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'Magic' Fuel-Saving Buses Fall a Bit Short on Wonders
By MATTHEW L. WALD

WASHINGTON, Dec. 25 - The fleet of hybrid buses that General Motors promised would save Seattle more than 750,000 gallons of fuel a year will actually save less than half that amount, according to the fleet operator, and although G.M. said the hybrid buses would show a fuel economy improvement of up to 60 percent, the savings around the country appear to be in the range of 10 percent to 20 percent, transit managers say.

General Motors, which got a late start bringing hybrid technology to market in cars, has argued that buses are a better vehicle to convert to hybrid drive, because they are used more heavily than cars.

"We decided we would go after hybrids by going after the highest consuming vehicles first" because that would save the most petroleum, said Tom Stephens, a G.M. vice president for powertrains.

The company is also creating hybrid versions of its pickup trucks and sport utility vehicles, although their hybrid systems are relatively small adjuncts to the gasoline engines.

But the fuel savings for G.M.'s bus hybrids, which it named "magic buses," are more modest than for some bus hybrids already in use, and even at the current elevated price for diesel fuel the savings are unlikely to repay the cost premium for a hybrid, about \$200,000, experts say. There are other benefits, however, including lower maintenance costs and smoother, cleaner operation.

All hybrids are powered by both an internal-combustion engine and an electric motor, but G.M. chose a "parallel" approach, in which the engine and the electric motor turn the wheels simultaneously, a technology more suited for freely flowing traffic. Some bus agencies report greater fuel savings using a "series" hybrid, in which the engine is connected only to an electric generator, with all the power to the wheels coming from an electric motor.

Some of the best results for hybrid buses have been for series hybrids running in extremely congested cities. New York City, for example, has more than 100 series hybrids on the streets and next month will begin receiving the first of an additional 200 buses with a hybrid drivetrain built by BAE Systems of Johnson City, N.Y., with a fuel savings of 35 percent to 45 percent, according to transit officials.

Electric motors excel at getting a heavy bus moving from a standing start, and when it is time to stop again - which in New York is often only a few yards later - the hybrid system recaptures a lot of that energy by converting the momentum of the bus into electric current, which flows back into the batteries. The batteries are also directly charged by the diesel engine.

But the series system is not well suited to buses in highway use, experts say, because converting the energy from the diesel engine into electricity, and then putting the electric current through a motor to turn the wheels, is not as efficient as simply connecting the

diesel engine to the wheels through a conventional transmission. In the parallel system, the bus wheels are driven by both a conventional transmission and an electric motor. Either type can reduce air pollution, by cutting the amount of time that the diesel engine operates at very high strain and low revolutions per minute. As is obvious to any urban pedestrian, that is when diesels give off great clouds of dark smoke. With an electric motor to assist or take over at start-up, though, the diesel engine can run at a higher speed and lower strain, a range in which it is cleaner.

The buses in Seattle, which ordered 235 hybrids, were chosen mostly for cleanliness, said Jim Boon, the maintenance manager at King County Metro Transit. The buses go through a tunnel under the downtown section, a little more than a mile long, which has limited ventilation.

"We're quite happy, actually," said Mr. Boon. "We did not buy these for fuel economy." According to G.M., both the company and the King County transit authority concluded from early tests that a fuel savings near 60 percent was possible.

Connecticut Transit, a state bus agency, is running two 40-foot buses with the G.M. hybrid transmission. They started in Hartford and have been running in Stamford since June. Stephen W. Warren, the assistant general manager for maintenance, said that drivers and customers liked them because they were smooth and fast. But, he added, "We were slightly disappointed with the fuel economy," which he said was 10 percent to 15 percent better than new buses of conventional design.

New Jersey Transit runs seven of the buses. The agency bought them believing they would save 20 percent to 40 percent on fuel, and the actual savings have been at the bottom of that range, said Penny Bassett Hackett, a spokeswoman. New Jersey paid \$600,000 to \$800,000 extra for each of its buses, and had no possibility of earning that back, she said, but paid for the extra cost with a grant meant to stimulate new technologies. "The buses are achieving what they are intended to do, and that is emissions reduction," Ms. Bassett Hackett said.

At the American Public Transit Association, an association of transit agencies based in Washington, Lurae Stuart, senior project manager of Bus Technical Programs, said: "We don't define 'good' as fuel economy. We define good as the combination of emissions, brake savings and acceleration, which saves time and scheduling."

Still, many experts expected the hybrid to do better, and they disagree about why it does not. Mr. Boon, of Seattle, said that at the time his agency switched buses, it also switched to new engines, which comply with a 2004 Environmental Protection Agency standard for reduced emissions of nitrogen oxides and soot, and that the new engines were less fuel-efficient than the old ones. In fact, he said, an old engine would make the hybrid nearly 60 percent more fuel efficient.

But Caterpillar, the company that makes the engine used in the Seattle buses, said that while some competitors' engines that met the new standard were about 5 percent less fuel efficient, its engine used a different approach, which it has patented, that unlike the others did not reduce fuel economy.

An E.P.A. spokesman, John Millett, said his agency certified the engines only for emissions, not fuel economy, and did not know what effect, if any, its requirements had had on mileage. A more stringent set of emission rules takes effect in 2007.

At General Motors, Larry Nitz, director of hybrid powertrain engineering, said the 60 percent estimate was based on a treadmill-type test, and the 750,000 gallon estimate was a separate calculation based on side-by-side tests using a hybrid and a conventional transmission, and older engines. "I think we're doing what we expected to do in Seattle," Mr. Nitz said in a telephone interview.

Others say that the technology has promise for several reasons, and that fuel economy could improve as the vehicles are tweaked, with better software controlling the hybrid powertrain.

In the Philadelphia area, the Southeast Pennsylvania Transportation Authority is operating 32 G.M. hybrid buses but is not tracking their fuel economy, which would require precise comparison with conventional buses running on exactly the same routes.

But Patrick Nowakowski, the assistant general manager of operations, gave an indication of how well the buses were performing. "We're not getting worse mileage," he said, "but if somebody's justifying the cost differential based on fuel savings, it's a stretch."

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