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Fuel-cell plug-in hybrids and the thermal hydrogen economy

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Thermal Hydrogen is an energy economy engineered to enable economy-wide decarbonization through new chemical energy carriers. The economy is built upon the principle of using both byproducts of water (or CO₂) electrolysis hydrogen (or CO) and pure oxygen. The pure oxygen is used to enable emissions free hydrocarbon utilization without “Carbon Capture”, just sequestration. The energy carrier produced from electrolysis is combined with the output of auto-thermal reforming to produce either methanol or ammonia. The methanol is envisioned to provide electric range for battery electric vehicles by using a solid oxide fuel cell (SOFC). The heat from the SOFC reforms the methanol back to syngas, and the syngas is oxidized and produces both electricity and heat. The purpose of using an SOFC is to enable oxidation of syngas rather than pure oxygen. SOFC’s also allow the products to be limited to CO₂ and H₂O, also known as carbonated water. Given the ease of handling carbonated water, it is envisioned to be stored onboard the vehicle and returned to the gas station for eventual sequestration and recycling. The advantage of plug-in hybrid SOFC vehicle is not limited to turning CO₂ emissions into water production. Plug-hybrid SOFC vehicles require only a very small battery (for acceleration) and a very small fuel cell (for range). Just a 10-kWh battery is sufficient to provide acceleration (~110 kW) and range of ~50 km. The medium sized battery provides acceleration while the fuel cell provides heat and range with just a ~10 kW fuel cell. Overall, the car provides the best of both electric and hydrocarbon worlds—lightweight, electric torque, and instantly refuellable.

Biography

Jared Moore is an independent energy consultant based in Washington DC advising on economy-wide decarbonization. He has published his papers in multiple peer reviewed journals including *Environmental Science and Technology*, *Environmental Research Letters*, *Energy Procedia* (GHGT-12), and the *International Journal of Hydrogen Energy*. He is also a contributing author of the book “Variable Renewable Energy and the Electricity Grid”. He has completed his BS in Mechanical Engineering from Rose-Hulman Institute of Technology in 2008 and a PhD in Engineering and Public Policy from Carnegie Mellon University in 2014.

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