Growing energy demand has driven the investigation of new renewable energy sources including various forms of ocean energy due to the abundant potential and widespread availability of this source. This technology typically includes wave power, tidal currents, and ocean thermal energy. Wave Energy Converters (WECs) are a possible solution to this energy demand that have been explored in recent decades through a variety of different methods. In this project, we explore the design, development, testing, and grid scale implementation of a point-absorber type WEC using a Direct Drive Linear Permanent Magnet Generator (LPMG) based Power Take-Off (PTO) system. We also explore the integration of this system into the green hydrogen production industry and the required power input for industrial hydrogen production. In order to approximate the output of this device, a model was created to calculate the voltage in the coil according to Faraday's law. This was used with oceanic data from the target location to estimate the power output and to optimize the dynamic response of the buoy. Preliminary estimates for a grid scale WEC are evaluated using a scaled down buoy that undergoes a number of tests. Dry oscillation tests are used to simulate the motion of the waves and test the LPMG system and free decay tests are used to test the dynamic buoy response. Simulations have found that the PTO system is capable of producing 822.8 volts giving the system a rated power of 33 kW per buoy. To get to this value the simulation we developed the power electronics systems within the system to get the power from the PTO to the electrolyzer. First the Low Frequency AC generated from the PTO system is converted to a positive half wave DC. This half wave DC is used to charge a battery energy storage system (BESS) which for the sake of simulation is marked with a 10 farad capacitor. The BESS is then discharged into a half bridge IGBT transistor DC-DC converter to step up the ripple frequency of the DC input to the electrolyzer. Finally DC is filtered down to an acceptable ripple in an LC filter then electrolysis is conducted with a controlled voltage through the duty cycle of the IGBT transistors.

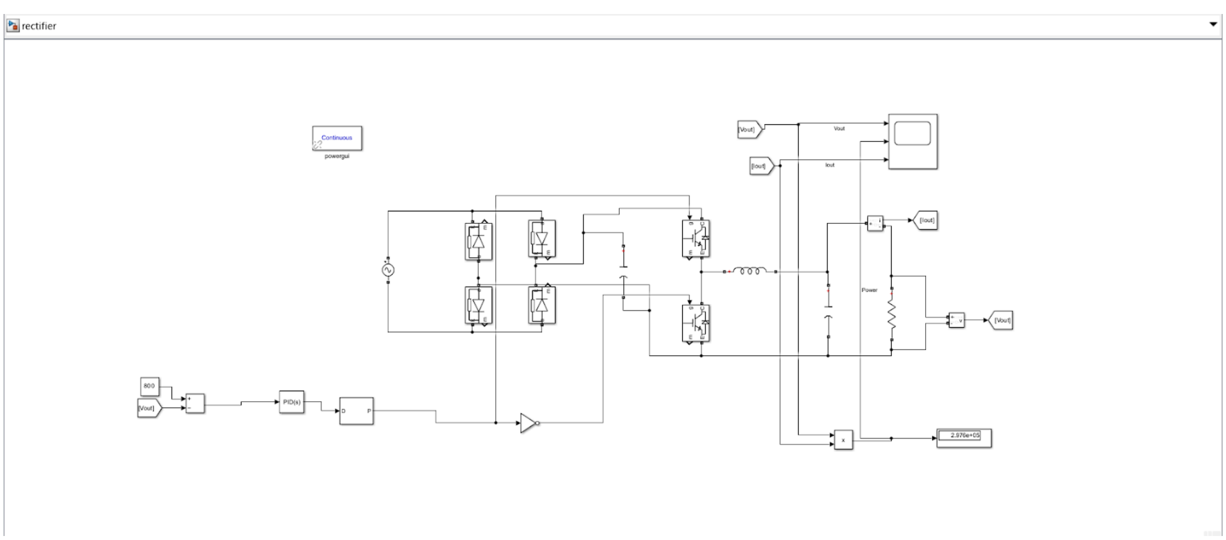

Fig. 1 Simulink circuit of power electronics for electrolysis

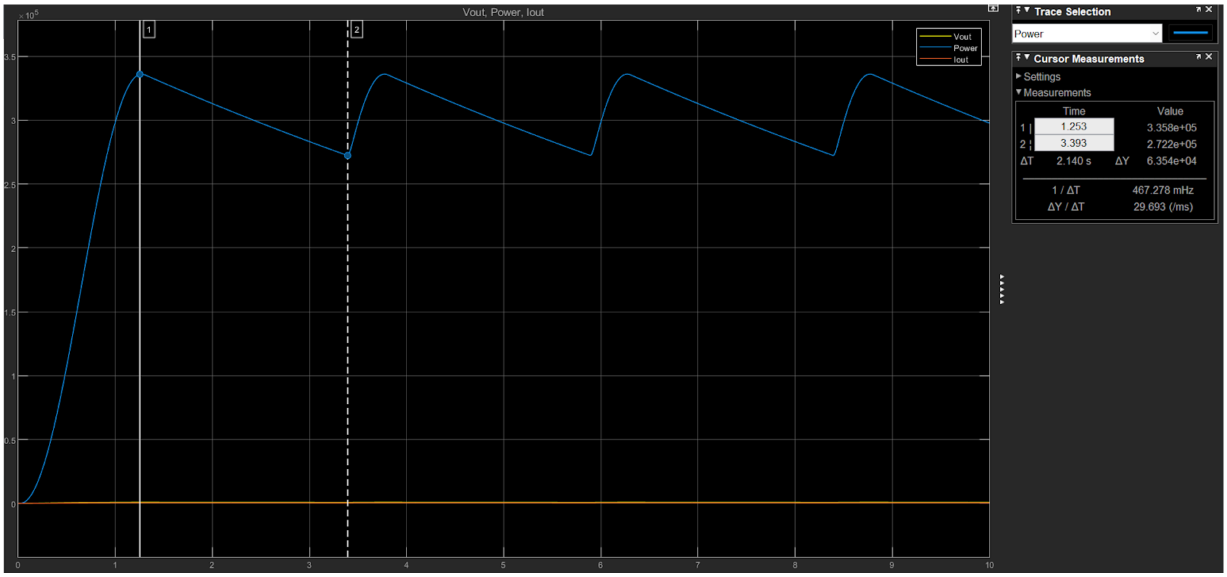

Fig. 2 Power results from the simulation high variation is due to the discharging of the capacitor

