Major Government-Supported Fuel Cell Vehicle Projects

Government support for fuel cell projects is critical to the development of fuel cell technology. Among other things, governments provide capital for pre-commercial research initiatives, encourage technology transfer, create incentives, and serve as early adopters of fuel cell products. This section summarizes major government-sponsored fuel cell activities.

Australia

Both the Commonwealth and Provincial governments are involved in demonstration activities designed to move Australia toward a hydrogen economy.

STEP

The government of Western Australia has launched a wide-ranging vehicle demonstration program called the Sustainable Transport Energy Program (STEP). The program includes research and field trials involving biofuels, hybrid vehicles, and fuel cell buses. Three DaimlerChrysler/EvoBus hydrogen fuel cell buses will be placed on normal service routes in Perth for two years from late 2004 to 2006.

Overall program costs are estimated at AUS$14 million over 5 years, including AUS$7.5 million for the buses. The Western Australia Government has committed AUS$8 million, with BP and the Australian Commonwealth Government each committing AUS$2.5 million.

The Western Australian Government, through the Department for Planning and Infrastructure, will own the buses. They will be operated as part of the Transperth public transport system by Path Transit.

BP is supplying the hydrogen fuel for the trial, produced from its oil refinery at Kwinana.

The project hopes to determine the critical technical, environmental, economic, and social issues facing introduction of hydrogen fuel cell buses; the Government's role in supporting a hydrogen based energy system; and what opportunities there might be for Western Australian and Australian industries.

National Hydrogen Study

The Australian Federal Resources Ministry released a National Hydrogen Study in 2003. The study suggested that by 2030, Australia might operate 20% of its vehicle fleet fuel on hydrogen. The study recommended adopting a national vision for hydrogen, addressing codes and standards, participating in international research efforts, and establishing an Australian Hydrogen Group.

Also in 2003, an AUS$36 million "Energy Centre" was opened at the Commonwealth Scientific and Industrial Research Organization (CSIRO) in New Castle, New South Wales. The Center is

dedicated to demonstrating how industry and government partners can work together to promote sustainable energy.

The Centre will develop partnerships to research, demonstrate, and ultimately transfer technologies to the market. It will focus upon distributed energy and new-generation transportation that is based upon advanced drive technologies, intelligent transportation systems, and energy efficiency. The Centre also will house a "National Research Flagship," entitled "Energy Transformed," that will focus national research efforts on technologies that could lead to the development of an Australian hydrogen economy. Energy Transformed will include research into drive train, energy storage, and energy management technologies to advance hydrogen fuel cell vehicles.

Even the building is dedicated to demonstrating sustainable energy technologies, including solar, gas micro-turbines, and wind generators that will initially provide most of its power. In the future, there are plans to use fuel cells, a solar-thermal system, and a one-megawatt energy storage system.

CSIRO Energy Centre, NSW

Canada

Canada is aggressively seeking to maintain a major role in a global fuel cell and hydrogen industry. Canada currently is home to some of the world's leading fuel cell and hydrogen companies. According to one government web site, "Canada's long-term objective to maintain its position as a world-leader in the evolution of a hydrogen economy…"[2] Consequently, Canada has a number of interesting fuel cell partnerships and programs.

Canadian Transportation Fuel Cell Alliance (CTFCA)

The Canadian Transportation Fuel Cell Alliance is a CAN$23 million government initiative that will demonstrate and evaluate fueling options for fuel cell vehicles in Canada. The main objectives of the Alliance are to demonstrate greenhouse gas (GHG) reductions, evaluate different fueling routes for fuel cell vehicles, and develop the necessary supporting framework for the fueling infrastructure (including technical standards, codes, training, certification, and safety).

Different combinations of fuels and fueling systems will be demonstrated by 2005 for light-, medium-, and heavy-duty vehicles. The initiative also will develop standards and training and testing procedures related to fuel cell and hydrogen technologies. Funding for the Alliance is drawn from Canada's Action Plan 2000, a CAN$500 million greenhouse gas reduction program. The Alliance was announced in 2001.

