Council of the
European Union

Brussels, 22 March 2022
(OR. en)

7452/22

MAR 55
OMI 35
CLIMA 126
ENV 259

COVER NOTE

From:	Secretary-General of the European Commission, signed by Ms Martine DEPREZ, Director
date of receipt:	21 March 2022
To:	Mr Jeppe TRANHOLM-MIKKELSEN, Secretary-General of the Council of the European Union
No. Cion doc.:	SWD(2022) 77 final
Subject:	COMMISSION STAFF WORKING DOCUMENT Union submission to the International Maritime Organization's 12th Intersessional Working Group on Reduction of GHG Emissions from Ships providing an Initial Impact Assessment of a GHG Fuel Standard

Delegations will find attached document SWD(2022) 77 final.

Encl.: SWD(2022) 77 final

EUROPEAN
COMMISSION

Brussels, 21.3.2022
SWD(2022) 77 final

COMMISSION STAFF WORKING DOCUMENT

Union submission to the International Maritime Organization's 12th Intersessional Working Group on Reduction of GHG Emissions from Ships providing an Initial Impact Assessment of a GHG Fuel Standard

Union submission to the International Maritime Organization's 12th Intersessional Working Group on Reduction of GHG Emissions from Ships providing an Initial Impact Assessment of a GHG Fuel Standard

PURPOSE

This Staff Working Document contains a draft Union submission to the International Maritime Organization's (IMO) 12th Intersessional Working Group on Reduction of GHG Emissions from Ships. The IMO has indicatively scheduled ISWG-GHG 12 from 16 to 20 May 2022.

The draft submission accompanies the Union submission[1] to ISWG-GHG 12 suggesting a Greenhouse Gas (GHG) Fuel Standard (GFS) as a mid-term measure and provides an initial impact assessment of GFS in line with the Procedure for assessing impacts on States of candidate Measures.

The aim of this initial impact assessment is to:

- Identify the potential of the GFS in terms of fuel transition and emissions reduction;
- Identify which impacts should be assessed;
- Analyse the extent of impacts on States; and
- Assess whether the GFS is likely to result in disproportionally negative impacts on States, and how such impacts could be addressed, as appropriate.

EU COMPETENCE

Regulation (EU) 2015/757[2] (EU MRV Regulation) establishes the legal framework for an EU system to monitor, report and verify (MRV) CO_2 emissions and energy efficiency from shipping. The regulation aims to deliver robust and verifiable CO_2 emissions data, inform policy makers and stimulate the market uptake of energy efficient technologies and behaviours. It does so by addressing market barriers such as the lack of information. It entered into force on 1 July 2015.

Any IMO measure on GHG matters, which will unequivocally require the monitoring, verification and reporting of GHG emissions from shipping, would affect the EU MRV Regulation. Therefore, the EU has exclusive competence for GHG emissions in shipping.

In addition, on 14 July 2021, the Commission adopted the *Fit for 55* package of legislative proposals to further reduce GHG emissions. *Fit for 55* includes a number of Commission proposals that specifically target the shipping sector, such as the revision of the EU Emission Trading System (ETS) to include the maritime transport sector (and the corresponding amendments to the EU MRV Regulation)[3] but also the FuelEU maritime proposal[4], which focuses on the use of renewable and low-carbon fuels in the maritime sector and mandates the uptake thereof by the ships calling EU ports. Under the case-law[5], the risk of affectation concerns not only the rules as they stand, but also their foreseeable future development. These legislative initiatives further lead to the exclusive competence of the EU for GHG emission in shipping.[6]

[1] Currently under interservice consultation ISC/2022/01840.

[2] Regulation (EU) 2015/757 of the European Parliament and of the Council of 29 April 2015 on the monitoring, reporting and verification of carbon dioxide emissions from maritime transport, and amending Directive 2009/16/EC, OJ L 123, 19.5.2015, p. 55–76

[3] COM(2021) 551 - Proposal for a directive of the European Parliament and of the Council amending Directive 2003/87/EC establishing a system for greenhouse gas emission allowance trading within the Union, Decision (EU) 2015/1814 concerning the establishment and operation of a market stability reserve for the Union greenhouse gas emission trading scheme and Regulation (EU) 2015/757

[4] COM(2021) 562 - Proposal for a regulation of the European Parliament and of the Council on the use of renewable and low-carbon fuels in maritime transport and amending Directive 2009/16/EC.

[5] Opinion 1/03 of the Court of Justice of 7 February 2006, Lugano Convention, point 126.

[6] See in particular Commission proposal COM(2021) 551 referred to in footnote 3. It introduces a reporting and review

The European Commission has adopted in 2021 a communication on a new approach for a sustainable blue economy in the EU[7], taking a systemic view that integrates ocean policy into Europe's new economic policy. Our ocean, and the 'blue economy' it supports, is indispensable to achieving the transformation set out in the European Green Deal. Prominent examples are the contributions of oceans to energy production and to the greening of transport and ports.

An EU position had been established for the Union submission ISWG-GHG 10/5/3 concerning the GHG Fuel Standard (GFS) that was put forward as a mid-term measure. The measure was extensively discussed at ISWG-GHG 10. The draft Union submission to ISWG-GHG 12 suggesting a Greenhouse Gas (GHG) Fuel Standard (GFS) as a mid-term measure further develops the GFS and provides a more detailed description, taking into account the comments made during ISWG-GHG 10 in order to advance discussions on prioritisation of mid-term measures. This submission accompanies the draft Union submission to ISWG-GHG 12 suggesting a GFS.

