Innovative Climate Change Emissions Reduction: Flettner Vortex Scrubber With Active Seakeeping

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Climate change can be solved, but the window is closing. 90% of goods move by cargo ships, resulting in 4% of climate change emissions. There is a need for climate change technology that works within the existing political and economic structure, addressing externalities through a profit incentive. Flettner rotor wind power has entered service. This work adds novel active seakeeping control to the innovative Flettner Vortex Scrubber (FVS), creating a hybrid wind and fossil fuel powered vessel that cleans exhaust while expanding the vessel's operating envelope. A functional proof of concept prototype was designed and built using 3D CAD and computational fluid dynamics. A custom wave pool simulating open water conditions, and a custom mass and buoyancy model of a neopanamax cargo ship were developed to evaluate the novel active seakeeping algorithm and control systems. Statistical analyses were used to compare seakeeping performance, with and without the Active FVS system, with data sets from a Forced Vibration Ocean Wave Simulation, and a Free Vibration Simulation. Results show that the Active FVS is a significantly effective seakeeping system, with maximum rolling angle reduced by 65.6%, and recovery time from angular displacement reduced by 45.0%. Beyond reducing climate change and illness e.g., asthma, this investment pays for itself in less than a year through fuel savings and increased cargo space. An Active FVS increases the value of each trip from Shanghai to New York by $185,000, while improving IMO emissions compliance, reducing harmful parametric rolling, and improving crew effectiveness. Scaling to our global cargo fleet could mean a reduction of: 93 million tonnes of CO2, 1900 kilotonnes of nitrogen oxides (NOx), and 160 kilotonnes of particulate matter.

Awards Won:

Second Award of $2,000