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Tier 4 Vehicles Make Bright DEF Future Even Brighter



by
Kim Doran

In the first year after U.S. Environmental Protection Agency (EPA) standards mandating near-zero levels of nitrogen oxides (NOx) and particulate matter emissions in new heavy-duty trucks went into effect, EPA has certified 71 on-highway heavy-duty diesel engine families with selective catalytic reduction (SCR) systems produced by 11 engine manufacturers. Studies in California report diesel exhaust fluid (DEF) is now available in 92 percent of refueling stations and at 30 percent of parts retailers. And a recent survey by the American Trucking Association (ATA) of 12 large trucking fleets reveals no problems with locating DEF or the quality of DEF, and shows every indication that the fleets will purchase more SCR-equipped trucks in 2011.

As a result, the economics of DEF business are very attractive:

- The 2.3 million gallons of DEF used in December 2010 suggest that the SCR-equipped trucks put into operation in 2010 will require approximately 27.6 million gallons of DEF annually.
- Forecasts are that 310,000 more large- and medium-duty trucks (Class 6, 7 and 8) will be sold in 2011. A significant portion of these trucks will use SCR technology and, therefore, will also require DEF—approximately 74 million gallons annually, based on conservative estimates for annual miles per truck, fuel consumption and a 2.5 percent DEF dosing rate.

Together, these statistics suggest a reasonable estimate of the 2011 need for DEF on-road trucks is approximately 101.6 million gallons. This is in line with other estimates that peg DEF use in 2012 as high as 130 million gallons.

Storage and Dispensing



Industry reports show nearly 300 DEF bulk-storage installations are already in place at truck stops and fleet terminals across North America, with more than 150 new bulk-tank installations (storage volumes between 1,000 and 4,000 gallons) projected to come online in 2011.

To meet demand that should reach 350 million gallons by 2015, high-volume truck stops are already moving to larger 10,000 gallon underground DEF storage tanks.

On the dispensing front, Pilot and Flying J truck stops will increase the number of fuel lanes dispensing DEF from 68 to 1,000 by October 2011. TravelCenters of America and Petro Stopping Centers are rolling out new “1+1” single dispensers that fill trucks with both diesel and DEF—simultaneously authorizing both transactions and payments, and eliminating the need for drivers to move their trucks from one fill location to another.

Trucking Trends Positive



Will the positive trends continue? The AIA forecasts a solid decade of growth ahead for trucking. Total freight tonnage is expected to grow 24 percent over the forecast period, with revenues jumping 66 percent by 2022. Risks that accompany aging fleets, the rising cost of fuel and inflationary pressures are driving many trucking companies (large and small) to buy fuel-efficient SCR equipment, leading to a corresponding growth in demand for DEF.

Looking Ahead to Tier 4



Starting in 2011, a new generation of clean-diesel technology for off-road (Tier 4) equipment is making its way onto construction and industrial jobsites and farmlands around the country.

Tier 4 compliance dates for NOx emissions are being phased in, based on the size of engine and other factors. By 2014, however, near-zero emissions—99 percent NOx reduction and 96 percent particulate matter reduction—will be required. As this process continues, new clean-diesel technologies and emissions standards for marine and railroad applications also will be introduced.

While the EPA mandate for Tier 4 off-road emissions applies only to new engines and equipment, states like California that are focused on immediate air quality improvements also are developing programs to accelerate adoption of low-emitting equipment retrofits—most of which will demand ready supplies of DEF.

What's Different in Tier 4?



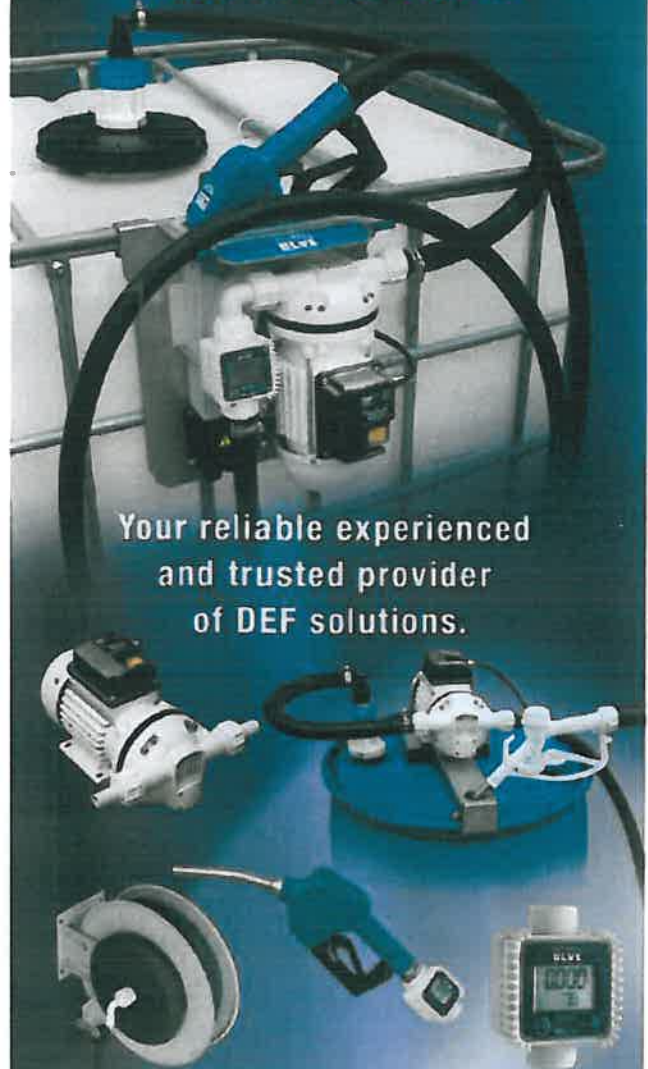
Unlike on-highway vehicles, the jobsite-bound Tier 4 machinery is used primarily in land grading, construction, road building, demolition, mining, farming and other industrial applications. Productivity is not measured in miles per gallon but in reliability and hours per gallon.

