

The U.S. transportation sector is still almost totally dependent on oil, and it consumes more than 60 percent of the oil used in this country. Reducing the Nation's vulnerability to oil disruptions will require major changes in the transportation sector's energy demand patterns. Achieving improvements in air quality is also linked to breakthroughs in transportation propulsion technology, as well as changes in the mix of fuels used for transporting people and freight. To accelerate the introduction of more efficient, less polluting transportation technologies, the Department's activities focus on advanced propulsion systems, improved materials, and cost and performance improvements.

Ceramic Regenerator Matrix/Catalytic Exhaust Converters for Automobiles and Heavy Duty Engines

The Department of Energy research and development in ceramic turbine and materials programs is spawning an entirely new industry with many spinoff components. As an example, the Department's ceramic regenerator development work provided the technological "roots" for a catalytic converter that is now commonly used to reduce automotive emissions. **Current sales of such ceramic components for automobiles are \$600 million per year worldwide and are expanding.** Other component sales are projected at \$1 billion and 10,000 jobs for the year 2000. Corning Incorporated holds the largest market share.

Silicon Carbide Whisker-Reinforced Ceramics

Silicon carbide whisker-reinforced ceramics developed by the Department of Energy have increased machining rates up to 800 percent and have dramatically decreased the frequency of cutting tool replacement. These advantages have allowed the United States to recapture a substantial international market share of the cutting tools industry. This composite material was developed in coordinated Department programs with a 7-year **investment of \$3.8 million; worldwide sales now exceed \$30 million.**

Sintered Silicon Carbide Used as a Seal Face in Automotive Water Pumps

The Department of Energy Transportation Materials Technology Program, with the Carborundum Company, has developed an improved sintered silicon carbide (ceramic) seal face for water pumps. These seals are used in 30 percent of new U.S. automobiles--up from 5% in 1993. Shipments will total 10 million seal faces this year for worldwide markets. A Department of Energy investment in mechanical characterization of approximately \$500,000 over a 5-year period has resulted in a **potential worldwide market for these seals in excess of 65 million units per year.**

AC Electric Drive Train

Under a cost-shared contract with the Department of Energy, the Ford Motor Company and General Electric have developed a new electric drive train. This drive train uses one design for a wide range of production vehicles. This new multivehicle design will reduce consumer costs and allow electric vehicles to enter the market sooner. Ford is testing this technology in 105 Ecostar electric vehicles operating around the country. The California laws mandating zero-emission vehicles will result in **approximately \$70 million in electric vehicle sales in 1998 (the only current solution to the California mandates), growing to \$350 million by the year 2003.** Should the New England states implement the California mandates, the market will grow to at least \$1 billion by 2003.

Ceramic Material Heat Engine Components

High melting temperatures, hardness, light weight, and other properties of ceramic materials promise to enable energy efficiency, emissions reduction, and durability improvements in automobile and truck engines. The Department has worked with industry to develop processes that have improved the properties and reliability of ceramics. In 1983, ceramic heat engine parts repeatedly broke. Ten years and \$109 million of DOE cost-shared research and development has resulted in U.S. industrial ceramic