INTERNATIONAL MARITIME ORGANIZATION

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MARINE ENVIRONMENT PROTECTION COMMITTEE
82nd session
Agenda item 7

MEPC 82/7/4/Add.4
26 July 2024
Original: ENGLISH
Pre-session public release: ☒

REDUCTION OF GHG EMISSIONS FROM SHIPS

Report of the Steering Committee on the comprehensive impact assessment of the basket of candidate GHG reduction mid-term measures
Executive summary of the report on Task 4 (Stakeholder analysis)

Submitted by the Secretariat

SUMMARY

Executive summary:	This document contains the executive summary of the report on Task 4 (Stakeholder analysis) of the comprehensive impact assessment of the basket of candidate mid-term GHG reduction measures, as approved by the Steering Committee.
Strategic direction, if applicable:	3
Output:	3.2
Action to be taken:	Paragraph 2
Related documents:	MEPC 80/17, MEPC 80/17/Add.1; MEPC 81/7, MEPC 81/7/Add.1; MEPC 82/7, MEPC 82/7/1, MEPC 82/7/2, MEPC 82/7/4; MEPC 82/7/4/Add.1, MEPC 82/7/4/Add.2, MEPC 82/7/4/Add.3, MEPC 82/INF.8, MEPC 82/INF.8/Add.1, MEPC 82/INF.8/Add.2, MEPC 82/INF.8/Add.3 and MEPC.1/Circ.885/Rev.1

Introduction

1 The comprehensive impact assessment of the basket of candidate mid-term GHG reduction measures consists of five distinct and interrelated tasks (MEPC 82/7/4, paragraph 5). This document provides the executive summary of the report of Task 4 on the complementary qualitative/quantitative stakeholders' analysis conducted by Starcrest Consulting, as approved by the Steering Committee, set out in the annex. The full report on Task 4 is set out in document MEPC 82/INF.8/Add.3.

Action requested of the Committee

2 The Committee is invited to consider, in conjunction with document MEPC 82/7/4, the executive summary of Task 4 (Stakeholder analysis) of the comprehensive impact assessment of the basket of candidate GHG reduction mid-term measures, taking into account the full report contained in document MEPC 82/INF.8/Add.3, and to take action as appropriate.

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ANNEX

Disclaimer

1 This report has been completed by Starcrest Consulting Group, LLC (Starcrest). It contains the report on Task 4 on complementary qualitative and quantitative stakeholders' analysis of the comprehensive impact assessment of the basket of candidate mid-term greenhouse gas (GHG) reduction measures.

2 Whilst this report has been commissioned by the International Maritime Organization (IMO), the information contained within this report represents the views of its authors only. It should not be interpreted as representing the views of the IMO, the Steering Committee on the comprehensive impact assessment of the basket of candidate mid-term measures, or the States that are represented on the Steering Committee. This comprehensive impact assessment of the basket of candidate mid-term GHG reduction measures consist of five distinct but interrelated tasks for which different reports have been prepared.

3 Task 4 of the comprehensive impact assessment of the basket of candidate mid-term GHG reduction measures is being undertaken solely to assist the members of the IMO's Marine Environment Protection Committee (MEPC) in making evidence-based decisions. Any information included in this report is provided solely for analytical purposes and should not be interpreted as suggestions or recommendations for how the basket of mid-term GHG reduction measures should be designed. The policy combination scenarios and any other information included in this report are provided solely for analytical purposes and should not be interpreted as suggestions or recommendations for how the basket of mid-term GHG reduction measures should be designed.

4 The designations employed and the presentation of material on any map in this report do not imply the expression of any opinion whatsoever on the part of the United Nations concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

Executive summary

5 This study comprises the Task 4 complementary qualitative and quantitative stakeholder analyses, which is one of five tasks of the comprehensive impact assessment of the mid-term GHG reduction measures (CIA MTM). This portion of the CIA MTM is conducted by Starcrest Consulting Group, LLC (Starcrest). It assesses the possible impacts of certain policy combinations of candidate mid-term measures in 10 selected Member States, namely Argentina, Belize, Brazil, Chile, Cook Islands, Peru, South Africa, Togo, Tonga and the United States, across 39 identified commodity case studies and specific trade routes (including ports of origin and ports of destination) selected by the participating Member States. Cook Islands and Tonga are Small Island Developing States (SIDS) and Togo is a Least Developed Countries (LDCs) in this study. The 39 commodity case studies include a mix of essential goods and trade commodities.

6 This study aligns with Step 4, paragraph 15 of the Revised procedure for assessing impacts on States of candidate measures, found in MEPC.1/Circ.885/Rev.1 and the Revised work plan for the conduct of the comprehensive impact assessment of the basket of candidate mid-term measures – Task 4 complementary qualitative/quantitative Stakeholders' Analysis (Task 4 work plan) (MEPC 82/7, annex 1).

7 Each of the first four tasks of the CIA MTM provides different perspectives on the potential impacts of the various policy combinations of the MTM. Task 1 provides a systematic review of relevant literature related to CIA MTM (Literature Review). Tasks 2, 3, and 4 provide three different perspectives on understanding the potential impacts from the MTM. Task 2, conducted by DNV,[1] examines the impacts of the MTMs on the global fleet of vessels and their future costs. Task 3, conducted by UNCTAD,[2] focuses on economic impacts at the country and regional levels. Task 4 (this report) examines costs and timing impacts due to ship-side and ocean transit time and economic impact implications on 39 actual commodities shipped to or from 10 different countries on selected trade routes.

8 To use an analogy, Tasks 2 and 3 are global perspectives on the potential impacts of the fleet and countries from the various scenarios, similar to the view from the International Space Station. In these global analyses and results, there are aggregations that "flatten" the "topography" of what is seen below. Task 4 is taken from the local perspective, where aggregations are minimized, akin to flying through the landscape where features like mountains and valleys are more prominent. As such, Task 4 does not inform on what could happen globally, it provides context and informs what could happen to nationally important sectors. This is the purpose of this analysis.

9 Task 2: Assessment of Impacts on the Fleet modelled the costs of transitioning the international fleet through the basket of mid-term measures – the ship-side cost intensity increases due to the various selected MTM scenarios for the three forecasted years of 2030, 2040, and 2050. It is assumed that the ship-side cost increase estimates are absorbed by the freight rates that the shipping line charges the commodity/cargo owner. Ultimately these costs are borne by end consumers.[3]

10 Task 3 (Assessment of impacts on States) used the modelled outputs from Task 2 to conduct global modelling simulations at the national and regional level to determine GDP and trade flow impacts at a country/regional level. This is done by using an adapted Global Trade Analysis Project (GTAP) model, for which the underlying database is aggregated to 115 countries and 15 sectors. "It is important to note that for most SIDS and LDCs, GTAP does not represent them as single economies, but are aggregated to part of a composite one. "[4] For information on impacts on States, see UNCTAD 2024.

