Informing the subjected entities		13800	110400	€7.396.800,00	0,1	€739.680,00	€0	€0,00	0	€739.680	€739.680	27	€19.961.360	€19.961.360
Verification of the information submitted		4600	36800	€2.465.600,00	1	€2.465.600,00	€0	€0,00	0	€2.465.600	€2.465.600	27	€66.571.200	€66.571.200
Controlling the payment of the tax		2300	18400	€1.232.800,00	1	€1.232.800,00	€0,00	€0,00	0	€1.232.800	€1.232.800	27	€33.285.600	€33.285.600
<b>Total</b>						<b>€4.451.748,00</b>	<b>€200.000,00</b>	<b>€0,00</b>		<b>€4.651.748</b>	<b>€4.651.748</b>		<b>€100.468.896</b>	<b>€100.468.896</b>

If all ships above 5000GT are included:

Actions required	Tariff (per hour)	Time per CA (man-days)	Time per competent authority (hours)	Price (per CA)	Frequency (per year)	Price (per CA & per year)	Equipment costs (per entity & per year)	Outsourcing costs (per CA & per year)	Business as usual costs (% of administrative costs)	Total administrative costs (per CA & per year)	Total administrative burden (per CA & per year)	Total administrative costs (per year)	Total administrative burdens (per year)	
Familiarizing with the information obligation	€67,00	55	440	€29.480,00	0,1	€2.948,00	€0	€0,00	0	€2.948	€2.948	27	€79.596	€79.596
Designing information material		200	1600	€107.200,00	0,1	€10.720,00	€200.000	€0,00	0	€210.720	€210.720	1	€210.720	€210.720
Informing the subjected entities		8550	68400	€4.582.800,00	0,1	€458.280,00	€0	€0,00	0	€458.280	€458.280	27	€12.373.560	€12.373.560
Verification of the information submitted		2850	22800	€1.527.600,00	1	€1.527.600,00	€0	€0,00	0	€1.527.600	€1.527.600	27	€41.245.200	€41.245.200
Controlling the payment of the tax		1425	11400	€763.800,00	1	€763.800,00	€0,00	€0,00	0	€763.800	€763.800	27	€20.682.600	€20.682.600
<b>Total</b>						<b>€2.763.348,00</b>	<b>€200.000,00</b>	<b>€0,00</b>		<b>€2.963.348</b>	<b>€2.963.348</b>		<b>€74.091.676</b>	<b>€74.091.676</b>

## 5. CONTRIBUTION BASED COMPENSATION FUND (OPTION 3C)

### ➤ Private based compensation fund

- For ship owners and ship operators

If all ships above 400GT are included:

Actions required	Tariff (per hour)	Time per vessel (man-days)	Time per vessel (hours)	Price (per vessel)	Frequency (per year)	Price (per vessel & per year)	Outsourcing costs (per vessel & per year)	Business as usual costs (% of administrative costs)	Total administrative costs (per vessel & per year)	Total administrative burden (per vessel & per year)	Number of entities concerned	Total administrative costs (per year)	Total administrative burdens (per year)
Familiarizing with the information obligation	€41,50	24	192	€7.968,00	0,1	€796,80	€0	0	€797	€797	18400	€14.661.120	€14.661.120
Preparation of the monitoring plan		6	48	€1.992,00	0,1	€199,20	€0	0	€199	€199	18400	€3.665.280	€3.665.280
Retrieving relevant information from existing data		3	24	€996,00	1	€996,00	€0	80	€996	€199	18400	€18.326.400	€3.665.280
Adjusting existing data		3	24	€996,00	1	€996,00	€0	0	€996	€996	18400	€18.326.400	€18.326.400
Filling in forms and tables, including recordkeeping		1	8	€332,00	1	€332,00	€0	0	€332	€332	18400	€6.108.800	€6.108.800
Verification		2	16	€664,00	1	€664,00	€3.750	0	€4.414	€4.414	18400	€81.217.600	€81.217.600
Submitting the information		1	8	€332,00	1	€332,00	€0	0	€332	€332	18400	€6.108.800	€6.108.800
Setting up the fund (central)				€0,00	0,1	€0,00	€70,00	0	€70	€70	18400	€1.288.000	€1.288.000
Setting up the fund (work by affiliated members)				€373,50	0,1	€37,35	€0,00	0	€37	€37	18400	€687.240	€687.240
Contribution to the fund administration			0	9	€373,50	1	€373,50	€373,50	0	€747	€747	18400	€13.744.800
<b>Total</b>						<b>€4.727</b>	<b>€4.194</b>		<b>€8.920</b>	<b>€8.124</b>		<b>€164.134.440</b>	<b>€149.473.320</b>

If all ships above 5000GT are included:

