
VIII.14 Analysis of Incentive Options for Hydrogen-Fueled Vehicles

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Introduction

Given the numerous barriers to commercialization, it is necessary to develop policies that provide incentives for the production and purchase of fuel cell vehicles (FCVs) and the development of a hydrogen infrastructure. Over the course of the transition, regulation and policy will need to fulfill certain objectives, including providing financial assistance to the stakeholders involved in developing the technology; reducing the risk and cost of infrastructure; supporting FCV sales to induce manufacturers to produce the vehicles and consumers to purchase them; and facilitate safety, customer awareness, and technology adoption. Once the infrastructure and technology achieve sufficient market penetration the inherent environmental benefits of FCVs will allow them to maintain and grow market share with only the support of overarching environmental policies and regulations.

To identify the best policy options to support the introduction of FCVs and development of a hydrogen infrastructure, TIAX examined a variety of policies and developed a framework that covers the vehicle introduction and infrastructure development. The analysis identified policies, evaluated the pros and cons of policy options, and reviewed options with DOE and hydrogen industry stakeholders. The need for policy support was considered at different phases of the development process.

Approach

In order to examine a pathway for FCV implementation, TIAX categorized policy options for hydrogen vehicles and infrastructure. Policy efforts considered for the DOE Scenario Analysis meetings, California Hydrogen Highway Network Blueprint Plan, California Zero Emission Vehicle (ZEV) program, local air quality programs, and other programs were identified and categorized into groups. Candidate policy options were examined in terms of their strengths and weaknesses for addressing the requirements of vehicle manufacturing and fuel infrastructure development. The analysis included both well known options as well as more innovative approaches. Historical precedent for implementing policies, the effectiveness of directing the policy towards hydrogen, and the extent that incentives would affect other fuels and industries was also examined. TIAX reviewed the analysis of hydrogen policy options with DOE and other stakeholders. The analysis was presented at DOE Scenario Analysis meetings [1,2] and discussed with industry representatives. In addition, the project was completed with the cooperation of the National Renewable Energy

Objectives

Identify and evaluate policy options to support the introduction of hydrogen vehicles and infrastructure.

Technical Barriers

This project addresses the following System Analysis barriers from the Hydrogen, Fuel Cells and Infrastructure Technologies Program Multi-Year Research, Development and Demonstration Plan:

- (A) Future Market Behavior
- (E) Unplanned Studies and Analysis

Contribution to Achievement of DOE Systems Analysis Milestones

This project is an unplanned study and therefore does not contribute to the achievement of the DOE Systems Analysis milestones.

Accomplishments

- Identified policy options.
- Evaluated options.
- Reviewed analysis with stakeholders.



Laboratory (NREL) and Oak Ridge National Laboratory and the participants of DOE's Hydrogen Transition Analysis Team.

Results

Incentive approaches are likely most effective during the transition stages while environmental mandates will maintain growth through the commercial phase. The commercial phase mandates are not hydrogen specific, but address the broader concerns of energy consumption and greenhouse gas (GHG) emissions. The leading policy measures and their timing are indicated in Table 1.

TABLE 1. Transition and Commercial Phase Policy Measures

Stage	Measure
Early-Transition (2010-2017)	50/50 vehicle cost share
	Infrastructure loan guarantees
	Accelerated depreciation
	Infrastructure support
	Producer fuel payment
	Fleet purchase program
Late-Transition (2018-2025)	Consumer tax credit
	Producer fuel payment
	Renewable hydrogen under RFS/RPS
Commercial Stage (2025+)	Carbon tax
	Modified CAFE standards
	GHG cap and trade

The incentive measures in the transition stages will require significant outlays of federal funds, but the manner in which those funds are allocated will change significantly as the hydrogen transportation system develops. Early transition measures will require large outlays of funds to a limited number of parties involved in the development and demonstration of hydrogen vehicles and the construction of a fueling infrastructure through cost sharing and other support in the form of loan guarantees and additional tax credits. As the investment in development leads to vehicles that approach affordability, the government spending will need to shift from assisting a limited number of developers to creating incentives for large numbers of consumers through vehicle tax credits and fuel tax credits. The relative cost to the federal government may remain the same, but the beneficiaries will shift from a limited number of initial developers to the public at large. It is necessary to make this transition in order to provide the proper incentive to those parties needing to make the largest transition at the given stage to keep advancing the adoption of FCVs.

Some measures could have significant drawbacks and need to be considered in a limited way or implemented in an innovative way. Some examples are presented in Table 2.

TABLE 2. Potential Drawbacks of Policy Measures

Measure	Drawback
Capital cost payment of fuel infrastructure	Should be limited to early production
	Better to link payments to fuel production
Parking/HOV lane/city driving benefits	Successful for CNG and HEV early transition, but benefit is quickly diluted
	Limited number of cities are ideal for city car (NYC, SF, London)
Fleet purchase rule	Unfunded mandate
	No positive incentive to consumer
	Extensive coordination requirements
	Easy to avoid compliance
Manufacturer mandate	Very unpopular: key stakeholder not motivated to succeed
Manufacturer tax credit	Value of tax credit varies widely among carmakers due to individual tax situations
Consumer education	Impact impossible to estimate

The adoption of a comprehensive and long-term policy that indicates the regulatory position of the government throughout the transition stage will be mutually beneficial for both parties as it will allow the stakeholders to properly plan long-term strategy and as a result, the government will not undertake the added cost and burden of devising new incentives to steer industry through an uncharted transition. Capital markets and financial investors rely on stable policies that allow for smart investment based on assumptions dictating future returns. Uncertain or ambiguous policies create added risk and a reluctance to invest in corporate research, ultimately causing an increase in the need for government subsidy and incentives.

Conclusions

- Tax credits and producer fuel payments can provide a targeted incentive for hydrogen.
- Environmentally-based measures accomplish energy security and GHG reduction goals but are prone to "leakage" into other sectors and fuels.
 - Most direct impact for a large number of vehicles.
 - Economic impact is not enough to drive early transition.

- External conditions, including the cost of incumbent transportation fuels and regulatory mandates, will likely influence both H₂ availability and demand for FCVs.

Future Directions

- Work on the design of incentive programs to promote hydrogen production, along with the impact of California state policy on the availability of hydrogen and FCVs.
- Validate assumptions of the HYTRANS model regarding sensitivity of customer preference for hydrogen and other vehicles to public incentives using real-world data.
- Design incentives for generation of hydrogen via new renewable energy and carbon sequestered coal power generation capacity.
- Analyze the impact of California's "four caps" on hydrogen fuel, FCV fuel economy, and consumer transportation demand.
 - Car and light truck GHG emission standard, low-carbon fuel standard, cap and trade, and electricity GHG limit.
 - AB1493, Exec. Order, AB32, and SB1368.

FY 2007 Publications/Presentations

1. Rutherford, D., S. Unnasch, M. Hooks, "Analysis of Incentive Options for Hydrogen Fueled Vehicles," Final Report to NREL, March 2007.
2. Unnasch, S., D. Rutherford, "Policy Options for Hydrogen Vehicles and Infrastructure," DOE Hydrogen Transition Analysis Workshop, January 26, 2007.

References

1. Gronich, S., "Scenario Analysis Meeting Presentation," January 31, 2007.
2. Unnasch, S., D. Rutherford, "Policy Options for Hydrogen Vehicles and Infrastructure," DOE Hydrogen Transition Analysis Workshop, January 26, 2007.