In light of the above, the present draft Union submission falls under EU exclusive competence.[8] This Staff Working Document is presented to establish an EU position on the matter and to transmit the document to the IMO prior to the required deadline of 1 April 2022.[9]

provision (Article 3 ge) into Directive 2003/87 regarding possible amendments in relation to the adoption by the International Maritime Organisation of a global market-based measure to reduce greenhouse gas emissions from maritime transport. The existence of such a review provision confirms the existence of a risk of affectation of the existing and foreseeable EU acquis.

[7] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM:2021:240:FIN

[8] An EU position under Article 218(9) TFEU is to be established in due time should the IMO Marine Environment Protection Committee eventually be called upon to adopt an act having legal effects as regards the subject matter of the said draft Union submission. The concept of '*acts having legal effects*' includes acts that have legal effects by virtue of the rules of international law governing the body in question. It also includes instruments that do not have a binding effect under international law, but that are '*capable of decisively influencing the content of the legislation adopted by the EU legislature*' (Case C-399/12 Germany v Council (OIV), ECLI:EU:C:2014:2258, paragraphs 61-64). The present submission, however, does not produce legal effects and thus the procedure for Article 218(9) TFEU is not applied.

[9] The submission of proposals or information papers to the IMO, on issues falling under external exclusive EU competence, are acts of external representation. Such submissions are to be made by an EU actor who can represent the Union externally under the Treaty, which for non-CFSP (Common Foreign and Security Policy) issues is the Commission or the EU Delegation in accordance with Article 17(1) TEU and Article 221 TFEU. IMO internal rules make such an arrangement absolutely possible as regards existing agenda and work programme items. This way of proceeding is in line with the General Arrangements for EU statements in multilateral organisations endorsed by COREPER on 24 October 2011.

INTERSESSIONAL MEETING OF THE
WORKING GROUP ON REDUCTION OF
GHG EMISSIONS FROM SHIPS
12th session
Agenda item 3

ISWG-GHG 12/3/XX
30 March 2021
Original: ENGLISH
Pre-session public release: ☐

REDUCTION OF GHG EMISSIONS FROM SHIPS

Initial Impact Assessment of a GHG Fuel Standard

Submitted by the European Commission on behalf of the European Union

SUMMARY

Executive summary:	This document accompanies the submission on the GHG Fuel Standard (GFS) in ISWG-GHG 12/3/XX and provides an initial impact assessment of GFS in line with the Procedure for assessing impacts on States of candidate Measures (MEPC.1/Circ.885).
Strategic direction, if applicable:	3
Output:	3.2
Action to be taken:	Paragraph 62
Related documents:	ISWG-GHG 10/5/3, ISWG-GHG 10/5/6, MEPC 77/WP.7, ISWG-GHG 12/3/XX, ISWG-GHG 12/3/XX

Introduction

1 ISWG-GHG 12/3/XX suggests a GHG fuel standard (GFS) which would mandate that the GHG intensity of marine fuels be gradually reduced in a predictable pathway consistent with the levels of ambition of the Initial IMO Strategy on the Reduction of GHG Emissions from Ships and its forthcoming review.

2 This submission presents an initial impact assessment of the above GFS suggestion in line with the Procedure for assessing impacts on States of candidate Measures (MEPC.1/Circ.885).

Aim and scope of the initial impact assessment

3 The aim of this initial impact assessment is to:

- Identify the potential of the GFS in terms of fuel transition and emissions reduction;
- Identify which impacts should be assessed;
- Analyse the extent of impacts on States; and
- Assess whether the GFS is likely to result in disproportionally negative impacts on States, and how such impacts could be addressed, as appropriate.

4 This initial impact assessment pays particular attention to the needs of developing countries, especially SIDS and LDCs, as required for an initial impact assessment of candidate measures.

5 This analysis starts with presenting an illustrative scenario for the GFS to demonstrate its potential in incentivising the fuel transition and reducing the emissions in medium and long term. Inevitably, the exact GFS reduction trajectory would be driven by the level of ambition of the reviewed IMO GHG Strategy and this initial Impact Assessment does not intend to pre-empt the outcome of such review.

6 The assessment is based on emission baselines from the Fourth IMO GHG Study. The analysis of the extent of the impacts is based on a literature review and inevitably skewed towards quantifiable impacts. However, for the sake of completeness of the analysis, all significant impacts are described at least qualitatively. The aim is to pave the way for a full quantification of impacts to be carried out at a later stage as part of a comprehensive Impact Assessment, subject to the outcome of the lessons learned exercise and possibly in combination with other measures.

7 Unless otherwise stated, this initial impact assessment builds on the analysis of the Fourth IMO GHG Study (2020), a study by CE Delft, UMAS and TTU on assessment of possible global regulatory measures to reduce greenhouse gas emissions from international shipping (2021) and, to the extent relevant, a European Commission's impact assessment on the use of renewable and low-carbon fuels in maritime transport (2021).

GFS potential in terms of fuel transition and emissions reduction

8 Currently, the fuel mix in the maritime sector relies entirely on fossil fuels. Ships are costly and long-lived assets; in accordance with data from UNCTAD, the average age of the world merchant fleet in 2019 was around 21 years, even though differences can be observed across different market segments. In the baseline scenario, the penetration of low- and zero-GHG fuels is expected to be rather limited, situation driven by the lack of sector-wide coordination and harmonised approach at global level regarding the type and emission footprint of fuels as well as the timeframe for their deployment.