The program will support several co-funded projects designed to provide a variety of "opportunities for learning and solving technical and economic issues associated with the introduction of fueling for fuel-cell vehicles."

The program has approximately 50 partners, from industry, municipalities, non-government organizations, federal and provincial governments, and universities.

Hydrogen Early Adopters ("h2EA") Program

In October 2003, the Government of Canada announced a commitment of CAN$215 million to create the h2EA program. The program, which is being run through Industry Canada, will demonstrate new hydrogen technology concepts designed to lead to a hydrogen economy for Canada.

The Government of Canada has expressed its intention to use the h2EA program to work with industry to create a "Hydrogen Team." It is envisioned that, among other things, the Hydrogen Team will demonstrate new concepts, such as "hydrogen highways" and "hydrogen villages." Specific goals for the program include:

---

[2] See http://www.tpc.ic.gc.ca/h2/en/

- Increased public, consumer, and investor awareness and acceptance of the hydrogen capability;
- Integration of hydrogen and hydrogen-compatible technologies;
- Development of hydrogen infrastructures;
- Development of skills and supply chain in the hydrogen industry;
- Development of codes and standards for the hydrogen industry; and
- Increased performance, reliability, durability, and economical viability of hydrogen and hydrogen-compatible technologies.

It is anticipated that three to five projects will be funded initially.

Fuel Cells Canada Hydrogen Village Partnership

In December 2003, Fuel Cells Canada, an industry association, announced the formation of a Hydrogen Village Partnership. The Hydrogen Village will "deploy and demonstrate" a variety of hydrogen infrastructure technologies in the greater Toronto area. Participants include government and private sector entities.[3] No budget was announced.

[3] The 27 participants include Air Liquide; Astris Energi, Inc.; Ballard Power Systems, Inc.; Bell Canada; BET Services; BC Gases; the city of Toronto; the city of Mississauga; the Centre for Automotive Material and Manufacturing; Dynetek Industries, Ltd.; Enbridge Gas Distribution; Enviromotive; Fuel Cell Technologies, Ltd.; General Hydrogen Corporation; Giffels Associate, Ltd.; HERA Hydrogen Storage Systems; Hydrogenics Corporation; John Deere ePower Technologies; Kinectrics, Inc.; KPMG, LLP; Ontario Power Generation, Pivotal Power; Purolator Courier, Ltd.; QuestAir Technologies, Inc.; Sarnia/Lambton Economic Partnership; Stuart Energy Systems, Inc.; and the University of Toronto at Mississauga.

China

Fuel-cell-related research has been under way in China since the 1950s, but serious interest in vehicles dates only to the mid-1990s, spurred by the Global Environmental Facility's (GEF's) interest in supporting an appropriate fuel cell bus demonstration in China (the GEF program is discussed in the next section). Since that time, China has made impressive progress. Passenger cars, two-wheel vehicles, and buses are being test-driven in the hope of making a major statement on hydrogen and fuel cells at the 2008 Beijing Olympics (which China has dubbed the "Green Olympics") and the 2010 Shanghai World Expo.

An estimated 60 organizations currently are involved in fuel cell research in China. Most of these organizations are research institutions, generally with a focus on PEM technology. An estimated three-fourths of the work focuses on vehicles.

Among the leaders is the Pan Asia Technical Automotive Center (PATAC) in Shanghai, a joint venture with General Motors and the largest Chinese auto company, Shanghai Auto Industry Corporation (SAIC). PATAC developed a functioning vehicle with modest initial support. General Motors is said to be increasing its research investment in China, and SAIC has its own independent program.

Several developers have multi-vehicle demonstration plans. For example, SAIC intends to put a small demonstration fleet on the road in 2005. Tongji University is expected to produce five to seven vehicles over the next few years, supported by government funding. There are plans for several updated minibuses and transit buses. There is even a fuel-cell-powered boat under test.

