

Planting a seed

by Panos Koutsourakis, VP, Global Sustainability, ABS

Maritime decarbonization is a complex challenge with multiple pathways at various technological and operational readiness levels. Because of the industry's regional aspects and varied trading routes, the shipping value chain has a unique opportunity to serve as a test bed for implementing infrastructure, developing and applying novel technologies and adopting alternative fuels.

Establishing green shipping corridors allows us to test, calibrate and assess risk in a regionalized or specific industrial ecosystem which can be further scaled to other regions or sectors. Optimization and simulation tools are expected to play an expanding role in helping stakeholders from across the green shipping corridor value chain in their decision-making process. This advanced modeling capability provides a detailed simulation of the complex nexus of stakeholders involved in corridor development, providing the data required to support policy and investment decisions.

To back up the development and implementation of green shipping corridors, ABS has launched a pioneering new Green Shipping Corridors Simulation service designed to assist international design and development of clean energy initiatives, together with an accompanying publication, [*An Approach to Green Shipping Corridor Modelling and Optimization*](#), to provide practical support.

Aligning the disaggregated industries

A green shipping corridor represents a system of systems interacting with each other in unique ways, and modeling them using optimization methodology provides a framework for problem-solving and collaboration.

As a concept, green shipping corridors are likened to special economic zones at sea, where various value chain stakeholders can come together and deploy new technologies and business models that interact at full scale. The biggest advantage of such an initiative is to help diverse and disaggregated industries align and diversify their collective risks.

Any envisioned green shipping corridor will require close collaboration between stakeholders such as shipowners, fuel providers and ports. In addition, green shipping corridors will need an enabling environment where each value chain member can share risk at a smaller scale before upping the ante.

The ABS insight publication aims to communicate the need for optimization models

in resource planning and techno-economic analysis for such a complex system of systems as the green shipping corridor. The publication also provides a step-by-step logical methodology to achieve the same, considering multiple variables and constraints. The input data in the developed models are approximations from publicly available sources. The scope of this insight is to look at the results from mostly two specific points of view: the port and the shipowner, who are at the center of this value chain and have the greatest impact on emissions.

Every green shipping corridor should be considered unique, as the geographical locations, behavior of the stakeholders, fuel availability, economy, and trade patterns will be different in each case. For example, a corridor may have commercial ships and port operations that utilize alternative fuels derived from renewable energy with or without energy efficiency technologies. Simulating and optimizing all those operational aspects is vital to accelerating decarbonization across the various stakeholders.

Finding common ground

The development of a green shipping corridor begins by establishing a core group of stakeholders who will drive the development and implementation of it, often with one organization or a third party acting as a facilitator to guide the process. A working group develops a vision/charter and performs an initial analysis (often called a pre-feasibility or feasibility study) to help set end-state and intermediate goals.

Based on this analysis, the working group develops phased plans to achieve reduction targets and then advocates for action by the stakeholders to implement those actions. Key decisions that focus on the critical building blocks of green shipping corridors are viable fuel pathways, policy & regulation, customer demand, and cross-value chain collaboration.

The working group monitors implementation progress and attainment of

goals while continually reassessing options and strategies amid changing regulations/policies, technology availability, funding sources and operation incentives, etc. This is an iterative process informed by key analysis insights along the way.

Because of the number and variety of stakeholders involved in green shipping corridors, government agencies are sometimes expected to play a pivotal role in integrating individual stakeholder interests while testing and establishing policies.

