Project Summary

Texas Department of Transportation

0-5590: Strategic Plan Development for Hydrogen Vehicles and Fueling Stations

Background

In June 2005, the Texas legislature passed Texas House Bill 2702, which mandated that the Texas Department of Transportation (TxDOT) seek funding from public and private sources to acquire and operate hydrogen-fueled vehicles and to establish and operate hydrogen refueling stations. This mandate provided TxDOT the opportunity to continue its role as an innovator in transportation technology.

In many ways, Texas is well positioned to lead the U.S. in hydrogen adoption. The petrochemical industry in Texas produces and uses hydrogen daily. Primary applications are in the manufacturing of ammonia and fertilizers, and in refineries where hydrogen is needed to reduce the sulfur content in fuel. As a result, there are nearly 1,000 miles of hydrogen pipeline in Texas today. The design, construction, and maintenance of this infrastructure have provided the state with a skilled workforce in this technology. In addition, major State universities are conducting research broadly across this field. As a result, the state has a physical infrastructure, experienced practitioners, and recognized technology developers, all key ingredients in achieving a leadership position.

Under research project 0-5590, a strategic plan was developed defining a path for TxDOT to facilitate the introduction of hydrogen as a fuel in Texas. This plan responds not only to the legislative requirement, but also to TxDOT's mission to provide safe, efficient, and effective movement of people and goods. The key planning challenge was the immaturity of the technology. As with all emerging technologies, there is a risk that hydrogen fuel will never produce anticipated benefits. The federal government is attempting to mitigate this risk through investments in research and development.

While there are risks, there are also significant potential benefits that accrue to early adopters if the technology is successful. Three of these benefits are economic growth, energy security, and cleaner air. While energy security and cleaner air are national issues that help drive the Federal program, the economic impacts will be localized. Manufacturing, support services, and repair facilities will likely be located near successful early adopters. So, wise choices on the part of TxDOT can positively influence important aspects of Texas' economic future.

What the Researchers Did

The strategic plan developed by researchers outlined steps that TxDOT could take to stimulate the development of a hydrogen economy in Texas and make TxDOT a leader in hydrogen technology. This high level strategy was to:

1. Identify candidate TxDOT facilities in which a stationary fuel cell would provide reliable emergency power and assess the feasibility of using some or all of these locations as fueling stations.
2. Determine cost-effective hydrogen fuel distribution options for various hydrogen production approaches for both internal combustion engines and fuel cells.

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3. Participate, as appropriate, in hydrogen-fueled demonstration programs in Texas to gain insight into hydrogen-fueled vehicle performance and attributes. This activity relies on monitoring the various fuel cell and hydrogen activities in Texas in order to partner with larger, multi-faceted programs. TxDOT can leverage its fleet structure, alternative fuels expertise, and funding mechanisms to play a critical role in programs that may bring expertise, resources, and other funding sources to potential programs.
4. Review this strategic plan annually to build on the advancements made as a result of the Federal investments and the private sector efforts in these areas.

What They Found

Researchers believe that to implement this high-level strategy, a portfolio of possible projects should be developed highlighting opportunities to team with other organizations to leverage federally and privately funded programs in areas in which TxDOT has significant interest.

While none of these are funded projects which will be developed immediately, these are areas where appropriate partnerships could be explored. Similar projects could be added or discarded if appropriate partnerships could not be developed. The proposed projects in the initial portfolio are:

- Explore options for development of a state-wide infrastructure of hydrogen fueling stations (the "hydrogen highway")
- Establish a hydrogen fueling station in connection with a hydrogen-based, stationary, fuel cell installation providing electric power
- Explore the benefits of blending hydrogen with natural gas to produce a lower emissions fuel
- Investigate the steps necessary to bring hydrogen produced in a variety of ways to the purity levels needed for vehicle fuel
- Study the use of hydrogen-fueled internal combustion engines as a near-term step towards air quality improvement
- Add fuel-cell-powered fork lifts to the TxDOT fleet, as they are commercially available and can provide an operational experience base
- Conduct a modest, focused research program to stay abreast of this rapidly changing technology

What This Means

There is an array of motivating factors associated with the establishment of the promising hydrogen economy. These factors are complicated by politics, economics, hope, skepticism, and uncertainty, so the path forward is not clear. Recognizing this uncertainty, this plan summarizes an initial high-level strategy and a portfolio of potential projects TxDOT can use to expand its experience with hydrogen and hydrogen-fueled vehicles.

Because the TxDOT focus must be on proven technologies, and although it naturally will have evaluation components to it, this is more than a research plan. Rather, it is a plan which has the potential of helping TxDOT do its job better, while providing leadership and stimulus for the broader scope of activities necessary for Texas to achieve goals in meeting today's transportation challenge.

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