Title: Converting Motorised Sailing Yachts to Carbon-neutral Vessels

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Abstract:

The conversion of motorised sailing yachts to carbon-neutral electric vehicles poses unique opportunities as well as challenges from business, design and engineering viewpoints. The reduced noise and smell that comes with electric propulsion attracts environmentally conscious sailors, who usually also have sufficient resources to finance such a conversion. The long lifetime of sailing yachts make conversion economically attractive, and keeping the sails as the main method of propulsion means that the demands on the electric drive are relatively modest.

Sufficiently dimensioned solar panels can solve the requirement of carbon-neutral propulsion, but their installation within the functional and aesthetic constraints of a sailing yacht poses considerable challenges. The harsh environment of the open sea requires ruggedised designs that can withstand the movement of the boat, high wind speeds and prolonged exposure to salt water. Another challenge is to provide reliable electricity supply for on-board appliances, which typically come at 12V DC and 240V AC.

Our team has converted a motorised sailing yacht to a carbon-neutral vessel by retrofitting it with a 2.5kW electric outboard motor and a 24V 200Ah marinised lithium-ion phosphate battery set. Three 275W mono-crystalline solar panels serve as cockpit roof and are mounted on a custom-built stainless steel truss. The battery lasts for 2 1/2 hours of continuous operation. At daytime, the solar panels allow for docking manoeuvres even without any batteries. They can fully charge the battery set in less than two days under typical light conditions in Singapore. DC-DC converters, in combination with an auxiliary battery, supplies 12V DC for navigational equipment and 240V AC for household appliances. The auxiliary battery can also serve as an emergency power source for the motor.

The boat was converted in October 2014 and is currently the only carbon-neutral motorized sailing yacht in Singapore.