Joint Economic Committee
Alternative Automotive Technologies and Energy Efficiency

Statement of Mark Chernoby

Vice President
Advanced Vehicle Engineering
DaimlerChrysler Corporation

July 28th, 2005

Mr. Chairman and distinguished members of the Joint Economic Committee, I want to thank you for the opportunity to appear before you today.

I am coming before you today to describe DaimlerChrysler's efforts in developing and implementing alternative technologies for powering automobiles and what we are doing in advanced technologies to with respect to the hydrogen economy.

Petroleum prices remain high

Crude oil prices remain very high, especially in contrast to the lows reached in '98 and '99. They are still considerably lower than the peak in real oil prices which was reached in the early eighties. The monthly average price for June was $57 per barrel and in July oil prices have closed above $60 on several days. While most analysts think prices have probably peaked, prices are expected to remain above $50 per barrel for some time. While the consensus outlook for oil prices has continued to move higher, most economists still expect prices to decline steadily from the current price of $57 per barrel. The consensus is for oil to decline to less than $50 per barrel next year and with additional declines in the following years.

Current oil prices have limited impact on consumers

Despite oil prices consistently much higher than predicted, economic growth has slowed only moderately. The economy and the auto industry seem to be weathering very high oil prices much better than expected. Though it is a near certainty that the economy will slow in the face of both expensive oil and continued central bank rate increases, the slowing appears to be gradual and modest so far. Total vehicles sales through June are about 2% above the comparable period in 2004. In addition, the market share of trucks is slightly higher then in the prior year. Based on the sales data for 2005, consumers do not seem to be altering their purchasing preference due to more expensive oil.

While the economic effects of high oil prices have not had as dramatic effect as originally anticipated, DaimlerChrysler is focused on in improving automobile energy efficiency in short-term and long-term and is pursuing a broad portfolio of alternatives.

Improving energy efficiency via alternative and advanced propulsion related technologies

DaimlerChrysler is engaged in a broad range of advanced propulsion technologies. Fuel cell vehicles are a long term focus of this technology portfolio, which also includes efficient gasoline engines, advanced diesels, and hybrid powertrain systems. (See Figure 1: DaimlerChrysler's Advanced Propulsion Technologies)

DaimlerChrysler is focused on providing the market with the ability to select the advanced propulsion technology that best fits the needs of the individual customer. Each of the short term technologies optimizes its benefit to the consumer in specific drive cycles, hence its value to the customer.

DaimlerChrysler has developed and implemented technologies that improve the efficiency of the current gasoline propulsion system. We must continue to enhance the gasoline combustion propulsion system since it will be the dominant choice in the market for many years to come. We offer the Multi-Displacement System (MDS) available in the HEMI in seven Chrysler Group vehicles. MDS seamlessly alternates between smooth, high fuel economy four-cylinder mode when less power is needed and V-8 mode when more power from the 5.7L HEMI engine is in demand. The system yields up to 20 percent improved fuel economy.

We are also working on further development of gasoline direct-injection which considerably enhances fuel economy by closely monitoring fuel atomization.

While enhancements to existing internal combustion engine (ICE) technology offer opportunities for improvements in fuel economy in the short to mid-term, these improvements to ICEs must be accompanied by continuous improvements to the fuels on which they run. Thus, the availability of sulfur-free gasoline and diesel fuels, with other properties tightly controlled is a critical enabler for significant improvements in fuel economy.

DaimlerChrysler offers four different diesel powertrains in the United States, not including heavy trucks. Advanced diesel technology offers up to 30 percent better fuel economy and 20 percent less CO_2 emissions when compared to equivalent gasoline engines. While the fuel economy advantages of some vehicle propulsion technologies, such as hybrids may be limited to, or accentuated in a single mode of driving, an advantage of the diesel engine is that it offers significant fuel economy improvements under all driving conditions.

Advanced diesel is a technology that is available today and can help reduce our nation's dependency on foreign oil. According to a J. D. Power and Associates study, light duty diesels are expected to grow from a 3% market share in 2004 to 7.5% in 2012.

