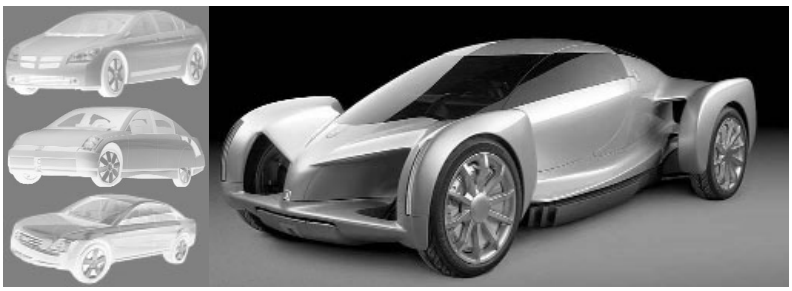
Today's Promises, Tomorrow's Cars?



LESSONS FOR FREEDOMCAR FROM THE GHOSTS OF SUPERCARS PAST

ENVIRONMENTAL DEFENSE
finding the ways that work

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This document was prepared as a special report for Environmental Defense by Barry C. Lynn; the views expressed here are those of the author and do not necessarily represent those of Environmental Defense.

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Cover photos: Reverse ("ghosted") images of the DaimlerChrysler ESX3, Ford Prodigy, and General Motors Precept concept cars, plus General Motors Autonomy concept vehicle (images © 2000, 2004 DaimlerChrysler Corp., Ford Motor Co., General Motors Corp., and Wieck Media Services).

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Introduction

In his January 2003 State of the Union address, President George W. Bush promised to work towards a future in which cars would be powered by hydrogen as a way to free the country from dependence on foreign oil and to reduce pollution. He asked Congress for $720 million in new money over the next five years for a "Freedom Fuel" program to help the energy industry develop technologies to produce, distribute, and store hydrogen. This was in addition to the $169 million his administration had already set aside for 2004 to subsidize the development of hydrogen-powered fuel cell vehicles. That program, dubbed FreedomCAR, had been launched a year earlier, at the 2002 Detroit auto show.

"With a new national commitment," the President said, "our scientists and engineers will overcome obstacles to taking these cars from laboratory to showroom so that the first car driven by a child born today could be powered by hydrogen and pollution-free." Powering vehicles with hydrogen, he said, "will make our air significantly cleaner, and our country much less dependent on foreign sources of energy."

It is hard to argue with a program that seems bold in its goals and elegant in its simplicity. And the drive towards a future "hydrogen economy" is building momentum, thanks to strong interest in the Bush plan by the automotive and energy industries. Similarly, European Commission President Romano Prodi in October 2002 announced a $2 billion initiative to develop technologies for a hydrogen economy.

Yet a closer look at the FreedomCAR program reveals that a number of critical questions remain unanswered. Can fuel cells be made cheaply enough for mass use? Can hydrogen storage and refueling methods be made practical? Can carbon left over when hydrogen is refined from fossil fuels be permanently kept out of the earth's atmosphere? More problematic, is it smart to focus so much research and development activity on a single technology, especially when other technologies are maturing rapidly? Could these same resources be put to better use by promoting more timely cuts in energy consumption, pollution and the release of carbon dioxide into the atmosphere? The complex nature of these numerous questions makes it difficult to judge the Bush proposals from either a long-term or short-term perspective.

Luckily, we can learn a lot about how to evaluate the Bush administration's FreedomCAR program by studying the accomplishments and failures of the Clinton-Gore administration's program from which it evolved. The Partnership for a New Generation of Vehicles (PNGV) was the most comprehensive effort ever by the U.S. government to work with the U.S. automobile industry to develop and commercialize technologies to cut fuel use, pollution, and emissions of carbon dioxide. This program promised to develop "supercars" of tripled fuel economy while enhancing the competitiveness of America's domestic automakers.

PNGV is little remembered outside of Washington; in Washington, it is remembered but generally not well regarded. Indeed, in policymaking circles and among journalists, the program is widely viewed as a failure, and after Bush's

2003 State of the Union speech, some critics evoked PNGV as a way of questioning the wisdom of any government effort to help industry. PNGV is proof, journalist Jodie Allen of *U.S. News & World Report* said recently, of why the United States government is "no good at industrial policy."