Driving this activity is China's transportation policy, which is encouraging the development of motorized transportation. China is building a substantial new highway infrastructure. Total passenger vehicle sales exceed 1 million units per quarter, including about 400,000 passenger cars, and year-to-year percentage increases are dramatic. Beijing and Shanghai, among others, have adopted policies to limit the use of bicycles.

At the same time, China is a net importer of oil. China also has large coal reserves that could be used to produce hydrogen.

In 2001, China increased its investment in fuel cell vehicle research, pledging about $20 million a year for five years. In 2002, the Chinese Academy of Science announced it would invest $12 million over three years on hydrogen technology, including PEM fuel cells.

Most recently, General Motors launched a full-scale attempt to convince the Chinese to move rapidly to a fuel cell vehicle future. In high-level visits late in 2003, GM suggested a hydrogen infrastructure could be built in tandem with the expanding gasoline infrastructure, allowing China to skip much of the internal combustion age and move directly to electrochemical fuel cell engines.

GM estimated a sufficient hydrogen infrastructure might cost $6 billion to $15 billion, a manageable number given that China pays roughly $22 billion for imported oil annually (2 million barrels/day at $30/barrel).

Passenger Cars and Buses

China has made remarkable progress from modest beginnings. In 1998, Tsinghua University built the first known fuel cell vehicle in China, a golf cart powered by a 5-kW stack supplied by Beijing Fuyuan Century Fuel Cell Power. A passenger sedan was shown in 1999. It is a mark of the team's progress that Beijing Fuyuan is now testing stacks up to 140 kW for use as bus engines.

Beijing LN Green Power Company partnered with Tsinghua and the Beijing Institute of Technology to build a fuel-cell-powered taxi, a passenger car, and a 12-seat bus, all unveiled in 2001. Tsinghua also integrated a fuel cell into a transit bus and is working with Samsung and Toyota on vehicle development.

Among the commercial leaders is PATAC, which developed a functioning vehicle with modest initial support, unveiling it in 2001. The vehicle, called the Phoenix, features a Buick minivan body and GM fuel cell technology. General Motors featured the vehicle, along with its HyWire, in a technology forum in China in 2002. GM is said to be increasing its research investment in China.

SAIC has an independent program. Working with Tongju University, SAIC unveiled the Chao Yue 1 in 2003, based on an old VW Santana sedan. SAIC hopes to field a test fleet in 2005. The company produces almost half of the passenger vehicles sold in China.

Shanghai Shen-Li High Tech Company Ltd. was founded in 1998. In its short lifetime, it has demonstrated a jitney, an automobile, a scooter, and an electric bicycle, using fuel cells up to 40 kW. It is working on a minibus that would use a PEM engine up to 80 kW.

Two-Wheel Vehicles

Because of its vehicle mix, China has pursued not only passenger cars and buses, but also two-wheel vehicles. The country already manufactures about 2.5 million *electric* bicycles, comparable to the total number of automobiles produced in 2001. Fuel cells are believed to have more desirable performance characteristics than batteries.

Suzhou Small Antelope Electric Bicycle Company has teamed with PALCAN to develop a fuel cell system to power its electric bicycle; a separate arrangement with Beijing Fuyuan aims to produce engines up to 5 kW for a range of two-wheel vehicles. Shanghai Forever Bicycle Company is also working with PALCAN to test fuel cell power on its electric bicycle and small scooter. Shanghai Shen-Li High Tech Company's activities are outlined above.

In Taiwan, Asia Pacific Fuel Cell Technologies Ltd. has produced several generations of fuel cell scooters. (See Specialty Vehicles section.)

Europe

Hydrogen has been a priority of the European Commission at least since 2001, when its Alternative Motor Fuel Communication suggested that by 2020, 20% of motor fuel should be from nonpetroleum sources and identified "a possible market share of 5% by 2020 for hydrogen." To date, Europe has focused much of its attention on fuel cell buses.

