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**before the**

**SUBCOMMITTEE ON ENERGY AND POWER**

**COMMITTEE ON ENERGY AND COMMERCE**

**U. S. HOUSE OF REPRESENTATIVES**

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Mr. Chairman and Members of the Subcommittee, I appreciate the opportunity to appear before you today to address the outlook for light duty vehicles and the fuels used in those vehicles.

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**Petroleum dominates energy use in transportation**

The transportation sector and the use of petroleum fuels are tightly linked. In 2009, 72 percent of total U.S. petroleum consumption occurred in the transportation sector, while petroleum products provided about 94 percent of total transportation energy. Light-duty vehicles (LDVs), including both passenger cars and light-duty trucks, accounted for 63 percent of total transportation energy use in 2009. Freight trucks and buses together used 17 percent of transportation energy, followed by aircraft, marine, pipeline, and rail with shares of 10, 5, 3, and 2 percent in total transportation energy use, respectively.

LDVs are almost entirely fueled by petroleum, with the petroleum content of motor gasoline accounting for 92 percent (8.0 million barrels per day (mmbd)) of energy use and diesel fuel representing another 3 percent (0.2 mmbd). Biofuels account for essentially all remaining LDV energy use. For heavy-duty trucks, petroleum is even more central to meeting energy needs, with diesel accounting for about 91 percent of consumption (1.9 mmbd), gasoline about 7 percent (0.2 mmbd), and the remainder divided between liquefied petroleum gas, biofuels, and natural gas. Of the remaining transportation modes, aircraft (1.3 mmbd) and marine (0.6 mmbd) are entirely dependent on petroleum and rail energy consumption is 96 percent diesel (0.3 mmbd) and 4 percent electricity.

**The *Annual Energy Outlook 2011***

EIA recently released the *Annual Energy Outlook 2011* (*AEO2011*), which presents projections for the U.S. energy system through 2035. The *AEO2011* Reference case is a business-as-usual trend estimate, using known technology and technological and demographic trends, and is prepared under the assumption that current laws and regulations remain unchanged throughout the projection period. The large share of U.S. energy and petroleum use by LDVs has made them a focal point for legislation, regulation, and tax policies to both improve fuel economy and promote the sale of alternatively-fueled vehicles and alternative fuels. Higher fuel economy standards reduce both petroleum and energy consumption, while alternatively-fueled vehicles and fuels displace the use of petroleum without necessarily reducing overall energy use.

The *AEO2011* Reference case includes model year (MY) 2011 Corporate Average Fuel Economy (CAFE) standards enacted by the National Highway Traffic Safety Administration (NHTSA) for light-duty vehicles, as well as the jointly issued CAFE and LDV greenhouse gas emissions standards for MYs 2012 to 2016 promulgated by NHTSA and the Environmental Protection Agency (EPA). It also assumes a further increase in CAFE standards to 35 miles per gallon by MY 2020, as required by the Energy Independence and Security Act of 2007. In addition, the Reference case incorporates other provisions impacting the transportation sector, such as the Renewable Fuels Standard (RFS) for biofuels, waivers allowing the use of E15 in MY 2001 and newer vehicles, existing emissions standards for conventional criteria pollutants from LDVs, and existing tax credits for alternative/advanced vehicles and fuels. Tax credits for vehicles and fuels are assumed to sunset at the dates specified by laws in effect as of the start of 2011.

Although sales of unconventional vehicles (those that use, diesel, alternative fuels, and/or hybrid electric systems) have increased in recent years, conventional gasoline vehicles have maintained a dominant share of new LDV sales. In 2009, conventional gasoline vehicles had an 85 percent market share out of 9.8 million new LDVs sold, followed by flex fuel, hybrid electric, and diesel vehicles at 11, 3, and 2 percent, respectively (**Figure 1**). However, unconventional vehicles are projected to play a growing role in the *AEO2011* Reference case, due both to policy and rising fuel prices, growing to 42 percent of the projected new LDV sales in 2035.

Flex-fuel vehicles (FFVs), which can use ethanol in blends of up to 85 percent, represent the largest share of projected unconventional vehicle sales by 2035, at 19 percent of total new LDV sales. Manufacturers selling FFVs currently receive incentives in the form of fuel economy credits earned for CAFE compliance through MY 2016. FFVs also play a critical role in accommodating the RFS mandate for increased use of biofuels.