The story, however, is not that simple. Judged fairly, on its own merits and not on attributes incorrectly ascribed to it, PNGV in many respects was a success. Unfortunately, this program must also be judged on its role as a key component of the overall U.S. automotive energy policy of the 1990s, a policy that is widely regarded as a failure.

In the 1990s, American society made no progress in cutting the emissions of carbon dioxide from its immense fleet of motor vehicles, or in cutting consumption of oil. This lack of progress occurred despite rapid advances in automotive technology, despite growing fear of environmental disruption due to global warming, despite ten years of relative peace and prosperity, and despite eight years under a single administration that had pledged to address global warming. The fact that by 2003 Toyota and Honda—two companies that were not invited to take part in PNGV—had sold 100,000 hybrid cars seemed only to emphasize how far short of its goals PNGV had fallen.

It is vitally important, however, to separate the very real failure of U.S. energy policy during the 1990s from an effort to judge the success of the PNGV program itself. This is not easy, as the blurring of the two issues dates to PNGV's launch at the White House on September 29, 1993. In many ways, perceptions of PNGV were warped from the start by the Clinton-Gore administration's overselling of the program's scope and nature.

"Today we are going to … launch a technological adventure as ambitious as any our nation has ever attempted," is how President Clinton described PNGV in a Rose Garden ceremony attended by the chief executives of General Motors, Ford, and Chrysler. Vice President Gore was no less effusive. "The public should expect breakthroughs that will redefine the automobile industry and position our companies to have an excellent chance to dominate the market for an entirely new kind of automobile," he said. The effort, Gore told a *New York Times* reporter, was nothing less than an "act of patriotism."

The goal of PNGV did sound radical—to help U.S. carmakers "build" a family-size vehicle that would travel 80 miles on a gallon of gasoline. And the method, which was to create a public-private partnership designed to enable U.S. carmakers to tap into the research base of the U.S. government's super high-tech national weapons laboratories, also seemed innovative. Little wonder that despite the lack of optimism among automakers—"there's no promise the desired technologies will be found," Ford CEO Harold Poling said that day—many of the participants remember the White House ceremony very fondly, as the opening of an era of great hope.

In reality, PNGV was much less than it was made to appear by the Clinton administration. First, the program initially received essentially no new funding, relying almost entirely on the "repurposing" of a potpourri of existing federal research programs. Second, although PNGV is often credited with creating dramatically new levels of cooperation between the federal government and the automotive industry and within the automotive industry itself, the basis of this

accomplishment actually dates to the launch of the United States Advanced Battery Consortium (USABC) in January 1991. Third, although PNGV was presented as a visionary adventure by the Clinton-Gore team, the core program was actually the brainchild of automotive executives who had worked closely with the George H.W. Bush administration. At the 1991 *Automotive News* World Congress, General Motor's vice president for advanced engineering proposed a government-industry "moon shot" to solve the automobile's energy, air pollution, and safety problems within a decade.

President Clinton launches PNGV at a White House Rose Garden ceremony as leaders from the United Auto Workers and Big Three look on, September 29, 1993.
(AP Photo/ J. Scott Applewhite)

The biggest shortcoming of PNGV was that it was designed only to "push" technology into the auto industry. There was no corresponding program to "pull," or direct, this technology towards any particular goal within the U.S. national markets for passenger vehicles or fossil fuels. Absent a federal-level program to significantly raise the fuel economy of new vehicles or to otherwise require measurable reductions in oil use or greenhouse gas emissions, PNGV could never be anything more than a very modest technology transfer program. Judged on this level, PNGV was largely successful. Unfortunately, due to the bigger failings of U.S. energy policy, most of the transferred technologies, if actually commercialized, went to enabling automakers to improve performance or enhance other vehicle features, rather than improve gas mileage.

It is perhaps not surprising then that many of the government and industry executives who took part in PNGV express a strong sense of disappointment. This feeling is due in part to the fact that many participants really believed the Clinton administration's rhetoric, while the program fell far short of those lofty phrases. The disappointment also derives from the sense that so much more could have been accomplished. PNGV participants from both industry and government express great pride in how well their partnership worked and in how swiftly goals were set, teams formed, and technology transferred. Had the administration and Congress really intended to remake the passenger automobile, most PNGV participants feel their team was extremely capable of handling the engineering end of the task.