Actions required	Tariff (per hour)	Time per vessel (man-days)	Time per vessel (hours)	Price (per vessel)	Frequency (per year)	Price (per vessel & per year)	Outsourcing costs (per vessel & per year)	Business as usual costs (% of administrative costs)	Total administrative costs (per vessel & per year)	Total administrative burden (per vessel & per year)	Number of entities concerned	Total administrative costs (per year)	Total administrative burdens (per year)
Familiarizing with the information obligation	€41,50	20	160	€6.640,00	0,1	€664,00	€0	0	€664	€664	11400	€7.569.600	€7.569.600
Preparation of the monitoring plan		5	40	€1.660,00	0,1	€166,00	€0	0	€166	€166	11400	€1.892.400	€1.892.400
Retrieving relevant information from existing data		2	16	€664,00	1	€664,00	€0	80	€664	€133	11400	€7.569.600	€1.513.920
Adjusting existing data		2	16	€664,00	1	€664,00	€0	0	€664	€664	11400	€7.569.600	€7.569.600
Filling in forms and tables, including recordkeeping		1	8	€332,00	1	€332,00	€0	0	€332	€332	11400	€3.784.800	€3.784.800
Verification		2	16	€664,00	1	€664,00	€3.750	0	€4.414	€4.414	11400	€50.319.600	€50.319.600
Submitting the information		1	8	€332,00	1	€332,00	€0	0	€332	€332	11400	€3.784.800	€3.784.800
Setting up the fund (central)				€0,00	0,1	€0,00	€70,00	0	€70	€70	11400	€798.000	€798.000
Setting up the fund (work by affiliated members)				€373,50	0,1	€37,35	€0,00	0	€37	€37	11400	€425.790	€425.790
Contribution to the fund administration			0	9	€373,50	1	€373,50	€373,50	0	€747	€747	11400	€8.515.800
<b>Total</b>						<b>€3.897</b>	<b>€4.194</b>		<b>€8.090</b>	<b>€7.569</b>		<b>€92.229.990</b>	<b>€86.174.310</b>

The administrative burden under a privately managed compensation fund is similar to the administrative burden under option 3b (tax on emissions).

➤ *Public based compensation fund*

- For ship owners and ship operators

The administrative burden under a publicly managed compensation fund is similar to the administrative burden under option 3b (tax on emissions).

- For public authorities
  - For national competent authorities

If all ships above 400GT are included:

Actions required	Tariff (per hour)	Time per CA (man-days)	Time per competent authority (hours)	Price (per CA)	Frequency (per year)	Price (per CA & per year)	Equipment costs (per entity & per year)	Outsourcing costs (per CA & per year)	Business as usual costs (% of administrative costs)	Total administrative costs (per CA & per year)	Total administrative burden (per CA & per year)	Number of entities concerned	Total administrative costs (per year)	Total administrative burdens (per year)
Familiarizing with the information obligation	€41,50	55	440	€18.260,00	0,1	€1.826,00	€0,00	€0,00	0	€1.826	€1.826	27	€49.302	€49.302
Designing information material		200	1600	€66.400,00	0,1	€6.640,00	€200.000	€0,00	0	€7.653	€7.653	1	€206.640	€206.640
Informing the subjected entities		680	5440	€225.760,00	0,1	€22.576,00	€0,00	€0,00	0	€22.576	€22.576	27	€609.552	€609.552
Verification of the information submitted	€67,00	340	2720	€112.880,00	1	€112.880,00	€0,00	€0,00	0	€112.880	€112.880	27	€3.047.760	€3.047.760
Setting up the fund				191000	0,1	€1.279.000,00	€0,00	€0,00	0	€1.279.700	€1.279.700	1	€1.279.700	€1.279.700
Fund administration				204000	1	€13.668.000,00	€0,00	€0,00	0	€13.668.000	€13.668.000	1	€13.668.000	€13.668.000
Informing the subjected entities		440	3520	€235.840,00	1	€235.840,00	€0,00	€0,00	0	€235.840	€235.840	1	€235.840	€235.840
<b>Total</b>													<b>€19.096.794</b>	<b>€19.096.794</b>

If all ships above 5000GT are included:

Actions required	Tariff (per hour)	Time per CA (man-days)	Time per competent authority (hours)	Price (per CA)	Frequency (per year)	Price (per CA & per year)	Equipment costs (per entity & per year)	Outsourcing costs (per CA & per year)	Business as usual costs (% of administrative costs)	Total administrative costs (per CA & per year)	Total administrative burden (per CA & per year)	Number of entities concerned	Total administrative costs (per year)	Total administrative burdens (per year)
Familiarizing with the information obligation	€41,50	55	440	€18.260,00	0,1	€1.826,00	€0,00	€0,00	0	€1.826	€1.826	27	€49.302	€49.302
Designing information material		200	1600	€66.400,00	0,1	€6.640,00	€200.000	€0,00	0	€206.640	€206.640	1	€206.640	€206.640
Informing the subjected entities		420	3360	€139.440,00	0,1	€13.944,00	€0,00	€0,00	0	€13.944	€13.944	27	€376.488	€376.488
Verification of the information submitted		210	1680	€69.720,00	1	€69.720,00	€0,00	€0,00	0	€69.720	€69.720	27	€1.882.440	€1.882.440
Setting up the fund	€67,00		119000	€7.973.000,00	0,1	€797.300,00	€0,00	€0,00	0	€797.300	€797.300	1	€797.300	€797.300
Fund administration			126000	€8.442.000,00	1	€8.442.000,00	€0,00	€0,00	0	€8.442.000	€8.442.000	1	€8.442.000	€8.442.000
Informing the subjected entities		220	1760	€117.920,00	1	€117.920,00	€0,00	€0,00	0	€117.920	€117.920	1	€117.920	€117.920
<b>Total</b>													<b>€11.872.090</b>	<b>€11.872.090</b>

○ For EU competent authority

If all ships above 400GT are included:

Actions required	Tariff (per hour)	Time per CA (man-days)	Time per competent authority (hours)	Price (per CA)	Frequency (per year)	Price (per CA & per year)	Equipment costs (per entity & per year)	Outsourcing costs (per CA & per year)	Business as usual costs (% of administrative costs)	Total administrative costs (per CA & per year)	Total administrative burden (per CA & per year)	Total administrative costs (per year)	Total administrative burdens (per year)
Familiarizing with the information obligation	€41,50	55	440	€18.260,00	0,1	€1.826,00	€0	€0,00	0	€1.826	€1.826	€1.826	€1.826
Designing information material		200	1600	€66.400,00	0,1	€6.640,00	€200.000	€0,00	0	€206.640	€206.640	€206.640	€206.640
Informing the subjected entities		13800	110400	€4.581.600,00	0,1	€458.160,00	€0	€0,00	0	€458.160	€458.160	€458.160	€458.160
Verification of the information submitted		4600	36800	€1.527.200,00	1	€1.527.200,00	€0	€0,00	0	€1.527.200	€1.527.200	€1.527.200	€1.527.200
Controlling the membership	€67,00	2300	18400	€763.600,00	1	€763.600,00	€0,00	€0,00	0	€763.600	€763.600	€763.600	€763.600
Setting up the fund			191000	€12.797.000,00	0,1	€1.279.700,00	€0,00	€0,00	0	€1.279.700	€1.279.700	€1.279.700	€1.279.700
Fund administration			204000	€13.668.000,00	1	€13.668.000,00	€0,00	€0,00	0	€13.668.000	€13.668.000	€13.668.000	€13.668.000
Informing the subjected entities	440	3520	€235.840,00	1	€235.840,00	€0,00	€0,00	0	€235.840	€235.840	€235.840	€235.840	
<b>Total</b>						<b>€2.757.426,00</b>	<b>€200.000,00</b>			<b>€18.140.966</b>	<b>€18.140.966</b>	<b>€18.140.966</b>	<b>€18.140.966</b>

If all ships above 5000GT are included:

Actions required	Tariff (per hour)	Time per CA (man-days)	Time per competent authority (hours)	Price (per CA)	Frequency (per year)	Price (per CA & per year)	Equipment costs (per entity & per year)	Outsourcing costs (per CA & per year)	Business as usual costs (% of administrative costs)	Total administrative costs (per CA & per year)	Total administrative burden (per CA & per year)	Total administrative costs (per year)	Total administrative burdens (per year)
Familiarizing with the information obligation	€41,50	55	440	€18.260,00	0,1	€1.826,00	€0	€0,00	0	€1.826	€1.826	€1.826	€1.826
Designing information material		200	1600	€66.400,00	0,1	€6.640,00	€200.000	€0,00	0	€206.640	€206.640	€206.640	€206.640
Informing the subjected entities		8550	68400	€2.838.600,00	0,1	€283.860,00	€0	€0,00	0	€283.860	€283.860	€283.860	€283.860
Verification of the information submitted		2850	22800	€946.200,00	1	€946.200,00	€0	€0,00	0	€946.200	€946.200	€946.200	€946.200
Controlling the membership	€67,00	1425	11400	€473.100,00	1	€473.100,00	€0,00	€0,00	0	€473.100	€473.100	€473.100	€473.100
Setting up the fund			119000	€7.973.000,00	0,1	€797.300,00	€0,00	€0,00	0	€797.300	€797.300	€797.300	€797.300
Fund administration			126000	€8.442.000,00	1	€8.442.000,00	€0,00	€0,00	0	€8.442.000	€8.442.000	€8.442.000	€8.442.000
Informing the subjected entities	220	1760	€117.920,00	1	€117.920,00	€0,00	€0,00	0	€117.920	€117.920	€117.920	€117.920	
<b>Total</b>						<b>€1.711.626,00</b>	<b>€200.000,00</b>			<b>€11.268.846</b>	<b>€11.268.846</b>	<b>€11.268.846</b>	<b>€11.268.846</b>

## 6. CLOSED ETS (OPTION 4A)

- For ship owners and ship operators

If all ships above 400GT are included:

Actions required	Tariff (per hour)	Time per vessel (man-days)	Time per vessel (hours)	Price (per vessel)	Frequency (per year)	Price (per vessel & per year)	Outsourcing costs (per vessel & per year)	Business as usual costs (% of administrative costs)	Total administrative costs (per vessel & per year)	Total administrative burden (per vessel & per year)	Number of entities concerned	Total administrative costs (per year)	Total administrative burdens (per year)	
Familiarizing with the information obligation	€41,50	55	440	€18.260,00	0,1	€1.826,00	€0	0	€1.826	€1.826	18400	€33.598.400	€33.598.400	
Preparation of the monitoring plan		6	48	€1.992,00	0,1	€199,20	€0	0	€199	€199	18400	€3.665.280	€3.665.280	
Retrieving relevant information from existing data (MRV)		3	24	€996,00	1	€996,00	€0	80	€996	€199	18400	€18.326.400	€3.665.280	
Adjusting existing data (MRV)		3	24	€996,00	1	€996,00	€0	0	€996	€996	18400	€18.326.400	€18.326.400	
Filling in forms and tables, including recordkeeping (MRV)		1	8	€332,00	1	€332,00	€0	0	€332	€332	18400	€6.108.800	€6.108.800	
Verification (MRV)		2	16	€664,00	1	€664,00	€3.750	0	€4.414	€4.414	18400	€81.217.600	€81.217.600	
Submitting the information (MRV)		1	8	€332,00	1	€332,00	€0	0	€332	€332	18400	€6.108.800	€6.108.800	
Surrendering allowances		1	8	€332,00	1	€332,00	€0,00	0	€332	€332	18400	€6.108.800	€6.108.800	
Purchasing allowances		1	8	€332,00	1	€332,00	€0,00	0	€332	€332	18400	€6.108.800	€6.108.800	
Designing information material		6	48	€1.992,00	0,1	€199,20	€0,00	0	€199	€199	18400	€3.665.280	€3.665.280	
Retrieving relevant information from existing data (benchmarks)		3	24	€996,00	0,1	€99,60	€0,00	80	€100	€20	18400	€1.832.640	€366.528	
Adjusting existing data (benchmarks)		3	24	€996,00	0,1	€99,60	€0,00	80	€100	€20	18400	€1.832.640	€366.528	
Filling in forms and tables, including recordkeeping (benchmarks)		1	8	€332,00	0,1	€33,20	€0,00	0	€33	€33	18400	€610.880	€610.880	
Verification (benchmarks)		2	16	€664,00	0,1	€66,40	€375,00	0	€441	€441	18400	€8.121.760	€8.121.760	
Submitting the information (benchmarks)		1	8	€332,00	0,1	€33,20	€0,00	0	€33	€33	18400	€610.880	€610.880	
<b>Total</b>							<b>€6.540</b>	<b>€4.125</b>		<b>€10.665</b>	<b>€9.709</b>		<b>€196.243.360</b>	<b>€178.650.016</b>