Sales of electric and hybrid vehicles that use stored electric energy also grow considerably in the Reference case. Micro hybrids used in conventional gasoline, diesel, and flex-fuel vehicles, which use start/stop technology to manage engine operation when the vehicle is stopped, are projected to account for 11 percent of all LDV sales by 2035. Hybrid vehicles, a category pioneered by the Toyota Prius more than a decade ago, account for 5 percent of projected light-duty vehicle sales in 2035, and plug-in and all-electric hybrid vehicles account for 2 and 1 percent of LDV sales, respectively.

Sales of diesel vehicles, which have fuel economy advantages relative to comparable conventional gasoline vehicles and also offer torque benefits valued by some users, also increase in the Reference case, accounting for 5 percent of total LDV sales in 2035. However, natural gas or fuel cell vehicles are not expected to capture a significant share of new LDV sales in 2035.

In the *AEO2011* Reference case, conventional gasoline vehicles maintain a projected 58 percent share of new LDV sales by 2035 because they are able to incorporate technology such as lightweight materials and advanced engine and transmission technologies that

improve fuel economy and allow manufacturers to meet the CAFE standards. In the Reference case, conventional gasoline passenger car fuel economy improves from 30.9 miles per gallon to 37.3 miles per gallon between 2008 and 2035, while conventional gasoline light-duty truck fuel economy improves from 23.9 miles per gallon to 29.1 miles per gallon over the same time period.

The changing mix of LDV sales is reflected over time in the composition of the LDV fleet. By 2035, about 30 percent of total LDVs are unconventional vehicles, which contribute to higher efficiency or provide a capability for increased use of fuels other than petroleum. Growth in the number of drivers and vehicle miles per driver results in a projected growth of 50 percent in total LDV vehicle miles of travel between 2009 and 2035 in the *AEO2011* Reference case (**Figure 2)**. However, due to rising fuel economy, overall LDV energy consumption is projected to increase by only 10 percent, or 1.7 quadrillion Btu, between 2009 and 2035 despite rising travel demand. Projected LDV petroleum use in 2035 is about 8.2 mmbd, the same level as in 2009, reflecting both changes in the fuel mix and improved fuel economy.

Petroleum products remain the dominant LDV fuel, with the motor gasoline (excluding ethanol) share falling to 82 percent (from 92 percent currently) but diesel rising to nearly 5 percent (from 3 percent) by 2035. Biofuels play a growing role and are projected to provide almost 14 percent of energy used by LDVs by 2035, up from 5 percent. Electricity usage begins to grow but remains small at about 0.2 percent while natural gas

accounts for less than 0.1 percent (**Figure 3**). This is due partially to the fact that electric vehicles are very efficient and for the same amount of travel use significantly less fuel.

Projected total energy and petroleum use by LDVs grows at a much slower rate (10 percent) than in other parts of the transport sector, where total energy use and petroleum use are projected to grow by 32 percent and 18 percent respectively between 2009 and 2035. (**Figure 4**).

**Uncertainty in the *AEO2011* projections for the LDV vehicle mix and fuel use**

The *AEO2011* Reference case projections for LDVs and their fuel use are inherently uncertain. This section discusses four key areas of uncertainty: fuel prices, technology costs, consumer acceptance, and potential changes in policies.

First, all vehicle types face uncertainty regarding future fuel prices. Higher or lower fuel prices can change the relative attractiveness of all vehicle types, either making more fuel-efficient vehicles more attractive to consumers in a high oil price case or less attractive in a low oil price case. For example, in the *AEO2011* High Oil Price case, the conventional gasoline vehicle sales share declines to about 50 percent in 2035 compared to 58 percent in the Reference case, while in the Low Oil Price case, the conventional gasoline share falls only to about 60 percent. Higher or lower fuel prices also affect projected vehicle efficiencies and growth in travel, which also affect the fuel mix and the level of fuel use. In the *AEO2011* High Oil price case, overall LDV fuel consumption increases by only 1.5

percent between 2009 and 2035, while LDV petroleum use in 2035 is 6.6 mmbd, 1.5 mmbd below its 2009 level.

