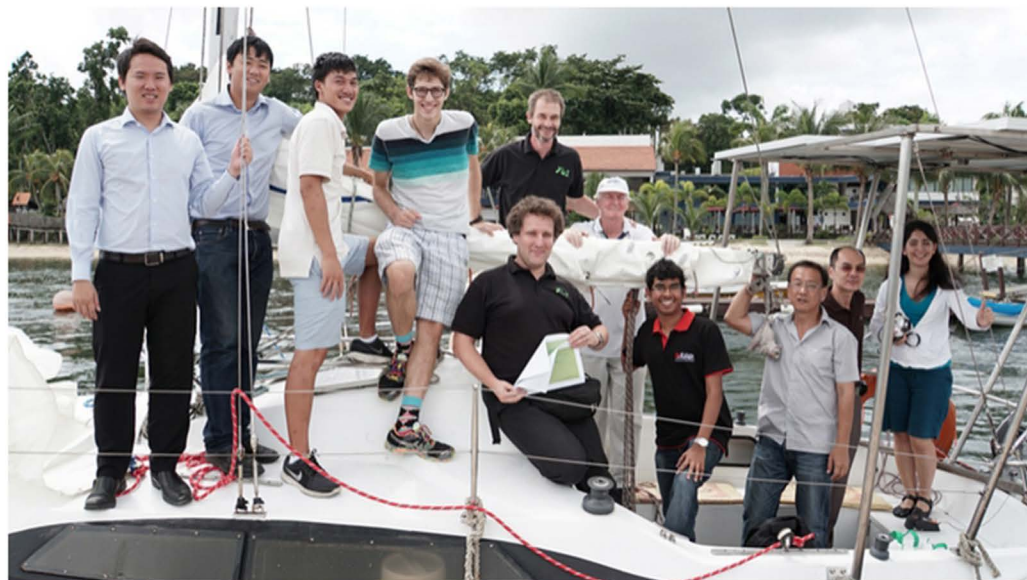


## Solar-powered yacht sets sail

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FrogWorks, a collaboration between the NUS University Scholars Programme and the Faculty of Engineering, has successfully developed a solar-powered yacht

After charging up the Swiss Alps on a **converted electric motorcycle** earlier this year, NUS' Team FrogWorks has taken to the waters on a yacht that runs on solar power. The vessel, christened FW2 (short for FrogWorks 2), went for its maiden test run on 20 November along the northern shores of Singapore.

A collaboration between the NUS University Scholars Programme (USP) and the Faculty of Engineering, Team FrogWorks comprises mainly USP Engineering students.

Associate Professor Martin Henz from the Department of Computer Science and USP served as the project manager, with Dr Joerg Dieter Weigl from the Design-Centric Programme of the Faculty of Engineering as the engineering supervisor. The pair guided a group of undergraduates in the conversion of a motorised sailing yacht into the carbon-neutral FW2, that is, a vessel that does not consume any fossil fuel during its operation. An electric outboard motor and a seaworthy lead-acid battery set were fitted, along with three mono-crystalline solar panels to provide clean energy.

The team members faced numerous hurdles, key among them the designing of a truss sufficiently stable to support the solar panels. Eventually, they designed, built and installed a robust stainless steel mounting which had minimal impact on the vessel performance and the sailors' activities. The unique requirements posed by the hybrid solar/wind-powered propulsion threw up interesting engineering challenges and provided perfect opportunities for project-based learning at the undergraduate level.

Batteries needed to power the boat at high speeds and during poor light conditions had to be carefully selected and securely fastened on the boat. Finally, the project members had to set up the electronic circuitry within a demanding environment exposed to moisture, salt water, light and motion. They decided on a Maximum Power Point Tracking device to transmit the power from the solar panels to the batteries.

Mounted solar panels on sailing boats are a common means of providing on-board electricity. However, recent advances in solar panel, battery and motor technology make it feasible to use the sun as the *only* source of energy for motorised yachts. FW2 is the first sailing yacht in Singapore that uses solely solar power for its motor and on-board electricity needs.

The project findings will be published in an academic paper at the 28<sup>th</sup> International Electric Vehicle Symposium and Exhibition in Korea from 3 to 6 May 2015.



The converted yacht is able to achieve four hours of full-speed operation or 10 hours of cruising

Expressing confidence in the boat's ability to deliver 100 per cent energy savings during operation, Assoc Prof Henz said: "We hope to completely eliminate the use of fossil fuels during the operation of the boat, even on long-distance voyages." He explained that actual savings of gasoline would depend on the wind conditions.

Dr Weigl agreed, saying: "The current configuration provides energy for four hours of full-speed operation or 10 hours of cruising. With sunlight, the boat is able to achieve six hours of full-speed operation or cruise mode for an entire day." Other configurations include lead-acid and lithium-ion batteries and offer exciting prospects for future undergraduate student projects.

First year Materials Science and Engineering student Zhang Siyao signed up for the project because of her keen interest in solar energy. "The most significant gain I have obtained through participating in the project is the exposure to an actual engineering process."