9 The slow uptake of low- and zero-GHG fuels in the maritime sector is a problem that needs to be addressed without delay because the adoption of new fuels in the sector takes time. LNG provides a good illustration of the time necessary for adoption of new fuels in the sector; while LNG was primarily used already as fuel in Norway in 2000, it took 13 years for it to spread outside Norway. Still today, LNG powered ships represent a minor fraction of the fleet, despite the competitive fuel price and the advantages of this option in terms of meeting the existing requirements on SOx and NOx emissions.

10 An additional element that needs to be taken into account concerns the compatibility of the new fuel options with the existing machinery (no or minor needs to retrofit the ship) and infrastructure. Biofuels, biomethane and drop-in fuels (incl. e-fuels and bio-sourced liquid and gaseous fuels) are compatible with the existing assets and infrastructure (liquid or gaseous) and can therefore be deployed immediately in existing oil- or LNG-fuelled vessels.

11 The introduction of alternative fuels requires the development of appropriate vessel technologies and the willingness of users to adopt a new source of energy, as well as sufficient availability of fuels in terms of production (type and quantity of fuel produced), supply and distribution through an adequate bunkering infrastructure. In other words, there is a mutual dependency between supply and demand that needs to be addressed. Moreover, the global nature of the maritime business means that many vessels need to be able to operate and refuel across the world. Therefore, any alternative technologies to fossil fuels will require the possibility to rely on sufficient production of the energy carrier, vessels capable of using it, and an infrastructure for its distribution in ports around the world.

12 Besides the provision of adequate distribution infrastructure, there is an additional interdependency with the production of fuels. Alternative fuels are not put in production unless there is a demand, or at least market prospects; but without guaranteed availability of fuels, operators do not invest in alternative fuel vessels and do not generate demand. Due to their large tank capacities, most ships are able to undertake long voyages on a single bunkering. Estimations indicate that bulk carriers can sail more than 30,000 nautical miles (nm) on average on full tanks, containerships up to 50,000 nm and tankers between 10,000 nm and 30,000 nm on average.

13 The difficulty for the market to converge on the choice of an alternative fuel or technology is also due to the operating conditions of the sector, which reflect the specific needs and constraints of market operators. The maritime sector is not uniform and important differences can be observed between market segments. In practical terms, this differentiation affects the operators' needs in terms of quantity of fuel carried as well as its energy density (energy per unit volume).

14 Furthermore, only by assessing the GHG performance of fuels on a well-to-wake basis, technologies and production pathways that provide real benefits compared to the existing conventional fuels can be incentivised. With regards to the type of emissions, the GFS should not be limited to CO_2, but also include other GHG emissions such as CH_4 and N_2O emissions. Even though the volume of these emissions is lower than CO_2 only, their global warming potential is stronger, in particular in the short term. Including these emissions is particularly relevant as they may be fuel-dependent, which is for instance the case of CH_4 which can be released as a slippage when using gaseous fuel.

15 These considerations suggest that a scenario in which a new dominant technology replaces rapidly the current one is not very likely. This tends to indicate that the process of decarbonisation of the energy used in the sector must start promptly and develop in parallel with the improvements in energy efficiency. Without a regulatory framework providing a clearly identified pathway for decarbonising the maritime fuel mix and for the necessary technology developments, the uptake of new fuels is likely to remain marginal and the costs for their introduction would solely fall upon first movers.

16 A clear and mandatory GHG fuel standard would facilitate planning of investments and counteract a 'wait-and-see' attitude of operators. It would set a clear pathway for decarbonising the marine fuel mix, with progressively more stringent requirements, to help the operators understand which technologies are more future proof than others, without locking the sector in a "one-size-fits-all" solution. An increased predictability of the regulatory framework would stimulate technology development and fuel production and help the sector unlock the existing chicken-and-egg situation between demand and supply of low- and zero-GHG fuels.

17 The modelling of the exact global fuel mix will ultimately depend on the assumptions related to possible evolution of technology, renewable electricity and feedstock costs, as well as additional incentives that may be considered for zero-GHG fuels. In this respect, introducing a flexibility mechanism that would reward over-achievers would further incentivise the uptake of zero-GHG fuels.

18 A failure to introduce the GFS well before 2030 means that a steeper trajectory for the reduction in the maritime transport emissions would be needed after 2030 and certainly after 2040. This would require a steep build-up of low- and zero-GHG fuels production capacities, starting from a low base and require substantially higher effort when approaching 2050, which may not be feasible. Such situation could result in steep reductions in maritime transport activity, with negative consequences for the sector, connectivity, as well as socio-economic development of businesses and States.

19 This initial impact assessment illustrates the impacts of a scenario in which the GHG intensity of fuels on well-to-wake basis is gradually reduced over time from its current level to zero emissions from 2050 onwards. Such scenario would start with initial, 5% reduction between 2025 and 2029 and result in a phase-out of GHG emissions from international shipping by 2050. This scenario has been chosen to best illustrate the potential of the GHG Fuel Standard in terms of both fuel transition and emissions reduction. In principle, alternative scenarios with a lower stringency or slower reduction would result in a lower demand for low- and zero-GHG fuels, a lower reduction in emissions and lower impacts than reported here, while a higher stringency or a faster reduction would result in opposite impacts, namely higher emission reductions and greater impacts on States.

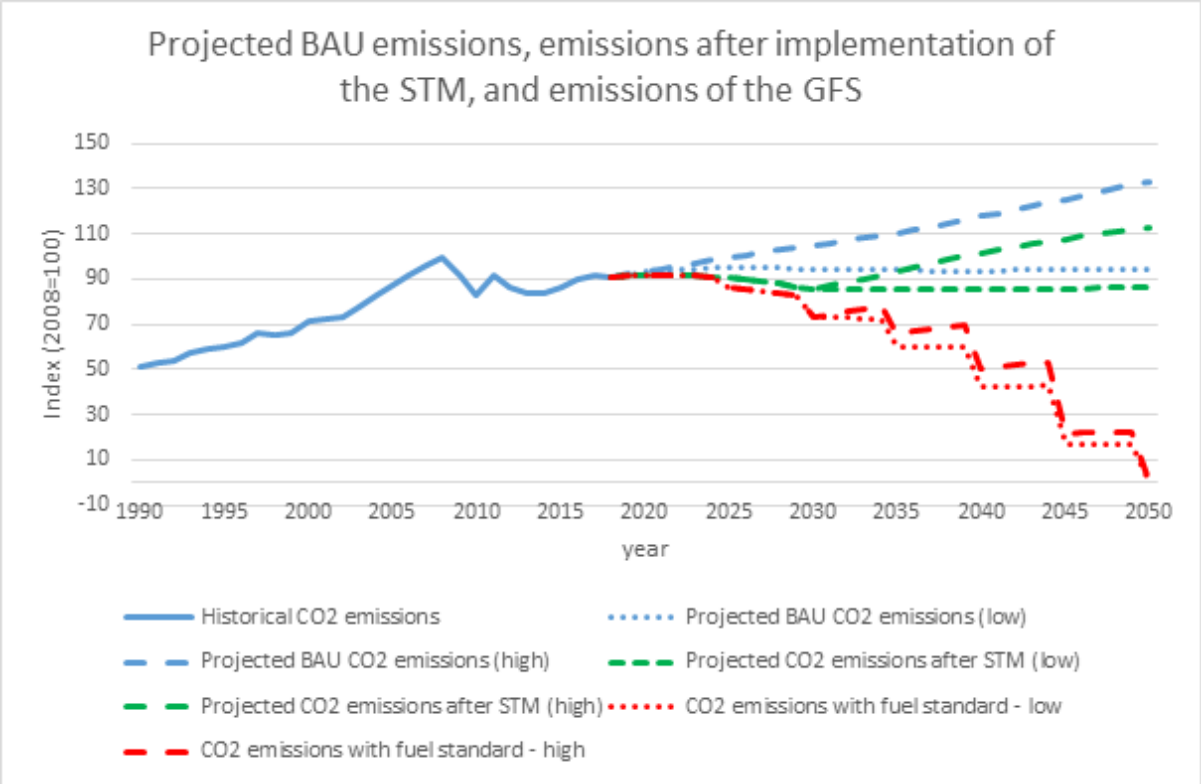
20 The chosen scenario illustrates the reduction in the average GHG intensity of marine fuels in a stepwise approach every five years according to the following pathway:

2025 - 2029: 5% reduction GHG intensity fuel relative to 2008
2030 - 2034: 15% reduction GHG intensity fuel relative to 2008
2035 - 2039: 30% reduction GHG intensity fuel relative to 2008
2040 - 2044: 50% reduction GHG intensity fuel relative to 2008
2045 - 2049: 80% reduction GHG intensity fuel relative to 2008
2050 and later: 100% reduction GHG intensity fuel relative to 2008.

21 The reference for the GHG intensity reduction has been set at 2008, in order to be consistent with reference in the Initial Strategy. The fuel mix for 2008 has been carried over from the Third and Fourth IMO GHG Studies. According to the latter, 98.4% of all engines used in the fleet in 2018 were conventional fuel oil engines and 0.52% were LNG engines (including dual-fuel engines).

22 By gradually reducing the GHG intensity of fuels, and subject to the assumptions on the growth in the shipping activity, the GFS will ensure that shipping emissions are reduced and the supply capacity of low- and zero-GHG fuels is progressively built up. As can be seen in Figure 1, the scenario of the GFS analysed in this initial impact assessment ensures that emissions stay below their 2008 peak level in all plausible scenarios included in the Fourth IMO GHG Study, and that emissions are reduced to zero by 2050.

Figure 1 – projected BAU transport work, BAU shipping emissions and emissions after implementation of an GFS (Source: Fourth IMO GHG Study 2020; this initial impact assessment)



Note:

- the emission projections of the short-term measure (STM) assume that the 40% efficiency improvement will be achieved for all ship types and that exemptions do not result in additional emissions.
- the projections are for TTW CO_2 emissions, not for GHG emissions; when upstream emissions and emissions of non-CO_2 greenhouse gases are reduced in tandem with TTW CO_2 emissions, the red line represents the reduction in WTW GHG emissions.
- the projections are for TTW CO_2 emissions, not for GHG emissions; when upstream emissions and emissions of non-CO_2 greenhouse gases are reduced in tandem with TTW CO_2 emissions, the red line represents the reduction in WTW GHG emissions.

23 It should be noted that the impact on emissions has been calculated assuming that the GFS will not change transport demand or the overall energy efficiency of the fleet, which is a conservative assumption. The reason being that the GFS would not directly incentivise other options ships have to reduce emissions, such as improving the operational efficiency of a ship. It would also not directly incentivise options to reduce the emissions of the transport system, e.g. by lowering demand for transport or increasing the size of ships.

24 Nonetheless, because the standard would have an upward impact on the fuel costs, ever more options to improve the operational energy efficiency would become cost-effective, as would the business case for reducing emissions in the transport system. Hence, it can be expected that the GFS would indirectly have also a positive effect on the energy efficiency of ships.

