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SPECIAL REPORT - ENERGY

Putting U.S. Trucking on a Diet

By ERICA GIES

SAN FRANCISCO — The backbone of U.S. commerce, given America's vast distances and reliance upon highway transportation, is the combined fleet of 500,000 U.S. long-haul trucks. And to many Americans, the macho trucking life holds a certain romance. It has, to be sure, its drawbacks, not least the pollution from all those rumbling diesels. But new technologies are emerging that should at least mitigate some of that.

A U.S. safety law requires truckers to rest for 10 hours after 11 of work, and most sleep in their cabs rather than paying for a motel. Traditionally truckers have idled their rigs while sleeping, keeping the engine going to provide heating or climate control and other creature comforts. This practice, along with workday idling, uses more than two billion gallons, or 7.6 billion liters, of diesel fuel a year, according to research at the Argonne National Laboratory, part of the U.S. Department of Energy.

Idling diesel engines are noisy and emit nitrogen oxide, volatile organic compounds, carbon dioxide and carbon monoxide.

As a response to increasing fuel prices and anti-idling regulations introduced by some cities and states, the industry has been exploring various alternatives. These include electrified parking spaces; auxiliary power units, or A.P.U.'s, for trucks, and detached heater or air-conditioner units.

"We are very much in favor of idle reduction," said Clayton Boyce, a spokesman for the American Trucking Associations, which represents trucking companies, their suppliers and private fleets. "Not running that main diesel engine for extended periods saves fuel and reduces carbon output and other emissions."

Electrified parking spaces, with plug-in electrical hookups for truckers, have increased in number over the past couple of years, sometimes with support from the sale of carbon offsets or government initiatives. They can provide truckers with heat, air-conditioning, electricity, even access to the Internet and satellite TV.

Two forms exist: single-system electrification and shore-based power. Single system requires no investment from the trucker aside from a \$10 plastic window adapter. IdleAire, the industry leader, uses this format.

Shore-based power requires the trucker to install some equipment: detached heater and air-conditioning units, professionally installed inside the truck, can cost around \$2,500. A less-costly approach is to buy a portable air-conditioner or heater powered by an extension cord run through the window. One company, Shorepower Technologies, sells a \$199 kit that includes a portable heater, an extension cord, a truck inlet, a junction box and wiring for the cab.

With electrified parking spaces, truckers do not have to pay high upfront costs, and truck-stop owners can benefit from a revenue-sharing model: but there are approximately 5,000 truck stops across the United States and IdleAire has spaces at only 129 of them in 34 states. Shorepower has even fewer.

In fact, there are not enough regular parking spaces at truck stops for the number of truckers on the road, let alone electrified ones, says Lamont Byrd, director for safety and health for the International Brotherhood of Teamsters, a union that represents truckers. The result is that truckers frequently just pull off by the side of the road to rest.

“My nightmare is I’m driving across Nebraska in January,” said Linda L. Gaines, a transportation systems analyst with the Argonne laboratory who has a doctorate in physics. There’s an electrified stop “100 miles up the road, and I even know there’s a spot available for me,” she said. But if it is snowing and it is slippery, “I’m going to pull off the road and rest here. And I’d better have something onboard the truck.”

“Something” could be an auxiliary unit. But A.P.U.’s weigh around 400 pounds, or 180 kilograms, and cost up to \$10,000: and they burn fuel, though more efficiently than truck engines.

Firing up an A.P.U. generates electricity to power the heater and air-conditioner contained in the unit. A less-costly onboard option is a direct-fired heater, which costs about \$1,200 and burns fuel to transmit heat directly to the air or to the engine’s coolant system. That can be paired with a separate air-conditioning unit for about \$4,000. Options include electrical battery and thermal energy storage. Both supplemental heating and cooling can also provide electricity for other appliances.

In the future, truckers may not have to choose between stationary and mobile technologies. Many new trucks and A.P.U.’s incorporate heat and air units that can run on either fixed or mobile power sources. IdleAire and Shorepower hope to capitalize on this development.

Trucks burn about a gallon an hour while idling, making the price per gallon of diesel fuel — around \$2.22, or 59 cents a liter, in early May — roughly the hourly rate to beat.

