HYDROGEN VEHICLES – POINTS TO CONSIDER RELATIVE TO FUEL TAX ADMINISTRATION (2025)

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Chapter 1

Purpose

The Environmental Protection Agency has expressed intentions to reduce emissions and invest in clean energy for the next several years. What began with electric vehicles has continued to evolve to include other types of zero emission vehicles (ZEVs) besides electric (EPA, 2023). A ZEV is a vehicle that does not emit exhaust gas or other pollutants from the onboard source of power. A ZEV is not necessarily a passenger car – it could also be a motorcycle or a commercial vehicle.

Fuel taxes on fossil fuels with higher carbon emissions have been the primary source of funding for federal and state highways. With the demand to reduce emissions with increased use and production of ZEVs, many states are looking at various methods of taxation of these alternative fuels. Several states are evaluating the use of hydrogen zero-emission vehicles and how best to address taxation as vehicle manufacturers ramp up production.

During the May 12, 2023, Motor Fuel Uniformity Meeting, a subgroup was formed to create a white paper on hydrogen zero emission vehicles and possible taxation methods for the energy used to propel those vehicles to help with uniformity among the states. This subcommittee utilized federal regulations to define hydrogen vehicles and potential taxing structures that states may use for the taxation of hydrogen vehicles. It is the intention of this white paper to provide a source of information on hydrogen vehicles and possible taxation options. We also discussed proposed legislation, taxation statutes, and other thoughts from various state agencies.

Chapter 2
Definitions

Fuel Cell [Federal]
Code of Federal Regulations Title 42, Chapter 149, Subchapter 8 defines a fuel cell as a device that directly converts the chemical energy of a fuel, which is supplied from an external source, and an oxidant into electricity by electrochemical process occurring at separate electrodes in the device (Spark M. Matsunaga Hydrogen Act, 2005).

Fuel Cell Electric Vehicles [US DOE]
The U.S. Department of Energy defines Fuel Cell Electric Vehicles (FCEVs) as vehicles powered by hydrogen. The term “fuel cell” is a device that directly converts the chemical energy of a fuel, which is supplied from an external source, and an oxidant into electricity by an electrochemical process happening between separate electrodes in the device. They are more efficient than conventional internal combustion engine vehicles and produce no harmful tailpipe emissions—they only emit water vapor and warm air (Fuel Cell Electric Vehicles, n.d.).

Hydrogen Internal Combustion Engine Vehicle [Green Hydrogen]
Hydrogen internal combustion engine vehicles (HICEVs) are a type of hydrogen vehicle which use an internal combustion engine. Hydrogen is mixed with air and compressed in the engine’s cylinders. A spark then ignites the mixture, causing a controlled explosion which generates motorized power (Pande, 2023).

Qualified Fuel Cell Vehicle [IRS]
This is a new vehicle propelled by power derived from one or more cells that convert chemical energy directly into electricity by combining oxygen with hydrogen fuel, and that meets certain additional requirements (Internal Revenue Service, 2022).

Hydrogen [FTA]
(FTA adopted 5-22) - (Hydrogen is a colorless, odorless, highly flammable gas, and is the lightest of all gases. It occurs chiefly in combination with oxygen in water, and also exists in acids, bases, alcohols, petroleum, and other hydrocarbons.

Chapter 3
Background

Production
Hydrogen fuel production can be categorized into colors based on the method of production. Hydrogen produced via specific pathways may potentially result in production credits or incentives from federal, state, or municipal governments. However, the focus of this white paper remains on possible methods of taxation of hydrogen fuel

when it is used for propulsion of a vehicle, rather than the means by which said hydrogen is produced and any accompanying incentives. The chart below shows the colors assigned to different production processes.

Color	Production Process	Naming Convention
Black/Brown	Black/Brown hydrogen is produced using a coal gasification. This process involves converting coal in its solid state into a gaseous form. (De Blasio, 2024)	The color name comes from the processing of black (bituminous) or brown (lignite) coal.
Gray	Gray hydrogen is produced by processing natural gas and steam at high temperature and pressure. The process produces hydrogen and carbon dioxide through a catalytic chemical reaction. (De Blasio, 2024)	The color name comes from the carbon dioxide that is a byproduct of the production.
Green/Yellow	Green hydrogen is produced using electrolysis of water using a renewable resource such as wind. Producing hydrogen with the electrolysis processing using solar power is sometimes referred to as yellow hydrogen. (De Blasio, 2024)	The color name comes from the processing producing no carbon dioxide or other pollutant.
Blue	Blue hydrogen is produced from natural gas using steam methane. The autothermal reforming process mixes natural gas with hot steam. This catalyst produces hydrogen and carbon dioxide. (De Blasio, 2024)	The color name comes from the processing using methane for production.
Turquoise	Turquoise hydrogen is produced using a modified pathway. A pyrolizer splits the natural gas feedstock to	The color name comes from its production process being in the middle between green

	produce hydrogen and solid carbon dioxide. (De Blasio, 2024)	and blue hydrogen processes. Even though natural gas is used it produces a lower carbon than blue hydrogen.
Pink/Purple/Red	Pink hydrogen is produced similar to green hydrogen but uses nuclear energy as a power source. Purple hydrogen is produced using nuclear power and heat through combined chemo thermal electrolysis splitting the water. Red hydrogen is produced through high-temperature catalytic splitting of water using nuclear power. (De Blasio, 2024)	N/A
White	White hydrogen is naturally occurring on Earth. It can be found in the oceanic or continental crust, volcanic gas, geysers, or hydrothermal systems. (De Blasio, 2024)	N/A

Distribution

Most hydrogen in the US is produced at or close to where it is used. On site production has a high startup cost. For those not producing onsite, there are three methods of transportation: pipeline, high pressure tube trailer, or liquefied hydrogen tanker.