Fueling and fluid refilling are primarily handled on the jobsite by mobile units called “wet hoses” or at a contractor’s home terminal. While the supply chain for DEF used in Tier 4 vehicles is significantly different than that for on-highway applications, key factors like rising fuel costs and ready DEF supplies remain important as part of cost-containment efforts.

To meet the new emissions standards, most new off-road equipment will incorporate either exhaust gas recirculation or SCR emissions control technologies. Applications that are best

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suiting for the DEF-based SCR technology include airport ground support equipment, construction equipment (up to 750 horsepower), quarry trucks, mobile and aerial cranes, and lightly loaded military vehicles that have engines idling for long periods or intermittent duty cycles. These applications require reliable power over short periods of time but do not generate enough heat to passively regenerate or clean diesel particulate filters (DPFs), leaving them more susceptible to clogging.

Also ideal for SCR technology are high-powered tractors for agriculture, forage harvesters and combines above 100 horsepower. Some equipment manufacturers report that fuel consumption in SCR-equipped engines is running 19 percent below industry averages for other non-SCR equipment. SCR is the natural choice for agricultural applications that require enhanced cooling systems. Under these conditions, SCR reduces the cooling requirement, while offering reliable and durable power along with improved fuel efficiency.

Support for SCR growth in agricultural applications is positive. According to industry reports, 2011 combine sales are up 7.4 percent, due in part to higher commodity prices

and improvement in the dairy and livestock sectors (all of which also will contribute to increased sales of implements and hay equipment).

To manage the new emissions technologies, many engine compartments have had to be redesigned—to allow placement of the after-treatment system and accommodate larger air intake systems. Some equipment manufacturers place these new systems inside a reworked sheet metal skin, while others adapt traditional locations through additional shielding and mounting hardware.

With such a wide range of applications, Tier 4 engines and equipment vary in horsepower ratings, engine displacement, power/torque performance, fuel economy and other key characteristics.

Some SCR-equipped Tier 4 machinery will require a storage tank holding up to 15 gallons of DEF. The rate of consumption will depend on the equipment use, load factors and idle time. As with on-highway vehicles, indicator lights will warn the operator when the DEF supply is running low.

Tier 4 engines also will be electronically controlled by computers that monitor and adjust the fuel and air mixture for optimized emissions and engine performance.



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Incentive for Adoption



Growing pressure on government and private industry to “go green” will mean that contract specifications, job bids, project riders and contingencies will increasingly consider the emissions profile of equipment

in the award evaluation process. Public projects for transportation facilities and infrastructure will more often than not expect (or require) the use of new or retrofitted low emissions equipment.

According to the Diesel Technology Forum, “outside of California, there are presently no state laws requiring the mandatory retrofitting of existing, privately owned diesel engines or equipment. However, there are a growing number of states, including Illinois, New Jersey, New York and Rhode Island, that require the retrofitting of state-owned equipment or that which is under contract to the state.”

Since some of the oldest engines and machines have 20 to 40 times the emissions levels of a new Tier 4 engine, state and regional officials will be looking for cost-effective ways to accelerate the upgrade to new and retrofitted lower-emissions technology.

Going Forward?



Looking beyond 2014, the industry's focus on increasing fuel economy and lowering CO₂ emissions may lead to further exploration of hybridization, hydrogen injection technologies, electronic motors, batteries and storage systems.

Long-term, these goals also support the continued adoption of SCR technology—which potentially could mean exponentially increasing demand for DEF to serve both on-highway and off-road systems.

On behalf of the North American SCR Stakeholders Group, Quixote Group will moderate a DEF educational session on October 2 at the 2011 PEI Convention in Chicago. The session will discuss how the industry is meeting DEF supply and equipment needs for heavy-duty and medium-duty fleets, as well as the progress in distribution, storage, dispensing and packaging required to meet DEF needs for Tier 4 applications. 📍

Kim Doran is CEO of Quixote Group, www.quixotegroup.com, and editor of FactsAboutSCR.com.



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