

MARINE ENVIRONMENT PROTECTION
COMMITTEE
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REDUCTION OF GHG EMISSIONS FROM SHIPS

Comprehensive analysis of R&D projects to be supported by the IMRB to rapidly increase Technology Readiness Levels and decarbonize international shipping

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SUMMARY

Executive summary: The co-sponsors have commissioned an independent analysis, by the consultancy Ricardo, which demonstrates the magnitude and complexity of the challenge of decarbonizing shipping within the timeline set by the Initial IMO GHG Strategy due to the need to rapidly increase Technology Readiness Levels (TRLs) to the level of maturity required. This analysis therefore demonstrates the urgent need to accelerate R&D of zero-carbon technologies through the proposed establishment of an International Maritime Research and Development Board (IMRB). This analysis also provides the Committee with a detailed understanding of the projects which the IMRB might commission, coordinate and administer within a collaborative global R&D programme and contains a comprehensive analysis of the projects that will be required to increase TRLs for zero-carbon technologies suitable for maritime application. This analysis (240 pages, English only) can be found in the annex to this document.

*Strategic direction,
if applicable:* 3

Output: 3.2

Action to be taken: Paragraph 20

Related documents: Resolution MEPC.304(72); MEPC 75/INF.5; MEPC 76/7/7 and MEPC 76/7/39

INTRODUCTION

1 MEPC 76 considered document MEPC 76/7/7 (Denmark et al.) containing a revised proposal for an International Maritime Research and Development Board (IMRB), consideration of which will continue at MEPC 77 with a view to approval by the Committee.

2 The co-sponsors have commissioned a comprehensive analysis by the consultancy Ricardo, included in the annex to this document. The analysis is intended to provide the Committee with a detailed understanding of the R&D projects which the proposed IMRB might commission, coordinate and administer in order to accelerate the development and deployment of zero-carbon technologies and fuels. This analysis also provides the Committee with a better understanding of the magnitude and complexity of the R&D projects needed to increase Technology Readiness Levels (TRLs) to the maturity required to achieve the current IMO level of ambition for 2050.

3 This new analysis builds on the previous report from Ricardo contained in document MEPC 75/INF.5 (ICS et al.), which identified that the minimum funding necessary to accelerate R&D, so as to increase TRLs within the available timeframe, would be about 5 billion.

4 The comprehensive analysis in the annex to this document identifies, inter alia, 120 distinct challenges for increasing TRLs and more than 260 separate R&D projects, with an assessment of their urgency, impact and need.

5 The analysis also includes detailed case studies for 20 major projects which are considered to be vital priorities as part of the collaborative R&D programme to be conducted by the IMRB. As well as providing cost estimates, these case studies identify the benefits to all Member States and the contribution these will make to the Organization's efforts to decarbonize international shipping.

6 The analysis also includes a series of 93 interactive visualisations (using Sankey diagrams) to illustrate, with the use of 'project trees', how the various R&D projects will inter-relate to raise TRLs (see paragraph 17 below about accessing this interactive function).

DISCUSSION

7 Consistent with the challenge identified by the Mission Innovation¹ initiative and supported by many IMO Member States, hundreds, if not thousands, of zero-carbon ships will need to be delivered from 2030 if the current IMO level of ambition for 2050 is to be achieved. TRLs with respect to zero-carbon technologies and fuels, suitable for marine application, are currently inadequate to achieve this by 2030. Unless R&D of zero-carbon technologies is quickly accelerated between now and the end of the decade, the required acceleration of R&D will occur too late to achieve the goal identified by Mission Innovation "*for ships capable of running on zero-emission fuels to make up at least 5% of the global deep-sea fleet by 2030*"² thus jeopardising achievement of the current level of ambition set by the Organization for 2050.

¹ Mission Innovation is the global initiative "catalysing a decade of action and investment in research, development and demonstration to make clean energy affordable, attractive and accessible for all. This will accelerate progress towards the Paris Agreement goals and pathways to net zero". Members include Australia, Austria, Brazil, Canada, Chile, China, Denmark, European Union, Finland, France, Germany, India, Italy, Japan, Morocco, Netherlands, Norway, Republic of Korea, Saudi Arabia, Sweden, United Arab Emirates, United Kingdom, United States.

