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AUDIT REPORT

THE U.S. DEPARTMENT OF ENERGY'S PARTICIPATION IN THE PARTNERSHIP FOR A NEW GENERATION OF VEHICLES PROGRAM

U.S. DEPARTMENT OF ENERGY
OFFICE OF INSPECTOR GENERAL
OFFICE OF AUDIT SERVICES

July 1998

July 21, 1998

MEMORANDUM FOR THE ACTING SECRETARY

FROM: Gregory H. Friedman
Acting Inspector General

SUBJECT: INFORMATION: Audit Report on "The U.S. Department of Energy's Participation in the Partnership for a New Generation of Vehicles"

BACKGROUND

The Federal Government and the United States Council for Automotive Research (USCAR), representing Chrysler, Ford, and General Motors, entered into a Partnership for a New Generation of Vehicles (PNGV). The aim of the partnership was to apply joint resources to develop and implement advanced technologies for a new vehicle. The partnership had three specific, interrelated technological goals and an aggressive timetable for developing the new generation of vehicles. We conducted this audit to determine whether the Department's research projects support the goals of the PNGV program.

RESULTS OF AUDIT

Although the research projects being pursued by the Department contributed to the goals of the PNGV program, it was unlikely that some of the technologies would be fully developed in time to meet the PNGV timeframe of 2004. Specifically, fuel cells and CIDI engine research had a low probability of being developed by 2004 because of the technological barriers in achieving established reliability, cost, or emission criteria. The Government and industry jointly identified technology areas in which advancements were needed to meet the PNGV goals. Work on these various technologies was to continue until the end of 1997 when its focus was to be narrowed down. In January 1998, the partnership selected the most promising technologies and it was announced that the Government would focus on longer-term research and development efforts. The USCAR would continue on high-mileage concept vehicles to debut in 2000 followed by production prototypes in 2004.

MANAGEMENT REACTION

Management concurred with the report.

Attachment

cc: Deputy Secretary
Under Secretary

DEPARTMENT OF ENERGY'S PARTICIPATION IN THE PARTNERSHIP FOR A NEW GENERATION OF VEHICLES PROGRAM

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Overview

INTRODUCTION AND OBJECTIVE

The Federal Government and the United States Council for Automotive Research (USCAR), representing Chrysler, Ford, and General Motors, entered into a Partnership for a New Generation of Vehicles (PNGV). The agreement to develop and implement advanced technologies for a new vehicle was set forth in a Declaration of Intent between the White House and USCAR in September 1993. The aim of the partnership was to apply joint resources to meet specific goals that provide benefits to the partners and the Nation. Government funding for the PNGV was to be applied primarily to develop technologies that involve high risk and USCAR funding would be greater for technologies with a clear, near-term market potential. The purpose of the audit was to determine whether the Department's research projects support the goals of the PNGV program.

BACKGROUND

The Declaration of Intent was the beginning of a new era where, through a partnership, USCAR and the Government declared their separate but coordinated plans toward the achievement of specific goals for clean and efficient cars. The partnership has three specific, interrelated technological goals:

- Significantly improve national competitiveness in manufacturing.
- Implement commercially viable innovation from ongoing research on conventional vehicles.
- Develop a vehicle to achieve up to 3 times the fuel efficiency of today's comparable vehicle.

In addition, there was an aggressive timetable for developing the new generation of vehicles. By the end of 1997, the focus of technology development was to be narrowed down to only those that had become sufficiently developed and demonstrated adequate progress that met PNGV vehicle requirements. Furthermore, the auto partners were to develop concept vehicles in order to evaluate the engineering feasibility of incorporating these potential technologies into total vehicle systems. As the concept vehicles were further developed the auto partners were to incorporate them into production prototype vehicles. According to the timetable, the partnership was to develop a concept vehicle by 2000 and a production prototype by 2004.

