

Memo

To: Dongquan He
From: Michael P. Walsh
Date: June 3, 2005
Re: New York City Bus Fleet Upgrade Status¹

Background

NYCT began to evaluate “clean fuel” technologies designed to significantly reduce bus exhaust emissions in 1988. At that time, virtually all transit buses were powered by 2-stroke diesel engines, and the EPA had only recently begun to regulate diesel emissions. After review of the available technologies, NYCT decided that buses powered by compressed natural gas (CNG) were the most promising, and between 1990 and 1993 purchased one dual-fuel and two dedicated CNG buses for testing in service.

In 1994 NYCT purchased 31 Orion V CNG buses to join the 3 RTS-model CNG buses that had been operating. In 1995 NYCT leased a small “slow fill” compressor station from the local gas utility. The CNG station was installed at the Jackie Gleason depot in Brooklyn. At the same time, changes were made to a small portion of the depot so that work could be done safely on CNG buses in 3 maintenance bays. This significant pilot fleet of CNG buses went into revenue service at the Jackie Gleason Depot in October 1995.

Based on the experience with the pilot CNG bus program at Gleason Depot, in 1996 NYCT forged its first Clean Fuel Bus Plan. The plan included the conversion of Jackie Gleason Depot to full CNG operation, the construction of Coliseum Depot as a CNG-compatible depot, the identification of a depot in Manhattan to be made CNG compatible, and a commitment to purchase a total of 500 CNG buses. The 1995 - 1999 Capital Program was amended to accommodate the commitments made in the Clean Fuel Bus Plan, by authorizing projects to complete the full facility modifications at the Jackie Gleason and Coliseum depots, construct fast-fill CNG fueling stations at these depots, and purchase a total of 315 CNG buses.

¹ Based on Personal Communication with Dana Lowell, formerly with the NYCT and Rich Kassel, NRDC.

While NYCT was beginning to incorporate CNG vehicles into its fleet, it continued to explore other options. In 1992, the MTA Board authorized efforts to develop a new and promising clean fuel bus technology called hybrid diesel-electric propulsion. In 1993, NYCT kicked off a project to design and develop a prototype hybrid-electric bus. This first hybrid project, with Orion Bus Industries and General Electric, resulted in the development of a prototype vehicle for non-revenue testing, which was completed in 1996.

In 1995 NYCT entered into a second hybrid bus program, with the Allison Transmission Division of General Motors, to retrofit a hybrid propulsion system into an existing NYCT bus. That bus operated in revenue service in 1999 as a further demonstration of hybrid-electric technology.

Based on the success of the prototype hybrid-electric bus, NYCT proceeded in 1998 to award contracts for a pilot fleet of hybrid-electric buses. It began operating hybrid-electric buses in revenue service in September 1998. Based on the experience with these 10 buses, NYCT proceeded with plans to expand the fleet; and in 1999 it purchased 125 hybrid-electric buses under the 1995-1999 Capital Plan.

In October of 1998, NYCT responded to an RFP from the New York State Department of Environmental Conservation (NYSDEC) asking for "Clean Diesel Demonstration Projects". NYCT was subsequently awarded a grant to complete the proposed demonstration of catalyzed particulate filters, in conjunction with ultra low sulfur diesel fuel (ULSD). The full project included a 50-bus in-service field test of the CRTTM catalyzed diesel particulate filter (DPF) made by Johnson Matthey, Inc., as well as significant emission testing. The goals of the project were to verify/demonstrate the CRT's effectiveness at reducing particulate emissions and its durability in the demanding service environment at NYCT.

The CRT demonstration program kicked off in February 2000, when NYCT put 25 buses equipped with CRTs into regular revenue service in Manhattan. At the same time, NYCT began an emissions test program at a test laboratory in Canada. The program was extremely successful, demonstrating that particulate filters in conjunction with ULSD are durable on 4-stroke diesel engines in NYCT service and could reduce particulate, hydrocarbon, and carbon monoxide emissions by 88-95% compared to modern diesel engines with catalyst mufflers.

More Recent "Clean Fuel" Commitment

In April 2000, NYCT forged a new clean fuel plan based on the successful results from its various clean fuel technology programs. This plan was fuel and technology neutral, incorporating several approaches intended to result in significant emissions reductions in the shortest possible time frame. Specific projects, and \$304 million in funding in the MTA's 2000 – 2004 Capital Plan, backed up these commitments. The Clean Fuel plan included these specific commitments:

- NYCT will use ultra low sulfur diesel fuel in its entire fleet of diesel buses starting in the year 2000. This fuel has 90% less sulfur than standard commercial diesel fuel and will result in immediate emissions reductions from every bus.

