The State of All-Elec Trucks in the U.S. Medium-Duty Market

More and more vehicle manufacturers are entering the electric vehicle market, but will companies be able to provide a medium-duty option that lives up to its gasoline-powered predecessor?

By Sean Lyden

The promise of all-electric medium-duty (Class 3-7) trucks is compelling. Fleets can eliminate fossil fuel use (and cost), achieve zero direct emissions, and reap the PR benefits that come with touting their commitment to sustainability. But, can medium-duty electric vehicles (EVs), or E-Trucks, become a practical reality any time soon?

High profile fleets, such as Frito-Lay, Staples, and Coca-Cola, have all made big investments in E-Trucks that can haul as much as 16,000 pounds, with a range up to 100 miles on a single charge.

According to Lisa Jerram, senior research analyst with Navigant Research, there are roughly 1,000 all-electric medium-duty trucks on U.S. roads today, with sales in this segment projected to reach 3,500 to 6,000 units per year by 2020, comprising 1 to 3 percent of the overall U.S. medium-duty truck market.

While that's only a tiny sliver of the total medium-duty market, these numbers still represent a steep growth curve through 2020. And, among medium-duty trucks used for under 100-mile daily applications, E-Trucks are expected to comprise 25 percent of that market in five years, predicted Tedd Abramson, founder and chief marketing officer for ZeroTruck, a manufacturer of all-electric medium-duty trucks from 12,000- to 19,500-pounds GVWR.

Working in the E-Truck Sweet Spot

What characteristics mark the ideal application for today's medium-duty E-Trucks?

Jerram said that duty cycles that present the greatest opportunity for E-Truck growth are urban delivery or other uses that fit these parameters:

- Return-to-base operation, where the vehicle returns at end of shift for overnight charging.
- Fixed route, within 40 to 80 miles round trip.
- A lot of stop-and-start driving to allow for regenerative braking.
- Diminishing load, where the truck gets lighter after each delivery, helping extend vehicle range.
- Lower-speed operation (usually below 60 mph) to preserve battery power.

Under these conditions, an EV actually offers a lower total cost of ownership (TCO) than a comparably equipped diesel truck, according to a recent study by the Georgia Institute of Technology. The study entitled "Electric Urban Delivery Trucks: Energy Use, Greenhouse Gas Emissions, and Cost Effectiveness" found that, in urban delivery routes with a lot of stop-and-start driving, EVs are roughly 50-percent more efficient to operate than diesel trucks overall, making them at least 20-percent less expensive in TCO. *(Editor's Note: See the November/December issue of* Green Fleet *for an in-depth overview of the study's results.)*

AT A GLANCE

Before going electric, fleet managers need to consider:

- Finding the right application for electric vehicles.
- Training drivers on the differences and similarities between EVs and gasoline-powered cars.
- Identifying the requirements for setting up an accessible charging station.
- Researching the availability of tax breaks and incentive programs.

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"For urban routes with lots of stop-and-go driving, electric trucks can be cheaper overall than diesel trucks," said Marilyn Brown, a co-author of the study and a professor in Georgia Tech's School of Public Policy. "Generally, the environmental and cost benefits work together: in urban driving, electric vehicles are markedly more efficient than diesel; this results in less energy use, less greenhouse gas emissions and lower costs on urban routes."

Making the Business Case

How can E-Trucks offer lower TCO than conventional vehicles, considering the initial investment can be as high as $80,000-$100,000 or more?

And, while there are federal and state government incentives that help narrow the price gap — New York State, for example, is offering vouchers on eligible Class 3-8 E-Trucks covering up to 80 percent of the incremental cost or a maximum of $60,000 per vehicle — there's still a long way to go to achieve payback.

According to the August 2013 report. "Battery Electric Parcel Delivery Truck Testing and Demonstration" by the California Hybrid, Efficient and Advanced Truck Research Center (CalHEAT), the business case hinges on minimum daily miles.

Three different scenarios were analyzed: a Class 4-5 parcel delivery E-Truck driving 25, 50, and 75 miles per day, five days a week, and 50 weeks a year, replacing an equivalent conventional diesel truck.

The report said that the 75-miles-per-day application offered the most compelling business case, with the higher up-front cost repaid in about five years from fuel and maintenance cost savings. But, as the vehicle is driven fewer miles per day, the business case worsens. At an average of 25 miles driven per day, for example, the payback would take longer than the 10-year vehicle lifetime.

The quantity of stops is also essential for E-Trucks to be viable because fewer stops means shorter available range due to insufficient opportunities for regenerative braking, the report said.

Staples currently utilizes 53 Smith Newton battery-power electric trucks in or near eight cities across the U.S. on routes that include lots of stops and limited miles.

The Operational Advantages

Here are three areas where E-truck payback in urban delivery applications can be especially attractive:

1. Fuel Cost Savings:

How do you compare the cost of electricity to recharge an E-truck versus a conventionally fueled vehicle?

The U.S. Department of Energy (DOE) recently launched an online resource (www.energy.gov/maps/egallon) that compares the cost of driving with electricity with gasoline, with the unit eGallon, which is the cost of fueling a vehicle with electricity compared to a similar vehicle that runs on gasoline. As of press time, the national average for gasoline is $3.22 per gallon, whereas the electric eGallon is $1.23 — about one-third the cost. While this is based on the price of gasoline, not diesel, it at least provides a frame of reference to perform reasonably accurate payback calculations.