11 It is important to note that Task 4 was not able to discern how revenue is moved internally within a country to a specific segment or part of a segment within the overall economy. Therefore, the revenue disbursements associated with those scenarios that include revenue, were not considered in Task 4. The Task 4 impacts shown do not take into account any future revenue disbursements. To understand potential country revenue disbursements by applicable scenario, see UNCTAD 2024.

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1 DNV, *Comprehensive impact assessment of the basket of candidate mid-term GHG reduction measures, Task 2: Assessment of Impacts on the Fleet, Final Report*, July 2024 [DNV 2024].

2 UNCTAD, *Comprehensive impact assessment of the basket of candidate mid-term GHG reduction measures, Task 3 Assessment of Impacts on States, Final Report*, July 2024 [UNCTAD 2024].

3 First, the additional cost is paid either by the importer or exporter, depending on the terms in the purchase/sale agreement. The extra cost is then passed to all the supply chain actors, who finally charge the costs to the final consumer (end consumer) who is the one paying for additional costs and inefficiencies.

4 UNCTAD 2024.

12 Two key cost elements make up the total increases related to the MTM: ship-side cost increases and cargo-side cost increases due to longer transit times. The ship-side cost increases include everything modelled by DNV in Task 2, which includes the impacts of both the Short-Term Measures (STM) and MTM, as well as projecting the use of vessel speed reductions and other compliance measures over time. Increases in the cargo costs due to longer transit times are not modelled in Task 2. These cargo related increases are from daily costs that include finance/interest charges, depreciation, and insurance for additional vessel transit time to reach the destination. For each of the 39 commodity case studies, Task 4 provides the separate and combined ship-side and cargo-side cost changes. Together, these are the total commodity cost intensity increases. The concept described above is illustrated in figure ES.1.

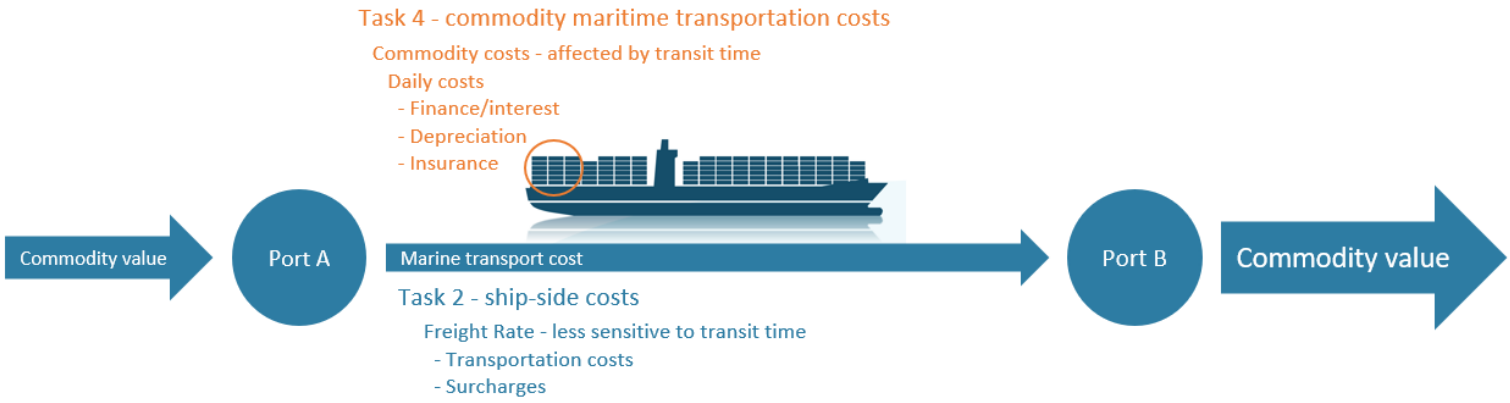

Figure ES.1: Illustration of maritime transport costs

13 In cases where cargo is transhipped at intermediate ports (cargo is unloaded and transferred to another ship to continue its voyage to its destination port), our analysis covers all water transit times (only ship navigational time), but not the port stays. For this analysis, the time the cargo spends within intermediate ports is assumed not to change and so is not included in maritime transport cost changes.

14 Task 4 does not prescribe nor estimate where speed reduction should be used for any commodity case study or ship segment. Task 4 does provide the projected commodity cost impacts should speed reductions be implemented by the ship operator due to cost, compliance needs or other timing criteria. This study should be seen as a "sensitivity analysis" for the 10 participating Member States, and the ship type, size and age, market and commodity combinations. These analyses can be informative for other stakeholders with similar combinations of trade and fleet types.

15 To support the specific analyses, a broad range of data, contextual information, and insights/perspectives is captured by Task 4. This information was provided by participating Members States and their national stakeholders, as well as Leaders of Tasks 2 and 3 and data provider Marine Benchmark. National stakeholders included a broad range of organizations including: industry representatives, trade associations, product/sector associations, institutes, government ministries, exporters, shipping lines, ports, customs departments, national statistic offices, and Chambers of Commerce.

16 Note that for this report, cost increases refer to commodity cost intensity increases and the terms are used interchangeably.

Key findings

What variables drive cost increases?

17 The ultimate maritime transport cost increases for each of the 39 commodity case studies are driven by their unique combinations of the following variables:

.1 **Ship-side cost increases** – These are the cost increases modelled by DNV for Task 2 across the fleet for each MTM scenario and the forecast years (2030, 2040 and 2050). For each scenario, the cost impacts are dependent on the ship type, size, and age. These cost increases include all the ship-side estimated costs associated with the various MTM scenarios. These costs vary widely for each ship type, size, and age combination based on the many assumptions and scenarios documented and referenced in Task 2 (DNV 2024). These include:

.1 **CAPEX** – capital expenses associated with the ship, including newbuild ships, fleet renewal, capital improvements on existing ships associated with the MTM, energy-efficiency retrofits on existing ships, etc.;

.2 **OPEX** – operational expenses including fuel, crew, provisions, maintenance, etc.;

.3 **Carbon capture and control** – carbon capture CAPEX and OPEX expenditures, as applicable; and

.4 **Regulatory costs** – costs associated with regulations including MTM, except joining compliance pools under the GFI flexibility mechanism.

