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Study on the Application of All Electric Vehicle Carriers in Upper Yangtze River of China

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ABSTRACT

Electric drive is an inherent and important part of ship development. Now it becomes one kind of standard on the way towards more efficient ship concepts. As one of the challenging topics in ship, a key step is how to find resolution for improvement of the performance of Ro/Ro ships, according to safety, friend environment and less cost. Definitely, electric propulsion systems for marine vessels are an interesting alternative to conventional manner. In this paper, we'll investigate development of the vehicle/passenger carriers with all electric system, including benefit analysis about environmental performance assessment and life cycle costing, based on the LCA (life cycle analysis) philosophy. A test case is from the Chuan river (Yangtze River upstream, China) transportation market.

Based on the net present value available, we'll demonstrate that the environmental effects and future benefits in this area are closely associated with ship owners' invest capacity. As an environmental friendly ship with obvious social profits, therefore, AES (all electric ship) will be widely used in markets of China in the near future.

KEY WORDS: All electric ship; vehicle/passenger ship; environmental assessment; LCA method.

INTRODUCTION

The vast majority of today's ships are diesel-mechanical; that is, the diesel engine mechanically powers the propellers through reduction gears. Because these propulsion system, and other onboard system, such as cargo-handling, must have their own power sources, most ships have many independent power sources. The disadvantages are evident: noise and environmental pollution, relatively high maintenance cost, high installed power, and inefficient use of space (because generators must be located close to energy system).

Instead of several independent power sources, the all electric ship has one integral energy system. The latest developments in power electrics enhance the conversion of power to suit the needs of the various power consumers on board. Electric propulsion systems are also an interesting alternative to conventional configurations for marine vessels. Nowadays much more importance is attached to cost effectiveness than was formerly the case. The same applies to environmental compatibility. The common generation network for propulsion and onboard services with high power ratings permits the integration of high power loads without any problem.

Moreover, the flexibility available in the setting up of power generators greatly reduces the hazard length of the units. Mounting of the generating units on anti-vibration foundations reduces noise problems. Availability of the full torque at the propeller over the full speed range makes it unnecessary to impose restrictions on operating performance during duty with buoys.

At present the AES may in some cases, be more expensive than conventional diesel-mechanical vessels. However this price differentiation will soon be eradicated by rapid technical innovations, especially in power electronics, and the continuing optimization of design to harvest potential benefits （Schulz, 2005）. In fact, the future development of fuel cells and other emerging technologies will eventually make the AES (much) cheaper than a conventional ship.

The role of electric propulsion is no more just to be a machinery option. It was noted (Lively,K.;and McCoy.T.J.,2000; Carpentier, 1999)that the choice has impacts on ship operation, cargo capacity, ship construction, delivery time and environmental issues. Electric power plant principle is actually a combining force; a link in-between possible prime mover options, modular building technology and new, podded propulsion system. Electric drive is today an inherent part of ship development and it is one of the cornerstones on the way towards more efficient ship concepts today. Thus ship evolution is really a chance for electric propulsion and the suppliers must consider it as such when developing their own products towards better reliability, simplicity and lower cost.

DEVELOPMENT OF RO/RO SHIP IN THREE GORGE AREA IN CHINA

Requirement for the New Ship Type. Ro/Ro ship in Chuan River is a kind of heavy load vehicle carrier shipping in the route from Chongqin to Yichang which is a section of main stream of Yangtze River. It is actually a vehicle/passenger ship. To the middle of 2006, about 10 series standard vehicle/passenger ships have been put in to the operation. The standard Ro/Ro ships in Chuan River covers 3 types, that is 40 vehicle carriers [CJB(2004)G40], 50 vehicle carriers [CJB(2004)G50] and 60 vehicle carriers [CJB (2004) G60].

The problem that the authority is facing is to find a proper way to