The Clean Urban Transport for Europe (CUTE) project (see below) was established in 2001, and a "contact group" was put to work to develop scenarios for meeting the 2020 targets. The EU leadership convened a Hydrogen and Fuel Cell High Level Group in 2002 to develop a vision statement, which was published in May 2003. One of the recommendations was creation of a European Platform for the Sustainable Hydrogen Economy with public and private participation. The first "General Assembly" is scheduled for early 2004.

Late in 2003, the EU announced a massive research program in energy, communications, and electronics that envisions spending tens of billions of Euro by 2015, including €2.8 billion on hydrogen. The plan sets a "down payment" for hydrogen of €500 million by 2007, with another €1.2 billion in 2007–2012.

CUTE

CUTE is a comprehensive demonstration of fuel cell buses in nine European Cities. The European Commission is contributing €18.5 million to the project. Buses began operating in 2003. When the project is fully under way, three Citaro buses will be operating in revenue service in each of nine European cities: Amsterdam, Barcelona, Hamburg, London, Luxembourg, Madrid, Porto, Stockholm, and Stuttgart. The buses will operate on existing routes alongside conventional buses. Fueling stations have been designed to test a variety of feedstocks, infrastructure strategies, and safety requirements in center cities. DaimlerChrysler will supply the Citaro fuel cell buses.

A companion project is ECTOS, a four-year project in Reykjavik, Iceland, which is also testing three Citaro fuel cell buses.

FEBUSS

The FEBUSS[4] project is a five-year program designed to develop a hydrogen-fueled 100-kW PEM fuel cell power module that is standardized for transit and stationary applications. Cost reduction is the main driver. FEBUSS began in 2002 and is backed by the European Union. FEBUSS includes a two-year test of two power modules to evaluate data on maintenance costs, system reliability, and other factors critical to market development.

FEBUSS was established under the premise that the best path to commercialization of fuel cells is a systems approach aimed at meeting end-user defined objectives and constraints. The project

[4] FEBUSS = **F**uel cell **E**nergy systems standardized for large transport **BUS**es and **S**tationary applications

brings together end-users, system designers, fuel cell component suppliers, and safety and regulatory specialists.[5]

The Fuel Cell Bus for Berlin, Copenhagen, Lisbon

Several European manufacturers and public transit agencies are participating in this project with financial support from the European Commission's Directorate-General for Transport and Energy under the ENERGIE program. The aim is to demonstrate a fuel cell bus using liquefied hydrogen in central cities. The bus will be operated, in turn, by the transit operators in Berlin, Copenhagen, and Lisbon. In addition, BVG (Berliner Verkehrsbetriebe), the Berlin transit agency, has ordered two double-decker fuel cell buses under a German Ministry for Economics program.

The filling station installed in 2002 at BVG's depot will be used for the fuel cell bus fleet that BVG anticipates putting into service in the coming years.[6]

CITYCELL

This hydrogen bus demonstration initially was a 48-month program designed to operate in four countries and involve five fuel cell buses, but as of mid-2003, it was only active in Spain, sharing the hydrogen filling station in Madrid with the CUTE buses. Irisbus is the bus supplier so far.

ENERGIE

ENERGIE, the non-nuclear energy program of the European Union, supports several fuel cell and electric vehicle transport projects. The program's goal is to identify CO_2 reduction strategies. Priorities in the transport sector are "to optimize combustion technologies using cleaner hydrocarbon fuels and other alternative fuels, such as hydrogen; to develop and demonstrate hybrid and electric propulsion systems, such as batteries, fuel cells, fuel processors and other energy storage and conversion devices and hybrid systems; to demonstrate innovative public and private transport systems by making comparative assessments of the energy efficiency, emissions, feasibility, reliability, safety, operability and economics of alternative vehicles; promoting the advanced transport technologies made in the EU."

[5] Partners include Axane Fuel Cell Systems; Alstom Transport; Centre National de la Recherche Scientifique; Institut National Polytechnique de Toulouse (INPT); Centre National de la Recherche Scientifique; Schneider Electric; Irisbus; TUV Saarland; Ineris; INTA; INPG; UJF and CNRS; Air Liquide; Commissariat a l'Energie Atomique; Johnson Matthey; Ineos Chlor; and SGL Technologies.

