Harnessing Ocean Waves: A Sustainable Approach to Desalination

Rong, Sunny (School: Greenhills School)

Despite 70% of our planet being covered by water, only 3% of that is fresh water, with the vast majority being saline. World WildLife predicts that two-thirds of the world's population may face water shortages by 2025. While traditional desalinating systems exist, their reliance on energy stresses the fresh water supply even more. In this situation, a green energy generation solution is crucial to support the desalination process. Offshore energy enables the direct utilization of abundant wave energy, providing a reliable power source, making it especially important for desalination in isolated offshore environments. This research aims to develop a carbon-free electrodialysis desalination system powered by ocean wave energy. The system will be simulated using an axial flux permanent magnet generator spun by a rack and pinion system, mimicking a point absorber(Wave Energy Convertor). The built prototype generator in this project is able to produce a constant energy of about 5-10 Watts. This power will be able to supply enough energy to desalinate a high salinity of water at a rate of 1~2 liter/hour. This project will optimize the power supply design for wave energy by using CAE tools for the generator through multiple factors, including scaling, rotor iron cores, etc. By changing these factors, the power of the generation system can be increased by more than twice in certain scenarios, making the utilization of ocean wave energy to desalinate water a promising approach with a sustainable and effective solution to water scarcity.

Awards Won: