EUROPEAN COMMISSION
HORIZON 2020 PROGRAMME - TOPIC H2020-LC-BAT-2020

Solutions for large batteries for waterborne transport

GRANT AGREEMENT No. 963560

D1.1 – Battery options to reach emission targets

Report details

Deliverable No.	SEABAT D1.1	
Deliverable Title	Battery options to reach emission targets	
Deliverable Date	2021-04-30	
Dissemination level	Confidential – only for members of the consortium (CO)	
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Document History

Version	Date	Author	Remarks
V0.1	2021-04-12	Driss Madouch	For Technical Review
V0.2	2021-04-21	Driss Madouch	For Quality Review
V0.3	2021-04-29	Driss Madouch	Improvements and final updates based on reviews
V0.4	2021-04-30	Cor van der Zweep	Final editing and layout -ready for submission

Project Abstract

The goal of the SEABAT project is to develop a full-electric maritime hybrid battery concept that is based on:

- Modularly combining high-energy batteries and high-power batteries,
- novel converter concepts and
- production technology solutions derived from the automotive sector.

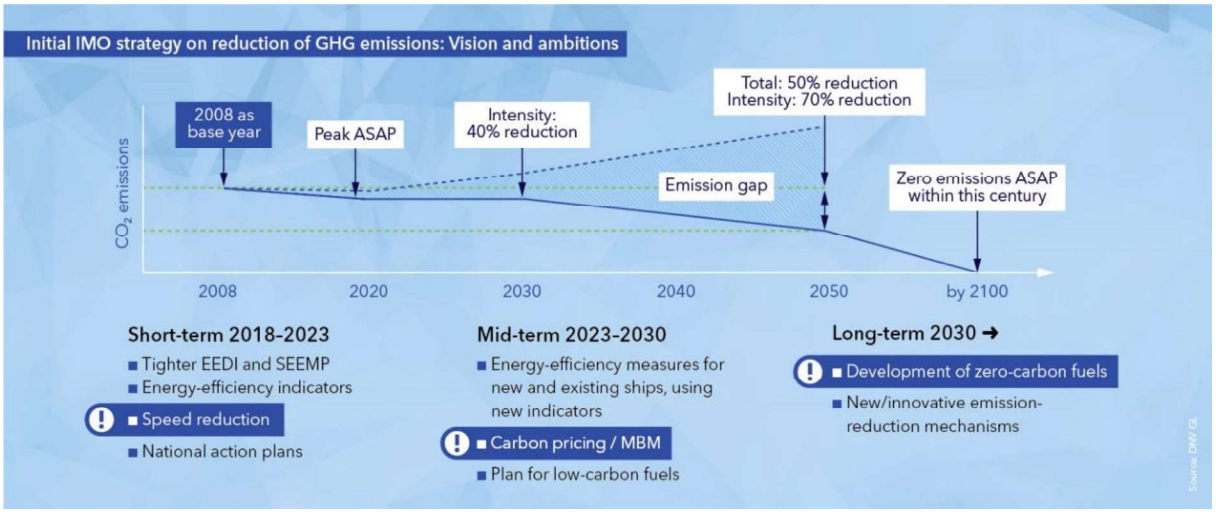
The modular approach will reduce component costs (battery cells, convertors) so that unique ship designs can profit from economies of scale by using standardised low-cost components. The concept will be suitable for ships requiring up to 1 MWh of storage or more.

Public summary

The present document is mainly focused on the identification of the environmental goals set for the maritime industry by the International Maritime Organization (IMO) and the European Union (EU). In this perspective, the following environmental/efficiency indexes have been identified and proposed:

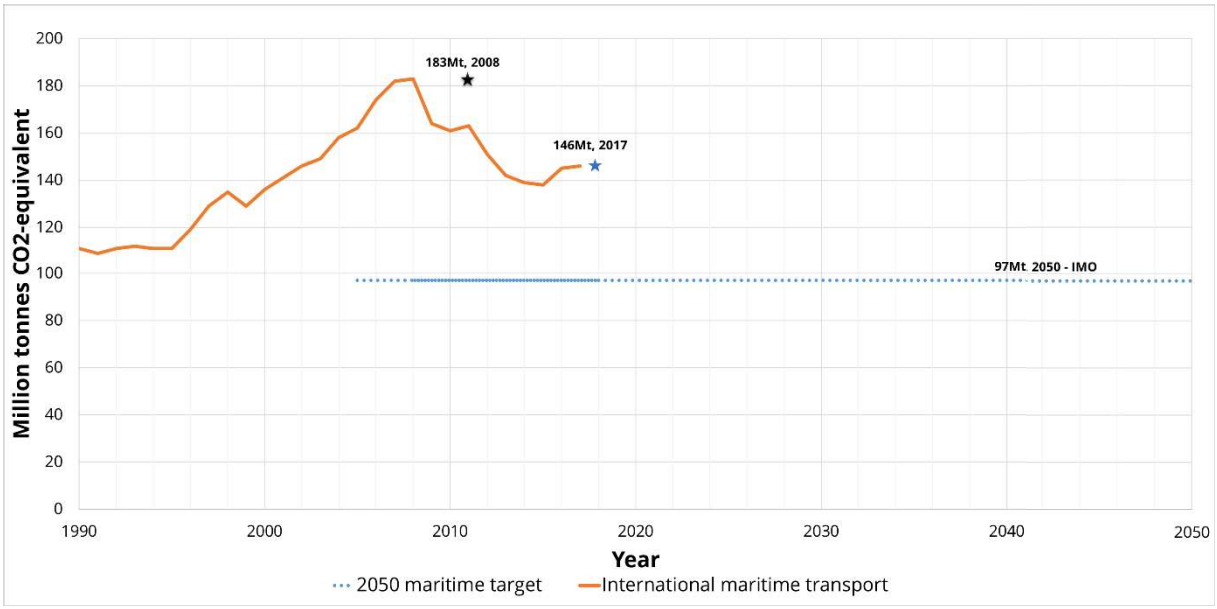
- EEDI (Energy Efficiency Design Index), that can be summarized as the ratio of the environmental cost of the ship operations and the relative benefits for Society, taking into consideration design parameters;
- EEOI (Energy Efficiency Operative Index), that can be defined in a very similar way to the EEDI, even if the main focus is on the operative parameters;
- SEEMP (Ship Energy Efficiency Management Plan), which can be identified as an operational measure that establishes a mechanism to improve the energy efficiency of a ship in a cost-effective manner;
- EEXI (Energy Efficiency Existing Ship Index), is a technical or 'design' efficiency index which requires a vessel to achieve a required level of technical efficiency (required EEXI) under specified reference conditions. The compliance with EEXI is determined by the vessel's design and arrangements;
- CII (Carbon Intensity Indicator), which is a mandatory indicator for the annual efficiency ratio for all cargo and cruise vessels.