Designing more engines to run on Biodiesel is a current objective at DaimlerChrysler. Biodiesel fuel reduces emissions of diesel vehicles, including carbon dioxide, and lowers petroleum consumption. Each Jeep Liberty Common Rail Diesel (CRD) built by DaimlerChrysler is delivered to customers with B5 biodiesel fuel. Nationwide use of B2 fuel (2 percent biodiesel) would replace 742 million gallons of gasoline per year, according to the National Biodiesel Board. DaimlerChrysler is also investigating the potential use of B20 fuel.

While alternative, renewable fuels such as ethanol or biodiesel offer an attractive opportunity to reduce petroleum dependence, we do not see these fuels completely replacing petroleum in the foreseeable future. Rather, alternative fuels should be seen as pieces in the puzzle which represents the reduction of petroleum dependence. The role of renewable ethanol and biodiesel, and ultimately, renewable hydrogen, should be considered in the context of improved efficiency of conventional gasoline and diesel powertrains, hybrids, and fuel cells. Innovative public policy aimed at reductions in vehicle miles traveled (VMT) can also be part of this equation. DaimlerChrysler has set itself the goal of systematically promoting the development, testing and market launch of renewable fuels.

Rising gasoline prices in the United States have increased the interest in Flexible Fuel Vehicles (FFVs). Chrysler Group has sold nearly 1.5 million FFVs capable of running on E85 (85% ethanol), gasoline or a mixture of the two. In total, over 4 million FFVs have been produced by the U.S. auto industry. Internal estimates have calculated that if the current fleet of over 4 million FFVs on the road today was operated on E-85 made from corn using the current fermentation and distillation processes, CO_2 emissions would be reduced by 10 million tons/yr and gasoline use would be reduced by 130 thousand barrels per day. Shifting to a new process of ethanol production from herbaceous biomass would result in essentially the same petroleum reduction, but CO_2 emissions would be reduced by over 22 million tons/yr. However, there currently is only minimal infrastructure to support vehicles capable of running alcohol based fuels (ethanol and methanol) and the cost for alcohol based fuels is higher than gasoline on an energy equivalency basis. (See Figure 2: Energy and Cost Comparison of Fuels)

DaimlerChrysler and GM have recently combined efforts to develop a two-mode hybrid drive system that surpasses the efficiency of today's hybrids. The partnership will cut development and system costs while giving customers an affordable hybrid alternative that improves fuel economy. The first use of the system by DaimlerChrysler will be in early 2008 with the Dodge Durango.

We are also looking at market niches where alternate technologies can have an impact in reducing our dependence on gasoline for transportation. One such opportunity is the Neighborhood Electric Vehicle (NEV), all-electric, battery-powered vehicles for use in reduced-speed on- and off-road settings. Some 30,000 DaimlerChrysler GEM electric vehicles are in use around the country, mostly for short trips – the kind of trip in which gas-powered vehicles produce most of their emissions.

In addition to the propulsion related activities underway, mentioned above, DaimlerChrysler sees opportunities in using advanced materials as a way to reduce vehicle mass and therefore improve vehicle efficiency. Materials currently being investigated for new or increased vehicular application include: advanced high strength steel, aluminum, composites, titanium, magnesium, and improved alloys for casting. With each of these materials comes the challenge of new joining methods and technologies as well as compatibility with other materials.

Consumer response potential for advanced and alternative propulsion technologies

Consumers are rational and will purchase vehicles embodying advanced fuel saving technologies when the purchase makes economic sense. This implies that the added cost of the technology must be less than the net present value of the fuel savings. In this regard, both higher fuel prices and higher tax subsidies for advance technology vehicles make such vehicles more attractive to consumers.