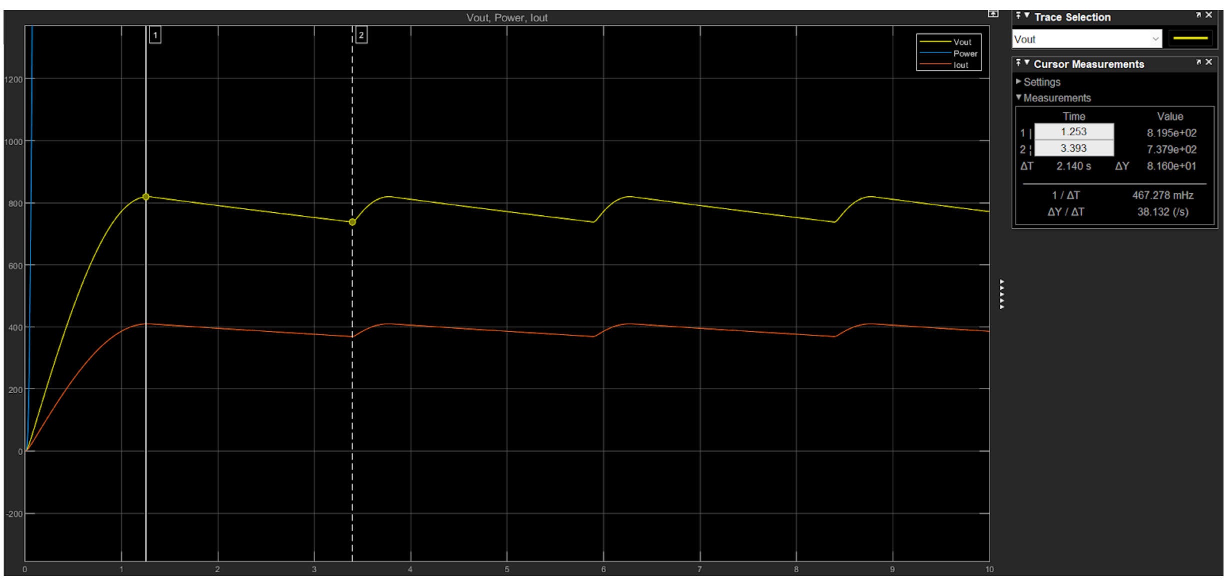

Fig. 3 Voltage results from the simulation high variation is due to the discharging of the capacitor

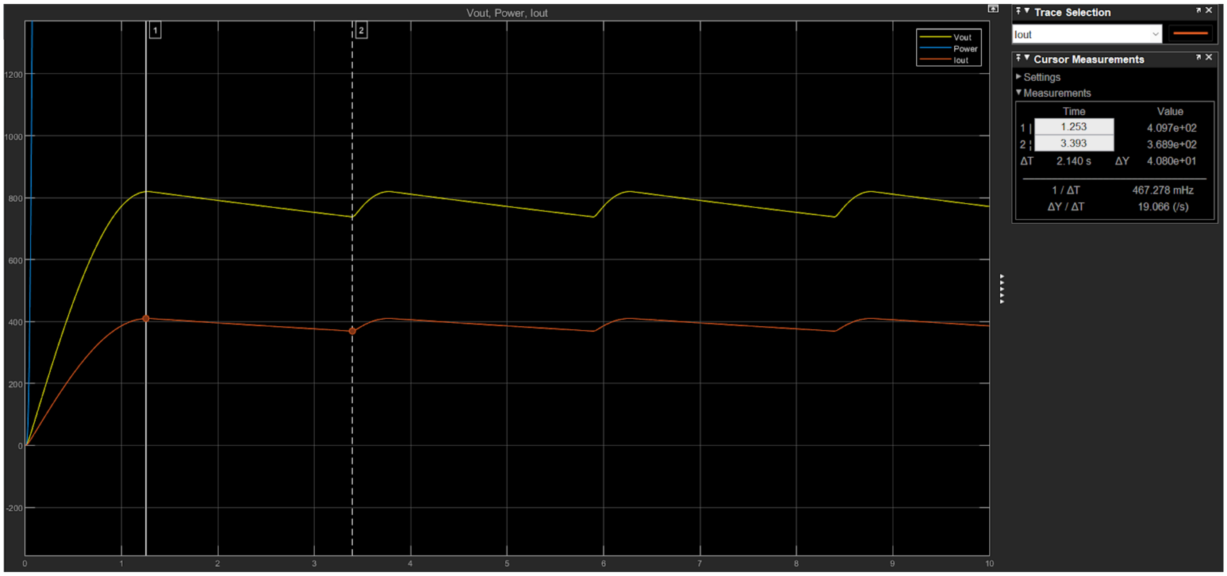

Fig. 4 Current results from the simulation high variation is due to the discharging of the capacitor

The Direct Drive LPMG based system provides an alternative to more traditional wave energy converters that requires fewer mechanical components and reduces friction wear. This improves the survivability of the device and reduces maintenance costs which typically provide a major barrier to ocean renewable energy systems. Exploration of the design and behavior of this device provides a foundation for similar design work in the future.