Framework for accessing decarbonization risk

5 FRAMEWORK FOR ASSESSING DECARBONIZATION RISK

Chapter 3 of the Handbook described a landscape where different financial, commercial, and regulatory drivers move shipping towards decarbonization. This, in combination with an uncertain future technology space for cutting emissions covered in Chapter 4, means that shipowners today face a complex carbon-risk picture. To address this, we present in this chapter a framework for assessing decarbonization risk.

Ships were previously designed considering aspects such as technical performance, demand for seaborne transportation, earnings, oil prices and fuel consumption. Today's shipowner must, to a much larger extent, also factor in the sustainability, GHG aspects, and technology developments to ensure the ship is prepared for the future. The ship must comply with implemented and planned regulations, and efforts must also be made to ensure it remains competitive in a future where sustainability and GHG performance are closely linked to both market and financial risks. This is increasing both the amount of information needed for decision making and the number of constraints challenging the ship's design.

DNV has previously presented structured and knowledge-based approaches to manage uncertainty related to decarbonization of ships (DNV GL, 2018a, 2019a, 2021a; and related DNV services[53]). Building on this work, we present a three-step framework for managing decarbonization risk that can be applied to both newbuilds and existing vessels (Figure 5-1).

Figure 5-1 A three-step framework for managing decarbonization risk, building on previously presented approaches (DNV GL, 2018a, 2019a, 2021a; and related DNV services[53]).

Each step of the framework is described in more detail below.

Step 1

- Quantify GHG emissions, fuel consumption, and operational profile of baseline vessel. Calculate carbon intensity of the baseline vessel.
- Consider relevant commercial and regulatory decarbonization drivers and set a target carbon intensity trajectory. The carbon intensity trajectory may be minimum requirements for staying aligned with requirements, or it may be more ambitious – for example, moving towards net-zero carbon in 2040. A shipowner contends with a unique set of circumstances depending on factors such as type of cargo, charter-contract types, operational area, and financing. These factors translate into different environmental regulatory policy measures and different expectations from commercial stakeholders (e.g. cargo owners and financial institutions) to limit GHG emissions. The above elements should be reflected in the chosen target carbon intensity trajectory.

[53] https://www.dnv.com/maritime/insights/topics/CII-carbon-intensity-indicator/advisory-services.html

- Compare the GHG performance of the baseline vessel with the selected target trajectory. Identify when measures are needed to reduce carbon intensity for the vessel, in order to stay aligned with the target carbon intensity trajectory – that is, compliance status.

Step 2

- Identify applicable decarbonization measures for the baseline vessel defined in Step 1, including energy-efficiency measures, alternative fuels, and Fuel Ready options (mostly relevant for newbuilds). Conduct cost-benefit assessments for the identified measures (i.e. calculate GHG-reduction potential and cost). Abatement cost, the cost of reducing one tonne of CO_2 in terms of USD/tonne CO_2, may be used as a metric for the cost-efficiency of each measure.
- Based on the cost-benefit assessment, develop compliance strategies that meets the set target carbon intensity trajectory. A compliance strategy may include several decarbonization measures. For example, one compliance strategy could involve blending in carbon-neutral fuel, while another could include retrofit to a new fuel. In both cases, energy-efficiency measures could also be part of the picture.
- Assess each compliance strategy with respect to cost and GHG emissions, taking into account the lifetime of the vessel (and the remaining lifetime if already in operation). There are great uncertainties associated with how the drivers for decarbonization (e.g. regulations) will develop in the future, and when different decarbonization technologies will be available for commercial use. Future availability and price of alternative carbon-neutral fuels is also a big uncertainty. Because of this, it is important to evaluate each compliance strategy in many scenarios[54], each one representing a plausible future. If a compliance strategy proves to make sense financially and environmentally across many scenarios, it is a robust strategy.

Step 3

- Select the most robust compliance strategy from Step 2 and create a decarbonization roadmap. The roadmap contains a description of the elements needed to implement a selected decarbonization strategy. Before implementation, and during the implementation phase, several actions and preparations must be performed, and these must be specified in the roadmap. In the case where a roadmap contains use of alternative fuels as an action, it would be important to map out the current and future expected availability of these fuels at relevant bunkering ports.
- The roadmap should be continuously updated, so that the most robust compliance strategy is reflected at any given time.

Figure 5-2 shows a visualization of Step 1 and 2 of our framework for assessing decarbonization risk. First, a target (GHG) trajectory is selected, a baseline vessel is defined, and the compliance status of the vessel can be seen as the period before the vessel intersects with the target trajectory. Second, different compliance strategies are developed (*Strategy 1* and *Strategy 2*), and the most robust strategy is used as basis for developing a roadmap with one or more decarbonization measures included.

[54] Scenario analysis is a well-established method that can provide valuable input to strategic newbuilding plans and enhance fleet flexibility and resilience to a range of possible futures. Scenarios need to be updated so that the most recent developments in regulations, technological developments, fuel prices and availability are reflected. For more details on how to develop scenarios, consider, for example, DNV (2020b).

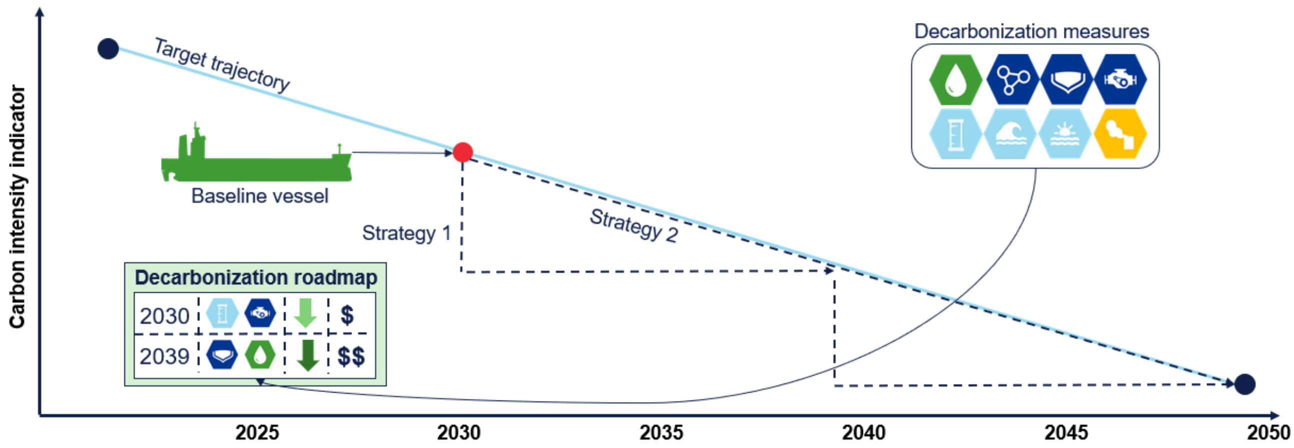

Figure 5-2 Visualization of Steps 1 and 2 in DNV's framework for assessing decarbonization risk. A baseline vessel and target carbon intensity trajectory must be defined, and compliance strategies assessed, before a decarbonization roadmap is developed (Step 3).

Chapter 6 outlines the use of this framework by using three example cases simplified for illustration purposes. To carry out a full analysis, expert tools, detailed input data (e.g. fuel prices) and competence on the drivers for decarbonization of shipping and the available decarbonization technology space are prerequisites.

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