Longer term advanced technologies – DaimlerChrysler's efforts to advance the "hydrogen economy"

DaimlerChrysler has been working on fuel cell technology for transportation utilizing hydrogen for over ten years. We have invested over $1 Billion in R&D and have developed multiple generations of varying types of vehicles, including five generations of passenger cars (NECAR1, 2, 3, and 4, and the F-Cell). Of all manufacturers, we have the largest world wide fleet of fuel cell cars and buses (more than 100 vehicles) participating in several international demonstration projects in the United States, Europe, and Asia. (See Figure 3: DaimlerChrysler Fuel Cell History)

As a member of the United States Council for Automotive Research (USCAR), DaimlerChrysler is a partner in the Department of Energy's (DOE) FreedomCAR and Fuel Partnership along with General Motors and Ford Motor Company, and BP America, ChevronTexaco Corporation, ConocoPhillips, Exxon Mobil

Corporation, and Shell Hydrogen. The recent addition of these five major energy providers has strengthened the Partnership considerably, by providing expertise to solve the infrastructure challenges. DaimlerChrysler has also been working with the DOE since 1993 on advanced automotive technology research. We support the initiative as members on technical teams related to advanced automotive technology, including:

- Energy Storage
- Light Weight Materials
- Advanced Combustion
- Hydrogen Storage
- Fuel Cell
- Codes & Standards
- Electrical and Electronics
- Vehicle Systems Analysis

Through these tech teams, we help develop priorities based on future needs and manage a portfolio of research projects directed at a set of research goals and objectives.

We also are one of four recipients to participate in the DOE Hydrogen Learning Demonstration Project. By the end of 2005, we will have 30 vehicles located in three ecosystems (Southern California, Northern California, and Southeastern Michigan) and were the first OEM to provide valuable technical data to the DOE. (See Figure 4: DOE Hydrogen Fleet & Infrastructure Demonstration & Validation Project)

The current technology is being evaluated in several fleet demonstration projects around the world. The largest is the DOE's program in the United States. These programs include a few hundred vehicles world wide and several hydrogen fueling stations.

DaimlerChrysler projects that the hydrogen fueled vehicle technologies will evolve in discreet phases driven be the following cadence of events:

- Breakthrough in basic research
- Bench/laboratory development
- "On road" testing and development
- Parallel manufacturing process development

Technological breakthroughs are required in hydrogen storage and fuel cell technology (focused on cost & durability). DaimlerChrysler shares a commitment with our partners in the FreedomCAR and Fuel Partnership effort to achieve these gains. It is a challenge to predict a definitive timeline for technological discovery. The vehicle fleet could grow to tens of thousands if significant shifts occur in the infrastructure and value to the consumer. The infrastructure must expand to a much larger scale beyond local support. This will be critical to support the freedom to travel that consumers will demand when we move from a market dominated by local “fleet” customers to the average consumer.

High volume commercialization will require a highly distributed infrastructure capable of delivering cost competitive hydrogen and fuel cell powered vehicles that can compete with other fuel efficient technologies. It is likely that this will require continued government policy support for vehicle and fuel. Additionally, transitioning the manufacturing sector and supply base will require large investments in both time and resources. Along with DOE and the Department of Commerce, DaimlerChrysler is participating in identifying and addressing the most significant issues associated with this transition.

In addition to the technology challenges identified above, the cost challenges are significant barriers. To realize large scale market penetration, we will have to approach the value that customers enjoy with current propulsion technologies.

Even with a viable vehicle, the hydrogen economy will not become a reality without a highly distributed infrastructure. Our energy partners in the FreedomCAR and Fuel effort are committed to the research and technology development required to realize this goal. Industry and government will need to work together to develop an implementation plan with financial viability for all entities.

Due to the enormity of the transition to a hydrogen economy, DaimlerChrysler actively participates in the FreedomCAR and Fuel Partnership. The research required to solve the technical challenges of the hydrogen economy is universally viewed as “high risk” by industry. The enabling, pre-competitive research sponsored by DOE through the FreedomCAR and Fuel Partnership is very important to the industry and is focused on overcoming the aforementioned challenges. These challenges can not be solved by any one company, industry or country. As a global company we also support DOE’s participation in the IPHE and other activities around the world to address these challenges.