Identified types of positive and negative impacts

<u>Transport costs and trade patterns</u>

25 Initially, small amounts of low- and zero-GHG fuels will be required to meet the GFS, resulting in a limited increase of the transport costs. Over time, increasing shares of low- and zero-GHG fuels will be used, which will lead to higher cost increase as the share of

hydrogen-based fuels (e-fuels, hydrogen and ammonia) and electricity rise. On the other hand, the prices of these fuels will decrease as their production increases to meet the demand from the shipping sector and from other sectors. IRENA (2021) projects the costs of e-ammonia to decrease by about 40% between 2020 and 2050.[10] Moreover, ships will become more efficient, partly in response to regulation, and partly in response to increases in fuel prices. This will further mitigate the impact of the GFS on shipping costs.

26 Drawing conclusions on the impacts of fuel prices on freight rates is complex due to the diversity of the maritime sector. The proportion of fuel costs in the operating costs differ from one market segment to another. For instance, while bunker costs may account for around 35% of the freight rate of a small tanker, this proportion is much higher (53%) for container/bulk vessels.

27 The type of traffic can also influence the importance of fuel price fluctuation. Generally, the share of bunker cost is lower for deep sea shipping, compared to short sea shipping. This results in important differences on the impact of fuel prices on freight rates among different sectors. While the general freight index shows a strong correlation with the price of marine diesel, freight rates in the dry bulk sector (Baltic Dry Index) are decoupled from bunker prices and mainly influenced by the demand and supply of raw materials, fleet composition and demand and supply of ships.

28 Furthermore, it is difficult to directly relate freight rates to consumer prices. Historical data showed a decline of the cost of maritime transport in the transport of certain commodities, while over the same period freight rates were not following the same trend.

29 Finally, the amount of energy per tonne-mile is projected to decrease significantly in BAU scenario's of the Fourth IMO GHG Study, from around 70% of the 2008 value in 2018 to 50% in 2050, i.e. an improvement of 30%. The short-term measures approved by IMO in 2021 may further improve the efficiency and reduce the costs, as will fuel cost increases.

30 On this basis, also taking into account the existing literature[11], it can be expected that the impact of GFS on freight rates will be much smaller than the impact of the GFS on fuel prices. In addition, given the low share of transport costs in final consumer prices, the GFS would not lead a significant overall impact on commodity, product and raw material prices.

31 Having said that, it is likely that such impact would be more pronounced for certain States, depending on their location, import and export mix, et cetera. In general, higher transport costs may affect trade of low-value cargoes more negatively than high-value cargoes. Likewise, transport of specific types of cargo like perishable goods may be negatively affected when higher transport costs change for example optimal speeds. Taking into account this specific impact is also important from the perspective of ensuring food security, especially with respect to possible changes in import prices of essential food commodities, additional time or possibility to procure them.

32 Furthermore, States that are highly dependent on maritime transport, e.g. to provide essential goods or services, are more likely to be affected more significantly by changes in shipping costs than States which have a lower transport dependency. Similarly, higher

[10] IRENA (2021), *A pathway to decarbonise the shipping sector by 2050*, International Renewable Energy Agency, Abu Dhabi, https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2021/Oct/IRENA_Decarbonising_Shipping_2021.pdf

[11] UNCTAD (2010). Oil Prices and Maritime Freight Rates: An Empirical Investigation., OECD (2008) Clarifying Trade Costs in Maritime Transport, Hummels(2007) Transportation costs and international trade in the second era of globalization, Mirza and Zitouna (2009) Oil prices, geography and endogenous regionalism.

transport costs may affect States that are far away from their main markets more significantly than States close to their main markets or better connected. Some States are also more prone to disasters than others and may be less resilient, e.g. because they are more likely to be hit by disasters that affect the entire State rather than a specific region within a State. Apart from changes in transport costs, which may impact disaster relief costs, a GFS could also require different inventory requirements for essential goods.

33 On the other hand, States which have the capacity to produce and export renewable fuels will be positively impacted. For example, the sustainable bio-energy production potential is highest in tropical regions, as shown in Figure 2. Green hydrogen can be produced against the lowest costs in the most sunny and windy regions of the world, shown in Figure 3.

Figure 2 - Global advanced bioenergy potential under environmental protection policies and societal transformation measures (tonne ha^{-1} year^{-1}).. Wu et al. 2019[12]

