Economics of Near-term CA H_2 Infrastructure

OVERVIEW

A detailed economics model of hydrogen infrastructure in California has been developed and applied to assess several potential fuel cell vehicle deployment rate and hydrogen station technology scenarios. The model accounts for all of the costs in the hydrogen supply chain and specifically examines a network of 68 planned and existing hydrogen stations in terms of economic viability and dispensed hydrogen cost. Results show that (1) current high-pressure gaseous delivery and liquid delivery station technologies can eventually be profitable with relatively low vehicle deployment rates, and (2) the cost per mile for operating fuel cell vehicles can be lower than equivalent gasoline vehicles in both the near and long term.

GOAL

Evaluate the economics of near-term hydrogen infrastructure in California.

HIGHLIGHTS

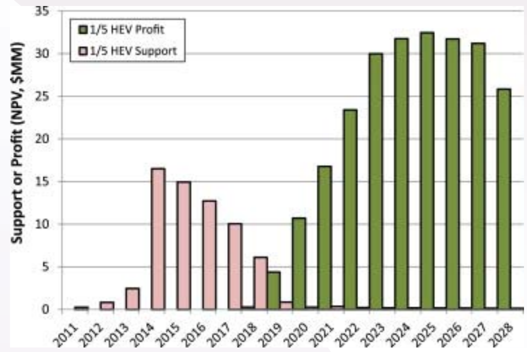
- All hydrogen network scenarios examined are eventually profitable.
- A properly designed hydrogen station network is critical for financial success.
- Station network configurations can be profitable, even with slow FCV deployment.
- Government support continues to be necessary due to required up-front investment.
- With competitive hydrogen pricing, FCV operating cost can be half that for gasoline.

RESULTS

The economic model is a discounted cash flow model that accounts temporally for both capital and operating and maintenance (O&M) costs for a statewide network of 68 hydrogen stations. Based in Matlab, the model iteratively determines daily hydrogen throughput at each station in the network based on relative demand ranking, such that stations in higher FCV deployment areas per CaFCP survey results, receive greater FCV usage. A major assumption of this research is that consumer fuel cost per mile for FCVs will be equivalent to comparable gasoline vehicles at all times during the life of the hydrogen station network. This assumption is based on the comparable performance between FCVs and combustion vehicles in terms of range, refueling characteristics, and vehicle size.

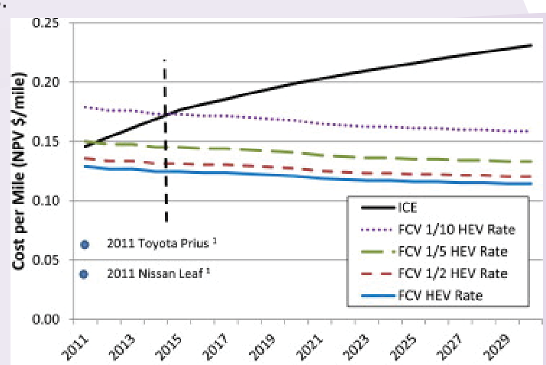
68 Hydrogen Station Network determined by the UCI STREET model and adopted by the California Fuel Cell Partnership

Station and equipment cost and specification information was gathered from and tacitly approved by active hydrogen station and equipment providers. It was assumed that the 18 existing and funded hydrogen stations continue operating for the duration of their lifetimes (prescribed here to be 15 years) and investment in the 50 proposed new stations is split between larger liquid delivery locations and smaller gaseous delivery locations such that $34 million is financed to build 17 liquid delivery stations to be completed in 2014, and $33 million is financed to build 33 gaseous delivery stations to be completed in 2014. With an assumed FCV adoption rate that is 20% of the hybrid adoption rate, the economic analysis shows that for the scenario described above most of the hydrogen stations become profitable in 2019.



Potential profit and required support for a 68 station network (Scenario 1: Realistic) given FCV deployment rate at 20% HEV pace.

If hydrogen is priced competitively (10¢ markup per kg) instead of being priced on par with gasoline cost per mile, FCV drivers could realize significant fuel savings on a per mile basis compared to gasoline vehicle drivers. The figure below shows that the average fuel cost per mile for FCVs can be lower, or on par with, the corresponding price for gasoline vehicles at the beginning of projected commercialization in 2015 for all of the FCV deployment rates.



Comparison of vehicle fuel costs per mile for four FCV deployment rates

RECENT PUBLICATIONS/PAPERS

Brown, T., Schell, L. S., Stephens-Romero, S., & Samuelsen, S. (2013). Economic analysis of near-term California hydrogen infrastructure. International Journal of Hydrogen Energy, 38(10), 3846–3857.

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