.2 **Cargo-side cost increases** – These are elements on the cargo-side that result in cost increases, including

.1 **Cargo value** – Higher value commodities are generally more sensitive to increases in time than they are to ship-side cost increases (maritime transport costs or freight rates) due to their typically lower *ad valorem* rates; generally higher value cargoes and time-sensitive commodities tend to incur higher freight rates. Lower value commodities are generally more ship-side cost sensitive than time sensitive and tend to have higher *ad valorem* rates;

.2 ***Ad valorem* rate** – The *ad valorem* rate is the maritime transport cost as a percentage of the total landed commodity cost (ocean freight rate as a percentage of total landed commodity cost). For this study, the landed cost is the total value of the commodity at the receiving port including costs associated with maritime transport. Generally, the lower the *ad valorem* rate, the lower the sensitivity to ship-side cost increases, and the higher the sensitivity to time delays. The same is generally true in reverse. Generally, the higher the *ad valorem* rate the higher the sensitivity to ship-side costs (maritime transport costs/freight rates), and the lower sensitivity to time delays;

.3 **Longer transit times** – The longer transit time resulting from voluntarily reduced transit speeds may generally reduce ship-side energy consumption, but generally adds cargo-related daily costs such as finance/interest charges, depreciation, and insurance. In addition, for perishable commodities or commodities that have shelf life or expiration limitations, added time in transit can reduce cargo value due to reduced remaining shelf life, deterioration, spoilage, and expiration. This might impact Member States' competitive positions. Note that Tasks 2, 3, and 4 all incorporate potential longer transit times based on the speed reduction groups presented in Task 2; and

.4 **Distance to market** – The distance to market is the total nautical miles to transport cargo from port of origin to port of destination. Many variable costs are distance-related across both ship-side and cargo-side. However significant differences in vessel size, age and efficiency can provide or reduce economies of scale, making the actual freight rate picture complex.

Quantitative findings following from the 39 identified commodity case studies from the 10 participating Member States

18 As one would expect, commodity cost increases are observed across *all scenarios* and forecasted future years.

19 In general, among the five scenarios evaluated, policy Scenarios 31/32 were on average approximately 50% higher in 2030 compared to Scenarios 23/24. All four scenarios are estimated to have significant relative cost increases, on average 5.5 to 6.6 times, across all 39 commodity case studies in 2040 and on average 7 times in 2050, compared to 2030.

20 In general, the strive Scenario 46 "brings forward" to 2030, the significant increases seen in 2040 and 2050 from the other scenarios, as noted above.

21 By 2050 all five MTM scenarios associated cost increases generally align.

22 The most cost sensitive commodity group is imported essential goods. While trade goods may be important to a particular segment of an economy, essential goods are necessary to the broader economy and support life and health. Higher costs for essential goods are a particular concern for countries with various combinations of limited national GDP, limited population and infrastructure to provide economies of scale, limited disposal income to absorb cost increases, limited alternative transportation options to import essential goods, and country's remoteness to key trading partners. For example, the increases expected to the United States's (US) wood chip exports will have no impact beyond that limited sector, while increases to essential goods imported to SIDS and LDCs will have societal impacts.

23 Key drivers in determining commodity cost intensity changes: Commodity cost intensity changes may be driven primarily by ship-side commodity cost increases, by cost increases due to speed reduction, or a balance of these.

24 Ship-side commodity cost intensity changes drive the majority of case studies across all three forecasted years, across all scenarios, and across all speed reduction groups. The cost increases for the 13 imported essential goods cases studies were primarily impacted by ship-side cost increases across all three forecasted years.

25 The case studies with the greatest ship-side driven commodity cost increase are Tonga's kava exports and the United States' wood chips exports, due to their relatively lower value and much higher *ad valorem* freight rates of 30.2% and 32.1%, respectively.

26 The most sensitive commodities related to speed reduction were observed in Argentina, Brazil, Chile, Peru, South Africa, Togo, and the United States.

27 Lower speed reductions of 10% do not drive commodity cost increases after 2030.

28 Perishables are the most speed sensitive commodity group due to spoilage, or degradation, product expiration thresholds, medium to higher product value, and long distances to market. This finding aligns with and supports UNCTAD's similar finding.

29 The case studies that are the most sensitive speed reduction driven commodity due to their generally lower *ad valorem* rates or product expiration/shelf life were:

.1 Cook Islands eggs due to very tight expiration dates – a few days delay can render the product expired and full value is lost.

.2 Peru's copper due to its higher value, production facility time sensitivity, distance to market and an extremely lower *ad valorem* freight rate of around 1.3%, meaning ship-side cost increases impact less than 2% of the commodity's landed cost.

.3 Argentina's chilled bovine meat due to its higher value, product time sensitivity, distance to market, and its extremely lower *ad valorem* freight rate of 2.7%, meaning ship-side cost increases impact less than 3% of the commodity's landed cost.

.4 Chilean cherries that must arrive timely and in perfect blemish-free form to receive their highest prices. Even minor spoilage significantly reduces product value.

Qualitative insights following from the stakeholder analysis carried out in the 10 participating Member States

30 Several stakeholders emphasized the importance of efficient transport for perishable commodities, where timely delivery and temperature control are crucial for maintaining quality and market competitiveness. Extended transit times due to slower speeds could impact shelf life and market share and could lead to shortages of essential goods. Note that over three quarter of the commodities identified by participating Member States and evaluated were agricultural products.[5]

31 Several stakeholders across a variety of fields reported that higher transportation costs tied to distance can impact market accessibility, competitiveness, product pricing, or market expansion strategies. Importers may choose suppliers with shorter transit times to assure quality and minimize costs, and exporters may face challenges in competing with suppliers from locations with lower transportation costs. Adjustments in product pricing may be necessary to maintain profitability, and market expansion efforts may be affected.

[5] Speed reduction is one of the active ways of complying with the STM, shipping companies may have several reasons to use planned speed reduction as a strategy. The shipping company's business decision will include concerns that are not always apparent to the cargo owner, such as penalties for not meeting GHG or other compliance requirements, and long-term issues such as the current Red Sea crisis.

32 Several stakeholders stated that higher maritime transport demand and shortages increase freight costs, affecting market competitiveness.

33 Ultimately, according to several of the stakeholders, changes in freight costs (rates) will affect prices for consumers.

34 A few stakeholders noted that transportation costs (freight rates) impact product affordability and accessibility. Certain goods may no longer be imported at all due to increased costs and time frames. This is a particular concern for one of the Small Island Developing States (SIDS) participating in this task.

35 Stakeholders from both SIDS highlighted concerns over increased transport times affecting certain goods and freight rates. Challenges posed by rising freight costs and logistical complexities are exacerbated by their remote locations.

36 The stakeholders from one SIDS stated that perhaps the most notable challenge is the lack of long-term and consistent research done for isolated SIDS on the decarbonization of shipping or the unknown implications future fuels could have for the evaluated commodities.

37 One stakeholder from the LDC in this study expressed concerns about LPG-dependent communities, where GHG reduction regulations could exacerbate the economic and social challenges LDCs already face.