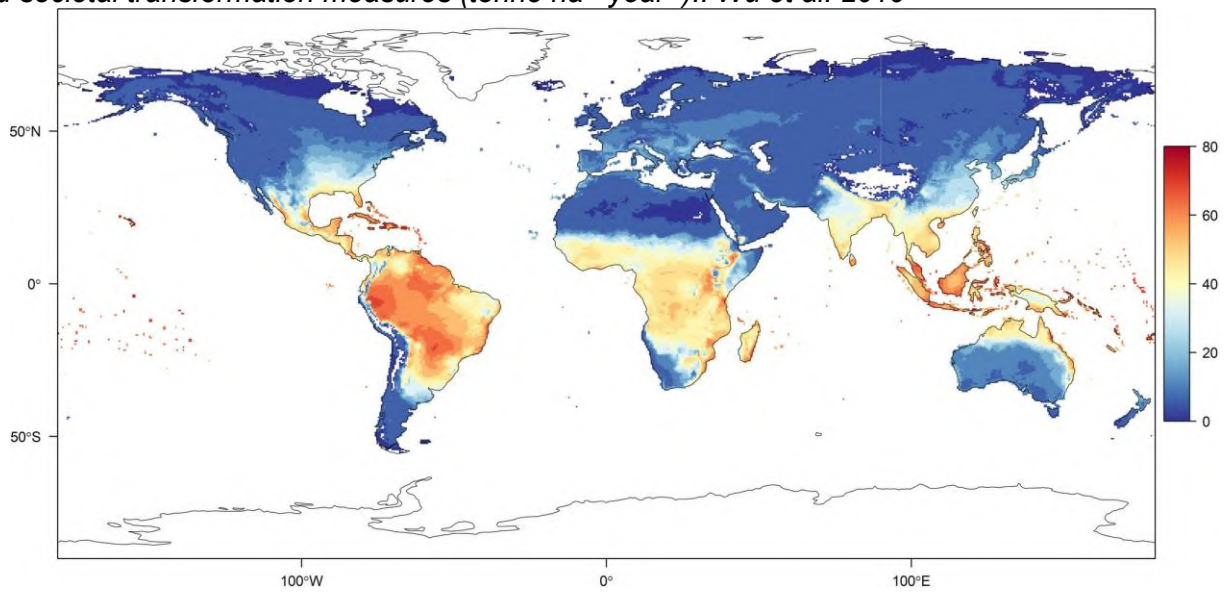
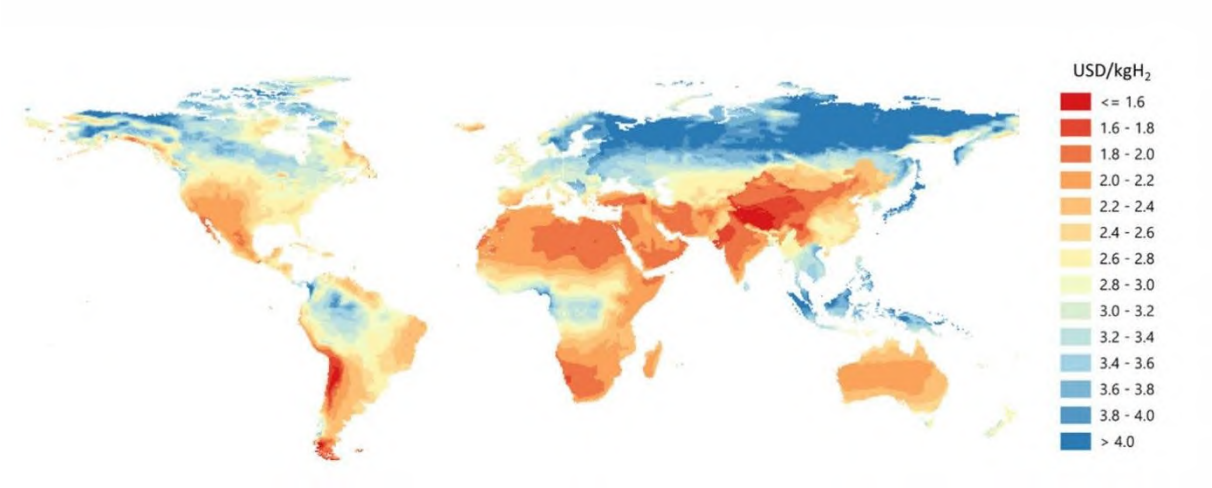


Figure 3 – Hydrogen costs from hybrid solar PV and onshore wind systems in the long term. IEA 2019.[13]

[12] Wu, W, Hasegawa, T, Ohashi, H, et al. Global advanced bioenergy potential under environmental protection policies and societal transformation measures. GCB Bioenergy. 2019; 11: 1041– 1055. https://doi.org/10.1111/gcbb.12614

[13] IEA, 2019, The future of hydrogen: seizing today's opportunities, Paris: IEA



34 The impact on trade cost and trade patterns of an individual country will therefore depend on the composition of its imports and exports, transport dependency and geographic remoteness and connectivity to main markets as well as its potential to produce alternative fuels. Illustrative quantification of such impacts on States by using the GTAP model is provided in chapter *Analysis of the impacts on States* below.

Socio-economic progress and development

35 The gradual uptake of low- and zero-GHG fuels is expected to have marginally positive employment impact for the seafarers. The need to upgrade their skills will result in additional investments in their training and certification, as already acknowledged in the framework of the ongoing review of the STCW Convention.

36 Equipment suppliers and ship construction and repair should see more positive impacts reflecting an expected increase in investments, and changes in the fleet, equipment, and facilities. For the bunkering sector, the job growth may be more restrained as potential increases in the new facilities may be counterbalanced by losses in "older" forms of bunkering. Finally, R&D employment should see a clear increase.

37 An additional noticeable impact concerns the use of non-drop-in fuels and innovative propulsion technologies, and indirectly the impact it has on innovation. Compared to the use of drop-in fuels in conventional internal combustion engines, the deployment of fuel cells and electric propulsion will represent the solutions requiring the highest innovation efforts, in particular with a view to scale them for use in longer distances.

38 Another aspect of innovation concerns the further development of internal combustion engines, to be able to operate more frequently as "dual-fuel" engines or to use emerging fuels (such as ammonia) as well as the necessary air pollution abatement-measures to further reduce ship emissions. In addition, the development and deployment of energy efficiency measures, including the use of wind assistance, is expected to increase as a means to mitigate the fuel costs increase induced by the GFS.

39 Important element of socio-economic development that should be also taken into account is the positive impact of the uptake of zero-emission vessels on public health due to the decrease in air pollution. Such impact, relative to the baseline, is expected to be significantly positive especially in the long-term. An example of monetising such costs can be found e.g. in the Handbook on the external costs of transport by CE Delft (2019), which

also suggests a methodology for monetising the external costs of GHG emissions and internalising them in a socio-economic or cost-effectiveness analysis.