[6] Partners include MAN, HT Copenhagen, Air Liquide, Instituto Superior Técnico, CARRIS (Lisbon transit), MVV Consultants and Engineers, and the Berlin Senate.

Munich Airport Demonstration Project

The Munich airport project is a multi-company demonstration of hydrogen refueling stations and fuel cell and hydrogen-fueled vehicles. The airport has two fueling units, one providing gaseous hydrogen for three MAN buses and the other for refueling BMW liquid hydrogen ICE vehicles. The project began in 1999 and is funded until 2006. Ballard Power Systems and MAN recently announced additional shipments of fuel cell buses to the project in 2004. Proton Motors, Still and Linde plan to run a fuel-cell-operated forklift truck at the airport.

Clean Energy Partnership (CEP) Berlin

CEP is a consortium of nine corporate partners and the German Federal Government. The goal is to demonstrate hydrogen fuel for cars and buses. The partners – Aral, the BMW Group, Berliner Verkehrsbetriebe (BVG), DaimlerChrysler, Ford, GM/Opel, Hydro/GHW, Linde, and Vattenfall Europe – are supplying the infrastructure, technology, and vehicles for this five-year project. In 2004, a hydrogen fueling station is planned, and up to 30 vehicles will be tested.

World Bank/GEF Fuel Cell Bus Development Program

The mission of the Global Environment Facility (GEF) is to finance activities that address global biodiversity loss, climate change, degradation of international waters, and ozone depletion. Among other things, GEF helps cover the incremental cost of advanced technologies that yield a reduction in climate change gases in developing countries. GEF is supporting the demonstration of a planned 46 fuel cell buses in five nations: India, China, Egypt, Mexico, and Brazil. Fuel cell buses are eligible for GEF funding under its Operational Program #11: "Promoting Environmentally Sustainable Transport." Investigations began in 1995 with plan approval in 2000. All but India are in the "implementation" stage; India is in the "development" stage.

GEF has expressed concern over delays in the procurement process and possible delays in delivery of the buses.

China

The China project involves purchasing six buses and one fueling station each in Shanghai and Beijing and operating the buses a total of 1.6 million kilometers. GEF will provide $12 million of the estimated $36 million project cost. National and local governments will provide $20 million with $4 million pledged from private companies. Shanghai's plans call for a follow-on project that would operate during the 2010 World Expo.

Detailed technical specifications are complete and have been released to potential bidders. An official invitation to bid is expected to be released in February 2004, with a target date of March 2004 for a signed contract.

The project goals are cost reduction, operator experience, capacity building, policy development, and technical and scientific understanding. A series of activities will also focus on defining a detailed strategy for large-scale fuel cell bus implementation in China, which is planned as a follow-on to this initial project.

Egypt

The overall objective of the project is to introduce to Egypt a viable electric, hybrid-electric, and eventually fuel cell technology program, starting with the Giza plateau and the Cairo public transport sector. The multi-phase plan will start with testing a bus in various sites in Egypt; conducting economic, environmental, and societal studies; and training managers, engineers, and technicians. Two electric buses will be used in the tests, according to GEF, and a technology transfer and commercialization plan will be drawn up on the basis of the results. In 2003, GEF reported it has committed $748,000 to the project.

Brazil

The Brazil project is designed to help accelerate the commercialization of fuel cell buses using renewably generated hydrogen, with cost reduction an important secondary goal. In mid-2003, negotiations were under way with suppliers with a target date of June 2004 for signed supply contracts and the delivery of the eight buses by the year of 2006. The managers of the project are discussing options for information sharing with the Clean Urban Transport for Europe (CUTE) and California Fuel Cell Partnership. Negotiations were under way on a networking agreement within the context of the Urban European Commission "Controlling Urban Mobility Program (URB-AL)" for Europe-Latin America, "enabling information and knowledge sharing between European and Latin American cities, namely the cities of Porto, Barcelona, Mexico City and Sao Paulo," according to GEF. The GEF financial commitment as of mid-2003 was $12,274,000.