38 Stakeholders from one SIDS emphasized that they are mostly reliant on imported fuel, foodstuffs and other essential goods.

Key uncertainties

39 Since Task 4 integrates both the outputs of Task 2 and the data from Task 3, all the uncertainties with those two reports are applicable in this study.

40 *Ad valorem* rates for each Member State were based on the detailed UNCTAD Trade and Development dataset that underlies Task 3's modelling of State impacts. There are no specific rates for Cook Islands nor Tonga, and an aggregated "Pacific SIDS" rate was used.

41 Related to Task 4, future ship-side cost impacts outputs from Task 2 are aggregated by ship type, size, and age combinations. There are uncertainties associated with determining when to apply the ship-side impacts in an aggregated combination when analysing a limited number of specific ships. This is especially true when ships have similar aspects to another ship type, size, and age combination.

42 Related to Task 4, when trying to apply aggregated cost impacts to specific ships, one of the key cost impacts is related to whether the ship joins a compliance pool or not. A compliance pool is a group of ships where some ships over comply and are compensated by under complying ships. At the global level this is not an issue, but when looking at specific ships, this becomes an uncertainty.

43 Cross referencing stakeholder qualitative responses with publications, papers, or to confirm the response is consistent with economic or industrial theories, was not completed as part of this project nor part of the scope.

Stakeholders in participating Member States

44 There were 10 participating Member States which were selected by the CIA Steering Committee to be part of Task 4. As in the previous CIA, the participating Member States selected a limited number of commodity case studies, which can be divided into two groups for the purposes of this report:

.1 **Essential goods –** those commodities needed to sustain life and society such as food, water, medicine, fuel, building materials, electronic equipment (communications, computers, etc.), and many others. Impacts from higher maritime transport costs and/or longer transits could include shortages, and might lead to rationing or disruption of the society that depends on these goods; and

.2 **Trade commodities –** a broad group of goods that are traded between countries and include everything from foods (perishables and nonperishables), raw materials, partial or finished products, animals, waste products, and fuels. Impacts from higher maritime transport costs and/or longer transits could include financial and employment disruption within the sector or portion of the national economy are associated with the trade commodity.

45 The differences between these types of goods lie in their fundamentally different potential for negative impacts. For people fully dependent on marine transportation to sustain life and society, potential negative impacts caused by port arrival delays of essential good imports could for example result in shortages for those essential goods or fuels that are not warehoused or stored in quantities sufficient to cover the delay period. In stark contrast, potential negative impacts from longer transit times for trade commodities generally affects only a specific sector of a country's greater economy; however, life will continue to be sustained and only a segment of society will be impacted. It is important to note that countries' selected commodities can include both essential goods imported, and trade commodities imported or exported. In this study all selected essential goods were imports, and the selected exports were all trade goods.

46 Note that one country's essential good is another country's trade commodity; it depends on the direction of trade.

Selection of commodity case studies by the 10 participating Member States

47 Of the 10 participating Member States in the MTM stakeholder analysis, six participated previously and four new Member States were added to increase geographical coverage of the cohort. The original six included Argentina, Brazil, Chile, Cook Islands, Peru and the United States. The new participating Member States include Belize, South Africa, Togo and Tonga. It was agreed by the CIA Steering Committee that the original participating Member States in the CIA STM could continue with the same number of commodities as in the past, and due to time constraints and scope, the new Member States could choose a maximum of three each. In total 39 commodity case studies were identified, as listed below in table ES.1.

Table ES.1: Selected commodities

Case Study	Country	Trade Direction	Cargo type
1a	Argentina	Export	Soybeans
1b	Argentina	Export	Soybean meal
1c	Argentina	Export	Chilled bovine meat
1d	Argentina	Export	Apples and pears
1e	Argentina	Export	Soy oil
1f	Argentina	Export	Corn
2a	Belize	Export	Bananas
2b	Belize	Export	Sugar
2c	Belize	Import	Steel
3a	Brazil	Export	Iron ore
3b	Brazil	Export	Soybeans
3c	Brazil	Export	Woodpulp (paper and paper products)
4a	Chile	Export	Cherries
4b	Chile	Import	Petroleum oils
4c	Chile	Export	Lithium carbonate
5a	Cook Islands	Import	Miscellaneous edible preparations
5b	Cook Islands	Import	Pharmaceutical goods
5c	Cook Islands	Import	Fuels (LPG)
5d	Cook Islands	Import	Articles of iron and steel
5e	Cook Islands	Import	Edible vegetables, certain roots, & tubers
5f	Cook Islands	Import	Electrical machinery & equip
5g	Cook Islands	Import	Meat & edible meat offal
5h	Cook Islands	Import	Dairy produce, birds eggs, natural honey+
5i	Cook Islands	Import	Products of the milling industry, etc.
6a	Peru	Export	Copper
6b	Peru	Export	Grapes
6c	Peru	Export	Pota (squid)
7a	South Africa	Export	Iron ore
7b	South Africa	Export	Citrus foods
7c	South Africa	Export	Grapes
8a	Togo	Import	Essence (LPG)
8b	Togo	Import	Iron and steel
8c	Togo	Import	Palm oil
9a	Tonga	Import	Petroleum oils
9b	Tonga	Export	Fish
9c	Tonga	Export	Kava
10a	United States	Export	Soybeans
10b	United States	Export	Wood and wood products
10c	United States	Export	Automobiles

48 Note that essential goods do not necessarily have any premiums above trade goods related to transport costs (freight rates).[6] Where they differ is in the impacts.

Approach

49 Task 4 analysis looks at specific ship-side cost increases with no speed reduction and the combination of ship-side cost increases and commodity cost increases across the three speed reduction (SR) groups as modelled by DNV in Task 2. Task 4 is centred on two primary analyses:

.1 **Quantitative analysis** – provides a sensitivity analysis related to the 39 identified commodity case studies, and their potential cost impacts related to ship-side cost increases from the MTM as modelled by DNV and potential cargo-side cost impacts from the speed reductions defined by DNV and modelled by Starcrest; and

.2 **Qualitative analysis** – gathered national level stakeholder contextual input for 16 questions focused on speed reduction, higher costs and other factors. Stakeholder responses were analysed using a strength, weakness, opportunity, and threat (SWOT) analysis adapted to centre on cost increases and longer transit times. Similar to the CIA STM, these responses were not validated as part of the project, but presented solely as stakeholder responses to provide contextual information that could not be determined in the modelling.

[6] It is a common industry practice that freight rates for reefer containers are higher than the ones for dry containers.

