Transitioning from PNGV to FreedomCAR

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Good morning. My name is Daniel Sperling.
I am Professor of Transportation Engineering and Environmental Science and Policy, and founding Director of the Institute of Transportation Studies at the University of California, Davis. I have been a member of several National Research Council committees on vehicle technology and fuels, have authored or co-authored 4 books and over 100 papers and reports on these topics, and regularly consult with and advise many major energy and automotive companies and government agencies in the US and abroad. I have closely followed and written about PNGV since its beginning. I will summarize my written testimony.

1. *What is your assessment of the overall value of the Partnership for a New Generation of Vehicles (PNGV)? What were the advantages and disadvantages of PNGV having a concrete, integrated, deliverable product as a goal?*

PNGV clearly had some important successes. Milestones were achieved on schedule; communication between industry and government reportedly improved; new technologies were developed, many used to improve efficiency of conventional vehicle subsystems and components; the program disciplined federal advanced technology R&D efforts; science and technology was transferred from the national labs to industry; the potential for major technology enhancements gained greater public attention and within the automotive industry; and a "boomerang effect" was induced whereby apprehensive foreign competitors responded with more aggressive efforts, in turn motivating US automakers to accelerate their efforts.

On the other hand, it is uncertain to what extent PNGV R&D investments accelerated the development and commercialization of advanced technology. One concern is that the primary focus of PNGV – by all three companies -- was the development of diesel hybrid electric cars. This technology was incremental in nature, and therefore not well suited to government-industry R&D partnerships. It also was problematic from an air pollution perspective. A second concern is that fuel cells, a longer term technology with far greater potential energy and environmental benefits, were relegated to secondary status and support. The FreedomCAR program wisely redirects attention to fuel cells and hydrogen -- the riskier technology, but also the technology with the greater potential for large energy and environmental benefits.

Another issue is the use of a specific product as the goal. In general, it is wise to direct a program's activities toward a specific tangible goal. A production prototype serves that role, in general. But in the case of PNGV, the product (a production prototype in 2004 that could be built at no extra cost and with up to 80 mpg) was defined so narrowly that it drove decisions in the wrong direction – toward diesel hybrid technology. Government and industry managers were so focused on meeting the affordability goal that they felt obligated to pick a technology that didn't really make sense as a government-industry R&D initiative. Moreover, the public goal is not a hand-built prototype – automakers have garages full of innovative prototypes -- but accelerated **commercialization** of socially-beneficial technology.

2. *Did PNGV focus too much on shorter-range research and would FreedomCAR alter that? What is the appropriate balance between shorter- and longer-term research in the portfolio of a government-industry partnership? To what extent should government support smaller companies and independent researchers rather than large manufacturers?*

There are three principles to use in evaluating government R&D decisions. First, it should target technologies with potentially large societal benefits. FreedomCAR does exactly that. Second, government R&D is most effective when directed at far-off technologies and basic research. And third, it is most effective when the industries are fragmented with low R&D budgets.

Consider the following. The automotive industry is concentrated, with about 10 major companies in the world accounting for most of the sales. Each major company spends billions of dollars per year on R&D. The major car companies are increasingly relying on supplier companies for much of the design and manufacturing, and are focusing themselves more on assembling, marketing, servicing, and financing vehicles.

While it is important to keep major automakers engaged in federal R&D initiatives, I would argue that the best way to invest government R&D funds in this case is to target:

- small innovative technology companies and larger technology companies that are not already major automotive supplier companies; and
- universities, both for their expertise in basic research but equally importantly because they train the industry engineers and scientists that will design and build these vehicles of the future.

I'd like to emphasize, with respect to this last point, that we as a nation are completely unprepared in the most basic way for this next generation of vehicles – in terms of knowledge and expertise. To build an industry of the future, we need a foundation of people and knowledge. Right now, there are only handfuls of students being educated and trained to design and engineer fuel cells and related technologies. Automakers are being forced to hire engineers with no experience in fuel cells and train them in-house. That is highly inefficient, and will not allow for a rapid ramping up of fuel cell vehicle production. Universities need funding and support to develop new programs, especially when they are interdisciplinary, as these must be. DOE did provide minimal funding under the PNGV umbrella to several advanced vehicle university centers (GATE program) and student vehicle projects over the last few years, but it amounted to less than $2 million per year. I note that DOT provides about $35 million per year to university transportation centers. Either in the FreedomCAR program or another area of the DOE budget, an effort of major significance is needed to advance vehicle research and education at universities.

3. *How is government best able to accelerate the development and commercialization of new automotive technologies? To the extent that research programs should be part of a government strategy, which aspects of the transportation system should the government focus on? (For example, to promote a "hydrogen economy," should the government focus on vehicles or on other areas such as fuel distribution?)*

To create a more sustainable transportation system, we need to build and use much cleaner and more efficient vehicles. But for a variety of reasons, including low fuel prices, industry does not have a strong enough incentive to invest in the development and commercialization of advanced socially beneficial technology. The role of government is to assist with basic R&D on those technologies with large potential social benefits, to provide initial incentives to consumers and industry to build and buy those products that are in society's interest, and to ease any transition and start-up barriers, especially those related to government rules. And thus, a strategy to promote sustainable cars and fuels must contain the following elements:

<u>Advanced Vehicle Research and Education</u>

- Basic R&D directed at universities and national labs, especially focused on materials research and key subsystem technologies (that will also have application to a wide range of electric-drive vehicle technologies).
- Funding to universities to begin training the necessary cohort of engineers and scientists.

Hydrogen Distribution

- Assistance in creating a hydrogen fuel distribution system (with respect to pipeline rules, safety rules, initial fuel stations, standardization protocol, etc.).

Incentives and Regulation

- Incentives and rules that direct automakers toward cleaner, more efficient vehicles and fuels.
- Incentives to consumers to buy socially-beneficial vehicles and fuels.

These three sets of strategies must all be pursued to assure a successful and timely transition to socially-beneficial vehicle and fuel technology. They are all essential. The last set of initiatives are particularly critical, not just to assure a timely transition to fuel cells and hydrogen, but also to accelerate the commercialization and adoption of already existing socially beneficial technologies, including hybrid electric vehicle technologies.

Summary

Fuel cells and hydrogen may indeed prove to be the Holy Grail – as industry insiders like to say, they would take vehicles out of the environmental equation. In a narrow programmatic sense, the FreedomCAR plan is clearly a step in the right direction. It is unequivocally positive as an updating and refashioning of existing R&D partnerships and programs. It is also a positive statement that the nation is committed to pursuing technology development that is in the long term interest of society. But questions remain. Will an effective partnership be created that embraces not only automakers, but also technology suppliers and energy providers? And how will funds be spent, who will receive the funds, and what role will different stakeholders have in those decisions?

Perhaps most importantly, will the FreedomCAR program be used to divert attention from difficult political decisions about energy consumption, energy security, and greenhouse gas emissions? R&D is not effective when treated in isolation. These are important questions that have far reaching implications. A broader debate is called for.