If all ships above 5000GT are included:

Actions required	Tariff (per hour)	Time per vessel (man-days)	Time per vessel (hours)	Price (per vessel)	Frequency (per year)	Price (per vessel & per year)	Outsourcing costs (per vessel & per year)	Business as usual costs (% of administrative costs)	Total administrative costs (per vessel & per year)	Total administrative burden (per vessel & per year)	Number of entities concerned	Total administrative costs (per year)	Total administrative burdens (per year)
Familiarizing with the information obligation	€41,50	55	440	€18.260,00	0,1	€1.826,00	€0,00	0	€1.826	€1.826	11400	€20.816.400	€20.816.400
Preparation of the monitoring plan		5	40	€1.660,00	0,1	€166,00	€0,00	0	€166	€166	11400	€1.892.400	€1.892.400
Retrieving relevant information from existing data (MRV)		2	16	€664,00	1	€664,00	€0,00	80	€664	€133	11400	€7.569.600	€1.513.920
Adjusting existing data (MRV)		2	16	€664,00	1	€664,00	€0,00	0	€664	€664	11400	€7.569.600	€7.569.600
Filling in forms and tables, including recordkeeping (MRV)		1	8	€332,00	1	€332,00	€0,00	0	€332	€332	11400	€3.784.800	€3.784.800
Verification (MRV)		2	16	€664,00	1	€664,00	€3.750,00	0	€4.414	€4.414	11400	€50.319.600	€50.319.600
Submitting the information (MRV)		1	8	€332,00	1	€332,00	€0,00	0	€332	€332	11400	€3.784.800	€3.784.800
Surrendering allowances		1	8	€332,00	1	€332,00	€0,00	0	€332	€332	11400	€3.784.800	€3.784.800
Purchasing allowances		1	8	€332,00	1	€332,00	€0,00	0	€332	€332	11400	€3.784.800	€3.784.800
Designing information material		5	40	€1.660,00	0,1	€166,00	€0,00	0	€166	€166	11400	€1.892.400	€1.892.400
Retrieving relevant information from existing data (benchmarks)		2	16	€664,00	0,1	€66,40	€0,00	80	€66	€13	11400	€756.960	€151.392
Adjusting existing data (benchmarks)		2	16	€664,00	0,1	€66,40	€0,00	80	€66	€13	11400	€756.960	€151.392
Filling in forms and tables, including recordkeeping (benchmarks)		1	8	€332,00	0,1	€33,20	€0,00	0	€33	€33	11400	€378.480	€378.480
Verification (benchmarks)		2	16	€664,00	0,1	€66,40	€375,00	0	€441	€441	11400	€5.031.960	€5.031.960
Submitting the information (benchmarks)		1	8	€332,00	0,1	€33,20	€0,00	0	€33	€33	11400	€378.480	€378.480
<b>Total</b>							<b>€5.744</b>	<b>€4.125</b>		<b>€9.869</b>	<b>€9.231</b>		<b>€112.502.040</b>

- For public authorities

- For national competent authorities

If all ships above 400GT are included:

Actions required	Tariff (per hour)	Time per CA (man-days)	Time per competent authority (hours)	Price (per CA)	Frequency (per year)	Price (per CA & per year)	Equipment costs (per entity & per year)	Outsourcing costs (per CA & per year)	Business as usual costs (% of administrative costs)	Total administrative costs (per CA & per year)	Total administrative burden (per CA & per year)	Number of entities concerned	Total administrative costs (per year)	Total administrative burdens (per year)	
Familiarizing with the information obligation	€41,50	55	440	€18.260,00	0,1	€1.826,00	€0,00	€0,00	0	€1.826	€1.826	27	€49.302	€49.302	
Designing information material		200	1600	€66.400,00	0,1	€6.640,00	€200.000	€0,00	0	€7.653	€7.653	1	€206.640	€206.640	
Informing the subjected entities		680	5440	€225.760,00	0,1	€22.576,00	€0,00	€0,00	0	€22.576	€22.576	27	€609.552	€609.552	
Verification of the information submitted		340	2720	€112.880,00	1	€112.880,00	€0,00	€0,00	0	€112.880	€112.880	27	€3.047.760	€3.047.760	
Controlling of the surrendering		10	80	€3.320,00	1	€3.320,00	€0,00	€0,00	50	€3.320	€664	27	€89.640	€44.820	
Familiarizing with the information obligation (benchmarks)		50	400	€16.600,00	0,1	€1.660,00	€0,00	€0,00	0	€1.660	€1.660	1	€1.660	€1.660	
Designing information material (benchmarks)		200	1600	€66.400,00	0,1	€6.640,00	€0,00	€0,00	0	€6.640	€6.640	1	€6.640	€6.640	
Informing the subjected entities (benchmarks)		13800	110400	€4.581.600,00	0,1	€458.160,00	€0,00	€0,00	0	€458.160	€458.160	1	€458.160	€458.160	
Verification of the information submitted (benchmarks)		4600	36800	€1.527.200,00	0,1	€152.720,00	€0,00	€50.000,00	0	€202.720	€202.720	1	€202.720	€202.720	
Delivering the free allocations		2300	18400	€763.600,00	0,1	€76.360,00	€0,00	€0,00	0	€76.360	€76.360	1	€76.360	€76.360	
<b>Total</b>														<b>€4.748.434</b>	<b>€4.703.614</b>