The path to the future - Advantages of developing advanced vehicle technologies for more traditional propulsion systems

As stated earlier, DaimlerChrysler is working on a broad portfolio of technologies to improve the efficiency and environmental impact of transportation. In the short-term we continue to improve the internal combustion engine (ICE). In the mid-term we are developing hybrid vehicles utilizing electric drive systems, integrated power modules and advanced batteries. In the long term fuel cell vehicles with on-board hydrogen storage from a national hydrogen infrastructure will emerge.

The current portfolio of R&D within the DOE's FreedomCAR and Fuel Initiative is focused on the long term hydrogen vision, but many of the technologies are useful and will mature in the shorter term as transition technologies. Cost effective, light-weight materials can be applied to vehicles in the short term to improve fuel efficiency regardless of the propulsion technology. Advanced energy storage and motors will benefit both hybrid and fuel cell vehicles. Novel approaches to hydrogen storage are uniquely required by hydrogen fueled vehicles, but can support stationary and portable applications in the industrial and consumer markets.

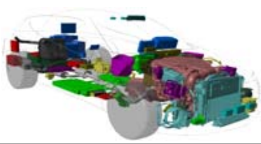
It is important to advance and mature many of the aspects of the technology as early as possible. There are many challenges and breakthroughs needed to realize the President's vision of a "Hydrogen Economy". (See Figure 5: Technology Relationship Strategy)

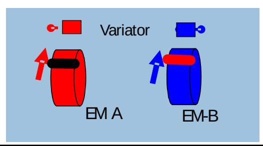
Figure 1: Some of DaimlerChrysler's Advanced Propulsion Technologies

- Multi-Displacement System (MDS)
- Gasoline Direct Injection
- Advanced Diesel Technology
- Bio-diesel
- Two-mode Hybrid

5.7L V-8 HEMI® with MDS

Two-mode Hybrid





Jeep® Liberty Diesel

Figure 2: Energy and Cost Comparison of Fuels

Fuel	Volumetric Energy Density (BTU/gal)	Gravimetric Energy Density (BTU/lb)	Cost ($)*	Cost $/Gasoline Gallon Equivalent
Gasoline	115,000	18-19,000	2.32/gal	1.00
Diesel	128,400	18-19,000	2.39/gal	0.93
E85	82,000	12,550	1.85/gal	1.11
Hydrogen	**	51,500	1.20/lb	7.50***

* Current retail prices, including taxes, except for hydrogen, which is a wholesale price

** The volumetric energy density for hydrogen is dependent on the form of storage (5,000 psi, 10,000 psi, liquid, or as metal hydrides).

*** If hydrogen were produced in transportation fuel quantities, forecasters suggest its cost for gasoline gallon equivalent would approach 1.

