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Current and future scale limitations for alternative marine power and propulsion solutions

Jan-Erik Rådén, Head of New Technology, Foremost Ltd

Alternative energy sources for marine power and propulsion are in a phase of development which may be decisive. For several years, the potential benefits to shipping offered by battery energy storage have faced accusations of hype, focusing on whether the footprint of plant required can truly justify the energy generated. While battery storage has been deployed on smaller vessels, some see lack of progress on space efficiency as potentially fatal for the technology in larger projects. However, recent installations have seen fast-paced development in energy density, with new ways of packaging the technology emerging rapidly. Within the last six months, ships batted generating 3-30kW have become available at the same price as their traditionally required for 6.3kWh. If the power space balance can change by 30% in half a year, what is the true potential for this technology as a source of marine power and propulsion over the next five years? Is the sky the limit, or do significant gains today promise only diminishing returns tomorrow? Drawing on Foremost’s unrivalled experience in cruise ship newbuilding and retrofit design work, Foremost Head of New Technology Jan-Erik Rådén will consider the technical advances made by battery energy storage, and assess whether it can make the leap from small to larger vessels. The acknowledged ship energy expert will offer a perspective on the obstacles faced for wider adoption, but also the true potential of battery energy storage, also exploring the pathways for shipping to exploit fuel cell technology in an economically viable way.

Commercial Wind Propulsion Solutions: Putting the ‘Sail’ back into Sailing

Gavin Allwright, Secretary, International Windship Association (IWSA), UK

We have seen a wind change in the wind propulsion industry over the last 4-5 years focusing on the commercial efficiency and this has gone hand in hand with a steady growth in commercial wind propulsion. A study of the new WindShip concept that combines hybrid and autonomous technologies that enable the WindShip to sail to tighter schedules. The feasibility study addresses a comprehensive research into the economics and sail technology showed that a wind powered vessel for bulk and liquid cargo was entirely feasible. Recent developments in materials and power systems now make the concept even more attractive. The WindShip sail system is more powerful and efficient than other proposed sail systems, and its operation can also be fully modernised. However the technology that will ultimately make the WindShip the ship of the future is autonomous and unmanned. Not only will this reduce operating costs, but it will increase the cargo capacity significantly and simplify the ship design and systems required. This paper presents a study of the new WindShip concept that combined hybrid and autonomous technologies that enable the WindShip to sail to tighter schedules. The feasibility study addresses a wide range of both design and operational issues and demonstrates that very large savings in emissions and the cost of operation are possible within technology that is available today.

Reducing CO2 for shipping is a high priority but making small efficiency gains in current internal combustion technology is unlikely to make the significant changes to greenhouse gases that are being sought. Back in 1989 RURIE E HAASEN developed an impressive concept design for a fully wind powered vessel sponsored by the Danish Environment Agency called the WindShip. Comprehensive research into the economics and sail technologies showed that a wind powered vessel would not only be competitive, but also significantly reduce the operational and technical requirements. Fewer technical and operational requirements makes the concept even more attractive.

Using hybrid electric propulsion on a warship to increase flexibility and efficiency of operations

Robert Taylor, Babcock International Group, UK

Warships have historically utilised a range of differing propulsion technologies from traditional diesel engine drive to electric motor propulsion powered by large diesel and gas turbine engines. This variation in propulsion options has given naval customers the ability to tailor the system to meet the operational requirements and fuel efficiency of each class of vessel. A recent focus, in particular for Offshore Patrol Vessel (OPV) type platforms, has been to utilise diesel engine propulsion supported by smaller Power Take In (PTI) motors providing efficiency gains at lower speeds whilst bolting. With the recent development and increase in capability of battery systems there is now an opportunity to further increase the flexibility and performance of vessels by using mixed power systems to address the requirements. This approach provides further advantages by increasing the efficiency of diesel generators but also helps meet the fluctuations in power demand that these types of vessels often have. Furthermore this technology can offer additional benefits for this application such as reduced airborne and electronic noise levels. This paper looks at what a hybrid electric system could look like on an OPV type of vessel and how it can be utilised to support its range of operating modes. It also discusses the impact of the additional advantages that can be realised by adopting this technological approach for this application.

Reduce European Port and Shipping Emissions - 3 Step Process

TIE, PES, EUNIS

1. Zero Emissions in Port - Tugboats, Cargo & Cruise Ships; 2. Coastal Shipping Hybridisation - Battery hybrid types and examples; 3. Shore Power - how batteries reduce burden on local grid and expand availability to today, more than 100,000 vessels travel through 4,500 ports worldwide, producing emissions equivalent to 220 coal-fired power plants. With seaborne trade expected to double as many as 24 million annually by 2030, the shipping industry must reduce its carbon footprint and adopt technologies that maintain ability to economically conduct trade. Zero Emissions in Port: Zero or low emission harbour activities are now available to all vessels and machines in ports. Each type utilizes battery power. The presentation will explore how cranes, ORV, tugboats, cruise ships and container vessels can implement the technology today with economic benefit. Coastal Shipping Short trip ferries and coastal shipping is prime for hybrid propulsion. Battery technology has increased and cost has decreased. Coastal ships and ferries can utilise shore power - traditional shore power connects directly to the grid; the addition of rechargeable battery banks (containers full of batteries) expands availability. Ports are no longer limited by power availability or infrastructure capacity. Battery packs are charged by grid or other renewable sources, and some cases be used to optimize and reduce on-shore power generation or provide emergency spinning reserve for the port.
This represents a preliminary programme and may be subject to change.

Power & Propulsion Alternatives for Ships

This presentation will discuss the design-side investigations and their outcomes. New calculations proved vital to the success of the project, including use of a new battery buffer system. This allows the multiple diesel engines which are the main energy producers, to work at their most efficient operating point (or they may at times be shut off entirely due to lower CAPEX incurred for the application of LNG as a fuel, the payback period could potentially be a few years and a step forward in delivering a competitive merchant vessel with favorable total cost of ownership.

Replacing of a diesel generator with a containerised battery system on-board a containership

Hybrid energy and propulsion system for vessels in timetable operation

Design-side Innovation to Minimize the Environmental Footprint of a Ro/Pax Ferry

Wind assisted ships design exploration and operational constraints

LNG powered dry bulk carrier

Role of Rim Driven Propulsors in Future Electric Ships

Replace ment of a diesel generator with a containerised battery syste m on-board a containership

Lunch

Coffee

Hybrid energy and propulsion system for vessels in timetable operation

Role of Rim Driven Propulsors in Future Electric Ships

Coffee

General Discussion