Second, future vehicle cost will play a critical role in determining the success or failure of unconventional vehicles in the future. For example, plug-in hybrid and plug-in electric vehicle incremental cost is dependent primarily on the cost of its battery. There is uncertainty today about what battery chemistry will be used in the future and what these batteries will cost. In addition to plug-in vehicles, diesel, natural gas, hybrid, and micro hybrids are all more expensive than a conventional gasoline counterpart. Just how much more these vehicles will cost a consumer depends on future technology breakthroughs, or lack thereof.

Third, consumer acceptance is also a critical area of uncertainty regarding future market success of unconventional vehicles and alternative fuels. Vehicle attributes, such as cost and performance, as well as alternative fuel prices and availability, will play key roles in the future success of these alternatives. Further, infrastructure availability is essential to consumer acceptance. Currently, there are fewer than 1,000 compressed or liquefied natural gas refueling facilities in the United States, many of which are private. Although consumers can purchase a home natural gas refueling system the limited range of natural gas LDVs on a single refueling can be a significant deterrent for many potential buyers. Unless more natural gas vehicles enter the market, there is little incentive to build out public refueling infrastructure. The lack of a dense public charging infrastructure and the resultant “range anxiety” could also be a significant concern for many potential buyers of

plug-in all-electric vehicles. Plug-in *hybrid* electric vehicles would not suffer from the range anxiety constraint, since the vehicle is also equipped with an internal combustion engine, which extends the range. Hydrogen vehicles probably face the greatest issues with respect to fueling and range anxiety given the absence of both a viable home refueling option and the high cost of establishing hydrogen refueling infrastructure.

Finally, the future regulatory environment is also uncertain. The possible effect of changes in fuel economy standards are perhaps the most important uncertainty affecting projections of the LDV vehicle mix and fuel use in the *AEO2011*. CAFE and greenhouse gas emissions standards for LDVs are currently set in final rule form only through MY 2016. While the *AEO2011* assumes that standards are raised through MY 2020 to meet the requirements of the Energy Independence and Security Act of 2007, additional fuel efficiency requirements that may be promulgated under existing legal authority could have a very significant impact on the LDV sales mix and projected fuel use by LDVs. In this regard, NHTSA and EPA have issued a Notice of Intent that outlines plans to formally propose more stringent fuel economy and greenhouse gas emissions standards for LDVs in MYs 2017 through 2025.

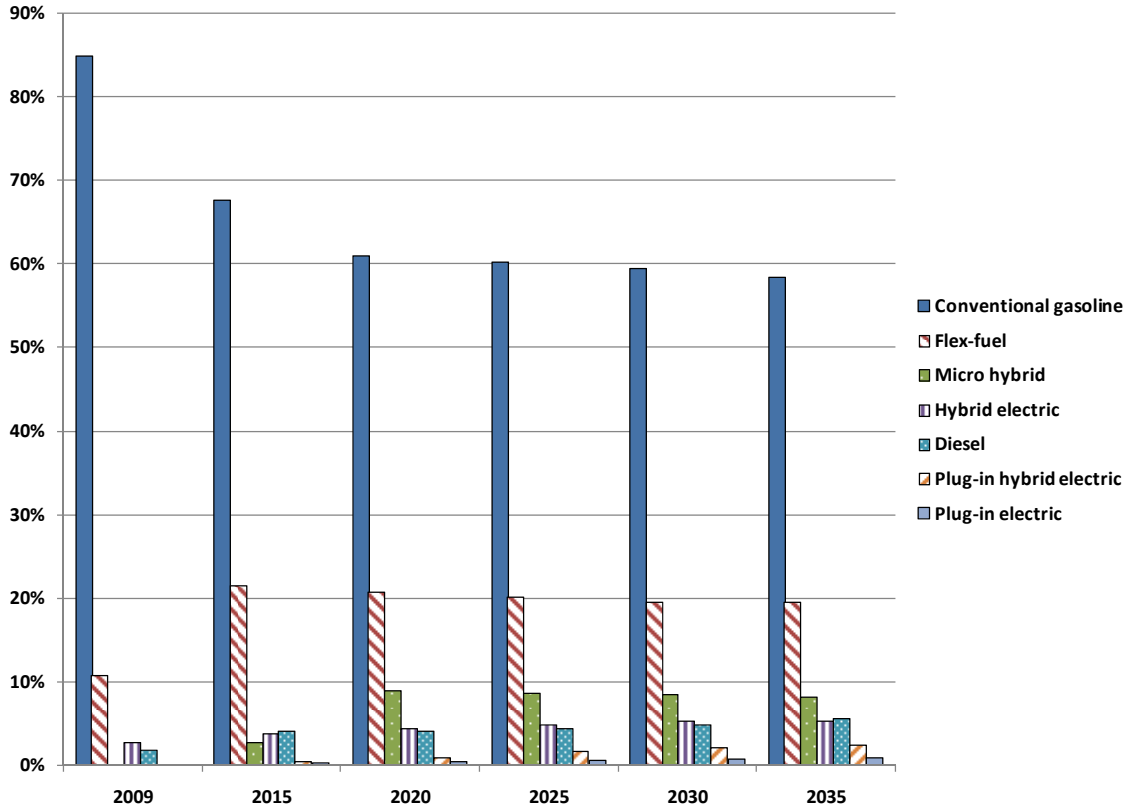
The *AEO2011* includes two sensitivity cases analyzing the impacts of more stringent greenhouse gas emissions and CAFE standards for LDVs in MYs 2017 through 2025. One case analyzes a 3-percent annual increase in standards over this period, resulting in a 46.1 miles-per-gallon standard by MY 2025. The other case assumes a 6-percent annual increase in standards over this period, resulting in a 59.3 miles-per-gallon standard by