Mexico

The project aims at promoting "the development, manufacture and large-scale commercialization" of fuel cell buses in Mexico. A test fleet of 10 buses will operate in Mexico City for five years. A project strategy was approved early in 2003 and a consultant hired to develop an implementation plan. GEF funding early in 2003 totaled $5.1 million. A tender to potential suppliers was expected "soon."

India

At last report, the India project was still in the assessment stage. The goal of the operational phase is a bus demonstration "designed to contribute significantly toward achieving the long-term objective of reducing the costs of fuel cell buses to near-competitive levels in India." Initial GEF commitments totaled $300,000.

Iceland (ECTOS)

Iceland is committed to developing the first hydrogen-based economy. Rich in hydroelectric and geothermal energy and small in size, Iceland sees itself as an ideal laboratory for the conversion. Shell, the Icelandic holding company VistOrka hf, Norsk Hydro, and DaimlerChrysler founded a joint venture in 1999 called Icelandic New Energy (INE). INE's task is to evaluate hydrogen options and fuel cells for use in Iceland.

INE established the Ecological City Transport System (ECTOS) project late in 2000. ECTOS is a four-year project in Reykjavik that will test three hydrogen-fueled Citaro fuel cell buses. Hydrogen will be generated via electrolysis of water. The project was launched in March 2001. The buses will operate on city streets for two years. The project is running parallel with the CUTE project in Europe. The European Community is contributing €2.8 million. The balance of the estimated project cost of €6.7 million will come from the commercial partners.

Japan

Hydrogen & Fuel Cell Demonstration Project (JHFC)

The Japan Hydrogen & Fuel Cell Demonstration Project (JHFC) is a multi-year government-sponsored demonstration designed to evaluate fuel cell vehicle technology and begin the development of a hydrogen infrastructure. The project is also designed to educate the public about fuel cells and hydrogen safety. The Japanese government has committed to revising its transport and consumer safety regulations by 2005 to support a hydrogen infrastructure. JHFC will be directed by Japan's Ministry of Economy, Trade and Industry (METI). The vehicle tests will be overseen by the Japan Automobile Research Institute, and the hydrogen infrastructure evaluations will be overseen by the Engineering Advancement Association of Japan. The government's share of the project was ¥2 billion in 2002 and ¥2.5 billion in 2003.

Facilities for producing liquid hydrogen were designed in 2002, but Japan's fuel cell vehicle demonstration program began in earnest in 2003, with fuel cell vehicles from a field trial of eight car manufacturers, along with a fuel cell bus. Nine hydrogen stations are in development, designed to test a variety of feedstocks and fueling strategies, including desulfurized gasoline reforming, naphtha reforming, LPG reforming, liquid-hydrogen storage, methanol reforming, high-pressure hydrogen storage, lye electrolysis, petroleum reforming, and city gas reforming.

Participating vehicle manufacturers include Toyota, Nissan, Honda, DaimlerChrysler, General Motors, Mitsubishi, Suzuki, and Hino Motors, a member of the Toyota group that is testing fuel cell buses.

Energy and infrastructure companies participating include Nippon Oil Corporation; Cosmo Oil Company, Ltd.; Showa Shell Sekiyu K.K.; Tokyo Gas Co., Ltd.; Iwatani International Corporation; Japan Air Gases, Ltd.; Nippon Sanso Corporation; Nippon Steel Corporation; Kurita Water Industries, Ltd.; Sinanen Co., Ltd.; Itochu Enex Co., Ltd.; Idemitsu Kosan Co., Ltd.; and Babcock-Hitachi K.K.

Singapore

Singapore will be host to seven Mercedes-Benz NECAR fuel cell vehicles in a two-year trial beginning in 2004. Daimler expects to put 60 A-Class F-Cells on the road in four countries. DaimlerChrysler said Singapore was chosen because of the challenging climate and driving conditions, "excellent" government support, and the fact that Daimler's regional headquarters is located there.