PNGV veterans also credit the program with two major, albeit oblique, accomplishments, both of which lay outside the goals set for the program. First, many participants firmly believe that neither Toyota nor Honda would have brought hybrid vehicles to market without PNGV's stimulus. Although executives of both these companies are loath to link their actions to PNGV, it is hard to imagine that either firm would have moved as quickly or spent as much without the program's impetus. The program seemed, in the early 1990s, a logical first step in an integrated energy policy under which regulation would ultimately be used to bring the new technologies developed by PNGV to market.

Second, many participants credit PNGV with eliminating, once and for all, the argument that U.S. automakers do not have the ability to manufacture automobiles that are radically more efficient and just as safe as the average car now on the road. Right through the early 1990s, the automotive industry and its defenders in Congress fought any effort to raise national fuel economy standards partly on the ground that technologies to raise fuel efficiency did not exist or were too expensive. Through PNGV, the American public subsidized development of many promising new technologies and gave these technologies to the big U.S. automakers. As expressed by one top government participant in the program, "What PNGV did was to put the necessary options into place." Whether these "options" are ever put to use to reduce fuel use and cut emissions is now up to the American public, acting through Congress and the President.

Of course, national policy should not be made, and public money spent, on the expectation that even if the core strategy fails there may be indirect payoffs. In order to be of use in judging the Bush administration's FreedomCAR program, any study of PNGV must focus on the specific ways in which the program met or did not meet its actual goals, and in how the program was integrated into national strategies to control energy use and emissions. As mentioned above, PNGV did succeed in shifting government technology into the hands of privately owned enterprise. Beyond that, conversations with top participants in PNGV yield a series of cautionary lessons. If anything, PNGV may ultimately be most useful as an illustration of the limits and dangers of government getting involved in promoting specific technological solutions as opposed to reshaping markets through regulation.

Lessons gleaned from PNGV

Speak to 25 people about the successes and failures of a government program, and you get 25 different views. Nevertheless, there is a surprising concurrence of opinion among the top participants in PNGV around certain issues. A distillation of these opinions yields six critical lessons that may help the public better understand and respond to the FreedomCAR and Freedom Fuel policies.

The program was oversold by the administration and therefore misunderstood by the public

It cannot be overemphasized that PNGV was at heart a simple *quid pro quo*. The Clinton administration and the automakers set up a process by which the U.S. government would transfer publicly developed technology to the big American automakers. There were two immediate goals: 1) to advance fuel efficiency and emissions reductions technologies in the standard passenger vehicle; and 2) to improve the global competitiveness of U.S.-based automobile manufacturers, especially vis-à-vis Japanese manufacturers who were said to benefit from their government's subsidies as well as from the freedom to form industry consortia. The end result of PNGV was to be three "pre-production prototype" vehicles delivered by 2003—one each from General Motors, Ford, and Chrysler. Each was to show how these new technologies could be blended together to meet PNGV's "Goal 3," creating an affordable family-size car that travels 80 miles on a gallon of gasoline.

The GM Precept concept, unveiled in January 2000, was designed to achieve 80 MPG with a diesel-hybrid engine and the equivalent of 100 MPG with a hydrogen fuel cell engine. (©2004 General Motors and Wieck Media Services, Inc.)

PNGV was not in any way a regulatory regime structured to promote changes in the efficiency or cleanliness of the total fleet of passenger vehicles on American roads. It was a program designed to give away technology developed at taxpayer expense in exchange for a commitment by U.S. automakers to demonstrate what sort of vehicle could be manufactured with these technologies. PNGV could have

been a worthy component of an integrated national energy strategy. It was not, however, effective as a stand-alone solution.

In the project's early days, participants liked to imagine PNGV as a "moon shot" program, comparable to the 1960s national effort that within eight years landed two men onto the Sea of Tranquility. In reality, PNGV was only the first half of a "moon shot" program. Under PNGV, the goal was to build a very-high-mileage car that, in theory, could be mass produced. For PNGV to be fully comparable to a moon shot, the government would have had either to: a) require the automakers to sell a specific amount of these new cars by a certain date; or b) reshape the market through regulation—such as a rapid ratcheting up of the Corporate Average Fuel Economy (CAFE) standards—thereby encouraging the automakers to blend the new technologies into their entire vehicle fleet to reach particular goals. Had NASA in the 1960s been constituted like PNGV, the goal would have been to hand-build by a specific date a prototype spacecraft that, in theory, could land a man on the moon.

