COMMITTEE ON SCIENCE AND TECHNOLOGY
Subcommittee on Energy and Environment
U.S. House of Representatives

Hybrid Technologies for Medium-to-Heavy Duty Commercial Trucks

Tuesday, June 10, 2008
10:00 a.m.
2318 Rayburn House Office Building

PURPOSE

On Tuesday, June 10 the Subcommittee on Energy and Environment of the Committee on Science and Technology will hold a hearing to receive testimony on the state of development of hybrid electric technologies for medium-to-heavy duty commercial vehicle applications and the role of the Department of Energy (DOE) in supporting research and development of these systems. The Committee will also receive testimony on a discussion draft of legislation to be introduced by Rep. Sensenbrenner.

WITNESSES

- **Mr. Terry Penney**, Technology Manager, Advanced Vehicle and Fuel Technologies, **National Renewable Energy Laboratory**
- **Mr. Eric M. Smith**, Chief Engineer, Hybrid Medium Duty Truck, **Eaton Corporation**
- **Mr. Joseph Dalum**, Vice President, **Dueco Inc.**
- **Ms. Jill Egbert**, Manager, Clean Air Transportation, **Pacific Gas & Electric Company (PG&E)**
- **Mr. Richard Parish**, Senior Program Manager, **Calstart Hybrid Truck Users Forum (HTUF)**

The witnesses will discuss the considerable potential for energy savings and emissions reductions through deployment of hybrid electric systems in heavy duty trucks, the range of hybrid heavy truck technologies and applications, the major technical and market barriers in deploying these technologies, and their experience with the federal energy research programs. The witnesses will also offer their views on the draft legislation to authorize a federal research and demonstration program on hybrid technologies for heavy-duty vehicles.

BACKGROUND

There are significant potential economic and environmental benefits from improving medium-to-heavy duty vehicles through the electrification of drive trains and auxiliary power systems. Hybrid technologies (ex: battery and hydraulic) are being developed for a wide range of

commercial vehicle platforms such as package delivery vans, refuse collection trucks, large utility "bucket trucks", military and construction vehicles, and even long-haul tractor trailer trucks. Conventional large truck models share the common characteristics of relatively low fuel efficiency and high emissions profiles since they must rely solely on a diesel or gasoline internal combustion engine for power. These inefficiencies are especially evident in trucks that require frequent starts and stops, or long periods of non-drive time engine idling in order to provide power for auxiliary systems such as bucket lifters and other work-related equipment, off-board power tools, air conditioning, and refrigeration. By switching some driving and auxiliary loads to hybrid systems large trucks stand to save a considerable amount of fuel and greatly reduce their emissions.

For defense applications, hybrid systems provide the added benefit of generating very little noise, providing power for radar and weapons systems, reducing overall weight and maintenance requirements, and allowing vehicles to run much longer between fueling. In fact, military requirements have been a major driver of innovation in hybrid technologies for heavy vehicles.

The power demands on heavy duty trucks are as varied as the applications. While several truck companies are testing hybrid models, significant technical hurdles remain, and there is no one-size-fits-all hybrid solution for the entire sector. Through the course of an average drive cycle the charging and discharging of a hybrid electric or hydraulic system on a trash truck, with its frequent starts and stops, dumpster lifting, and trash compaction, will be considerably different than that of a utility truck which may idle in one place for several hours in order to operate the bucket lifting boom and other equipment. Long haul tractor trailer rigs (Class 8) may prove even more challenging since they seldom brake during a drive cycle, providing little opportunities for battery systems to recharge. The next generation of trucks may also include plug-in hybrid electric models which can charge larger banks of batteries through direct connection to the electricity grid.

While the total number of these vehicles is small compared to passenger vehicles, their fuel consumption and emissions justify the high costs of development of hybrid models. According to figures by the Oshkosh Truck Corporation there are approximately 90,000 refuse collection trucks in the U.S. but their collective fuel consumption is roughly equivalent to 2.5 million passenger vehicles (based on 10,000 gallons/year per truck). Estimates done by the Eaton Corporation show that as little as 10,000 hybrid electric trucks could reduce diesel fuel usage by 7.2 million gallons/year (approx. 1 million barrels of oil), reduce NOx emissions by the amount equivalent to removing New York City's passenger cars for 25 days, and reduce carbon dioxide emissions by 83,000 tons.

The energy storage options for hybrid trucks generally include batteries, hybrid hydraulic systems, and ultra-capacitors. Batteries receive the most attention and research funding because of their applicability throughout the transportation sector. To expand the use of electricity in the vehicles sector batteries must be smaller, lighter, cheaper, and more powerful. Vehicle batteries typically fall into one of three families of technologies: lead-acid, nickel metal hydride (NiMH), and lithium-ion (Li-Ion). Lead-acid batteries have many advantages including their relative simplicity and low cost, wide-scale availability, domestic manufacturing capacity, and established recycling infrastructure. NiMH batteries are found in the current generation of

hybrid vehicles and will be the battery of choice for many of the first generation heavy hybrid trucks. However, high weight and low power density are significant issues for both lead-acid and NiMH batteries, and they may not be optimal for future plug-in hybrid applications. Many in the industry believe the future of hybrids depends on breakthroughs in new battery technologies, such as the lithium ion (Li-ion) batteries with their low weight and high power density. But, in addition to solving remaining technical issues such as heat management, the costs of manufacturing Li-ion batteries remain prohibitively high for large-scale deployment in vehicles. There is also concern that the U.S. is falling behind in the race to develop and manufacture batteries, and a significant effort is underway to build up a domestic supply chain.

The Department of Energy has funded research in this area over the years, most recently through the 21st Century Truck Partnership which conducts R&D through public-private efforts with the trucking industry. Other federal agencies involved in the 21st Century Truck Partnership include the Department of Defense, the Department of Transportation, and the Environmental Protection Agency. Federal research capabilities exist in DOE laboratories such as the National Renewable Energy Laboratory and Argonne National Laboratory, the EPA's National Vehicle and Fuel Emissions Laboratory, and the Army's National Automotive Center. Despite the potential economic and environmental benefits of hybrid trucks and the considerable technical hurdles that remain, the 21st Century Truck Partnership is facing decreased funding as the Administration chooses to shift the focus of federal research to the passenger vehicle market.

DRAFT LEGISLATION

Representative James Sensenbrenner will have draft legislation available for the Committee and witnesses to review. Specifically, the draft legislation would accelerate research of plug-in hybrid technology in trucks by creating grants for manufacturers to build, test, and ultimately sell plug-in hybrid utility and delivery trucks. The Act would also encourage DOE to expand its research in advanced energy storage technologies to include heavy hybrid trucks as well as passenger vehicles.