Caustic Aqueous Phase Electrochemical Reforming (CAPER) for process intensified hydrogen production

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This project will investigate a novel Caustic Aqueous Phase Electrochemical Reforming (CAPER) process on an oxygenated hydrocarbon, liquid ethanol in this instance, to make strides towards the DOE's long-term cost target of $4/kg of hydrogen at the dispenser. The proposed CAPER technology utilizes liquid ethanol and electricity, preferably from intermittent renewable sources, to produce high purity (99.99%) hydrogen at high pressure directly from the reactor. The CAPER technology also separates the produced CO_2 from H_2 *in-situ* by converting it to water-soluble HCO_3^-, leaving the gaseous hydrogen to bubble out of the caustic solution. The solution is then regenerated by removing high purity CO_2 from the solution that can be sequestered or reused. The scientific and commercial impact of our paper is significant because the CAPER technology can offer a much simpler overall design of fuel reforming process by combining the reformer and CO_2 capture units into one system, operate at much lower temperature ($\leq$ 150 °C), and produce higher purity H_2 (> 90%) at high pressure without using the external compressors.