PNGV's long-term technology pathways were limited by highly arbitrary decisions

From the start, PNGV was severely hamstrung by the lack of new money, which meant that at first the initiative was composed mainly of pre-existing government programs. PNGV managers spent most of their time rearranging what programs they could gather from willing agencies and departments, rather than focusing on the best way for the U.S. government and U.S. automakers to work together to reach a particular goal. One of the biggest problems of the Clinton administration's approach is that many excellent research programs that could have contributed much to PNGV were not mixed into the program, often for no other reason than bureaucratic territoriality. The most striking example was the failure to integrate the United States Advanced Battery Consortium into PNGV. USABC had been launched under the first Bush administration to coordinate industry and government efforts to develop a better battery for pure electric vehicles.

This failure to bring USABC under PNGV's purview had big repercussions. Especially when combined with the PNGV administrators' early success in corralling a number of fuel cell programs, the failure amounted to a form of on-the-fly policymaking. Though not obvious to participants at the time, the result was a *de facto* decision that the long-term passenger automobile architecture of choice would be an electric vehicle with a hydrogen fuel cell as its primary source of power. This decision was arrived at despite the sense by many within both government and industry that any solution based on storing energy as hydrogen would be less efficient and involve very high risks, much higher in fact than a solution that depended, for example, on the storage of energy in advanced batteries.

PNGV undercut support for other policies aimed at promoting vehicle fuel efficiency and reducing emissions

For years, many environmentalists and some government officials have contended that the Clinton-Gore administration cut a "raw deal" with the automotive industry. In exchange for industry participation in PNGV, the administration would not call for higher fuel efficiency standards. High-level PNGV executives indignantly reject this idea. The need for such a *quid pro quo* seems unlikely given that both the administration and the automotive industry strongly supported the program. PNGV was, after all, originally the idea of auto industry executives.

The Dodge ESX3 concept, unveiled by DaimlerChrysler in January 2000, showcased lightweight materials and a diesel-hybrid engine to achieve 72 MPG. (©2000 DaimlerChrysler)

Nevertheless, PNGV did become a bargaining chip used by the automotive industry in its negotiations with the Clinton administration on other fronts. A few weeks after PNGV was announced in the fall of 1993, the administration released its Climate Change Action Plan, with a notable lack of significant proposals to cut auto emissions. What the Action Plan did call for was the formation of a panel made up of automakers, environmentalists and others to develop recommendations to reduce greenhouse gas emissions from cars and light trucks. Dubbed "Car Talk," this panel disbanded after a year of fruitless deliberations. During these discussions, auto industry representatives held that the PNGV cooperative research effort, leavened by higher gasoline taxes to drive consumers towards more efficient vehicles, was the best way to reduce greenhouse gas emissions. At the same time, they adamantly opposed efforts to cut carbon emissions through direct regulation of vehicle design or incentives to encourage consumers to buy cleaner, more efficient vehicles.

Combined with the Clinton administration's overheated rhetoric, the existence of the program shifted much of the battle between government and industry away from debates on how much to raise Corporate Average Fuel Efficiency (CAFE) standards. PNGV became the focus of the small number of fuel efficiency experts, tying up much of their limited time and money.

High-level PNGV veterans in both government and industry now readily accept fault for not doing a better job of explaining to Congress and the

American people just how modest the program was, in both nature and scope. The main fault for this, however, a few of the most senior participants say, lay at the highest levels of the Clinton administration, both for initially selling the program as much more than it actually was and for not pushing harder to raise CAFE standards or promote other programs to reduce emissions of greenhouse gases. A more aggressive effort by the administration to engage the automotive industry on both of these fronts simultaneously would, these participants believe, have made it much clearer to Congress and to environmentalists that PNGV was at heart only a program to transfer technology and demonstrate what can be done with that technology. If the ultimate goal of U.S. national energy policy was to reduce U.S. national fuel use and emissions, a clear understanding of PNGV's limits would have clarified the need for government to impose other policies to reshape the market in order to put the new technologies to effective use.

