

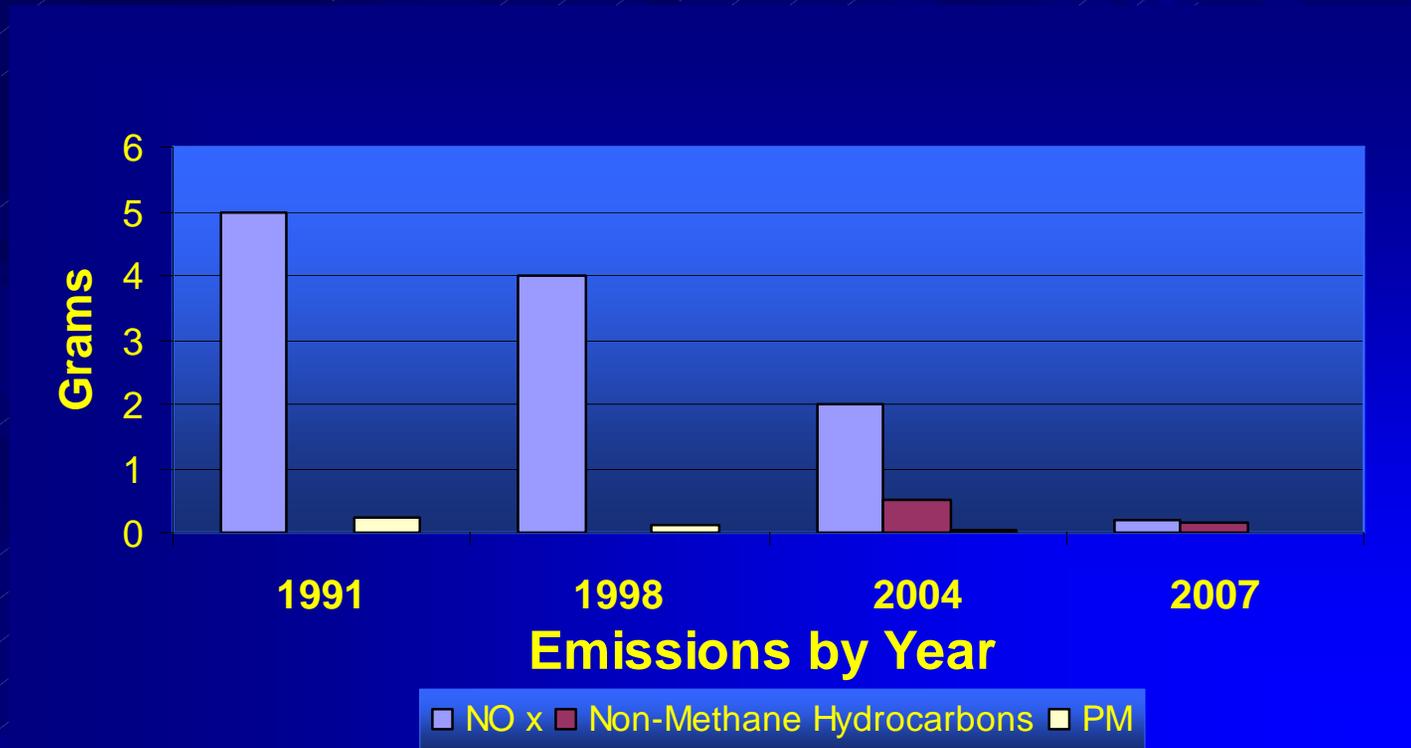
Alexandria Transit Bus Fuel Options



DESCRIPTION OF OPTIONS

- Conventional diesel buses w/ clean diesel engines using ultra-low-sulfur fuel
- CNG buses
- Diesel-electric hybrid buses
- Fuel cell buses

EPA Emissions Standards



All figures in grams per brake-horsepower-hour
•Source Metro Magazine May 2002

Current DASH Fleet and Facility Status

- Bus fleet currently using low-sulfur diesel fuel.
- 14 new clean diesel buses delivered and placed into revenue service in 2005. Replaced 14-1991 (oldest model) buses.
- Entire bus fleet will operate on ultra-low-sulfur fuel with new buses also equipped with Continuously Regenerating Technology (CRT) exhaust filters.
- Current facility has one 10,000 gallon underground fuel storage tank.
- New DASH facility in design phase and scheduled for completion in 2009.

“Clean Diesel” Buses using Ultra-Low-Sulfur Fuel

- Emission NOx reduction is comparable to CNG, with other emission levels actually lower than CNG. Sulfur level of 30 ppm (350 - 500 ppm standard).
- Modern diesel engines are 94% cleaner than engines purchased 10 year ago.
- Retirement of older diesel buses and replacement with new buses is an effective and cost-effective emissions reduction strategy.

CNG Buses

- Currently, most widely used alternative fuel.
- Advantages include: availability of vehicles and fuel, more than a decade of operating experience, and very low particulate matter emissions.
- Disadvantages include: considerable infrastructure costs for handling fuel and upgrading safety systems, lower reliability and fuel efficiency, variable nitrogen oxide emissions. CNG carbon monoxide and hydrocarbons emissions (greenhouse gases) are higher than clean diesel.

CNG Buses

- **Estimated costs include:**
 1. Infrastructure costs (new facility) – estimated \$6 to \$10 million.
 2. Current facility cannot accommodate CNG retrofit.
 3. Safety modification costs.
 4. Significantly greater costs for constrained urban sites. Natural gas pipeline issues.
 5. Capital costs for buses and operating costs significantly higher.

CNG in Transit

Lessons Learned

- CNG Buses work - they can be used to successfully provide passenger service.
- CNG Buses are only 50 - 75 % as reliable as comparable diesel buses.
- CNG buses are 20-40% less energy efficient than diesel buses, especially in urban service.
- CNG buses are significantly more expensive to operate than diesel buses.

Hybrid Diesel-Electric Buses

- Recently become commercially available.
- Combines best features of diesel and electric propulsion.
- Advantages include: very low emissions, excellent fuel efficiency, and excellent acceleration from stops.
- Disadvantages include: relatively new technology with limited operating experience in revenue service, but becoming less so.
- High initial vehicle cost but costs are coming down. About \$250,000 more than diesel.
- Maintenance cost higher and limited service experience.

Why not Hybrid Buses Now?

- Current facility constraints for maintenance of new technology vehicles and storage of batteries.
- Capital bus costs are almost twice that of diesel buses.
- Lack of operational and service experience.
- Reliability has not been fully tested, but performance shows promise.
- Higher operating costs.

Fuel Cell Buses

- Emerging technology as a prototype vehicle.
- May become available for revenue service within the decade.
- Advantages include: very low emissions and quiet operation.
- Disadvantages include: very high purchase costs, very limited operating experience, and an absence of established commercial bus manufacturers.