MY 2025. These sensitivity cases are intended to illustrate possible outcomes rather than definitively identify impacts of hard-to-foresee changes 6 to 14 years into the future that are likely to challenge the financial, engineering, and production capabilities of the automotive industry and interact in complex ways with the uncertainties previously discussed.

Compliance with the more stringent CAFE standards cases would require a rapid increase in sales of unconventional vehicles and significant improvement in the fuel economy of conventional gasoline vehicles. Sales of unconventional vehicles are projected to grow to 70 percent of total new LDV sales in 2025 in the 3-percent case and nearly 90 percent in the 6-percent case, as compared with 40 percent in the Reference case. In addition to changing the LDV sales mix, increased costs for vehicles that employ technologies unfamiliar to consumers would likely slow the rate of vehicle stock turnover relative to the Reference case. In the two CAFE sensitivity cases, more stringent fuel economy standards lead to reductions in both total LDV energy use and LDV petroleum use. In the 3-percent case, overall LDV energy consumption declines by 10 percent (1.7 quadrillion Btu) between 2009 and 2035, while projected LDV petroleum use in 2035 is 6.5 mmbd, 1.7 mmbd below its 2009 level. In the 6-percent case, overall LDV energy consumption declines by 19 percent (3.2 quadrillion Btu) between 2009 and 2035, while projected LDV petroleum use in 2035 is 4.7 mmbd, 3.5 mmbd below its 2009 level.