40 Besides the increase in the fuel costs related to the uptake of low- and zero-GHG fuels and propulsion technologies, ship owners and operators will be also concerned by the administrative costs. Such costs will be determined by additional requirements compared to existing monitoring, verification and reporting of the ship's fuel use under the Ship Energy Efficiency Management Plan (SEEMP) and the IMO Data Collection System.

41 It is expected that the GFS could largely rely on the existing reporting requirements in the IMO DCS, subject to its further improvements in terms of data quality and accessibility (hence additional one-off cost for adapting the IMO DCS IT system should be also taken into account, including additional tool to trace and, whenever necessary, balance over- or under-compliance, subject to the flexibility mechanism(s) chosen). Having said that, more emissions and energy sources would be included and additional information would need to be monitored, reported and verified as follows:

a) Annual plan, which would describe which fuels and technologies the ship is planning to use. This plan would build on SEEMP and include additional emissions as well as energy sources;
b) Annual report would include the calculation of the annual energy consumption of the vessel, broken down to different energy sources/types of fuel. This report would build on the IMO DCS report, but would be more extensive as well-to-tank, non-CO_2 emissions and electricity consumption would in principle be also included;
c) Annual document of compliance to demonstrate the compliance with GFS.

42 It is not expected that the above mentioned additional data requirements related to the implementation of the GFS would present significant costs for the ship owners or operators, also taking into account the increasing granularity of data on fuel consumption monitored, reported and verified to demonstrate compliance with the IMO operational energy efficiency standard (CII). This conclusion is however subject to further considerations on the scope of application GFS: In case it is applied to ships below 5000 GT currently not covered by the IMO DCS reporting scheme, the administrative costs of the monitoring, reporting and verification system would have to be counted in full.

44 As regards administrative cost for bunker suppliers, they would primarily consist of certification of fuel and upstream emissions/sustainability criteria. The certification requirements would build on existing certification schemes and international standards and be subject to the IMO LCA guidelines currently in development. For example, when a new (bio)fuel needs to be certified, for instance under the International Sustainability & Carbon Certification Scheme (ISCC), the entire supply chain has to be certified (this means that either all suppliers and other stakeholders need to cooperate in the certification, or are already ISCC certified themselves).

44 Certification schemes mostly have one-time registration fees that vary between €50 and €500, so these are one-off costs. Annual fees per certificate vary from €50 to €500 as well. Finally, fees have to be paid per quantity of material declared as certified. These fees range between €0.03 and €0.10 per metric ton. The costs of an external audit can range from €800 to €2,000 per day. Based on these illustrative costs listed above, it is not expected that the overall certification costs would have significant impact on the price of low- and zero-GHG fuels.

Analysis of the impacts on States

45 The study, by CE Delft, UMAS and TTU (2021)[14] on global mid-term measures to address GHG emissions of shipping, analysed which measures could result in a decarbonisation of shipping, how their impacts could be assessed and which options are available to address disproportionally negative impacts. The study also quantifies the economic impacts of a fuel transition. It deployed the GTAP model to quantify the economic impacts, which is a multiregional, multisector, computable general equilibrium model, with perfect competition and constant returns to scale, which is widely used by the IPCC, OECD, WTO and numerous national and supranational governments and agencies.

46 The scenario, for which the impacts have been modelled, is a 50% reduction in the average GHG intensity of fuels used in maritime transport, assuming that this reduction is achieved by deriving half of the energy used by the world fleet from sustainable electrofuels such as green hydrogen, green ammonia or green methanol, and the other half from conventional fossil fuels. This corresponds to the above-described scenario of the GFS proposal for 2040 and is intended to illustrate the extent of the impacts on States as part of this initial impact assessment.

47 At a high level, the study confirms one of the main findings of the Comprehensive Impact Assessment of the short-term measures, namely that the impacts of a measure on trade are at least one order of magnitude smaller than the impacts on transport costs, and the impacts on the economy at least two orders of magnitude. In fact, because GTAP also includes the effects of import substitution, the impacts are relatively small compared to those of the comprehensive impact assessment.

48 The study also shows that the impacts created by a generalised GHG reducing policy (such as the GFS or others) are typically much less than a tenth of a percent for most countries and regions, although they vary across different types of economy. These figures exclude potential benefits from fuel exports, which have not been modelled. The results are the product of the interactions between carbon intensity of different transport modes and the potential for substitution, the relative balance between imports and exports (and the respective trading partners for these), along with the consequent impacts on investment. Below, some of the results are presented and interpreted. The results for all assessed countries and country groups, including more specific methodological and policy assumptions, can be found in the study.

49 Focusing on high-income economies (EU, Canada, Japan and the USA), the United States and Japan see minor increases in GDP and Canada and EU very small reductions. All see similar reductions in exports (0.2 to 0.3% reduction in exports by value, for an effective carbon price of \$200/tCO_2). The explanation for the variation of net impact on GDP comes from the different consequences on investment – with the EU having the most significant negative impact on investment due to the increase in transport cost. In contrast, Japan and the USA experience increases in investment, driven by import substitution. This shows that the consequence of a generalised increase in transport costs depends on the country or region's circumstances. For nearby trading partners, the generalised increase in transport cost can result in substitution occurring and an increase in market share relative to more remote trading partners. The transport cost increase can also cause imports to be substituted with domestic production – therefore increasing investment in the country or region.

