Progress in Development of Batteries for Electric and Hybrid Vehicles, 1890- 2001

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This paper reviews contributions the U.S. Department of Energy Office of Transportation Technologies Electric Vehicles R&D and High Power Energy Storage Programs have made to the commercialization of technologies developed for use in electric and hybrid vehicles. Accomplishments and contributions in the areas of battery research and development, base research, and demonstration programs are reported. The effects and contributions of the California Air Resources Board Zero Emission Vehicle Mandate, U.S. Advanced Battery Consortium and Partnership for a New Generation of Vehicles on development of hybrid and electric vehicles are reported. Some projections of future progress are made.

The transportation sector of the economy accounts for over one-quarter of the total energy and nearly two-thirds of the petroleum used in the United States. Nonpetroleum based advanced transportation technologies have the potential to displace petroleum fuels, reduce atmospheric emissions, and substantially improve the efficiency and fuel flexibility of highway vehicles. The Department of Energy Office of Transportation Technologies cooperates with industry on the development of technologies that will facilitate the commercial production of electric and hybrid vehicles in the early 2000s. Longer-term goals include the development of technologies that will enable industry to commercialize zero-emission vehicles that are fully competitive with conventional gasoline-fueled vehicles in cost and performance. Past progress and future projections will be presented.

A historical perspective of technology development will be presented. During the late 1800s and early 1900s, electric vehicles were popular with urban dwellers who had access to electricity. With the invention of the electric starter in 1911, the need to crank-start gasoline engine vehicles was eliminated, and the last major inconvenience associated with gasoline vehicles was overcome. Gasoline-powered vehicles allowed extended range and became popular with rural citizens who had little access to electricity. Popular interest in electric vehicles waned, but has reemerged four times: in the mid-1960s due to air quality concerns; in the mid- to late-1970s because of foreign petroleum dependence concerns; in the mid-1980s because of both air quality and foreign oil concerns; and in 2001 because of national security concerns. The last two peaks of interests are projected to continue for the foreseeable future. In this decade, it appears that hybrid electric vehicles will begin to replace ICE power vehicles.