PNGV's structure inhibited the scope of research and the spread of technologies

One of the more controversial aspects of PNGV, at least for some environmentalists and other critics, was that it allowed the automakers to form a consortium. Though it was the USABC that first enabled the Big Three to join together in a research consortium, the fact that PNGV expanded the model to other research areas makes this a valid criticism.

Industry executives generally believe that one of PNGV's biggest benefits was to bring together engineers and managers from different companies, who would otherwise rarely, if ever, have interacted. This cooperation was valuable, they say, because it enabled their companies to reduce duplication in research, weed out less promising projects, and generally act more "efficiently." Industry executives say the consortium model helped the industry as a whole redirect spending in government labs from dead-end projects to technological solutions more likely to be adopted by the automotive and fuel industries.

The automotive industry's view seems reasonable enough, but it is far from unanimous. Critics from outside the automotive industry, and even some inside, say the very "efficiencies" that some automotive executives celebrate may actually have undercut PNGV in three ways: 1) redundancy in research programs—and competition among teams—can accelerate research; 2) projects that seem less promising today can lead to important breakthroughs tomorrow; and 3) the money saved through the consortium approach was not necessarily put back into other research programs to improve fuel efficiency and cut emissions. In the end, by enabling the Big Three automakers to pool research efforts, the government may actually have dampened the overall vibrancy and impact of U.S. R&D programs in these technologies.

A second fundamental problem with any research consortium is that, as many in the automotive industry admit, private sector companies are very reticent to bring their most promising technologies to a common table. The result, they say, is that a high-profile research consortium can actually push automakers to shift funds and top engineers from highly promising programs they want to keep secret

The Ford Prodigy concept, shown in January 2000, achieved 78 MPG using a diesel-hybrid engine and a lightweight, aluminum-intensive body structure. (© 2000 Ford Motor Company)

to projects based on less innovative or highly risky technologies that are less likely to yield practical advances.

A third flaw with any research consortium, critics say, is that once a common technological approach is adopted among all competitors within an industry, the members of the consortium lose much of their fear that their competitors will commercialize some other more revolutionary technology. The complacency bred by such lack of competition, in turn, blunts one of the main spurs to innovation. It is notable, for instance, that Japanese firms, kept out of PNGV, independently pursued research on new vehicle architecture with much greater vigor than their American counterparts. Indeed, competitive fear may well be the main reason why Toyota and Honda were first to market with hybrid-electric vehicles, which were a prime area of research in PNGV.

PNGV gave away public technologies without requiring that they be put to use

Within the small Washington, DC, community of policymakers and environmentalists who wrangled over automotive fuel efficiency and emissions issues in the 1990s, PNGV was a big deal. In Detroit, during those same years, it was much less so. The reason for the discrepancy comes down to numbers: in government, $200 million per year is a lot of money to spend on industrial research. In the U.S. automotive industry such a sum is only about 1% of total R&D spending. Many PNGV participants now say the Big Three did not sufficiently value the technologies transferred to them via PNGV.

Obviously, once a market has been shaped by government policy, it should be left up to individual private sector companies to determine the value of particular technologies within that market. PNGV's flaw was to transfer publicly developed technologies to private sector ownership without any ability to reclaim the technologies if they were not put to use. One specific example is the fuel cell program at Los Alamos National Laboratory, the second longest running program at Los Alamos after the nuclear weapons research program. In the late

1990s, this fuel cell program was transferred to a General Motors facility in Rochester, NY. The remaining members of the fuel cell team at Los Alamos were assigned to other projects and details of progress on this fuel cell technology disappeared from public view.

Was this fuel cell technology of value to General Motors? Would it have been of more value to other companies? Would it have been of more value to the American public if it had been kept in public hands or transferred to a foreign-owned company more eager to put the technology to use? As participants from both sides admit, these are hard questions to answer. Provisions for the recuperation of transferred technologies would help ensure that such questions don't undermine support for future cooperative R&D programs.

PNGV divided environmentalists with its promise of a technological quick fix

As the main public community pressing for more efficient and cleaner use of fossil fuels in vehicles, environmental organizations play an indispensable role in any debate over automobile fuel efficiency and emissions. There is, however, a disturbing and growing tendency within much of the environmental community and some academics on whom the community relies for insights, to favor the "home run" technological solution to any environmental challenge. The reasons for this lie in human nature (technological solutions can seem less painful than, say, regulating or raising prices to spur conservation), in differing philosophies on how to run an environmental campaign, and in the realities of fundraising for environmental goals.