50 The approach and methods used in this study align and build upon the stakeholder analysis of the CIA STM and as directed in the MTM Task 4 work plan. An additional quantitative step for the CIA MTM was the integration of the ship-side cost intensity changes as modelled by DNV for the selected scenarios of the basket of candidate MTM. An additional qualitative tool was the use of the SWOT analysis approach to organize and present responses provided inter alia around two main themes: sensitivities of the selected case studies to cost intensity increases and potentially longer transit times, similar to the CIA STM. The advantage of the SWOT analysis tool is that it allows for the qualitative inputs to be more easily considered around these two main themes.

51 As noted above and consistent with the previous CIA STM, two primary analyses are integral parts of Task 4, the complementary quantitative and qualitative analyses. These are highlighted below.

Quantitative analysis

The selection of scenarios to include in the quantitative analysis completed under Task 4

52 Due to time constraints, the scope of Task 4 does not include all the scenarios that DNV modelled for Task 2. Therefore, a bracketing approach was approved by the CIA Steering Committee. A key consideration for the scenarios selected for Task 4 is the need to select from the group of scenarios UNCTAD modelled in Task 3, thus ensuring alignment between the tasks. For Task 3, UNCTAD modelled the following Task 2 scenarios: 21, 22, 23, 24, 26, 31, 32, 36, 43, and 46.

53 For scenarios 26, 31, 32, and 46, UNCTAD also modelled four revenue distribution scenarios. Due to time and scope constraints, it was not feasible to model all of UNCTAD's scenarios in Task 4.

54 It is important to note that Task 4 was not able to discern how revenue is moved internally within a country to a specific segment or part of a segment within the overall economy. Therefore, the revenue disbursements associated with those scenarios that include it, were not considered in Task 4. Some of the scenarios are designed to generate excess funds that are intended to be used to help offset impacts, among other expenditures like research and development. For more information on revenue disbursement see DNV's report on Task 2 and UNCTAD's report on Task 3.

55 In consultation with DNV and UNCTAD, and approval by the CIA Steering Committee, and in consideration of the discussions related to tank-to-wake (TtW) and well-to-wake (WtW) emissions, five MTM scenarios were selected for inclusion in Task 4, as presented in table ES.2.

Table ES.2: Selected Task 2 Scenarios used for Task 4

Scenario number	Emissions trajectory	Seaborne trade growth	Policy combination						
			Policy code	GFI scope	GFI flexibility RU % of price	GFI flexibility SU % of price	Levy Levy USD/tCO_2eq	Levy Reward % of cost gap	Feebate Reward % of cost gap
BAULG	BAU	Low	None						
23	Base	Low	X.4	TtW	120%	80%	No Levy		No Feebate
24	Base	Low	Y.4	WtW	120%	80%	No Levy		No Feebate
31	Base	Low	X.5	TtW	120%	80%	30 to 120	105% to 2040	No Feebate
32	Base	Low	Y.5	WtW	120%	80%	30 to 120	105% to 2040	No Feebate
46	Strive	Low	Y.2	WtW	No flexibility		150 to 300	90 to 65% to 2040	No Feebate

56 Scenario pairs 23/24 and 31/32 differ only in TtW and WtW, and their differences are observed in the Task 2 modelling outputs. The business-as-usual low growth (BAULG) scenario was used as a benchmark to determine ship-side cost intensity changes for each of the forecasted scenarios.

57 While some Member States on the Steering Committee would have preferred to have additional scenarios considered, the above approach was ultimately approved. Note that from DNV's perspective, feebate-based scenarios were expected to fall between the selected scenarios for Task 4.

Total commodity cost intensity changes

58 In terms of potential impacts from the five selected MTM scenarios and the speed reduction groups, two key components were found to drive the total commodity cost intensity changes that were analysed:

.1 **Ship-side cost intensity changes.** These cost changes include all cost elements associated with the ship (capital expenditures, operational costs, regulation costs, carbon capture costs, global fleet capacity associated with speed reduction, etc.) for the forecasted years 2030, 2040, and 2050. Ship-side cost intensity changes modelled by DNV were assumed to be fully reflected in freight rates over the low growth BAU scenario; and

.2 **Commodity cost intensity changes due to speed reduction.** These cost changes are associated with the cargo (commodities value) and include the daily cost increases of finance/interest rates, depreciation, and insurance costs that increase with each additional day resulting from speed reduction.

59 These cost changes are added and are part of the landed costs of commodities upon arrival at the destination port compared to BAU transit times. Task 4 assumes that both cost intensity changes will be ultimately passed on to the final consumer.

60 DNV in Task 2 modelled four speed reduction (SR) groups:

.1 **SR 0%** – ***this group assumed no speed reduction*** and the associated cost increases are ***solely*** from the ship-side cost intensity changes associated with the MTM, for each scenario and forecasted year by DNV in Task 2;

.2 **SR 10% –** this is a 10% reduction in the observed ship baseline speed. For Task 4, the average speeds for each of the specific ship type, size, and age combinations identified for each of the 39 commodity case studies were reduced by 10% and the days of increased transit time (delay) were determined;

.3 **SR 20% –** similar to SR 10%, except using a 20% reduction in speed; and

.4 **SR 30% –** similar to the others, except a 30% reduction in speed. This is the highest level of speed reduction identified by DNV in this CIA.

61 Speed reduction was a critical part of the STM and was one of the primary options for meeting the Carbon Intensity Indicator (CII). For the MTM, speed reduction is still a relevant element but diminished in that the SR 50% included in the STM study was not included in Task 2 or this task.

62 The ship-side cost intensities were derived from comparing the various scenario modelled outputs to the BAULG modelled outputs provided by DNV. There was close coordination between Starcrest and DNV throughout the Task 4 effort. Speed reduction was applied to identified ships associated with the 39 commodity case studies on identified illustrative routes based on information provided by UNCTAD and Marine Benchmark, which is the same data that Task 2 uses. There was close coordination between Starcrest and other Task Leaders and data providers throughout Task 4.

63 In order to combine ship-side and commodity-side cost impacts both needed to be converted to the same basis – in this case a total commodity cost basis. To do so, detailed *ad valorem* freight rates from UNCTAD were multiplied times the applicable Task 2 ship-side cost intensities. This resulted in "freight rate adjusted commodity cost intensity" (FRACCI) which could then be added to the commodity cost intensity increases due to speed reduction, as applicable. This approach was coordinated and aligns with UNCTAD's modelling for Task 3. Due to the specific nature of the Task 4 commodity case studies, it was agreed between UNCTAD and Starcrest to use UNCTAD's specific (detailed) rates and not the aggregated rates used in the state level modelling in Task 3. The rates used in both tasks are 2021 basis rates, which are the latest rates from UNCTAD.