² <http://mission-innovation.net/missions/shipping/>

8 The Ricardo analysis demonstrates the enormous scale of the challenge due to the critical need to rapidly increase TRLs and thus the urgent need to accelerate R&D of zero-carbon technologies through the proposed establishment of the IMRB.

9 This independent analysis has been produced to provide the Committee with a detailed understanding of the projects which the proposed IMRB might commission, coordinate and administer within the total budget of some \$5 billion to be provided by the proposed IMO Maritime Research Fund (IMRF) via mandatory R&D contributions by shipping companies. Match funding that may be provided by some of the recipients of grants from the IMRB, could result in the total funding available being somewhat more than \$5 billion.

Identification of Challenges and Projects

10 The annex to this document provides an analysis of 120 distinct decarbonization challenges and more than 260 separate R&D projects, with an assessment of their urgency, impact and need and broad estimates of cost (less than \$5 million, \$5-20 million, and over \$20 million).

11 The main focus of the analysis concerns the challenges associated with the use by different types of ships of zero-carbon fuels including ammonia, hydrogen and batteries/electrification (as well as carbon capture and storage) with particular regard to vessel power systems and onboard fuel and energy storage systems. The analysis also addresses additional implications for components or systems surrounding these main systems for, inter alia, vessel design and bunker delivery systems. The various projects are defined, with their linkages identified, by categories such as safety of life at sea, operation & maintenance, efficiency, storage, bunkering and emissions control.

12 These challenges and projects have all been identified as necessary to rapidly increase TRLs, so that zero-carbon technologies and fuels can be safely applied to international shipping by 2030, the detailed specifications for which can be further considered and, as appropriate, further developed by the IMRB as soon as it is established.

13 The report also includes detailed case studies for 20 key projects which are considered to be vital priorities for increasing TRLs as part of collaborative R&D programme to be conducted by the IMRB, which the knowledge and experience gained from the other 200+ projects identified will support. These case studies explain the many tasks involved for each key project, the project's objective with cost estimates, an identification of the benefits that these projects will provide to all Member States and the contribution the projects will make towards the decarbonization of international shipping.

14 While this analysis has been produced as a tool to help the proposed IMRB begin its vital work as soon as it is established, given that the IMRB will act as a complement and catalyst to other R&D efforts globally, this report is also intended to be of assistance to any Member States or stakeholders engaged with or supporting applied R&D efforts to help decarbonize international shipping. This report should also help the Committee to identify the pathways for decarbonizing the industry within the ambitious timeline set by the Initial IMO GHG Strategy.

15 To demonstrate how the various projects identified will fit together within a coordinated programme, the analysis also includes a series of 93 visualisations or 'project trees' (using Sankey diagrams) to illustrate how these projects inter-relate with each other.

16 Member State and other interested stakeholders are particularly encouraged to explore the detailed analysis included in the appendices to the annex to this document:

- Appendix 1 – Challenges (Full List)
- Appendix 2 – Project Titles (Full List)
- Appendix 3 – Full R&D Project Tree (Interactive Visual)
- Appendix 4 – Supplementary Material

17 To use the interactive version of the project trees in appendix 3 of the annex to this document, Member States will need to access the following link:

https://cdn.ricardo.com/rsc/media/media/research_and_development_requirements_for_zero_carbon_shipping_online_visual.pdf

CONCLUSIONS

18 Approval of the proposed amendments to MARPOL Annex VI set out in document MEPC 76/7/7, to catalyse and accelerate applied R&D of zero-carbon technologies and fuels which can be applied to international shipping, will be vital to ensure that the current level of ambition for 2050 in the Initial IMO GHG Strategy can realistically be achieved.

19 The analysis in the annex to this document underscores the magnitude and scale of the challenge required to increase Technology Development Levels to the necessary extent, and the urgent need for the IMRB to be established by the Committee with the funding mechanism of the IMRF, as well providing the Committee with a detailed understanding of the specific R&D projects which the IMRB might undertake within a collaborative global programme.

ACTION REQUESTED OF THE COMMITTEE

20 The Committee is invited to consider this document, and the comprehensive analysis included in the annex, and take this into account when considering the proposed amendments to MARPOL Annex VI contained in document MEPC 76/7/7 with a view to approval of these amendments at MEPC 77.