United States

Freedom Car/Hydrogen Fuel Initiative

In his 2003 State of the Union Address, President Bush announced a new program designed to ensure that the United States become a world leader in hydrogen-powered automobiles. This program, which builds upon the President's FreedomCAR ("Cooperative Automotive Research") program, will invest a total of $1.7 billion to develop hydrogen-powered fuel cells, hydrogen infrastructure, and advanced automotive technologies, the President pledged.

Known as the FreedomCAR and Hydrogen Fuel Initiative, the President's program will partner with the private sector to make it practical to choose fuel cell vehicles by 2020. The program also will improve America's energy security by fostering the transition from petroleum fuel to hydrogen, thus reducing the demand for imported oil.

The FreedomCar and Hydrogen Fuel Initiative established teams to address advanced combustion and emission control, electrical and electronics, electrochemical storage, fuel cell systems, hydrogen storage and vehicle interface, and materials.

FreedomCar was first launched in January 2002. It is a partnership between DOE and DaimlerChrysler, Ford, and General Motors.

California Fuel Cell Partnership

The California Fuel Cell Partnership (CaFCP) is a collaboration of auto companies, fuel providers, fuel cell developers, and government agencies.[7] It was established in 1999 to demonstrate vehicle technology and alternative fuel infrastructure and to explore the path to commercialization, including increasing public awareness.

The CaFCP provides a centralized facility and other support for fuel cell vehicles being tested on California roads. The partners pool resources and work in committees to develop consensus on the partnership's major activities.

A headquarters facility in West Sacramento, California, houses vehicle maintenance bays, a hydrogen fueling station, and a methanol fueling station. Additional satellite fueling stations are in operation elsewhere in the state. The CaFCP has roughly 43 FCVs statewide and seven hydrogen fuel stations.

---

[7] Partners and associate partners include DaimlerChrysler; Ford; General Motors; Honda; Hyundai; Nissan; Toyota; Volkswagen; Ballard Power Systems; UTC Fuel Cells; BP; ExxonMobil; Shell Hydrogen; ChevronTexaco; the California Air Resources Board; the California Energy Commission; the South Coast Air Quality Management District; the U.S. Department of Energy; the U.S. Department of Transportation; the U.S. Environmental Protection Agency; Air Products and Chemicals, Inc.; Praxair; Pacific Gas & Electric; Proton Energy Systems, Inc.; Stuart Energy; ZTEK; Methanex; AC Transit; SunLine Transit Agency; and the Santa Clara Valley Transportation Authority (San Jose).

Bus Demonstrations

The U.S. government has supported research into fuel cell buses since the early 1980s. At that time, it appeared that fuel cells in transportation would need to focus on buses given their size, duty cycles, and centralized refueling and operation and maintenance. The program was led by DOE; the program produced the first U.S.-developed fuel cell buses — a fleet of three 30-foot buses on Bus Manufacturing Industries platforms. The first unit was unveiled in 1994. They were methanol-fueled hybrids utilizing phosphoric acid fuel cells. One unit has operated for nearly 10 years under a program managed by Georgetown University.

Funding shifted to the Department of Transportation in 1993. The second phase of the program focused on building two PEM hybrid buses on 40-foot Nova Bus platforms, one using a Ballard (EXCELLSIS) engine and one using a United Technologies Corporation engine. The buses were delivered in 1998 and 2001.

Georgetown University has managed the program since the beginning and is seeking funding for a third generation of buses.

The CAFCP also has a transit bus program. This program began with a Zebus provided by Ballard, which successfully completed an 18-month test at SunLine Transit Agency. The CaFCP currently plans to demonstrate seven fuel cell buses beginning in 2004. The buses will operate for two years in regular transit service, carrying fare-paying customers over normal routes. As discussed in greater detail in the bus section of this report, three buses will be deployed by AC Transit, three buses will be deployed by Santa Clara VTA, and one bus will be deployed by SunLine Transit.