Although the PNGV is a partnership of seven Government agencies and the three USCAR partners, there is no line management structure or budgetary authority to control projects by different agencies that may

have different missions. The Department has provided most of the federal funding but the Department of Commerce was designated as the lead agency for the program. In Fiscal Year 1998, the Department's budget for PNGV was about $123 million. Most of this amount was provided by the Office of Energy Efficiency and Renewable Energy.

To assist in the development and management of the PNGV program, the National Research Council (Council), an independent panel created by the National Academy of Sciences to advise the Government on scientific and technical matters, was asked to set up a peer review process to comment on the technologies selected for research and its progress. Annual peer reviews of the program were made in 1994, 1996, 1997, and 1998. The results were published and included observations and recommendations concerning the progress and status of technical PNGV research projects as well as the overall partnership.

AUDIT RESULTS

Although the research projects being pursued by the Department contributed to the goals of the PNGV program, it was unlikely that some of the technologies would be developed in time to meet the PNGV timeframe of 2004. Specifically, fuel cells and compression-ignition direct injection (CIDI) engine research had a low probability of being developed by 2004 because of the technological barriers in achieving established reliability, cost, or emission criteria.

From the outset of the PNGV program, the Department pursued several technologies that had varying levels of potential for successful development. Traditional research of the Department such as gas turbine engines, Stirling engines, flywheels, fuel cells, direct-injection engines, and lightweight materials were merged into the PNGV program. During 1994, the Government and industry jointly identified technology areas in which advancements were needed to meet the PNGV goals and various technologies that were to be developed concurrently. Work on these various technologies was to continue until the end of 1997 when its focus was to be narrowed down.

Annual Peer Reviews

The first peer review was a broad overview in coverage and perspective. It was recommended that an analysis be made in 1994 to divide all technologies into two categories: current PNGV and post-PNGV technologies. The current technologies would include all technologies that had a high probability of demonstrating PNGV system applicability

and performance by 1997. Post-PNGV technologies would be those that supported the PNGV goals but would not be developed within the established timeframe. The Council also recommended that these longer-term technologies be funded and continued in development for post-PNGV applications.

The second and third peer reviews included evaluations of the ongoing research to the PNGV goals and schedule. The Council concluded "...despite significant progress in a number of critical areas, there continued to be a wide gulf between the current status of system and subsystem development and the performance and cost requirements necessary to meet major PNGV milestones." The Council believed that some of the barriers could be overcome with sufficient funding and management attention, while others would require inventions and significant technical breakthroughs.

Partnership Technology Selection

In January 1998, the PNGV completed its selection of technologies considered to be the most promising for achieving the ambitious goals of the partnership. It was announced that the Federal Government would focus on longer-term research and development efforts in four key system areas: fuel cells, hybrid-electric vehicle drives, direct-injection engines, and lightweight materials. The USCAR would continue working on high-mileage concept vehicles to debut in 2000, followed by production prototypes. The Government partners and their laboratories would continue to participate in high risk research to advance critical enabling technologies for possible use in these vehicles.

Pursuit of Long-Term Research

In the latest peer review, dated April 1998, the Council stated that separate concept demonstration vehicles (by 2000) and production prototypes (by 2004) would be built by USCAR without significant Government participation. However, the Council noted that the Government can and should support the development of long-term technologies that are likely to be incorporated in subsequent concept vehicles. It was recommended that the Government should significantly expand its support for the development of long-term PNGV technologies that have the potential to improve fuel economy, lower emissions, and be commercially viable.

In addition to the annual peer reviews, the President's Committee of Advisors on Science and Technology (PCAST) recommended, in its November 1997, report that a second PNGV program be created. This program would focus on longer-term technologies such as fuel cells since the PNGV timeframe was too short to develop important medium and long-term technologies.

Meeting PNGV Timeframe of 2004

During the audit, responsible Department officials acknowledged that fuel cell and CIDI engine research funded by the Department would not be fully developed to meet the PNGV timeframe of 2004. However, officials stated it was the partnership's decision to pursue short and long-term research that showed the most promise for concept vehicles.

