Alternative Fuels

Finding the right fit, the right balance for emissions-friendly fuel

RICHARD A. MUELLER, *President/CEO, NETSCo., Inc.*

This first of a two-part article addresses technical challenges. In part two, we'll select one specific fuel and look in-depth at the challenges to show why there are no easy answers.

There has been much written over the past decade about the use of alternative fuels in ships, boats, airplanes, cars; basically, any form of transportation. At first, it might be easy to think this is some new phenomenon, perhaps brought on by recent changes in environmental laws and requirements at national and international levels. But this is old news, a great example of "what goes around, comes around."

The use of alternative fuels, and the need for them, has arguably been around for more than a century.

Beginning in the early 1920s, a means to convert natural gas, coal and biomass into liquid fuels and ammonia was invented. During World War II, it helped alleviate a shortage of diesel fuel. The same technology was used during the oil embargo in the '70s and '80s to reduce our worldwide reliance on refined fuels.

And today, as we look for new ways to make drastic reductions in SO_X, NO_X, particulate matter and greenhouse gases, alternative fuels are back in the limelight.

There is a long list of fuels with the capability of being used in ships. Fuels like Liquified Natural Gas (LNG), Biodiesel, Methanol, Ammonia, Liquified Petroleum Gas (LPG), electricity, Hydrogen, various synthetic fuels and even nuclear fuel are just some that have, to one degree or another, captured the imagination of engine manufacturers and designers alike.

All over the globe, research and development projects are underway at every major engine manufacturer. The race is on to find an alternative fuel solution to allow shipowners to comply with more stringent emissions regulations.

But it's not an easy problem to solve. It is, as they say in the modern vernacular, complicated.

Long textbooks could be written to describe the many challenges and difficulties, but they can be grouped in four technical areas: Environmental, Operational, Design and Economics.

Environmental

Recognizing the need for more international standardization in the realm of marine legislation, the International Maritime Organization (IMO) and its main maritime environmental arm, the Marine Environmental Protection Committee (MEPC), have been working for years to find common ground between the maritime countries in the world.

All over the globe, research and development projects are underway at every major engine manufacturer.

The rules governing many areas of ship operation, in particular engine emissions of SO_X, NO_X, particulate matter (PM) and greenhouse gases (GHG), as well as the overboard discharges of waters, oils and cargo residues, have become increasingly stringent and show every indication of continuing that way.

When we look at these international regulations as they pertain to alternative fuels, we begin to see that some fuels are better than others in one area, but not in another. LNG, for example, has certainly been getting a lot of press for being a cleaner alternative compared to marine gas oil (MGO) when looking at SO_X and NO_X and particulate matter, but it has its own issues when we look at GHG.

LNG, and other cryogenic alternative fuels, have their own challenges. They require energy to be made from naturally occurring (and plentiful) natural gas, and they require even more energy to be kept in the cryogenic (or near cryogenic) form. When they are ready to be burned, they need to be heated to return to their gaseous forms in order to be burned.

Operational

One of the often-overlooked aspects of the use of alternative fuels is the "people" part of the equation. As previously stated, each of these alternative fuels could be considered good in one area, but not good in another. It's the same with the people.

The use of biodiesel, for example, might be considered the most seamless of the alternative fuels from the people standpoint, as the systems to handle it, store it and burn it are basically the same. From a people standpoint, this means that the same personnel handling the MGO system will likely be able, with minimal differences, to handle biodiesel.

The same cannot be said for many of the other alternative fuels. Cryogenic fuels, gaseous fuels and nuclear fuel all require highly specialized and trained personnel; and that may or may not be the current crew members you have now. Just one more factor to consider as you review options.

Design

With the possible exception of biodiesel, the other alternative fuels will involve a significant level of engineering to make the switch. New engines, typically dual-fuel capable, will require new foundation arrangements, new fuel-handling systems and many other changes.

The capital cost of these changes, and the engineering and shipyard costs

required, are all part of the economic challenge that the shipowner faces as they look to determine if there is any payback and how soon the payback occurs.

Economics

Amid the technical challenges is the one challenge that never goes away, no matter what the issue: how are shipowners going to find ways to make alternative fuels economically viable? New alternative fuels will require a new distribution infrastructure; who will pay for that?

The new fuel often needs a new storage receptacle, both onboard and onshore, and since the BTU content per volume, or the storage temperature, or the chemical nature of the fuel requires different storage and handling, who will pay for that?

Should the shipowner pay for the necessary equipment to burn the new alternative fuels, or should the charterer? If the charterer is paying for the fuel in the charter agreement, where is the incentive to make the improvements and, again, who should pay? In the end, we all understand that the shipowner, the charterer and the fuel supplier need to work together to find ways to make this complicated equation financially viable.

Volumes can be written about all of the challenges and hurdles that need to be overcome to find the best alternative fuel. As stated earlier, at the moment, no one fuel solves all the problems and provides a fuel that works perfectly for every situation. But one thing is clear—the introduction of these alternative fuels will make a tremendous dent in the shipboard release of SO_X, NO_X and PM, and some of the fuels will even lead to significant reductions in GHGs.

Any fossil-based fuels will have limited contributions, but other alternative fuel possibilities, like hydrogen powered fuel cells, will have huge benefits in all of the shipboard emissions criteria; if, and it's a big if, science can figure out how to separate and harness hydrogen, the most abundant element in the known universe.

That is one of the many technical challenges that needs to be overcome. Whatever alternative fuels are used, fuel systems and fuel treatment systems will become increasingly complex, and the shipboard engineers required to operate these complicated systems will need to be better educated and highly trained if shipowners have any hope of cashing in on the benefits that these alternative fuels boast. ■