64 Results were produced at the ship type level, and aggregated to the case study level, to the participating Member State level, and to the entire project level including all 39 commodity case studies. The model inputs, fleet data, and extractions of Task 2 model outputs, result calculations and aggregations, figures, and report were reviewed multiple times by different internal reviewers to make sure quality assurance and quality control (QA/QC) checks were completed across all aspects of the project. The approach, methods, equations, defaults, and references are documented in detail in Appendix A and the Bibliography in Appendix C, and summarized in Section 2 of this report.

65 The 39 commodity case studies fell into three categories with respect to the cost intensity change drivers, associated with the MTM:

.1 **Ship-side cost intensity driven case studies**. These case studies typically include lower value commodities, traded on shorter to medium distance routes, and have relatively medium to higher *ad valorem* freight rates;

.2 **Speed reduction commodity cost intensity driven case studies**. These cases studies typically include higher value commodities, traded on medium to long distance routes, and have relatively lower *ad valorem* freight rates; and

.3 **Balanced cost driven case studies**. These case studies were generally equally driven by both costs and associated with commodities traded on medium distance routes, with relatively medium *ad valorem* freight rates. These were less common than the other two types.

66 Taking into account all 39 commodity case studies and the five MTM scenarios analysed, the average number of commodity cases by each type of driver, by speed reduction group, and forecasted year is presented in Figure ES.2. As observed from the figure, the ship-side cost intensity driver is the predominant driver across all commodity, scenario, speed reduction group, and forecasted year combinations, with the exception of 2030 SR 30%, for which speed reduction is the primary driver. Note that SR 0% is only the impact of the MTMs (no speed reduction).

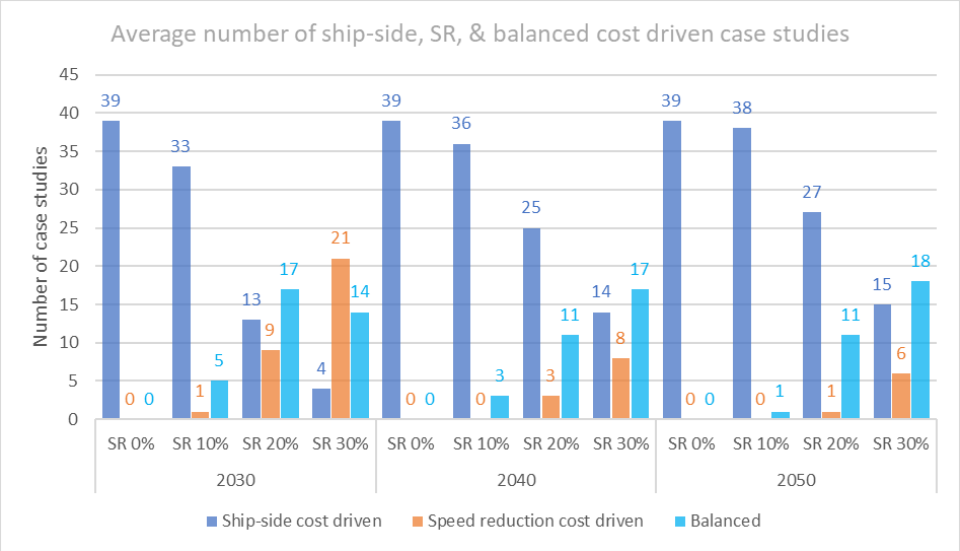

Figure ES.2: Average number of ship-side, speed reduction, and balanced driven commodity case studies

67 Looking at the 14 imported essential goods commodity case studies across the forecasted years, the ship-side cost intensity change is the primary driver for cost change with one exception: in 2030 the higher speed reduction groups are led by speed reduction and then balanced, as presented in table ES.3. Note that other than this one case, speed reduction is not a primary driver across any of the years and speed reduction groups.

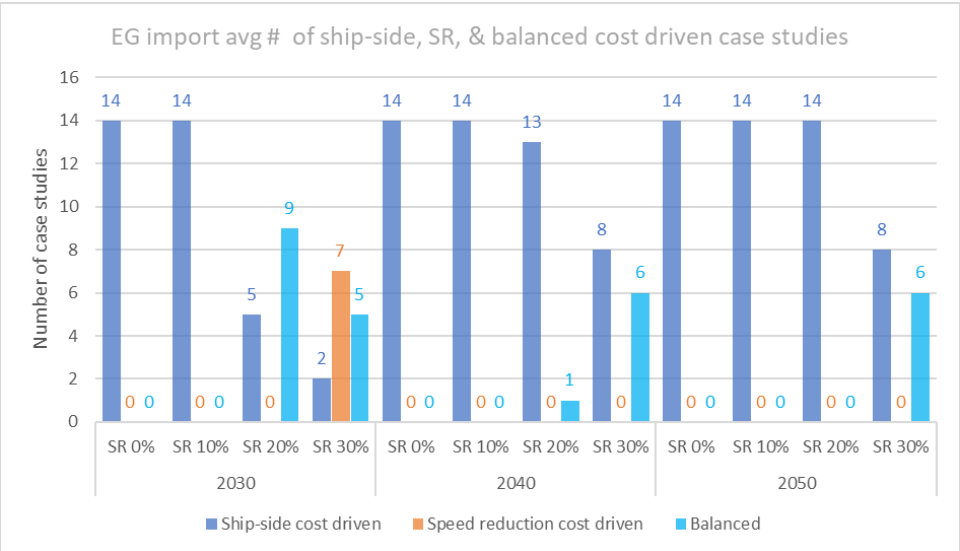

Figure ES.3: Import essential goods average number of ship-side, speed reduction, and balanced driven commodity case studies

68 Looking at the 25 export trade goods commodity case studies across the forecasted years, the ship-side cost intensity changes drive cost changes for the group with no or lower speed reductions, while at the highest speed reduction groups there is combination of all three, as presented in table ES.4. Speed reduction is only the primary diver at the highest speed reduction group in 2030.

