

Critical Metrics and Limiting Physical Parameters in Electrolytic and Photoelectrochemical Solar to Hydrogen Production Technologies

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Abstract: The US Department of Energy's (DOE) Fuel Cell Technologies Program (FCT) has made significant progress in fuel cell technology advancement and cost reduction, highlighted by reducing the cost of automotive fuel cells by more than 80% since 2002. The next major challenge is the widespread production of affordable renewable hydrogen. Near-term utilization of current reforming and electrolytic processes is important to early hydrogen markets, but there remains a critical need for transitioning to industrial-scale renewable hydrogen production for the longer term. Central to the long term vision are the solar-to-hydrogen conversion processes, including the photoelectrochemical and photo-assisted electrochemical routes. DOE utilizes techno-economic analyses to assess the long-term viability of these emerging solar hydrogen pathways and to help identify key materials- and system-level cost drivers. Key metrics and sensitivity analysis from the techno-economic studies will be discussed in connection with the fundamental electronic and electrochemical properties that have direct impact on these metrics.