



EXECUTIVE SUMMARY

The FreedomCAR and Vehicle Technologies (FCVT) Program has promise to produce new technologies in the next five years that address challenges facing the nation. With 2006 as its base year, details of the Program have been planned and delineated for the following five-year period of 2007 through 2011. The planning includes goals, targets, tasks, milestones and outputs covering each of the technology areas. It is defined in the context of the challenges addressed, the necessity of the federal role, the history of success, approaches and strategies, and the primary outcomes and benefits sought. The overall Program goes beyond this five-year time period to conduct research and development to ensure that new technologies are fully utilized to meet the challenges and goals that have been delineated. Success in the research and development and intended outcomes will lead to petroleum savings, beginning significantly in 2015 and growing dramatically thereafter until the vision of a petroleum-free transportation sector is realized.

Challenges in the 21st Century

Dealing with impending oil shortages, known air pollutants, and the potential of global climate change are the energy-related issues facing the world today. Energy security for the U.S. depends primarily on the efficiency of our transportation and fuel choices. While motor vehicles offer many benefits, they impact our energy resources considerably because they consume more oil than we produce domestically. Although major progress has been made, motor vehicles remain significant contributors to air pollutants and greenhouse gases that are elemental to climate change. Domestic oil production has declined for 20 years, and forecasts show that by 2025 about 70 percent of our oil consumption will be imported. Therefore it is important that the U.S. address these issues and work toward achieving energy security and eliminating pollution and the risk of global climate change.

Responding to the Challenge

FCVT provides technology-focused research and development activities for 1) improving the energy efficiency of current automobiles and 2) developing technologies that will transition automobile technology to use no petroleum fuels. These activities could have dramatic effects over the next 30 years as more hybrid-electric vehicles, light-weight materials, low-temperature combustion regimes, and alternative fuels including hydrogen are used.

The FCVT Role

There are times when national needs provide a compelling case for the judicious public support of applied R&D – energy security and climate change are two prime examples. In the case of vehicle research, the Program’s approach has been to involve the affected industries. This allows the planning of the research agenda and identification of technical goals to provide the basis for commercialization decisions. So the concise description of the approach taken here is *“collaboration in pre-competitive research, then competition.”*

Key industry involvement greatly enhances the commercialization opportunities of FCVT-supported technologies. FCVT is collaborating with the U.S. Council for Automotive Research (USCAR) and five energy companies in the FreedomCAR and Fuel Partnership to improve vehicle efficiency in the near term and facilitate the transition to hybrid fuel cell vehicles over the long term. In the 21st Century Truck Partnership, FCVT is teaming with three other federal agencies and 15 industry partners representing heavy-duty vehicle manufacturers and suppliers.

Building on Success

There is a track record of success with the R&D supported by FCVT and its predecessor organization, the Office of Transportation Technologies. The research has been highly regarded, receiving 19 R&D 100 Awards, and it provides a substantial base for furthering energy efficiency for transportation technologies in “high risk” areas.

The Technology Areas

FCVT has worked with industry to identify the priority areas of research needed to develop advanced vehicle technologies to reduce and eventually eliminate petroleum use. These research areas and associated activities described in this Plan are Vehicle Systems, Hybrid and Electric Propulsion, Advanced Combustion Engines and Fuels, Materials Technologies, and Technology Introduction.

Vehicle Systems integrates all other research activities and their performance targets to confirm the correct direction and ultimately the success of the FCVT Program. The Vehicle Systems subprogram is comprised of three key activities: Simulation and Technology Validation, Heavy Vehicle Systems R&D, and Light Vehicle Systems R&D.

Hybrid and Electric Propulsion focuses on the energy storage, power electronics and electric machinery required for hybrid drive systems. The Energy Storage activity will reduce the cost of a 25 kW battery from \$3000 (1998 baseline) to \$500 by 2010. An integrated inverter/motor subsystem is not currently available on the market, but if one were produced today, it is estimated that it would cost more than \$40/kW. By 2010, the Power Electronics and Electric Machinery Activity will reduce this cost to \$12/kW. In 2006, appropriate goals for plug-in hybrid electric vehicles will be established.

Advanced Combustion Engine R&D and Fuels Technology provide dramatically improved engine combustion efficiency and significantly affect petroleum consumption. Work in this area addresses the need to expand the fundamental knowledge of engine combustion to new regimes and the need to understand the scientific relationships between mobile emissions, quantifiable health hazards (to preclude introducing unintended human health impacts) and the advanced fuel requirements for these engines to realize their full potential. Fuels Technology activities will contribute to the success of energy-efficient advanced combustion regimes as well as identify practical, economic fuels and fuel-blending components with the potential to directly displace significant amounts of petroleum. These fuels and fuel-components are anticipated to be derived from non-fossil renewable resources such as biomass, vegetable oils, and waste animal fats, as well as from fossil sources other than light, sweet crude oil (e.g., natural gas, heavy crude, oil sands, oil shale, and coal). These subprograms will achieve light duty engine efficiency of 45 percent by 2010 (from 30 percent in 2002), heavy duty engine efficiency of 55 percent by 2013 (from ~40 percent in 2002), and identify fuel formulations by 2010 that will enable replacement of at least 10 percent petroleum fuels (currently less than 3 percent).

Materials Technologies includes the development of high-strength, lightweight materials for the frame, body, chassis, and powertrain systems for light- and heavy-duty vehicles. The targets are focused on affordability while meeting performance, safety, and recyclability objectives. By 2012, material technologies will enable 50 percent weight reduction in body and chassis components of automobiles, relative to the 2002 baseline. The High Temperature Materials Laboratory provides state-of-the-art capability for fundamental and applied research to users.

Technology Introduction accelerates the adoption and use of alternative fuels and advanced technology vehicles to help meet national energy and environmental goals. It also contributes to the training of a specialized workforce suitable for the advanced vehicle technologies of the future. As identified in the National Energy Policy, consumer education and demonstration activities are critical in accelerating the use of advanced energy technologies.

Successful attainment of FCVT goals will provide the pathway for the U.S. to dramatically change its energy use and petroleum dependence. This will greatly reduce emissions and the transportation sector's contribution to greenhouse gases while sustaining mobility and the freedom of vehicle choice. This vision is necessary for future national energy security and will benefit all.

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