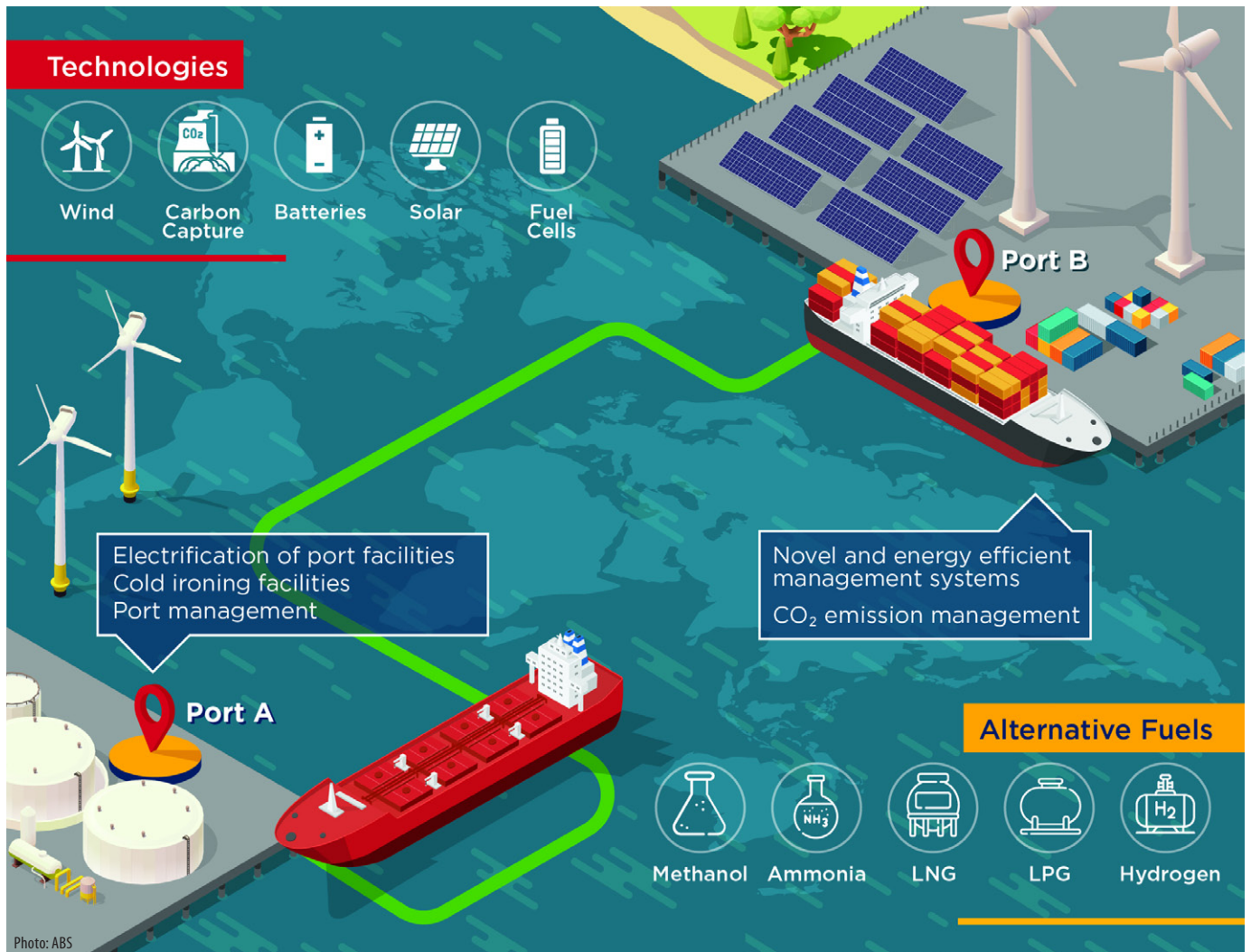
Optimization and simulation models can help in resource planning and techno-economic analysis of the selected corridor while considering any permutation and combination of alternative fuels and technologies. In this way, such tools provide the ability to bring all stakeholders, industry, non-governmental organizations, and government together to enable the exploration of the most optimal path forward for establishing and operating a green shipping corridor.

Real-world examples demonstrate how a green shipping corridor initiative can be viewed as a resource planning and optimization problem that considers the diverse requirements of each stakeholder. For example, the shipowner's requirements and decision-making criteria will differ fundamentally from a port's, but each decision is inextricably linked.

Hence, the model acts as the basis for common ground among the consortium members and helps them in their pre-feasibility and feasibility assessment. Such analysis will likely become a foundational requirement for any green shipping corridor as the concept matures. As more green shipping corridors take off, the methodology will evolve. As the data becomes easily available, there could be very creative use cases for these optimization and simulation tools.

Simulation in practice

Shipowners and port authorities can use the green shipping corridor optimization and simulation capabilities developed by ABS to



optimize their decarbonization strategy with quantitative evidence and trackable projections.

The simulation outputs cover fleet fuel shares, newbuilding vessel shares, annualized port investments, fuel demand prediction in specific ports, fuel storage requirements at particular ports, and year-over-year fuel procurement for port bunkering stations. Major KPIs of fleet fuel options, their shares, and the corresponding costs should be investigated to help green shipping corridor decision-makers develop a decarbonization strategy.

Both tank-to-wake and well-to-wake fuel lifecycle emissions of marine fuels should be considered with decarbonization goals set appropriately. The fuel mix shares have shown clear trends in all the scenarios developed to date: low-carbon fuel options will gradually substitute the current dominant bunker, very-low sulfur fuel oil, and a more ambitious strategy will tremendously accelerate the speed of fuel oil phase-out. Green ammonia has been projected to be a strong candidate

for tank-to-wake cases, and bio-methanol would be the most cost-effective fuel option for well-to-wake emissions in 2050.

Stakeholders should also consider the average total cost of ownership for the selected green shipping corridors fleet, considering operating expenditure, annualized building cost, fuel tank cost and carbon pricing. The OPEX and annualized building cost are the primary indicators used to determine the average.

The optimization outputs provide insights on fuel procurement shares for decision-makers within port authorities. The fuel sources and associated infrastructure readiness levels are essential to reach the maximum return on investment as well as meet the long-term maritime decarbonization goals.

De-risking the process

Optimization and simulation are potent capabilities that can help the various stakeholders in a green corridor project understand the variables in their systems with as much detail as possible to make the most prudent decisions from their point of view.

One of the most significant advantages of this optimization tool is that it can help each stakeholder understand their maximum risk profile and the impact of their decisions on the entire corridor.

When shared among the consortia members, the optimization model results will provide a common ground for de-risking and sharing the costs, which will be one of the most important outcomes of a collaborative initiative of this size. ■



Founded in 1862, the American Bureau of Shipping (ABS) is a global leader in providing classification services for marine and offshore assets. Our mission is to serve the public interest as well as the needs of our members and clients by promoting the security of life and property and preserving the natural environment. ABS' commitment to safety, reliability and efficiency is ever-present. Visit ww2.eagle.org to learn more.