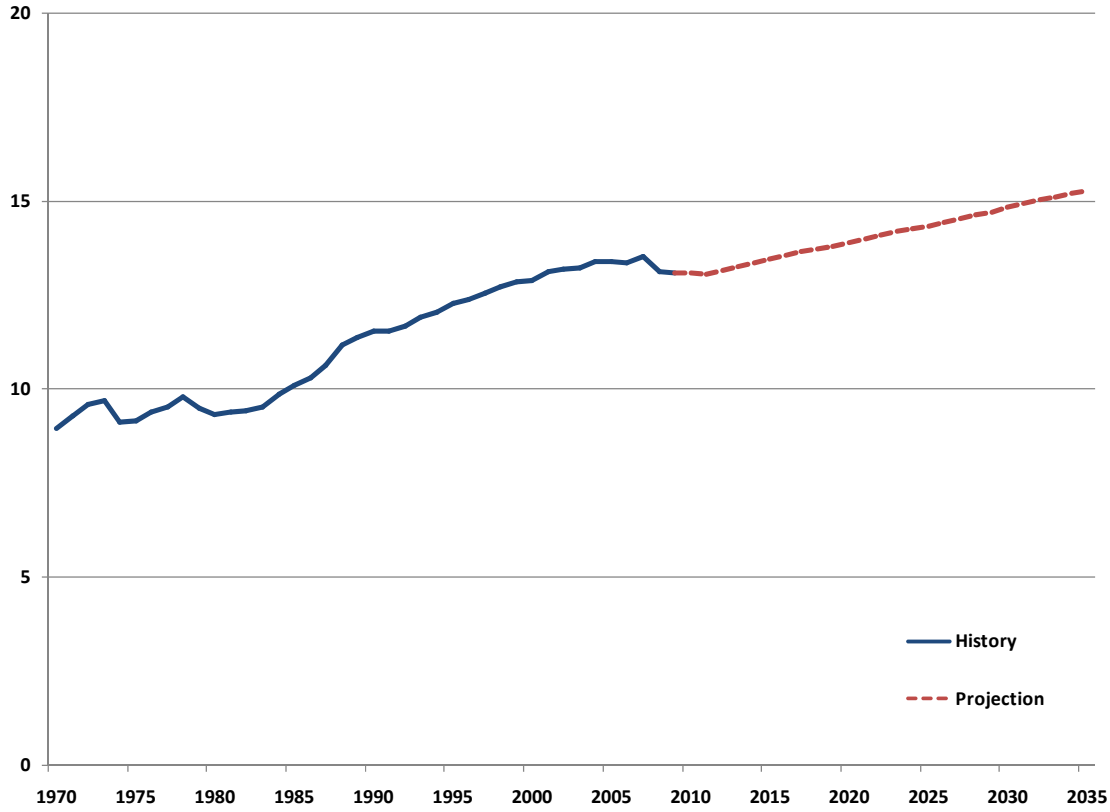
This concludes my statement, Mr. Chairman, and I will be happy to answer any questions you and the other Members may have.

