

## CASE STUDIES ON THE GOVERNMENT'S ROLE IN ENERGY TECHNOLOGY INNOVATION

# Public-Private Partnerships in Vehicle Technologies

By David Garman | April 2014

## EXECUTIVE SUMMARY

Oil accounts for one-third of the energy consumed by the United States, most of it by the transportation sector. Continuing dependence on oil has subjected American consumers to considerable economic volatility. As a result, a large share of the federal government's research, development, demonstration, and deployment activities to reduce oil dependence have focused on making vehicles more efficient and developing alternatives to oil, such as biofuels, natural gas, electricity, and hydrogen.

This case study examines the light-duty vehicle-technology and hydrogen fuel cell programs of the U.S. Department of Energy (DOE), paying particular attention to the broad collaborative research and development (R&D) partnerships among the federal government, U.S. automakers, and fuel providers through the Partnership for a New Generation of Vehicles (1993–2002), the FreedomCAR and Fuel Partnership (2002–2011), and the U.S. DRIVE Partnership (2011–present).

## EXECUTIVE SUMMARY *(Continued)*

The paper describes the origins and nature of U.S. vehicle-technology programs, tracks the evolution of vehicle-technology R&D partnerships, and concludes with a discussion of the efficacy and worthiness of such partnerships. While the Partnership for a New Generation of Vehicles, the FreedomCAR and Fuel Partnership, and U.S. DRIVE are popularly thought of as three discrete efforts undertaken by different presidential administrations, they are more accurately described as a single, evolving, and expanding partnership. The different programs varied in emphasis and approach as administrations changed. The Partnership for a New Generation of Vehicles focused on a near-term, singular “supercar” product goal. Learning from the failures to achieve this headline goal, FreedomCAR and U.S. DRIVE focused on systems and components that could be applied across a variety of vehicle platforms. FreedomCAR switched to longer-term pre-commercial fuel cell research, whereas U.S. DRIVE refocused to nearer-term electric vehicle research. Despite these differences, all three partnerships maintained a diverse R&D portfolio and allocated substantial resources to all four major vehicle-technology areas.

While a plausible estimate of the overall contribution of the partnerships to economic activity is not offered, the partnerships have accounted for a steady increase in technological accomplishments and progress toward performance, reliability, and cost targets for batteries, fuel cells, and other key enabling technologies for advanced light-duty vehicles. Vehicle fuel cell technology costs declined more than 50 percent from 2006 to 2012, and lithium ion battery technology costs declined more than 50 percent from 2008 to 2012; these cost reductions are attributable in large part to the R&D under the partnership umbrella. There have also been synergies in various technological achievements; for example, lightweight materials research and improvements in electric motors and power electronics have benefited all types of alternatively

fueled vehicles, as well as conventional vehicles. The “innovation ecosystem” that includes the vehicle-technology R&D partnerships and the work carried on beyond them has demonstrably increased the use of advanced technologies in the conventional light-duty fleet. Moreover, the partnerships did so while fostering a healthy collaborative partnership between the government and automakers—in spite of a preexisting relationship that had been fairly antagonistic.

What would have happened without the partnerships? It cannot be claimed that new vehicle technologies would not have emerged in the absence of the DOE public-private automotive partnerships. Moreover, regulatory requirements promulgated by the U.S. Department of Transportation, the U.S. Environmental Protection Agency, and the California Air Resources Board have been and will remain important forcing mechanisms that require automakers to go well beyond the pre-commercial activities performed under the partnership. It is clear, though, that the participation of automakers and their supplier teams in collaborative activities with government-funded and -led R&D has both helped to inform government regulators about the progress, prospects, and cost of candidate technologies while assisting automakers in the exploration of new approaches.

In sum, the generally favorable reviews by outside bodies like the National Academies, the increasing appropriations by Congress, the implementation of technologies in actual vehicles in the marketplace and the participation of a growing number of increasingly diverse partners constitute explicit and implicit confirmations of the efficacy of the work of the public-private vehicle-technology partnership and the DOE effort they guide. The evolving partnership has grown into a model of private-sector consultation, and participation in the planning and evaluation of R&D, and it deserves emulation in other areas of DOE’s portfolio of pre-commercial energy research.