

Fuel Economy and Cost may be Compromised to Meet Emissions Standards in Next-Generation Cars

The National Research Council has released the *Review of the Research Program of the Partnership for a New Generation of Vehicles—Sixth Report*, stating that a public-private partnership to create a highly fuel-efficient car reached a major milestone earlier this year with the unveiling of concept vehicles. However, the ability to meet both fuel-economy objectives and emissions standards by a 2004 deadline remains a monumental challenge, according to the report. The U.S. Environmental Protection Agency's new emissions standards for vehicle exhaust, which will be phased in beginning in 2004, are significantly more stringent than those that were in place when the Partnership for a New Generation of Vehicles (PNGV) was initiated six years ago. All of the demonstrated concept vehicles—DaimlerChrysler's ESX3, Ford's Prodigy, and GM's Precept—use hybrid electric technology, which incorporates electric power from a battery with a small diesel engine. While the concept vehicles can achieve a fuel economy in the range of 70–80 miles per gallon (mpg), none meet the new emissions standards.

In the Council's judgment, the EPA's "Tier 2" standards for nitrogen oxides and particulate matter will delay the use of the diesel engine—and its significant fuel-economy benefit—until systems can be developed that meet the new standards. PNGV also may have to shift its attention to other internal-combustion engine designs with greater potential for extremely low emissions and high fuel efficiency.

The partnership should develop models that can predict the type and amount of emissions for a variety of engines and exhaust-treatment systems in different versions of hybrid electric vehicles, the report said. These efforts will assist researchers in evaluating the feasibility of meeting the Tier 2 standards and provide data that could then be used to establish an appropriate plan for the next phase of the program.

Currently, fuel cells have the greatest potential to meet emissions standards and energy-efficiency requirements. All of the vehicle manufacturers are building concept vehicles powered by fuel cells that are estimated to get up to an equivalent of 100 mpg. Though notable progress has been made, the automotive fuel cell remains a long-range development facing significant hurdles, including the need to substantially reduce costs, which are running about five times higher than the program projected. The fuel cells are targeted for production automobiles sometime after 2004 by some vehicle builders.

New types of fuel and the infrastructure of refineries, distribution systems, and service stations are important considerations in developing both internal-combustion engines and fuel cells. The Council recommends that PNGV and the petroleum industry more fully address fuel issues and strengthen their cooperative programs.

As the program moves closer to commercially viable vehicles, the National Highway Traffic Safety Administration should support major safety studies to determine how lightweight cars perform in collisions with heavier vehicles, the report said. These activities are critically important because PNGV vehicles, although similar in size to today's vehicles, will weigh much less, with lighter bodies, frames, interior components, and window glass.

Although substantial accomplishments have been made, high cost is a serious problem in almost every area of the PNGV program, the Council said. The costs of most components of the concept vehicles are higher than their target values. For example, research continues to be conducted on aluminum and other composite materials for use in major vehicle components, but their cost is still not competitive with steel. Battery costs are at least three times greater than the program's target.

To obtain copies of the report, contact the National Academy Press, 2101 Constitution Ave. NW, Lockbox 285, Washington, DC 20055; tel. 202-334-3313, toll-free 888-624-8373, and web site www.nap.edu.

RAND Profiles Federal R&D Activities by State

RAND has released a report, *Discovery and Innovation: Federal Research and Development Activities in the Fifty States, District of Columbia, and Puerto Rico*, prepared for the White House Office of Science and Technology Policy (OSTP) that provides comprehensive and detailed information on the nature, magnitude, and whereabouts of the individual activities that make up the U.S. government's research and development (R&D) portfolio. Organized on a state-by-state basis, the study identifies and describes federally funded R&D activities within the states and provides estimates of funding and employment numbers for each operation.

Federal R&D is an \$80 billion annual enterprise mounted by 24 federal agencies and covers a large range of topics. In the aggregate, R&D accounts for 14% of all federal discretionary spending. While national survey data is compiled and published by various federal agencies, and while some organizations have listed federal R&D funding within individual

states, this is the first comprehensive attempt to detail all of this data in one document.

RAND's six-person research team, led by senior policy analyst Donna Fossum, unearthed little duplication of effort across the numerous research sites in their database. But the team did find substantial regional concentration. Fifteen states receive 80% of federal R&D dollars, with California, which receives an annual \$14.4 billion, ahead of the others. For many smaller states, federal R&D funding is a significant percentage of the total federal non-entitlement funding coming into the state. Similarly, for many smaller states, federal R&D funding on a per-capita basis is higher than in larger states receiving more federal R&D funds.

The report has found that in some states, federal R&D is big business. For example, in Maryland, 34% of all federal non-entitlement spending comes in the form of R&D dollars. New Mexico (30%), Massachusetts (22%), California (19%), Virginia (13%), and Texas (10%) are also in double digits on this score.

According to the report, different agencies use different definitions for "research and development," "science and technology," and "basic research, applied research, and developmental research." The discovery of these differences shows the difficulties in past attempts to survey and describe the federal R&D portfolio.

By organizing the information on a state-by-state basis and by simultaneously showing which agencies have stakes in each R&D topic, the authors hope to make the material useful to Congress, federal and state officials, scientists and engineers, the media, and the public.

Neal Lane, Assistant to the President for Science and Technology, said, "This report, and the database from which it was largely derived, 'Research and Development in the United States' (RaDiUS), will provide new insights for policymakers at all levels. While there is substantial regional concentration of federal research investments, it is noteworthy that many smaller states rank ahead of larger ones when expenditures are computed on a per-capita basis, and also as a percentage of total federal non-entitlement funding received."

The report was prepared within RAND's Science and Technology Policy Institute, a federally funded research and development center that supports the White House and is administered by the National Science Foundation. RAND is a nonprofit institution that helps improve policy and decision-making through research and analysis. The document can be accessed at www.whitehouse.gov/WH/EOP/OSTP/html/radius.html. □