2. Lower Maintenance Costs

The CalHEAT report noted that vehicles driven 15,000 miles per year achieve maintenance savings around $1,300 compared to conventional trucks.

The report cited the following reasons for the savings:

- The battery, motor, and associated electronics require little to no regular maintenance.
- There are fewer fluids to change.
- Brake wear is significantly reduced, due to regenerative braking.
- There are far fewer moving parts, relative to a conventional internal combustion engine.

3. Increased Productivity

Short-range applications that exceed 50 stops per day actually prove problematic for diesel-powered trucks with new diesel emissions technologies, such as diesel particulate filters (DPF) that require periodic regeneration cycles to burn off soot.

Since the vehicles rarely go faster than 45 to 50 mph in these applications, they don't have sufficient time to travel at highway speeds to allow for a full regeneration cycle during the course of daily business. Therefore, drivers need to take time out of their delivery schedules to either stop for DPF regeneration or travel at highway speeds long enough for the regeneration cycle to complete. Either way, this eats into driver productivity and fuel efficiency. With E-Trucks, the time lost for DPF regeneration is eliminated.

Overcoming the Challenges

The biggest challenge for E-truck expansion is the price premium above conventional trucks, which is largely driven by high battery costs. But, according to CALSTART's most recent E-Truck Task Force Report entitled "Best Fleet Uses, Key Challenges, and Early Business Case for E-Trucks," battery costs have been dropping and are expected to continue the trend, from a current $800 per kilowatt hour (kWh), to $500-$600 in 2015, $450 per kWh in 2020, and $300 per kWh by 2025.

To narrow the price gap in the near term, the report recommends rightsizing batteries to better match how the vehicle will actually be used. But, it's crucial to strike the right balance, said the report, because a smaller battery would require more frequent, deeper discharges, which could reduce battery life and increase cost in the long run.

Another cause for concern for fleets is the limited dealer and service network for E-Trucks. According to the E-Truck Task Force Report, fleets perceive there is little local support for E-Trucks and there are some high initial vehicle failure and reliability rates.

"While manufacturers have been generally very responsive to problems, local and regional support needs improvement, as does training for fleet technicians. The service network is not sufficiently built out, and parts are not in local supply," the report said.

One key for E-truck OEMs to expand their footprint and production capacity is greater access to capital, said Abramson with ZeroTruck.

"The industry needs investment banks, private equity, and venture capitalists to take another look at the commercial side of EVs versus just passenger EV markets. With EV trucks, there is a definable ROI for fleets of about three to five years," he said.

"The biggest challenge at this time is the lack of mass-produced medium-duty vehicles," added Andrew Daga, chief executive office for Momentum Dynamics, which develops high-power wireless charging technologies for the automotive and transportation sectors.

Daga noted that commercial EVs represent a vast market opportunity, where the economic justification is objective and clear to fleet operators. "To open this market, what is needed is the economic advantage of mass production to bring vehicle acquisition costs down," he explained. "The movement of a major commercial vehicle OEM into the medium-duty EV market will provide the business stability that fleet buyers are looking for. They require vehicle reliability, dependable supplies of spare parts, and warranty coverage. There are numerous smaller companies that can meet the technology need, but lack either stability or the ability to mass-produce and leverage an established supply chain."

Taking a Market Outlook

What are the prospects for E-Trucks going forward? "ZeroTruck believes that medium-duty EVs will represent 25 percent of the medium-duty market for fleets driving under 100 miles," said Abramson with ZeroTruck. "In 10 years, that number will double due to mandates for carbon output which only electric can achieve at sufficient payback. And, as battery technology evolves, longer-range markets will open up after the initial fleets demonstrate the reliability and return that EVs can offer."

Momentum Dynamics' Daga agreed: "Medium-duty electric vehicles will gain in range and reliability through the practice of rapid opportunity recharging. In the near term, we will see fleet managers assign EVs to their shortest routes until they gain confidence, but they will soon learn that they must put that vehicle to use on the longer, most stressful routes so it can really impact their costs. Again, it is rapid opportunity charging that will enable this to happen because rapid opportunity charging extends vehicle-driving range."

Daga predicted that there would be major automaker investments in the smaller "technologically agile" companies that are developing efficient EV power systems and drivetrains for the medium-duty market, with acquisition activity beginning in 2014. "I would also expect the major leasing and finance companies to move in concert with OEMs to provide EV-specialized financing programs that account for longer vehicle lifetimes and the inclusion of charging infrastructure," he said.

The ZeroTruck is an all-electric zero emissions medium duty truck based on the Isuzu N series chassis, featuring a low cab forward design and range up to 100 miles.

WHO'S BUILDING MEDIUM-DUTY EVs?

To learn more about E-Truck capabilities, check out these manufacturers websites:

- **ZeroTruck** (www.zerotruck.com)
- **Smith Electric** (www.smithelectric.com)
- **Boulder Electric Vehicle** (www.boulderev.com)
- **EVI-USA** (www.evi-usa.com)
- **AMP Electric Vehicles** (www.ampelectricvehicles.com)
- **Freightliner Customer Chassis Corporation** (www.freightlinerchassis.com)