Figure 3: DaimlerChrysler Fuel Cell History

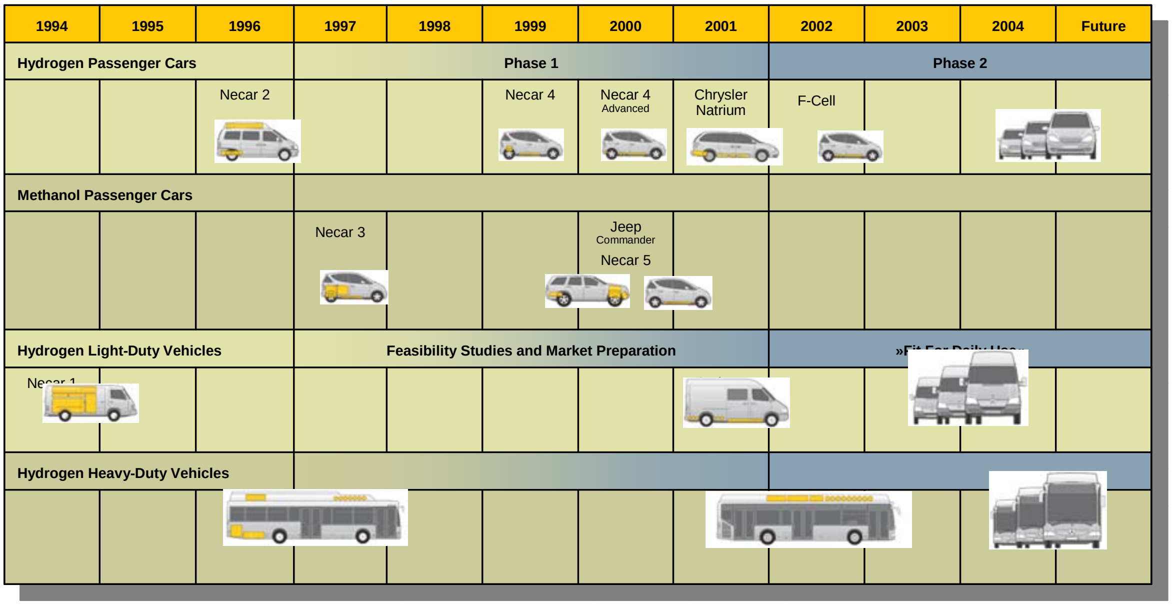


Figure 4: DOE Hydrogen Fleet & Infrastructure Demonstration & Validation Project

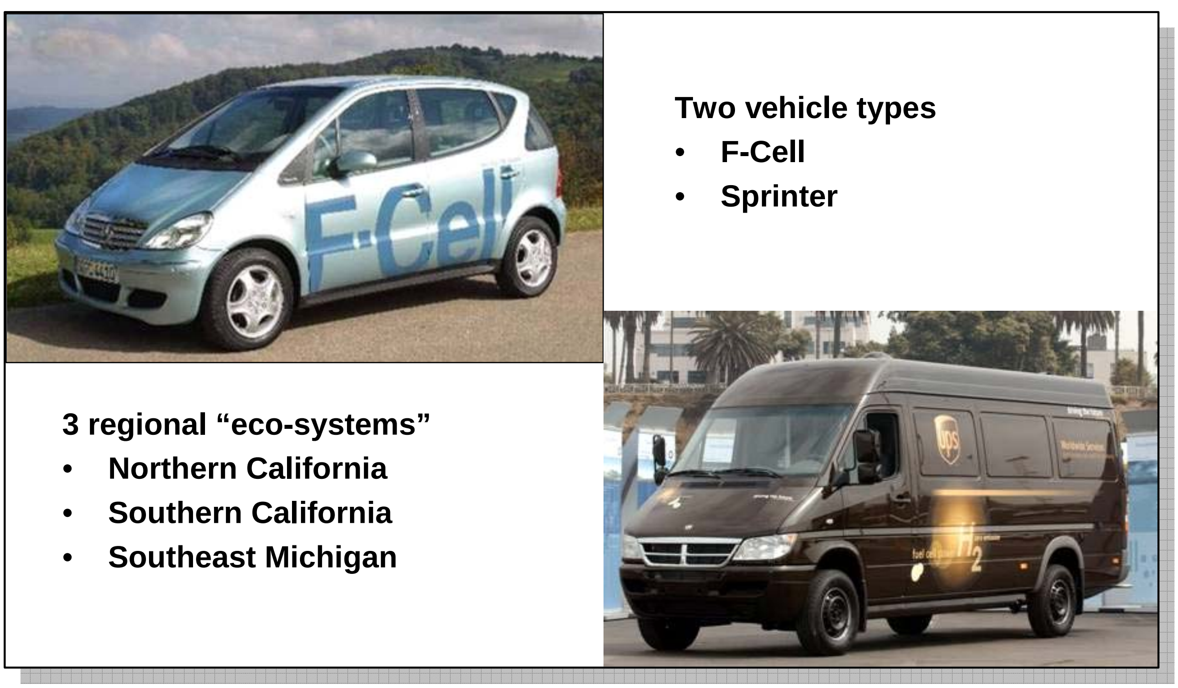


Figure 5: Technology Relationship Strategy