[14] CE Delft, UMAS and TTU, (2021) *Study on assessment of possible global regulatory measures to reduce greenhouse gas emissions from international shipping: final report*, Brussels: European Commission, https://data.europa.eu/doi/10.2834/330363

50 Middle income developing countries and emerging economies have small overall impacts. For example, the study shows that China, India, Russia, Brazil and the rest of South America would have net positive economic impacts. The net impacts are the result of some sectors being negatively affected and others positively. The impacts that occur on flows of imports and exports are generally counterbalanced by increased investment and domestic consumption. This is explained by the strength of these economies across multiple sectors so that whilst there might be negative impacts on some sectors of the economy, these become substituted by other sectors of the economy, with consequent upsides in investment and domestic consumption terms.

51 A case study of Brazil, which is included in the study, illustrates these findings. The exports of agricultural products, especially meat, milk, oil seeds and sugar, all decline as a result of the measure. In some sectors, e.g. sugar cane, this coincides with a decline in output, while in other sectors, e.g. dairy products, the output increases, suggesting that domestic consumption increases or that the raw products are increasingly processed before being exported. The largest gains in sectoral output in relative terms are seen in the 'other agricultural' sector, air transport, coal, and energy intensive industries. In the latter sector, which is relatively large, there appears to be import substitution: the imports decrease while the output increases. Note that any increased exports of sustainable fuels are not captured in this modelling exercise.

52 Other middle-income developing countries and emerging economies have small negative impacts. Malaysia and Indonesia for example have a combined moderate net negative impact (-0.006%). This potential for net negative impacts is also observed for some of the regional aggregations of economies, South Asia and South East Asia both experience net negative impacts of up to -0.05% of GDP. This indicates that the finding that many middle income and emerging economies do not have net impacts is not a generalizable rule and that analysis is desirable on all individual countries to understand the range of impacts experienced and whether these may be defined as disproportionate.

53 Focussing on SIDS and LDCs, a disadvantage of the GTAP model is that some of these countries are not well represented. Only five SIDS are included at national level: Jamaica, Trinidad and Tobago, Dominican Republic, Mauritius and Singapore. All five have net negative impacts ranging from -0.02% to -0.4% of GDP. This GDP reduction is associated with reductions in exports and imports, which are also accompanied by reduced investment in some but not all cases. The impacts on aggregations of countries representing SIDS e.g. 'rest of Caribbean' are similarly net negative.

54 The remaining Pacific, Atlantic, Indian Ocean and South China Sea SIDS are not included as groups and given the small size of their economies within the groups in which they are aggregated are hard to draw impacts on from the results. The depth of analysis is also restricted by the quality of data available for many of these economies. Without good trade statistics as well as information on the statistics of different sectors of the economy, representation within a CGE model is difficult. For the purposes of both assessing and addressing any identified disproportionate negative impacts, a higher quality of measurement is required. However, even without a minimum quality of data for CGE modelling, some inference can be drawn from the fact that those SIDS that have been analysed have universally been net negatively impacted, and it could be expected that given maritime transport dependency of SIDS, they would all experience similar impacts.

55 The results for LDCs are particularly variable and include the highest net negative and positive impacts, and largest magnitudes of change in investment, imports and exports. Some of this variability could be genuine and some could be an artefact of the low quality of the data and its knock on consequences to the quality of the modelling. Of the LDCs that are disaggregated in the analysis, approximately twice as many have net negative impacts than

those that have net positive impacts. This implies that in common with SIDS and in contrast to the middle-income economies studied, LDCs are less able to counterbalance the consequences on the sectors of their economy negatively impacted.

Likelihood of disproportionately negative impacts

56 Given that the concept of disproportionately negative impacts is subject to ongoing considerations by the Organization, this initial impact assessment does not intend to define how disproportionately negative impacts should be understood or described.

57 In essence, the GFS has been designed in a way to minimise the likelihood that sudden impacts occur, which typically have the highest likelihood of being disproportionate. For this reason, the GFS suggests a gradual decrease of the GHG intensity of fuels over a 30-year period.

58 Having said that, from the previous analysis of impacts on States it is clear that some States are more at risk of being disproportionally negatively impacted. Some of these states may be characterised by a combination of long trading distances, low income and a high transport dependency. Other States which appear to be at risk are low income countries with a specialised economy focussing on export of a few low-value commodities.

59 It should be however noted that this analysis focussed on the economic impacts, while a comprehensive impact assessment which analyses all impact categories may bring other States in focus which are at risk of being disproportionally negatively impacted. Likewise, deploying a different model or improving the quality of input data, especially for SIDS and LDCs, may shed more light on how States in these groups are affected.

60 To address such impacts on States such as SIDS and LDCs, it can be considered for example to integrate a certain additional criteria in the cost-effectiveness metric. For instance, a threshold value for the change in the GDP of individual States can be established. In case the change in the GDP of SIDS and LDCs is above this threshold value, a mechanism for impact mitigation can be considered.

61 As regards possible mechanisms for impact mitigation, the study identifies a broad range of possible ways to address eventual disproportionally negative impacts of policy measures on States, ranging from phased implementation (in principle already embedded in the design of the GFS) to different kinds of differential treatment or redistribution system for revenues (in case of GFS contributions to an IMO GHG Fund). All such options should be subject to further considerations in conjunction with the definition and more in-depth analysis of potentially disproportionate impacts of the GFS, possibly in combination with other measures.

Action requested by the Working Group

62 The Working Group is invited to consider the information in this initial Impact Assessment in conjunction with the suggestion for a GHG Fuel Standard contained in ISWG-GHG 12/XX, demonstrating the need to gradually introduce low- and zero-GHG fuels in the maritime fuel mix, while allowing the economic operators to make their own technology choice to meet the GHG Fuel Standard.