If all ships above 5000GT are included:

Actions required	Tariff (per hour)	Time per CA (man-days)	Time per competent authority (hours)	Price (per CA)	Frequency (per year)	Price (per CA & per year)	Equipment costs (per entity & per year)	Outsourcing costs (per CA & per year)	Business as usual costs (% of administrative costs)	Total administrative costs (per CA & per year)	Total administrative burden (per CA & per year)	Number of entities concerned	Total administrative costs (per year)	Total administrative burdens (per year)	
Familiarizing with the information obligation	€41,50	55	440	€18.260,00	0,1	€1.826,00	€0,00	€0,00	0	€1.826	€1.826	27	€49.302	€49.302	
Designing information material		200	1600	€66.400,00	0,1	€6.640,00	€200.000	€0,00	0	€206.640	€206.640	1	€206.640	€206.640	
Informing the subjected entities		420	3360	€139.440,00	0,1	€13.944,00	€0,00	€0,00	0	€13.944	€13.944	27	€376.488	€376.488	
Verification of the information submitted		210	1680	€69.720,00	1	€69.720,00	€0,00	€0,00	0	€69.720	€69.720	27	€1.882.440	€1.882.440	
Controlling of the surrendering		10	80	€3.320,00	1	€3.320,00	€0,00	€0,00	50	€3.320	€664	27	€89.640	€44.820	
Familiarizing with the information obligation (benchmarks)		50	400	€16.600,00	0,1	€1.660,00	€0,00	€0,00	0	€1.660	€1.660	1	€1.660	€1.660	
Designing information material (benchmarks)		200	1600	€66.400,00	0,1	€6.640,00	€0,00	€0,00	0	€6.640	€6.640	1	€6.640	€6.640	
Informing the subjected entities (benchmarks)		8560	68400	€2.838.600,00	0,1	€283.860,00	€0,00	€0,00	0	€283.860	€283.860	1	€283.860	€283.860	
Verification of the information submitted (benchmarks)		2850	22800	€946.200,00	0,1	€94.620,00	€0,00	€50.000,00	0	€144.620	€144.620	1	€144.620	€144.620	
Delivering the free allocations		1425	11400	€473.100,00	0,1	€47.310,00	€0,00	€0,00	0	€47.310	€47.310	1	€47.310	€47.310	
<b>Total</b>														<b>€3.088.600</b>	<b>€3.043.780</b>

- For EU competent authority

If all ships above 400GT are included:

Actions required	Tariff (per hour)	Time per CA (man-days)	Time per competent authority (hours)	Price (per CA)	Frequency (per year)	Price (per CA & per year)	Equipment costs (per entity & per year)	Outsourcing costs (per CA & per year)	Business as usual costs (% of administrative costs)	Total administrative costs (per CA & per year)	Total administrative burden (per CA & per year)	Number of entities concerned	Total administrative costs (per year)	Total administrative burdens (per year)
Familiarizing with the information obligation	€41,50	55	440	€18.260,00	0,1	€1.826,00	€0	€0,00	0	€1.826	€1.826	1	€1.826	€1.826
Designing information material		200	1600	€66.400,00	0,1	€6.640,00	€200.000	€0,00	0	€7.653	€7.653	1	€206.640	€206.640
Informing the subjected entities		13800	110400	€4.581.600,00	0,1	€458.160,00	€0	€0,00	0	€458.160	€458.160	1	€458.160	€458.160
Verification of the information submitted		4600	36800	€1.527.200,00	1	€1.527.200,00	€0	€0,00	0	€1.527.200	€1.527.200	1	€1.527.200	€1.527.200
Controlling of the surrendering		10	80	€3.320,00	1	€3.320,00	€0,00	€0,00	50	€3.320	€1.660	1	€3.320	€1.660
Familiarizing with the information obligation (benchmarks)		50	400	€16.600,00	0,1	€1.660,00	€0,00	€0,00	0	€1.660	€1.660	1	€1.660	€1.660
Designing information material (benchmarks)		200	1600	€66.400,00	0,1	€6.640,00	€0,00	€0,00	0	€6.640	€6.640	1	€6.640	€6.640
Informing the subjected entities (benchmarks)		13800	110400	€4.581.600,00	0,1	€458.160,00	€0,00	€0,00	0	€458.160	€458.160	1	€458.160	€458.160
Verification of the information submitted (benchmarks)		4600	36800	€1.527.200,00	0,1	€152.720,00	€0,00	€50.000,00	0	€202.720	€202.720	1	€202.720	€202.720
Delivering the free allocations		2300	18400	€763.600,00	0,1	€76.360,00	€0,00	€0,00	0	€76.360	€76.360	1	€76.360	€76.360
<b>Total</b>														<b>€2.942.686</b>