As a result of the previous measures and indices, a reduction in GHG emissions has been recorded, although a more significant reduction is expected in the next few years, also in the face of the increasingly stringent limits imposed by both the IMO and the EU (as proposed in the following Figure).



Source: DNV-GL (https://www.dnv.com/expert-story/maritime-impact/How-newbuilds-can-comply-with-IMOs-2030-CO2-reduction-targets.html)

Further, in order to present a global picture on the Greenhouse gas emission reduction targets, also the EU Green Deal goal has been reported (i.e. EU has put forward a plan to further cut emissions by at least 55% by 2030 and 90% by 2050, with respect to the emissions emitted in 2008), and proposed in Figure below.

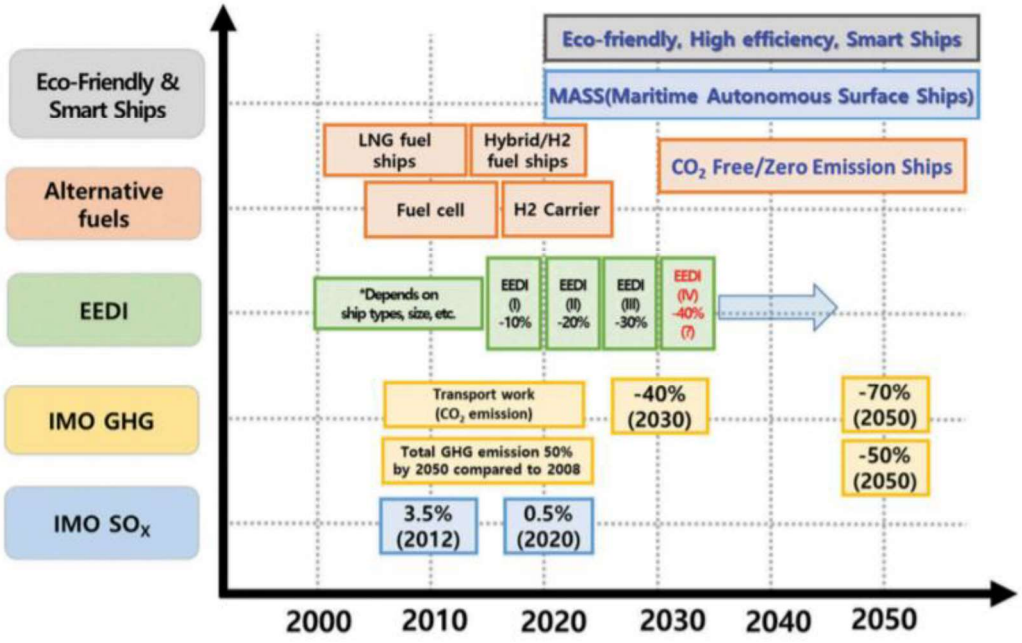


Source: based on the data provided by the European Environmental Agency

With respect to the whole SEABAT project, the current deliverable opens the door to the use of Energy Storage System (ESS) as possible solution for reducing the environmental footprint of the maritime sector.

It is to be noted that, small-medium ships with short operative autonomies are not regulated by the previous indexes and normative, even if they are among the main types that can benefit from the use of ESS to achieve complete decarbonization, especially in coast and protected areas.

At the same time, ESS would a central role for the qualification on board of alternative (i.e. Sustainable Alternative Fuels - SAF) and innovative technologies (i.e. power generation technologies) for the decarbonization of large ships characterized by long operational autonomy, as summarized in the following Figure.



IMO regulation and ship technology trend. Source: Joung, 2019

8 Acknowledgements and disclaimer

The author(s) would like to thank the partners in the project for their valuable comments on previous drafts and for performing the review.

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This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 963560. The information and views set out in this publication does not necessarily reflect the official opinion of the European Commission. Neither the European Union institutions and bodies nor any person acting on their behalf, may be held responsible for the use which may be made of the information contained therein.