Pipeline is the most cost-effective method in terms of transport costs; however, capacity is currently limited. Only 1,600 miles of pipeline capable of transporting hydrogen exists today. This small framework is centered near production facilities on the Gulf Coast, California, and Illinois. Challenges to building new pipeline or even repurposing existing pipeline for hydrogen delivery are the high capital costs (*Hydrogen Production and Distribution* n.d.).

Another distribution option is the high-pressure tube trailer. Hydrogen is compressed into cylinders or “tubes” that can be stacked into trailers for hauling. However, this option is best suited for low volume distribution over shorter distances as the tubes cannot hold as much energy per unit as other methods of distribution (Zacarias & Nakano, 2023).

The most efficient distribution method is to transport in liquid form. Hydrogen is cryogenically frozen to minus 250 degrees Fahrenheit and transported in liquid form. This method allows for the most energy per unit to be transported (*Hydrogen Production and Distribution* n.d.).

<u>Fueling Process</u>
Hydrogen fueling is no more time consuming than filling a standard internal combustion engine powered car with gas.

There are different nozzles or fuel pipe attachments which can be used to fuel vehicles with hydrogen and reference the respective pressures at which the hydrogen is dispensed. H70 nozzles dispense hydrogen at approximately 70MPa (megapascal) or approximately 10,153 PSI (pound-force per square inch), and H35 is dispensed at approximately 35MPa or approximately 5,076 PSI. When an H35 nozzle is used to fuel an H70 vehicle, it will only apply half the pressure of an H70 dispenser. For many H70 vehicles, this means that the tank can only be half-filled and cannot add additional hydrogen to the tank. All hydrogen nozzles currently used in the United States are a Type C nozzle, though there is some variation how the nozzles are activated to begin dispensing hydrogen into the vehicle. Fuel cell electric vehicles can go up to 300 miles or more on a full tank of hydrogen, with the ability to refill in three to five minutes (SAE International, 2002); (Toyota, 2022).

At the time of writing, California has more than 60 hydrogen stations and is continuously working to develop additional stations to support the growing infrastructure network for these vehicles (DriveClean-California.gov, 2021).

Chapter 4
Possible Taxation Solutions

An efficient and equitable taxation strategy needs to be developed for zero emission hydrogen vehicles. As fuel efficiency increases with all vehicles, government entities need to be cognizant of how they will continue to fund road maintenance, improvements, and general road infrastructure.

Section 1 Fuel Tax Options
While state, federal, and other jurisdictions may have difficulty properly taxing other zero emission fuels, hydrogen's taxation can be straightforward. Hydrogen fuel is measurable through weight or volume. Most jurisdictions will use this simple taxing structure because of the convenience and familiarity within the current industry. However, states or jurisdictions may not use the same units of measure.

For instance, Idaho has passed laws that will assess tax on hydrogen used in vehicles by the kilogram (Gaseous Fuels, 2015). While in Maine, hydrogen fuel is measured by the cubic foot (Fuel Tax Rates, n.d.). A concern is that jurisdictions or industry may not adopt the same unit of measure for hydrogen. This may cause confusion or difficulty for industry, states, or jurisdictions when dealing with interstate commerce.

A solution to this is for a governing body to establish universal conversions for different units of measurements. Similar to how FTA has established uniformity in the tax returns for states, a governing body of industry and jurisdictions can establish standard units of measure. This will ensure consistency in documentation and comparing taxing strategies amongst different states or jurisdictions.

If this approach is not feasible, then jurisdictions may need to draft measurement standards for the ease of their own taxation administration for themselves and industry.

Section 2 Alternative Options

Even though, hydrogen fuel can be weighed and measured, other taxation solutions can be implemented in lieu of or combined with a tax per unit system. A registration fee or mileage-based approach can be used alternatively or in conjunction to the tax per hydrogen unit system.

A mileage-based approach can also be seen as a reasonable and very efficient solution. Similar to taxing fuel per measured unit, a mileage-based taxing structure is equitable in nature. Drivers will pay tax proportional to their usage. However, concerns regarding how the mile will be measured are apparent. One way to measure a vehicle's mileage is through implementing a device to measure the miles driven on a vehicle. This strategy may pose questions about privacy and the state or jurisdiction's ability to monitor details that taxpayers do not wish to divulge. Another way to measure the mileage of a vehicle is to mandate inspections of the vehicles. States or jurisdictions that already require such inspections may find it easier to include a mileage inspection for taxing hydrogen fueled vehicles. States or jurisdictions that have yet to impose any inspections of vehicles may find difficulty with these new requirements.

A registration fee is a simple strategy to impose funding for road maintenance and infrastructure. This taxing strategy has its benefit due to its ease of administration. States and jurisdictions may already impose a vehicle registration fee. A hydrogen vehicle registration fee can be implemented into this process which could significantly increase compliance. The main problem with registration fees, in general, is that they are not as equitable as taxing the specific product unit. A person who drives a significant amount per day for their commute will pay the same amount of tax as a person who either does not commute or drives less. States and jurisdictions that wish for equitable solutions, may find difficulty implementing a taxing structure because of negative public sentiment.

Chapter 5

Summary / Closing

As demand rises for alternative fuels like hydrogen, the need to have thoughtful discussion regarding the production, logistics, and taxation increase. We hope that this white paper has been a good introduction to this topic. Having the foundational knowledge is only the beginning to fully utilizing the fuel and constructing equitable taxing policies as well. The lessons learned from older fuel commodities such gasoline or diesel fuels should help guide the future for hydrogen and similar alternative fuels.

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