If all ships above 5000GT are included:

Actions required	Tariff (per hour)	Time per CA (man-days)	Time per competent authority (hours)	Price (per CA)	Frequency (per year)	Price (per CA & per year)	Equipment costs (per entity & per year)	Outsourcing costs (per CA & per year)	Business as usual costs (% of administrative costs)	Total administrative costs (per CA & per year)	Total administrative burden (per CA & per year)	Number of entities concerned	Total administrative costs (per year)	Total administrative burdens (per year)
Familiarizing with the information obligation	€41,50	55	440	€18.260,00	0,1	€1.826,00	€0	€0,00	0	€1.826	€1.826	1	€1.826	€1.826
Designing information material		200	1600	€66.400,00	0,1	€6.640,00	€200.000	€0,00	0	€206.640	€206.640	1	€206.640	€206.640
Informing the subjected entities		8550	68400	€2.838.600,00	0,1	€283.860,00	€0	€0,00	0	€283.860	€283.860	1	€283.860	€283.860
Verification of the information submitted		2850	22800	€946.200,00	1	€946.200,00	€0	€0,00	0	€946.200	€946.200	1	€946.200	€946.200
Controlling of the surrendering		10	80	€3.320,00	1	€3.320,00	€0,00	€0,00	50	€3.320	€1.660	1	€3.320	€1.660
Familiarizing with the information obligation (benchmarks)		50	400	€16.600,00	0,1	€1.660,00	€0,00	€0,00	0	€1.660	€1.660	1	€1.660	€1.660
Designing information material (benchmarks)		200	1600	€66.400,00	0,1	€6.640,00	€0,00	€0,00	0	€6.640	€6.640	1	€6.640	€6.640
Informing the subjected entities (benchmarks)		8550	68400	€2.838.600,00	0,1	€283.860,00	€0,00	€0,00	0	€283.860	€283.860	1	€283.860	€283.860
Verification of the information submitted (benchmarks)		2850	22800	€946.200,00	0,1	€94.620,00	€0,00	€50.000,00	0	€144.620	€144.620	1	€144.620	€144.620
Delivering the free allocations		1425	11400	€473.100,00	0,1	€47.310,00	€0,00	€0,00	0	€47.310	€47.310	1	€47.310	€47.310
<b>Total</b>														<b>€1.925.936</b>

#### 7. OPEN ETS WITH FREE ALLOCATION (OPTION 4B)

The administrative costs and administrative burden under this option are equal to option 4a (closed ETS)

#### 8. OPEN ETS WITH FULL AUCTIONING (OPTION 4C)

- For ship owners and ship operators

If all ships above 400GT are included:

Actions required	Tariff (per hour)	Time per vessel (man-days)	Time per vessel (hours)	Price (per vessel)	Frequency (per year)	Price (per vessel & per year)	Outsourcing costs (per vessel & per year)	Business as usual costs (% of administrative costs)	Total administrative costs (per vessel & per year)	Total administrative burden (per vessel & per year)	Number of entities concerned	Total administrative costs (per year)	Total administrative burdens (per year)
Familiarizing with the information obligation	€41,50	29	232	€9.628,00	0,1	€962,80	€0	0	€963	€963	18400	€17.715.520	€17.715.520
Preparation of the monitoring plan		6	48	€1.992,00	0,1	€199,20	€0	0	€199	€199	18400	€3.665.280	€3.665.280
Retrieving relevant information from existing data (MRV)		3	24	€996,00	1	€996,00	€0	80	€996	€199	18400	€18.326.400	€3.665.280
Adjusting existing data (MRV)		3	24	€996,00	1	€996,00	€0	0	€996	€996	18400	€18.326.400	€18.326.400
Filling in forms and tables, including recordkeeping (MRV)		1	8	€332,00	1	€332,00	€0	0	€332	€332	18400	€6.108.800	€6.108.800
Verification (MRV)		2	16	€664,00	1	€664,00	€3.750	0	€4.414	€4.414	18400	€81.217.600	€81.217.600
Submitting the information (MRV)		1	8	€332,00	1	€332,00	€0	0	€332	€332	18400	€6.108.800	€6.108.800
Surrendering allowances		1	8	€332,00	1	€332,00	€0,00	0	€332	€332	18400	€6.108.800	€6.108.800
Purchasing allowances		1	8	€332,00	1	€332,00	€0,00	0	€332	€332	18400	€6.108.800	€6.108.800
<b>Total</b>							<b>€5.146</b>	<b>€3.750</b>		<b>€8.896</b>	<b>€8.099</b>		<b>€163.686.400</b>

If all ships above 5000GT are included:

Actions required	Tariff (per hour)	Time per vessel (man-days)	Time per vessel (hours)	Price (per vessel)	Frequency (per year)	Price (per vessel & per year)	Outsourcing costs (per vessel & per year)	Business as usual costs (% of administrative costs)	Total administrative costs (per vessel & per year)	Total administrative burden (per vessel & per year)	Number of entities concerned	Total administrative costs (per year)	Total administrative burdens (per year)
Familiarizing with the information obligation	€41,50	29	232	€9.628,00	0,1	€962,80	€0	0	€963	€963	11400	€10.975.920	€10.975.920
Preparation of the monitoring plan		5	40	€1.660,00	0,1	€166,00	€0	0	€166	€166	11400	€1.892.400	€1.892.400
Retrieving relevant information from existing data (MRV)		2	16	€664,00	1	€664,00	€0	80	€664	€133	11400	€7.569.600	€1.513.920
Adjusting existing data (MRV)		2	16	€664,00	1	€664,00	€0	0	€664	€664	11400	€7.569.600	€7.569.600
Filling in forms and tables, including recordkeeping (MRV)		1	8	€332,00	1	€332,00	€0	0	€332	€332	11400	€3.784.800	€3.784.800
Verification (MRV)		2	16	€664,00	1	€664,00	€3.750	0	€4.414	€4.414	11400	€50.319.600	€50.319.600
Submitting the information (MRV)		1	8	€332,00	1	€332,00	€0	0	€332	€332	11400	€3.784.800	€3.784.800
Surrendering allowances		1	8	€332,00	1	€332,00	€0,00	0	€332	€332	11400	€3.784.800	€3.784.800
Purchasing allowances		1	8	€332,00	1	€332,00	€0,00	0	€332	€332	11400	€3.784.800	€3.784.800
<b>Total</b>							<b>€4.449</b>	<b>€3.750</b>		<b>€8.199</b>	<b>€7.668</b>		<b>€93.466.320</b>

- For public authorities
  - For national competent authorities

If all ships above 400GT are included:

Actions required	Tariff (per hour)	Time per CA (man-days)	Time per competent authority (hours)	Price (per CA)	Frequency (per year)	Price (per CA & per year)	Equipment costs (per entity & per year)	Outsourcing costs (per CA & per year)	Business as usual costs (% of administrative costs)	Total administrative costs (per CA & per year)	Total administrative burden (per CA & per year)	Number of entities concerned	Total administrative costs (per year)	Total administrative burdens (per year)	
Familiarizing with the information obligation	€41,50	55	440	€18.260,00	0,1	€1.826,00	€0,00	€0,00	0	€1.826	€1.826	27	€49.302	€49.302	
Designing information material		200	1600	€66.400,00	0,1	€6.640,00	€200.000	€0,00	0	€7.653	€7.653	1	€206.640	€206.640	
Informing the subjected entities		680	5440	€225.760,00	0,1	€22.576,00	€0,00	€0,00	0	€22.576	€22.576	27	€609.552	€609.552	
Verification of the information submitted		340	2720	€112.880,00	1	€112.880,00	€0,00	€0,00	0	€112.880	€112.880	27	€3.047.760	€3.047.760	
Controlling of the surrendering		10	80	€3.320,00	1	€3.320,00	€0,00	€0,00	50	€3.320	€1.660	27	€89.640	€44.820	
Auctioning allowances		60	480	€19.920,00	1	€19.920,00	€0,00	€100.000,00	50	€119.920	€59.960	27	€3.237.840	€1.618.920	
Managed the revenue generated		30	240	€9.960,00	1	€9.960,00	€0,00	€0,00	50	€9.960	€4.980	27	€268.920	€134.460	
<b>Total</b>														<b>€7.509.654</b>	<b>€5.711.454</b>

If all ships above 5000GT are included:

Actions required	Tariff (per hour)	Time per CA (man-days)	Time per competent authority (hours)	Price (per CA)	Frequency (per year)	Price (per CA & per year)	Equipment costs (per entity & per year)	Outsourcing costs (per CA & per year)	Business as usual costs (% of administrative costs)	Total administrative costs (per CA & per year)	Total administrative burden (per CA & per year)	Number of entities concerned	Total administrative costs (per year)	Total administrative burdens (per year)	
Familiarizing with the information obligation	€41,50	55	440	€18.260,00	0,1	€1.826,00	€0,00	€0,00	0	€1.826	€1.826	27	€49.302	€49.302	
Designing information material		200	1600	€66.400,00	0,1	€6.640,00	€200.000	€0,00	0	€206.640	€206.640	1	€206.640	€206.640	
Informing the subjected entities		420	3360	€139.440,00	0,1	€13.944,00	€0,00	€0,00	0	€13.944	€13.944	27	€376.488	€376.488	
Verification of the information submitted		210	1680	€69.720,00	1	€69.720,00	€0,00	€0,00	0	€69.720	€69.720	27	€1.882.440	€1.882.440	
Controlling of the surrendering		10	80	€3.320,00	1	€3.320,00	€0,00	€0,00	50	€3.320	€1.660	27	€89.640	€44.820	
Auctioning allowances		60	480	€19.920,00	1	€19.920,00	€0,00	€100.000,00	50	€119.920	€59.960	27	€3.237.840	€1.618.920	
Managed the revenue generated		30	240	€9.960,00	1	€9.960,00	€0,00	€0,00	50	€9.960	€4.980	27	€268.920	€134.460	
<b>Total</b>														<b>€6.111.270</b>	<b>€4.313.070</b>

- For EU competent authority

If all ships above 400GT are included:

Actions required	Tariff (per hour)	Time per CA (man-days)	Time per competent authority (hours)	Price (per CA)	Frequency (per year)	Price (per CA & per year)	Equipment costs (per entity & per year)	Outsourcing costs (per CA & per year)	Business as usual costs (% of administrative costs)	Total administrative costs (per CA & per year)	Total administrative burden (per CA & per year)	Number of entities concerned	Total administrative costs (per year)	Total administrative burdens (per year)	
Familiarizing with the information obligation	€41,50	55	440	€18.260,00	0,1	€1.826,00	€0,00	€0,00	0	€1.826	€1.826	1	€1.826	€1.826	
Designing information material		200	1600	€66.400,00	0,1	€6.640,00	€200.000	€0,00	0	€7.653	€7.653	1	€206.640	€206.640	
Informing the subjected entities		13800	110400	€4.581.600,00	0,1	€458.160,00	€0,00	€0,00	0	€458.160	€458.160	1	€458.160	€458.160	
Verification of the information submitted		4600	36800	€1.527.200,00	1	€1.527.200,00	€0,00	€0,00	0	€1.527.200	€1.527.200	1	€1.527.200	€1.527.200	
Controlling of the surrendering		10	80	€3.320,00	1	€3.320,00	€0,00	€0,00	50	€3.320	€1.660	1	€3.320	€1.660	
Auctioning allowances		60	480	€19.920,00	1	€19.920,00	€0,00	€2.000.000,00	50	€2.019.920	€1.009.960	1	€2.019.920	€1.009.960	
Managed the revenue generated		30	240	€9.960,00	1	€9.960,00	€0,00	€0,00	50	€9.960	€4.980	1	€9.960	€4.980	
<b>Total</b>														<b>€4.227.026</b>	<b>€3.210.426</b>

If all ships above 5000GT are included:

Actions required	Tariff (per hour)	Time per CA (man-days)	Time per competent authority (hours)	Price (per CA)	Frequency (per year)	Price (per CA & per year)	Equipment costs (per entity & per year)	Outsourcing costs (per CA & per year)	Business as usual costs (% of administrative costs)	Total administrative costs (per CA & per year)	Total administrative burden (per CA & per year)	Number of entities concerned	Total administrative costs (per year)	Total administrative burdens (per year)
Familiarizing with the information obligation	€41,50	55	440	€18.260,00	0,1	€1.826,00	€0,00	€0,00	0	€1.826	€1.826	1	€1.826	€1.826
Designing information material		200	1600	€66.400,00	0,1	€6.640,00	€200.000	€0,00	0	€206.640	€206.640	1	€206.640	€206.640
Informing the subjected entities		8550	68400	€2.838.600,00	0,1	€283.860,00	€0,00	€0,00	0	€283.860	€283.860	1	€283.860	€283.860
Verification of the information submitted		2850	22800	€946.200,00	1	€946.200,00	€0,00	€0,00	0	€946.200	€946.200	1	€946.200	€946.200
Controlling of the surrendering		10	80	€3.320,00	1	€3.320,00	€0,00	€0,00	50	€3.320	€1.660	1	€3.320	€1.660
Auctioning allowances		60	480	€19.920,00	1	€19.920,00	€0,00	€2.000.000,00	50	€2.019.920	€1.009.960	1	€2.019.920	€1.009.960
Managed the revenue generated		30	240	€9.960,00	1	€9.960,00	€0,00	€0,00	50	€9.960	€4.980	1	€9.960	€4.980
<b>Total</b>														<b>€3.471.726</b>

### 9. TARGET BASED COMPENSATION FUND (OPTION 5)

The administrative costs and administrative burden under this option are equal to option 3c (contribution based compensation fund)

## **ANNEX XIV – SPECIFIC ELEMENTS OF OPTION 2 – MONITORING AND REPORTING BASED ON FUEL CONSUMED**

CO<sub>2</sub> emissions from ships relate to the emission factor associated (in CO<sub>2</sub> per tonnes of fuel) of the type of fuel consumed and the volume of fuel consumed (in tonnes).

Fuels used for maritime transport are much more diverse compared to those used in other transport modes. However, default values for emission factors (as e.g. provided by Decision 2007/589/EC based on IPCC 2006 figures for standard fuel types) can be used to lower administrative effort.

Fuel consumption on EU related routes required for the monitoring of emissions is already available for almost all ships. In this context, Regulation 18 of MARPOL Annex V already makes compulsory the availability of bunker delivery notes<sup>16</sup> for ships engaged in international transport over 400 GT. So, the global fuel consumption of a ship is already monitored. However, in order to get the fuel consumed on EU related routes, the global fuel consumption has to be split between different routes (at least for ships involved in routes related to third countries).

Regulation V/28 of SOLAS already require all ships of 500 GT and above, engaged on international voyages exceeding 48 hours, to submit a daily report to their company, to include ship's position, ship's course and speed. So, the fuel consumption per route can be monitored.

Several technical methods exist for the actual measurement of fuel consumption and this measurement is already done for commercial reasons. The choice of method depends on the available equipment on board a ship. There are no current international regulations mandating the use of specific equipment or a certain level of accuracy in the measurements. The particular method to measure fuel consumption need not be prescribed by a European scheme.

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<sup>16</sup> The bunker delivery note includes the name and IMO number of the ship receiving the fuel, the port of bunkering, the marine bunker supplier contact information, fuel quantity and density.

## **ANNEX XV – SPECIFIC ELEMENTS OF OPTION 4 – EMISSIONS TRADING SCHEMES**

A link to external carbon market mechanisms will result in an equalisation of prices. The potential range of impacts will be strongly determined by the available supply of allowances from for instance the EU-ETS, sectorial trading mechanisms or other carbon market mechanisms. The assessment does not look into potential sources of this supply and the impact of the potential demand from the maritime sector on these sources of supply (see Annex VI).

New allowances created for the maritime sector can be allocated for free to the ship owners and ship operators or auctioned. The auctioning of allowances allows revenue generation that could *inter alia* be rechanneled in the sector to remove some market barriers. A central European entity could be in charge of auctioning allowances with full hypothecation.

The competent authority in charge of approving monitoring plans, receiving and validating verified emissions reports would be the Member States or a central EU competent authority. Moreover, the control of the surrendering of required allowances will also be done by the Member States, in accordance with existing provisions of Directive 2003/87/EC or by a central EU competent authority.