In the Council's 1998 report, it was acknowledged that fuel cells had the best long-term potential for automotive energy converters with high efficiency and low emissions and that impressive progress had been made in fuel cell research. However, fuel cells still faced substantial obstacles in meeting performance and cost goals within the 2000 to 2004 timeframe. It was also noted that excellent progress had been made in the development of CIDI engines; however, there were still significant challenges. The challenges included reducing the emissions of nitrogen oxides (NOx) and particulates, reducing the weight of the power plant, and reducing costs. Regardless, the Council concluded that the CIDI engine had the potential for the highest fuel conversion efficiency.

Alignment of PNGV and Department Goals

The Department's 1997 Strategic Plan included a strategy in the Energy Resources business line to cover the research contributions to the PNGV program. Also, the Department's Annual Performance Plan for Fiscal Year 1999 included an objective to cover the PNGV research efforts. The strategy and objective, the same in both plans, was to "develop and deploy vehicles, fuels, and systems of the future, contributing significantly to the PNGV to develop, by 2004, prototype mid-sized cars capable of 80 miles per gallon that will reduce NOx and CO_2 emissions by two-thirds compared to today's new car average without compromising safety, comfort, and cost." However, neither plan explicitly addressed the ongoing, long-term research at the Department in support of the PNGV program such as fuel cells and CIDI engines.

SUGGESTED ACTIONS

To bring the Department's promising but long-term research into alignment with PNGV goals, we suggest that the Assistant Secretary for Energy Efficiency and Renewable Energy:

1. Work with the PNGV partners to facilitate establishing goals for the development of both short and long-term technologies. The possibility for a post-PNGV should be considered that would focus on mid- and long-term technologies. This would help to strengthen the overall needs of the program to bring efficient, clean vehicles to market.

2. Modify the Department's Strategic Plan and the objective in the FY 1999 Annual Performance Plan to explicitly address the ongoing long-term research efforts in support of the PNGV program. In addition, the Annual Performance Report should address the barriers encountered in meeting the PNGV timeframe of 2004.

/s/
Office of Inspector General

Appendix A

SCOPE AND METHODOLOGY

The audit was performed between August 1997 and June 1998. Although the PNGV program involves several Federal agencies, we limited our review to the Department's participation and role in the program. We focused on evaluating how the Department's research would support the goals of the program. Due to the relative size of the Office of Energy Research's participation in the program, it was not included as part of the audit effort.

To accomplish our objective, we obtained and reviewed laws and regulations applicable to the PNGV program. In addition, we reviewed related reports issued by the Office of Inspector General, the General Accounting Office, and various advisory groups. We also reviewed the agreements and goals formulated between USCAR and the Federal Government. Discussions were held with Department officials from the offices of Energy Efficiency and Renewable Energy and Defense Programs. These discussions covered the Department's participation in the program, budget information, project selection process, progress made to date, and the potential for project completion within program timeframes. Discussions were also held with the individual responsible for PNGV budgeting and general matters at the Office of Management and Budget. We met with the PNGV coordinators and staff officials from General Motors and Chrysler Corporations to discuss their experiences concerning the Department's participation in the Program.

Site visits were made to Argonne, Los Alamos, and Sandia National Laboratories located in New Mexico and California and the National Renewable Energy Laboratory located in Colorado to discuss various current research projects and program work. We also reviewed the Department's 1997 Strategic Plan to determine whether performance measures had been developed that related to the PNGV program.

The audit was performed in accordance with generally accepted Government auditing standards for performance audits and included tests of internal controls and compliance with laws and regulations to the extent necessary to satisfy the audit objective. Accordingly, we assessed internal controls regarding the selection of research and development projects by the Department. Because our review was limited, it would not necessarily have disclosed all internal control deficiencies that may have existed. We did not rely on computer-processed data to accomplish our audit objective.

Appendix B

Past studies and audits relating to the PNGV program:

- *Congressional Research Service: Report for Congress: The Partnership for a New Generation of Vehicles (PNGV),* dated February 1996. This report provided an overview of the PNGV program, including opposing viewpoints on its validity as a Federal function. No findings or recommendations were included in the report.

