CHARGING AHEAD

The Prospects and Challenges of Electrifying Great Lakes Shipping in the Next 25-30 Years

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The Great Lakes shipping industry serves as a crucial transportation network for North America, carrying millions of tons of cargo each year. As concerns about environmental sustainability and energy efficiency continue to grow, there has been an increased interest in propulsion using batteries or electrification as a potential solution for reducing emissions and improving operational efficiency. However, there are significant technical challenges that must be overcome to make this vision a reality.

One of the key challenges facing electrification of Great Lakes shipping is the technological limitation of current battery and electric propulsion systems. While significant advances have recently been made in the ferry and harbor tug markets, the unique demands of shipping on the Great Lakes requires more powerful and robust systems to be developed.

Examining the Options

For example, while many battery and electric propulsion systems may look the same, they are uniquely tailored to each individual application. The cornerstone of any successful hybrid, or all-electric installation, is an accurate and comprehensive vessel operating profile. The sizing of energy storage systems requires extensive knowledge of not only the peak power demands, but also the amount of time that the power will be required. This makes it a much more complicated process than just selecting a traditional diesel driven generator. Knowing how much power is required, and for how long that power must

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be delivered, forms the foundation for the energy storage system design. When you also consider the many variations in Great Lakes vessel types, trades and routes, it is assured that the solutions will be as varied and as unique as the boats themselves.

Although hybrid and all-electric propulsion solutions are an excellent fit for many smaller vessels, scaling these solutions to meet the rigorous demands of the Great Lakes shipping fleet can be problematic. As with the case of self-unloaders, the peak power demand can be in megawatt range, with cargo handling operations typically lasting hours. Excessive capital costs aside, dedicating the space required to house the large number of batteries required would be nearly impossible. Instead, integrating battery systems with the vessels existing electrical system to provide peak power saving, is a more realistic goal; but still not without its own challenges.

Integrating a direct current (DC) battery system with a typical existing alternating current (AC) plant requires large and expensive transformers and power converters. Additionally, sophisticated battery and power management control systems must be introduced to make these components function seamlessly. Getting these systems to work with the legacy switchboards and generators often found on Great Lakes tankers and bulk cargo vessels can be a complex and costly undertaking.

In addition to the "on-board" challenges, there are considerations that must be made shore-side as well. To properly utilize battery-based energy storage systems on boats, the electrical infrastructure of the ports and terminals they utilize must also be upgraded to meet these demands. Afterall, installing a large battery bank on a vessel does little good if there is no way to charge it!

The development of powerful and efficient shore-side charging stations is necessary to provide the quick charging capability required to keep the vessels "topped off" and ready to go to meet the next task. This all comes at a cost, however, and many Great Lakes ports and terminals are in remote locations, where implementation of this infrastructure comes with its own unique challenges.

An Optimistic Future

Despite these challenges, there is reason to be optimistic about the future of electrification in Great Lakes shipping. Advances in battery technology, charging infrastructure, and hybrid propulsion systems are all helping to make this vision more feasible. Furthermore, there is growing support from governments, businesses, and environmental advocates for investment in eco-friendly maritime solutions.

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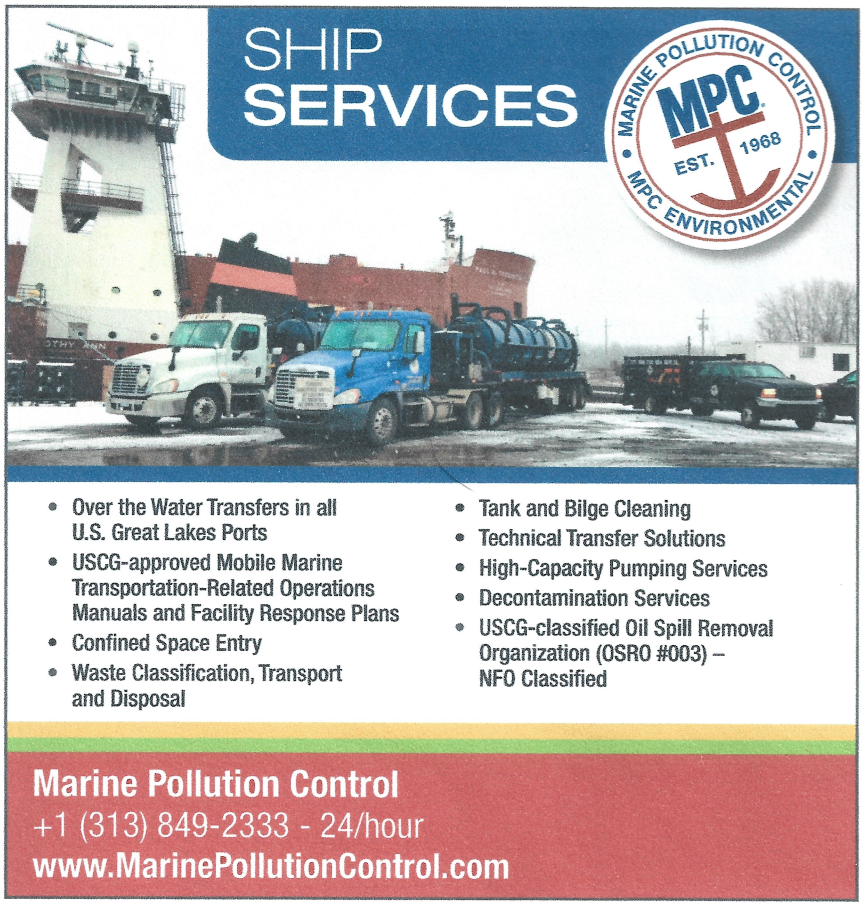
The benefits of battery or electric propulsion for ships on the Great Lakes are multiple. First, by reducing or eliminating the need for fossil fuels, these systems have the potential to significantly decrease greenhouse gas emissions. This is especially important, as the Great Lakes region faces challenges in relation to air quality and environmental degradation. Secondly, batteries and electric systems offer the potential for lower maintenance and operating costs, as they require less lubrication, have fewer moving parts, and generally experience less wear and tear than traditional diesel engines. Thirdly, these systems offer increased efficiency, with electric propulsion systems achieving higher levels of energy recovery and conversion than internal combustion engines. Finally, battery or electric propulsion systems can provide greater reliability and power, potentially enabling ships to operate in harsher weather conditions and to manage the navigational challenges of the Great Lakes more effectively, such as shallow waters and strong currents. While there currently remain technological limitations to widespread adoption of these systems, the benefits they offer suggest that they will be increasingly important in the eventual electrification of the Great Lakes shipping industry.

As we look ahead to the next 25-30 years, there is much work to be done to ensure that electrification can meet the needs of the Great Lakes shipping industry. However, the potential benefits of reduced emissions, improved operational efficiency, and increased economic competitiveness make this an effort worth pursuing. With continued innovation and financing, the future of Great Lakes shipping may just be electric. ■



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