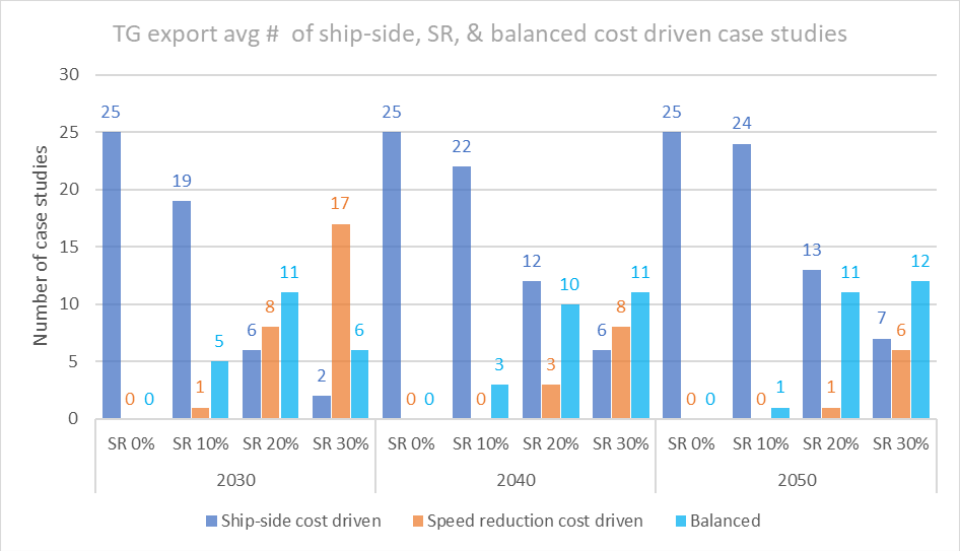

Figure ES.4: Export trade goods average number of ship-side, speed reduction, and balanced driven commodity case studies

Qualitative analysis

69 The previous CIA STM Task 4 solicited contextual information and insight from participating Member State stakeholders that are connected to their selected case studies and organized and documented that information to inform the development and implementation of the STM. The STM qualitative analysis focused on impacts from speed reduction as a means to comply with the CII.

70 As noted above, the MTM Task 4 analysis combines modelling of ship-side cost increases due to the basket of candidate MTM from Task 2, in conjunction with potential commodity cost increases due to vessel speed reductions, which DNV assumed would continue to be a component of compliance strategies. Building on the approach used for the STM and included the MTM Task 4 work plan, qualitative information was again sought from and provided by the participating Member States and their stakeholders.

71 A set of 16 questions on the impacts of cost and time changes to commodity movements was developed in conjunction with the participating Member states. The Member States then took these questions to their national resource teams to gather and provide input for each commodity. These stakeholders shared their knowledge and expertise through the questions related to their commodities of interest, and through other materials, meetings, and correspondence. Similar to the CIA STM, Starcrest did not "validate" or cross reference stakeholder responses provided by participating Member States; this was outside the Task 4 work plan and would be a project unto itself.

72 The SWOT framework was suggested by the SC as a tool for undertaking the qualitative analysis and was then included in the Task 4 work plan. SWOT analyses were used to organize and present qualitative responses, data, and input in a way that is standardized, allows for comparisons across Member States, and is more accessible than the call out boxes used previously in the STM report.

73 Two SWOT analyses were developed for each participating Member State. These focused on 1) sensitivities related to maritime transport cost increases, and 2) sensitives associated with potential longer transit times due to speed reduction. The stakeholder responses were typically aggregated by the participating Member State's focal point and sent to the Project Team to be reviewed for clarity and understanding, with the aim of identifying which information could be included in the two SWOTs and where to place each response within the framework. In addition, the responses were reviewed to identify which information could inform quantitative results like shelf life, spoilage, product value devaluation, and other related parameters.

74 For those responses where additional clarity was needed, the Project Team reached out to the participating Member State focal point to gather additional information through emails and online meetings. For each Member State, the SWOTs were completed by the Project Team along with identification of key findings from the materials submitted and shared with the Member States for review feedback to ensure that the materials were interpreted correctly.

75 Note that some of the data submitted was deemed confidential by the data provider. The participating Member States worked with their cohorts to determine what information could be shared and what needed to remain confidential.

Uncertainties

76 The following are key uncertainties associated with this analysis:

.1 Since Task 4 integrates both the outputs of Task 2 and the data from Task 3, all the uncertainties with those two reports are applicable to this study;

.2 Ad valorem rates for each Member State were based on the detailed UNCTAD Trade and Development dataset that underlies Task 3's modelling of State impacts. There are no specific rates for Cook Islands nor Tonga, and an aggregated "Pacific SIDS" rate was used. The uncertainty around those aggregated rates compared to the actual situation for each of those States is unknown;

.3 Related to Task 4, in Task 2 future ship-side cost impacts are aggregated by ship type, size, and age combinations. There are uncertainties associated with determining when to apply the ship-side impacts of an aggregated combination when analyzing a limited number of specific ships. This is especially true when ships have similar aspects to another ship type, size, and age combination. This becomes a "*boundary issue*." For example, the two general cargo ships servicing the Cook Islands and Tonga are classified as general cargo 5,000 – 9,999 deadweight tonnes, that are 17 years old, hold just over 500 teus, design speed of 15 knots, and have cranes. In the Task 2 model there is also a category of container 0 – 999 teu with the same age group, which these ships also fit, with an average design speed of 15 knots, and may also have cranes. These ships operate solely in the Pacific, and in discussions with DNV, it was agreed that the impacts of the MTMs would likely be driven by compliance pooling options and the latter vessel group was more representative;

.4 Related to Task 4, again when trying to apply aggregated cost impacts for specific ships, one of the key cost impacts is related to whether the ship joins a compliance pool or not. At the global level this is not an issue, but when looking at specific ships, this becomes an uncertainty;

.5 As noted from the Task 2 Project Leader, "joining a ship pool to meet compliance of MTM. Compliance pools under the flexibility mechanism and while it is voluntary to join a pool, you must comply with the regulations. The modelling has shown that it is more cost effective to join a pool. DNV have not been able to ascertain the correct price."[7]; and

.6 There was no cross referencing/validation of stakeholder qualitative responses with publications, papers, or to confirm the response is consistent with economic or industrial theories. Similar to the CIA STM, the stakeholder input was to provide context from the national level from professionals and experts in the Member State that were associated/highly familiar with the trade. It was outside the scope of the Task 4 work plan to cross reference all the input received for the potential that respondent(s) might be trying to "influence" policy decisions.

Quality assurance and control

77 Starcrest implemented its multi-review quality assurance and control (QA/QC) approach for the conduct and completion of Task 4 deliverables. The approach ensures that information, data, calculations, results, and drafted sections of the analysis are reviewed multiple times from within the Drafting team, an internal team of QA/QC experts outside the Drafting team, from the Member States that provided input, and third-party reviewers including external QA/QC reviewers nominated by the United Kingdom and China, as well as both verbal and written comments from Steering Committee members. The necessary time and resources were used to ensure that the analysis was fully reviewed and is sound. While the report itself also went through numerous QA review cycles, due to project timeline constraints and the sheer size of the document, there may be some inconsistencies.