- *Review of the Research Program of the Partnership for a New Generation of Vehicles, First Report, by the National Research Council,* dated 1994. The report recommended adopting an appropriate strategy to categorize the different technologies related to goal 3 and divide them into two categories: current PNGV and post-PNGV. It reported that the current organizational structure was inadequate to perform the program management function required for a complex program such as PNGV.

- *Review of the Research Program of the Partnership for a New Generation of Vehicles, Second Report, by the National Research Council,* dated 1996. The report stated that although a number of significant achievements had been made, there were still formidable barriers to meeting the program goals within the PNGV schedule. It was observed that, given the limitations on existing resources, the technology program must be focused if PNGV performance, cost, and schedule objectives were to be met.

- *Review of the Research Program of the Partnership for a New Generation of Vehicles, Third Report, by the National Research Council,* dated 1997. The report recommended a comprehensive assessment of the PNGV program regarding its competitive position in the world market to adjust its priorities and resources more efficiently. The report also recommended developing a schedule of funding and resource requirements for each technology by realistically evaluating their potentials.

- *Review of the Research Program of the Partnership for a New Generation of Vehicles, Fourth Report, by the National Research Council,* dated 1998. The report recommended that the government expand its support for the development

of long-term PNGV technologies that have the potential to improve fuel economy, lower emissions, and be commercially viable.

• *NRC Committee on Advanced Automotive Technologies Plan: Review of the Research and Development Plan for the Office of Advanced Automotive Technologies (OAAT), Pre-publication Draft,* dated December 1997. OAAT had established a development plan for 1997 through 2001 and requested that NRC conduct an independent review of the plan. NRC encouraged the use of industry partnerships, but recommended that OAAT only enter research partnerships that industry would not normally undertake solely.

• *Electric Vehicles,* GAO Report Number RCED-95-234, dated August 1995. This report addressed the Department's role in managing its U.S. Advanced Battery Consortium and stated that the Department had played an active and extensive role in managing the program. However, GAO stated the Department had not adequately responded to a 1993 "Lessons Learned" document.

• *Office of Technology Assessment: Advanced Automotive Technology: Visions of a Super-Efficient Family Car,* dated September 1995. This report originated from requests by House Committees on Commerce and Science and Senate Committees on Energy and Natural Resources and on Governmental Affairs. The potential for "breakthrough" technologies to dramatically improve fuel economies of light duty vehicles was examined. It was determined that achieving triple the current fuel economy averages by 2015 was realistic, but will be a more difficult challenge at a commercially viable price.

• *Federal Energy Research and Development for the Challenges of the Twenty-First Century,* Report of the Energy Research and Development Panel, The President's Committee of Advisors on Science and Technology, dated November 1997. This report stated that PNGV has been successful in some regards, but needs some adjustment if it is to fulfill its potential to create public benefits. The PNGV time line is too short and filled with too many interim deadlines to effectively develop important medium and long-term technologies. In addition, the PNGV program is insufficiently funded, increasing the risk of not meeting its goals.

Past Office of Inspector General Audits of Departmental Research and Development Activities:

- *Audit of the Department of Energy's Scientific and Technical Information Process,* Office of Inspector General Report Number DOE/IG-0407, dated June 1997. This report disclosed that the scientific and technical information generated by management and operating contractors was not managed on a life-cycle basis.

- *Audit Report on the Department of Energy's Peer Review Practices,* Office of Inspector General Report Number DOE/IG-0419, dated April 1998. This report concluded that peer review programs had been established to manage various research and development activities at the Department's National Renewable Energy Laboratory and the Pacific Northwest and Los Alamos Laboratories. Peer reviews were conducted prior to competitive award of subcontracts, selection of projects from research proposals, and inclusion in scientific journals and/or conferences.

- *Audit of the Department of Energy's Management of Research and Development Integration,* Office of Inspector General Report Number DOE/IG-0417, dated March 13, 1998. The audit disclosed that the Department did not have a systematic process in place to facilitate the integration of R&D projects because organizational responsibility and authority had not been clearly established.

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