IdleAire has a basic service rate of \$2.89 an hour, with extra charges for games, satellite TV, movies, Internet and phone options. The price reflects the expense of building its parking spaces, which cost an average of \$15,000, according to Wray Williams, its director of sales and marketing.

An over-rapid expansion from 2006 to 2008, coupled with the recession, sent the company into bankruptcy protection in May 2008, but it has since been purchased and refloated by new investors.

A Shorepower pedestal, meanwhile, costs about \$8,000, according to Joseph Licari, the company’s director for eastern operations. Shorepower charges \$1 to plug in and \$1 an hour.

Still, neither model competes on an hourly basis with A.P.U.’s, which burn about one-quarter gallon an hour, or detached heater and air-conditioners, which use even less. “If I’m a trucker and I’ve got an A.P.U. on my truck, to operate that overnight, that’s a couple of gallons, or \$4 to \$5,” Dr. Gaines said. “Whereas to check into an IdleAire location, it’s \$2.89 an hour, so it costs you \$30.”

But price is not the only factor. “We had 17 million hours of service in 2008,” Mr. Wray of IdleAire said. “That’s 200,000 unique users.”

The extra amenities appeal to truckers, said Terry M. Levinson, a senior project manager at Argonne who has been researching idling reduction for about 20 years. “If you’re going to be competitive and you’re a stationary source, you’ve got to find a way to convince a trucker that you offer more than the cost of fuel.”

There are no data about market share for these idling-reduction technologies, but an internal estimate from the Environmental Protection Agency showed more than 25,000 A.P.U.’s sold in 2007, and more than 83,000 direct-fired heaters. IdleAire’s usage data indicates that 40 percent of long-haul truckers have tried the company’s stops, according to Dr. Gaines. Yet each averaged just nine visits in a year in which they were probably on the road more than 200 nights. The company averaged 23 percent occupancy for its spots.

Major interstate intersections would be the target markets for IdleAire’s future expansion, Mr. Williams said. Still, Dr. Gaines said she doubted whether truck-stop electrification would ever reach a critical mass: “There are so many places trucks drive that are so unpopulated that economically it would never be likely to pay,” she said.

While the cost to truckers and feasibility will determine which technology succeeds commercially, reducing environmental and human health damage is their primary purpose: and determining which one does that best is not simple.

A.P.U.’s, which burn diesel, generally cause more emissions than electrified parking spaces or a detached heater and air-conditioner, but newer trucks emit less to run battery and thermal storage units, which are charged while driving.

Of all the technologies, electrified parking offers the sharpest reduction in nitrogen oxides, an ingredient in smog that causes asthma and other lung problems. A.P.U.’s release one-quarter the carbon dioxide emissions of idling, and electrified parking releases one-sixth. Separate heaters and air-conditioners release one-eighth, Dr. Gaines said.

Particle pollution attributable to the electricity used in electrified parking spaces, however, can be higher in some areas than the pollution because of other technologies. Inhalation of microscopic particulate matter — comprised of nitrates, sulfates, organic chemicals, metals, soil and dust — can cause damage to the heart and lungs.

“If you’re in a location where a lot of the electricity is generated by coal, then there are a lot of particulate emissions from the coal-fired power plants and also the mining, processing and transportation of the coal,” Dr. Gaines said. “On the other hand, in California, most of the electricity is developed from clean hydro and natural gas. And so the emissions are considerably lower.”

Still, all of these methods are an improvement over idling, and the American Recovery and Reinvestment Act of 2009 has allocated \$378 million to the Department of Energy to reduce transportation emissions as part of its effort to clean the environment while stimulating the economy.

Of that, \$10 million to \$75 million will go to idling-reduction technologies. The Environmental Protection Agency has also directed \$300 million in Recovery Act money toward a campaign to reduce emissions from diesel engines.

An E.P.A. program called the SmartWay Transport Partnership offers low-cost loans for truckers to buy wide tires, aerodynamic fairings, diesel oxidation catalysts, diesel particulate filters and A.P.U.'s.

If fuel prices rise again — and stay high — demand for long-haul trucking may wane as economies grow more local, less global. Meanwhile, idling-reduction technologies can help truckers provide cleaner service, while maintaining their allegiance to the open road.

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