Discerning impacts from cost changes

78 As noted above, this analysis is a "sensitivity analysis" that readers could use to determine what drives the impacts of the 39 commodity case studies. It illustrates what the various magnitudes the cost increases are by MTM policy scenario, with and without speed reduction, and by forecasted year. There is no established IMO MEPC bright line that indicates severity of impact, nor does this report suggest any bright lines. In order to understand the forecasted numbers below, one needs to take into account several contextual items including:

.1 Essential goods vs trade commodities. As noted above the impacts are fundamentally different:

.1 related to essential goods, Member State's GDP, GDP per capita, and income per capita to understand the capacity of the society to absorb higher costs; and

.2 related to trade goods, the sectoral/sub sectoral contribution to the national GDP, the number of employees associated with the trade, and supporting/reliant in-country industries.

[7] Email exchange with Tore Longa, Project Manager Task 2, 18 July 2024.

.2 Size of population to absorb costs and take advantage of economies of scale.

.3 Are there alternative competitive transportation modes available to move the commodity?

.4 The remoteness of the country from its trading partners.

.5 Are there trade agreements that reduce the cost impacts or amplify the cost impacts?

79 Refer to the individual Member State section in the report for more information and commodity specific results.

Forecasted cost increases by forecasted year

2030

80 The 2030 Task 4 total commodity cost intensity results for all 39 case studies, by scenario and by SR groups are presented below.

.1 The expected total commodity cost intensity increases for **SR 0%** across all case studies and scenarios are:

- Scenario 23 0.09% to 4.62%, with an average of 1.21%
- Scenario 24 0.15% to 4.44%, with an average of 1.25%
- Scenario 31 0.22% to 5.60%, with an average of 2.00%
- Scenario 32 0.22% to 8.54%, with an average of 2.38%
- Scenario 46 0.47% to 12.76%, with an average of 4.82%

.2 The expected total commodity cost intensity increases for **SR 10%** across all case studies and scenarios are:

- Scenario 23 0.10% to 5.17%, with an average of 1.50%
- Scenario 24 0.17% to 5.00%, with an average of 1.53%
- Scenario 31 0.75% to 5.61%, with an average of 2.29%
- Scenario 32 0.79% to 8.56%, with an average of 2.66%
- Scenario 46 1.04% to 12.77%, with an average of 5.10%

.3 The expected total commodity cost intensity increases for **SR 20%** across all case studies and scenarios are:

- Scenario 23 0.15% to 7.42%, with an average of 2.66%
- Scenario 24 0.22% to 7.25%, with an average of 2.70%
- Scenario 31 1.24% to 6.87%, with an average of 3.45%
- Scenario 32 1.52% to 8.60%, with an average of 3.83%
- Scenario 46 2.08% to 12.82%, with an average of 6.27%

.4 The expected total commodity cost intensity increases for **SR 30%** across all case studies and scenarios are:

- Scenario 23 0.26% to 15.85%, with an average of 5.48%
- Scenario 24 0.33% to 15.28%, with an average of 5.51%
- Scenario 31 1.36% to 15.84%, with an average of 6.26%
- Scenario 32 1.98% to 15.90%, with an average of 6.64%
- Scenario 46 2.88% to 17.78%, with an average of 9.08%

2040

81 The 2040 Task 4 total commodity cost intensity results for all 39 case studies, by scenario and by SR groups are presented below.

.1 The expected total commodity cost intensity increases for **SR 0%** across all case studies and scenarios are:

- Scenario 23 0.59% to 18.18%, with an average of 6.34%
- Scenario 24 0.54% to 14.47%, with an average of 5.26%
- Scenario 31 0.60% to 14.12%, with an average of 5.17%
- Scenario 32 0.60% to 14.65%, with an average of 5.37%
- Scenario 46 0.69% to 15.70%, with an average of 6.37%

.2 The expected total commodity cost intensity increases for **SR 10%** across all case studies and scenarios are:

- Scenario 23 1.16% to 18.19%, with an average of 6.63%
- Scenario 24 1.11% to 14.48%, with an average of 5.55%
- Scenario 31 1.17% to 14.23%, with an average of 5.46%
- Scenario 32 1.17% to 14.76%, with an average of 5.65%
- Scenario 46 1.26% to 15.81%, with an average of 6.66%

.3 The expected total commodity cost intensity increases for **SR 20%** across all case studies and scenarios are:

- Scenario 23 2.10% to 18.24%, with an average of 7.79%
- Scenario 24 2.01% to 14.53%, with an average of 6.71%
- Scenario 31 2.08% to 14.67%, with an average of 6.62%
- Scenario 32 2.10% to 15.20%, with an average of 6.82%
- Scenario 46 2.60% to 16.24%, with an average of 7.82%

.4 The expected total commodity cost intensity increases for **SR 30%** across all case studies and scenarios are:

- Scenario 23 3.79% to 21.13%, with an average of 10.60%
- Scenario 24 3.24% to 18.98%, with an average of 9.52%
- Scenario 31 3.04% to 17.68%, with an average of 9.43%
- Scenario 32 3.20% to 17.80%, with an average of 9.63%
- Scenario 46 3.37% to 20.44%, with an average of 10.63%

2050

82 The 2050 Task 4 total commodity cost intensity results for all 39 case studies, by scenario and by SR groups are presented below.

.1 The expected total commodity cost intensity increases for **SR 0%** across all case studies and scenarios are:

- Scenario 23 0.73% to 19.86%, with an average of 6.89%
- Scenario 24 0.73% to 19.56%, with an average of 6.80%
- Scenario 31 0.80% to 20.31%, with an average of 7.09%
- Scenario 32 0.78% to 18.81%, with an average of 6.81%
- Scenario 46 0.76% to 20.46%, with an average of 7.07%

.2 The expected total commodity cost intensity increases for **SR 10%** across all case studies and scenarios are:

- Scenario 23 1.30% to 19.88%, with an average of 7.17%
- Scenario 24 1.30% to 19.57%, with an average of 7.09%
- Scenario 31 1.37% to 20.32%, with an average of 7.38%
- Scenario 32 1.35% to 18.82%, with an average of 7.10%
- Scenario 46 1.33% to 20.47%, with an average of 7.36%

.3 The expected total commodity cost intensity increases for **SR 20%** across all case studies and scenarios are:

- Scenario 23 2.59% to 19.92%, with an average of 8.34%
- Scenario 24 2.58% to 19.62%, with an average of 8.25%
- Scenario 31 2.76% to 20.37%, with an average of 8.54%
- Scenario 32 2.72% to 18.86%, with an average of 8.26%
- Scenario 46 2.68% to 20.52%, with an average of 8.52%

.4 The expected total commodity cost intensity increases for **SR 30%** across all case studies and scenarios are:

- Scenario 23 4.27% to 20.42%, with an average of 11.15%
- Scenario 24 4.26% to 20.44%, with an average of 11.06%
- Scenario 31 4.45% to 20.83%, with an average of 11.35%
- Scenario 32 4.16% to 20.84%, with an average of 11.07%
- Scenario 46 4.36% to 20.90%, with an average of 11.33%