Some policymakers and environmentalists, however, emphasize that it is extremely important to recognize that a sharp focus on any one specific technological solution—whether in favor of that technological solution or against it—can play into the hands of a sophisticated and recalcitrant industry.

One example of how opposition to a specific technology may run counter to basic environmental goals is the opposition within the environmental community to any engine that burns diesel fuel. Both government and industry participants in

President George W. Bush and General Motors executive Larry Burns in front of GM's Hywire hydrogen concept car, February 2003. (AP Photo/ J. Scott Applewhite)

PNGV say that environmental critics failed to acknowledge the advances in diesel emissions control during the 1990s, due in part to research within PNGV. As a result, environmentalists may have helped undermine any hope for dramatic near-term advances in fuel efficiency in passenger vehicles. Advanced diesel engines, many PNGV participants say, are much more efficient than gasoline engines, are rapidly closing in on Tier 2 emissions standards, and fit into an existing fuel infrastructure. Advanced diesel engines were the clear choice of the PNGV process for quickly bringing to market a much more fuel-efficient vehicle. When placed within a hybrid vehicle architecture, they would be more efficient than the gasoline-powered Prius. Yet, advanced diesel engine hybrids are not destined to be on the road anytime soon.

Another example of how support for a specific technology can run counter to basic environmental goals is the hydrogen-powered fuel cell car, which is the objective of the current FreedomCAR program. It is not clear that fuel cells will ever be economical to build; moreover, it is unclear whether the hydrogen can be practically stored on vehicles or produced cleanly and at reasonable cost. If hydrogen is refined from natural gas, coal or petroleum, the system as a whole may actually be less efficient in terms of total energy usage than the present system of burning gasoline in an internal combustion engine. Either affordable processes must be developed to sequester the carbon removed from hydrocarbons or very economical ways to produce hydrogen from renewable sources must be commercialized. Otherwise, a hydrogen system may do little to reduce emissions of carbon dioxide, the main gas that contributes to global warming. Nevertheless, due in part to support by environmental groups and academics enamored of technological solutions rather than carbon management strategies, the hydrogen fuel cell vehicle has now emerged as the main U.S. federal program for reducing automobile fuel use and global warming emissions.

This "winner picking" has real effects. The hydrogen fuel cell automobile is a highly risky venture, yet it has become a big and growing draw for both scarce funds and engineers. The split in the environmental community resulted in a mixed message to policy makers. Environmentalists wary of pushing certain technological solutions lost out. Had policymakers focused on reshaping the market through regulation, rather than promoting particular technologies, it is quite possible that the American automotive fleet would have become more, rather than less, fuel efficient over the past decade, and that long-term solutions would look much different.

The Role of the Market

The success of any national energy policy is not measured by the development of new technologies, or even the harnessing of that set of technologies to manufacture a radically more efficient car. On the contrary, it can be highly counterproductive for any society wanting to change consumption habits to regard a particular set of technologies as an ultimate goal. Technologies are tools, which can be put to use to reach a particular social goal, such as cutting fuel consumption or emissions. Congress, for instance, could enact a set of policies that would put a million Prius-like vehicles on the road within three years. But, absent other policies to reshape the overall market to ensure that the rest of the U.S. national vehicle fleet does not simply become bigger and less efficient, such a program may actually do nothing to reduce overall national fuel consumption and carbon emissions. It may simply divert money and attention from easier, cheaper solutions.

The single most important lesson of PNGV, then, is that programs such as FreedomCAR and Freedom Fuel must be regarded as no more than complements to efforts to use regulation to reshape the overall market for energy at the national—or preferably the global—level. The keystone to any effective long-term energy policy aimed at reducing environmental damage is a technology-blind set of regulations that ratchets up the cost of emitting carbon. Similarly, the keystone to reducing dependence on imported oil must ratchet up the cost of using that fuel. In either case, the goal must be to reshape the market for energy use in vehicles in such a way that the automotive industry has a clear incentive to blend new technologies into their fleets—in whatever way the individual companies see fit—to reduce fuel consumption and emissions in line with well-defined objectives. Only once such goals are set can the public effectively evaluate a program, be it PNGV or FreedomCAR, that uses public funds to aid private enterprises in developing technologies useful in achieving these goals.

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