**Figure 1. Light-duty vehicle technology market share**



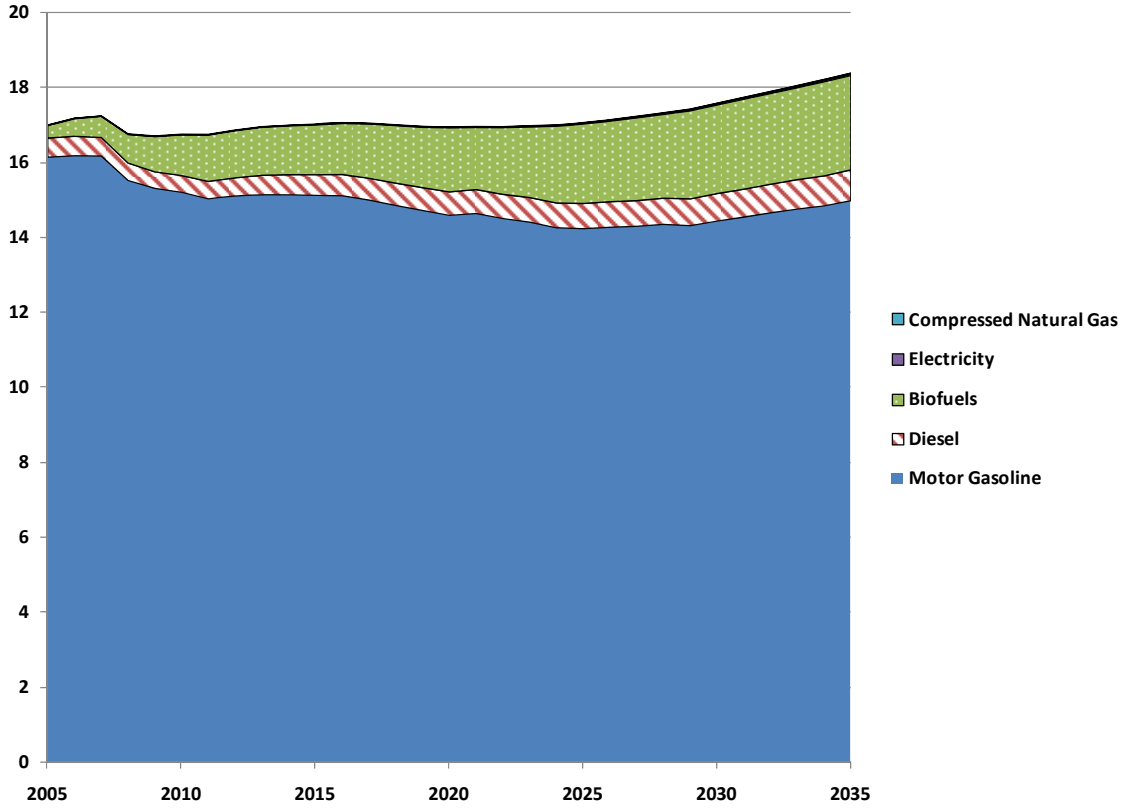

Source: EIA *Annual Energy Outlook 2011*, Reference case run d020911a

**Figure 2. Vehicle miles traveled per licensed driver, 1970 to 2035 (thousand miles)**



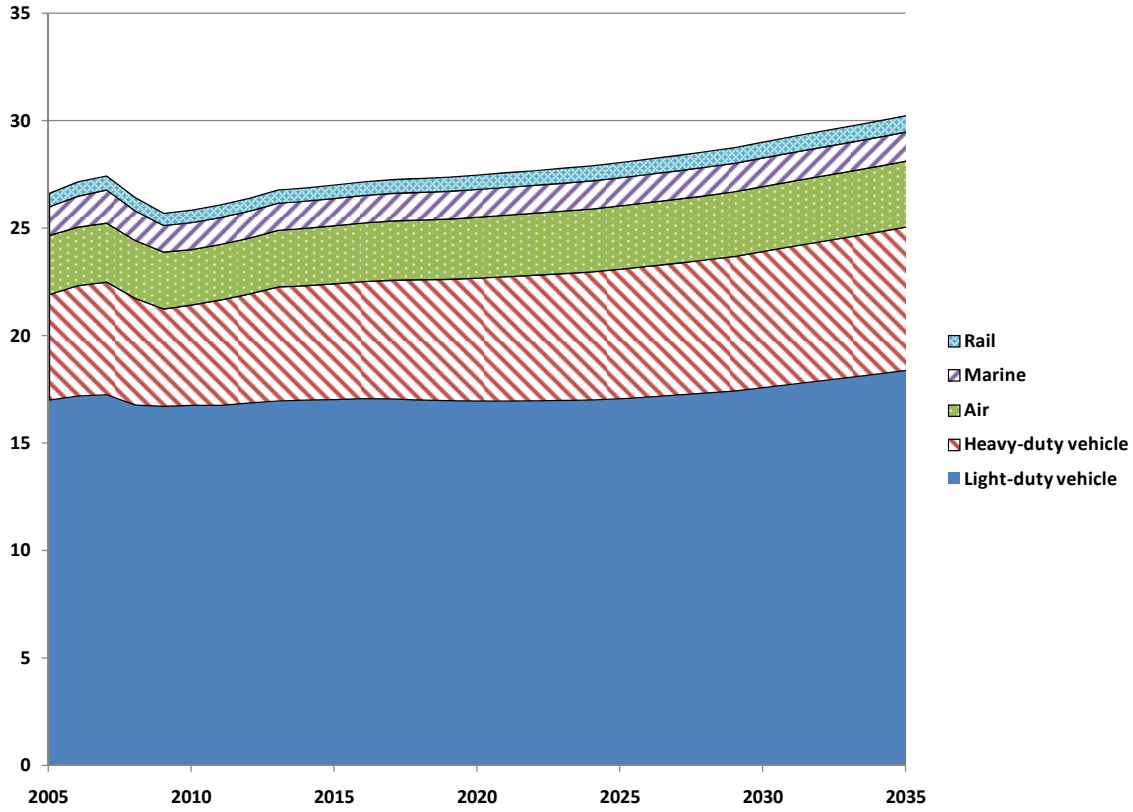

Source: History: Federal Highway Statistics 2008, Projection: EIA *Annual Energy Outlook 2011*, Reference case run d020911a

**Figure 3. Light-duty vehicle energy use by fuel in the *AEO 2011* Reference case (quadrillion Btu)**




Source: EIA *Annual Energy Outlook 2011*, Reference case run d020911a

**Figure 4. Transportation energy demand by mode (quadrillion Btu)**




Source: EIA *Annual Energy Outlook 2011*, Reference case run d020911a