Bio-derived Renewable Hydrogen in the Southern California Air Basin

OVERVIEW

This study looks into the utilization of biological waste products to produce renewable hydrogen. The region under consideration is the Southern California Air Basin (SoCAB), which has been elected as an early test-bed for hydrogen fuel cell vehicles. To aid in the deployment of these vehicles, a hydrogen supply chain must be established. The need for renewable hydrogen is especially great, following the enactment of Senate Bill 1505, which requires new hydrogen fueling stations to obtain 33% of their fuel from renewable sources.

The feedstocks examined in this study are sewage waste, municipal waste, agricultural waste, and forestry waste. The primary hydrogen production method for non-wood feedstock is anaerobic digestion and steam methane reformation (SMR). The primary hydrogen production method of wood feedstock is biomass gasification.

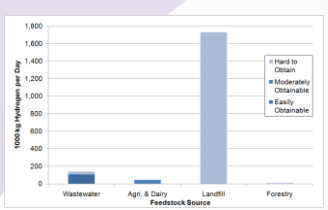
GOALS

- Analysis of the various sources of bio-derived renewable hydrogen
- Quantification of the current production potential of renewable bio-hydrogen in the SoCAB region
- Temporal prediction of the future production potentials of renewable bio-hydrogen in the SoCAB region
- Spatial location of the sources of renewable bio-hydrogen in the SoCAB region
- Assessment of pollutant emissions, greenhouse gas emissions, water usage, and resource consumption for the bio-derived renewable hydrogen supply chain

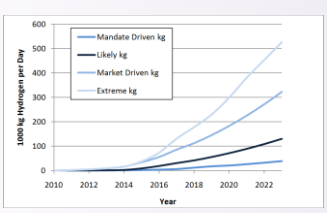
RESULTS

Wastewater in the SoCAB region has the current potential to generate over **90,000** kg of H_2 per day with a maximum future potential of over **125,000** kg of H_2 per day .

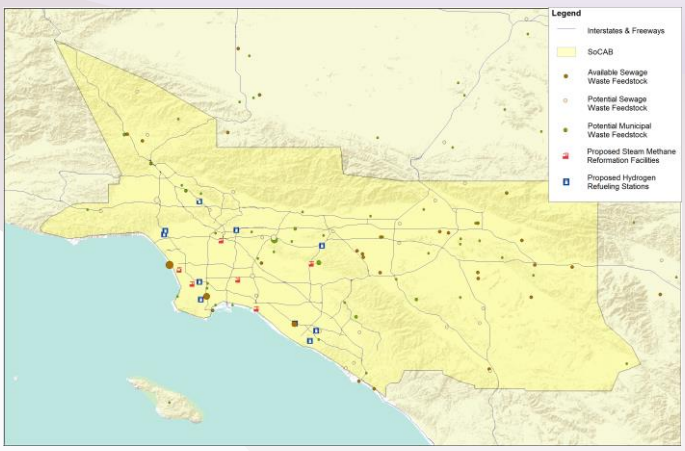
Landfills in the SoCAB region have the current potential to generate over **1.7 million** kg of H_2 per day. However, due to the greater degree of difficulty in purifying landfill gas, this source might not be immediately utilized.



Bio-derived Hydrogen Production Potential



SoCAB Hydrogen Demand Scenarios

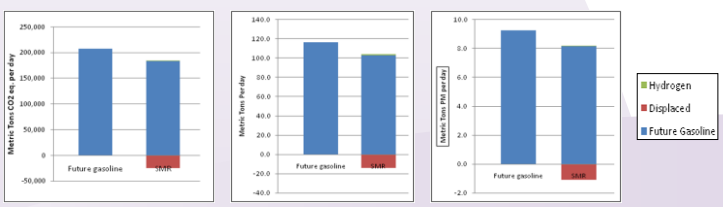


Current Hydrogen Production Resources in SoCAB

RESULTS

Agriculture and diary waste have the combined current potential to generate over **43,000** kg of H_2 per day. However, the challenge using this feedstock is the collection and transport of this waste source to a centralized plant.

Forestry waste has the potential to provide over **100,000** kg of H_2 per day using gasification. However, most of this waste is scattered and not collected. If counting only the collected forestry waste, only about **6,000** kg of H_2 per day could be produced.



Emissions Impacts of the Bio-derived Hydrogen Supply Chain. From left to right: *Greenhouse Gas, NOx, Particulate Matter (PM)*

RECENT PUBLICATIONS/PAPERS

S.D. Stephens-Romero, T. Brown, J.E. Kang, W.W. Recker, G.S. Samuelsen (2010). Use of Systematic Planning to Optimize Investments in Hydrogen Infrastructure Deployment. Int'l J. of Hydrogen Energy, Vol. 35, No. 10, pp. 4652-4667

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