- NYCT will retire all of its oldest, most polluting diesel engines by the end of 2004. In some cases these engines will be removed from service up to 6 years earlier than they otherwise would have been based on normal bus replacement cycles. These 2-stroke engines built prior to 1993 will be replaced with the latest technology engines that are up to 94% cleaner. Some engines will be retired by replacing older buses with new buses. However, up to 700 older buses will be “repowered” with new engines.
- NYCT will equip all of its diesel buses with diesel particulate filters (DPF) by the end of 2004. This new emissions control technology has been proven to reduce diesel particulate emissions from new engines by up to 95%
- NYCT will expand its CNG bus program to three depots (Jackie Gleason, the new Coliseum Depot, and Manhattanville Depot) and will purchase 250 more CNG buses in the next 5 years. This will bring the CNG fleet to a total of 600 buses. All new depots will also be made “CNG-compatible” so that the program can be expanded further in the future.
- NYCT will expand its hybrid-electric bus program by purchasing 200 more hybrid buses in the next 5 years. This will bring the hybrid fleet to a total of 335.

Status Of “Clean Fuel” Commitments in 2004

By the middle of 2004, NYCT’s clean fuel program plans had largely but not completely carried out:

- **CNG BUS PROGRAM:** NYCT had 312 CNG buses operating from Jackie Gleason depot. The West Farms depot opened as a CNG facility in September 2003 and had 15 CNG buses assigned. NYCT had 130 CNG buses on order. These buses are intended to be assigned to West Farms depot. The Manhattanville Depot CNG conversion project is in final design and the contract for construction was expected to be completed in late 2006. The approved capital program included funding for an additional 120 CNG buses, for delivery coincident with the opening of the Manhattanville Depot as a CNG facility.
- **HYBRID BUS PROGRAM:** NYCT’s 10 pilot hybrid buses remain in service, and have accumulated over 800,000 revenue miles. NYCT has an additional 325 hybrid buses on order. These hybrid bus deliveries have been delayed due to problems at the bus manufacturer.
- **ULSD IMPLEMENTATION:** NYCT converted its entire diesel fleet to ultra-low-sulfur diesel fuel in September 2000. This fuel has a sulfur content of 30 parts per million. At that time, NYCT signed a 3-year agreement for purchase of approximately 40 million gallons/year, which expired in September 2003. In July 2003, NYCT competitively bid and awarded a new 5-year ULSD fuel supply contract.
- **DIESEL PARTICULATE FILTER PROGRAM:** NYCT has installed diesel particulate filters (DPF) on 2,107 buses, and additional retrofit installations are on-going daily. In addition, 542 buses were delivered new from the factory with filters installed, so that there are currently 2,649 buses in the fleet with filters installed. NYCT is currently taking delivery of 260 articulated buses which are coming from the factory with filters installed, has contracts in place for the purchase of additional filters for retrofit, and expects to have filters installed on the entire diesel fleet (4,000+ buses) soon.
- **ENGINE REPOWERING PROGRAM:** NYCT has completed the “repowering” of 642 buses originally delivered in 1990 and 1993 with 2-stroke 6V92 engines by installing new Detroit Diesel Series 50 engines with exhaust gas recirculation. All of these new engine installations include a

diesel particulate filter. They also repowered 31 1995 CNG buses with new Detroit Diesel Series 50 Natural Gas engines in order to alleviate chronic reliability problems with the early generation natural gas engines originally installed in these buses. This part of the program has been completed. NYCT had less than 300 buses with older 2-stroke diesel engines in service. All of these buses will be retired as new CNG, hybrid, and DPF-equipped diesel articulated buses are delivered.

Latest (April 2005) Revisions From NYCT

New York City Transit has just decided not to convert the Manhattanville Bus Depot into a compressed natural gas fueling center. The conversion was to have been part of a broader effort to clean up the agency's fleet of 4,512 buses by gradually replacing the oldest diesel buses with natural-gas vehicles and with diesel-electric hybrids. Instead, the depot will continue to house diesel buses.

Meanwhile, the agency will shift new purchases from natural-gas buses to hybrids. (There are 346 transit agency natural gas buses on the streets now, and 126 hybrids; new orders will be hybrids.) The agency argues that hybrids do not require the special compressors and fueling stations that natural-gas buses do. And hybrids are, in fact, almost as clean as the natural-gas buses.

But they also cost as much as \$150,000 a bus more. This means that the money originally allocated for 120 new natural-gas buses and 55 extra-long clean-diesel buses will buy only 100 hybrids - leaving 75 of the old diesels on the street.