The Future of Heavy-Duty Powertrains: 2007 to 2020
An Overview

In the next 15 years, the heavy-duty truck powertrain will change significantly. Driven by substantially stricter emissions regulations, continued pressure on operating costs, increased traffic congestion, and a shortage of skilled drivers, these changes will take place in the engine, the exhaust gas treatment system, and the transmission, as well as in the utilization of several forms of hybridization.

The pace of change will also be dramatic. For example, some of the exhaust treatment technologies only now appearing on the horizon are expected to become obsolete, or nearly so, by 2020, as engines move from conventional diesel operation towards homogenous charge compression ignition (HCCI) under ever-increasing emissions constraints.

These are the overriding conclusions of "The Future of Heavy-Duty Powertrains," which explored the next generation of powertrain technologies for heavy-duty (5+ tons GVWR) commercial vehicles being developed and produced in Western Europe, Japan, and North America.

The study was designed to assist major component suppliers, OEMs, and policy makers develop future technology strategies and business plans. The study is based upon three plausible, internally consistent scenarios of emissions regulations and crude oil prices and availability. For each scenario, the mix of powertrain (engine type, exhaust gas treatment system, and transmission) technologies in each geographic region was forecast based on technical performance criteria and the expected impact on vehicle life-cycle costs. The technical barriers to the commercialization of advanced diesel engines, competing internal combustion engine types, hybrid powertrains, and fuel cells, as well as the various forms of advanced transmissions, exhaust cleanup, and alternative fuels were identified and assessed. These assessments determined if and when each technology could become a cost-effective solution to meet the ever-more stringent requirements in each scenario.

Market share forecasts indicate that the most likely scenario can be met with a mix of primarily diesel-fueled engine types (conventional, but highly evolved diesel, advanced bottoming-cycle diesel, and evolving HCCI technologies), complemented by spark ignition engines fuelled by natural gas for certain niche applications. Due to the diverse requirements in each region and the differing characteristics of the vehicle fleets, the mix of technologies varies significantly among regions, even in the most likely, baseline scenario.
Fuel cell powertrains are currently in the early stages of technology integration, and significant improvement is needed to produce market competitive fuel cell powertrains. As that technology develops, we may see increased demonstration fleet activities by 2020. Fuel cells are more likely to be useful for certain related applications such as auxiliary power units for trucks operated remotely from a truck-stop infrastructure (e.g., military vehicles).

Battery electric vehicles were not found to be substitutes for more conventional commercial vehicles. They will meet zero emissions vehicle requirements and are likely to see further service in niche applications, such as delivery/collection vehicles for closed communities and city centers.

The study forecasts are segmented by region and by scenario, and the expected ramp-up of the key power unit technologies are defined. Market shares of different transmission types are derived, exhaust gas treatment systems are assessed, and overall performance trends and characteristics are discussed, as is the likely contribution of improvements in related areas of the vehicle, such as aerodynamics and low rolling resistance tires.

Two forms of hybridization will appear. Power unit hybridization will employ exhaust gas energy to power auxiliary systems and provide some torque boost. Driveline hybridization will employ regenerative braking and thereby reduce overall operating costs and capture an important share of the market for some vocations.

Transmissions are treated in a similar manner.

The seven-volume study concludes with insights that will help a wide range of powertrain and electrical component suppliers identify and understand long-term business opportunities that are likely to enjoy high market share.
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