



Alternative Fuel
Information Series

February 2001

Alternative Fuel

NICHE
MARKETS

Airports

U.S. DEPARTMENT of ENERGY,
OFFICE of ENERGY EFFICIENCY and RENEWABLE ENERGY

Airport-based Alternative Fuel Vehicle Fleets

Airports represent attractive opportunities for the expanded use of alternative fuel vehicles (AFVs). They are commonly served by dozens of fleets operating thousands of vehicles. These fleets include both ground service equipment (GSE) such as tugs, tows, and baggage tractors; and landside vehicles including buses, shuttles, taxis and limousines.

Airport fleets are uniquely suited for AFVs for many reasons:

- They travel contained routes conducive to central fueling.
- Airport fleets typically travel many miles each day and consume large quantities of fuel, which can result in significant fuel cost savings.
- Their duty cycles include long idle times and frequent stops. AFVs can help these fleets reduce engine wear, pollution, and fuel costs.

- GSE often stays in operation for decades, providing long-term air quality benefits and cost savings, since incremental expenses can be amortized over many years.
- AFVs can help fleets improve the image of airports by reducing the exposure of travelers to noxious ground-level emissions from gasoline and diesel vehicles. This pollution is often trapped in curbside environments by overhangs, awnings, and buildings.
- Airport fleets are highly visible to the traveling public, providing the opportunity to educate the public to the benefits of AFVs and their broad proven applications, and to provide corporate stewardship in the community.

Opportunities for increased use of AFVs at airports

The need for cleaner air

More than one-quarter of all commercial airports operating in the United States are located in air quality non-attainment areas. As federal controls become increasingly stringent for industrial sources, airports are emerging as a major source of pollution and are projected to be responsible for up to 10% of total emissions in some urban areas. The need to improve air quality is the single most dominant factor accelerating the use of AFVs at airports. Air travel is the fastest growing segment of the transportation industry. These trends have placed unprecedented pressure upon airports to grow, with almost two-thirds of the biggest 100 planning expansion.

To receive regulatory approval, airports located in non-attainment areas must show that their growth will “conform” with air quality plans for the region and that, at a minimum, enforceable programs will be established to offset any projected increases in pollution. Motor vehicles are typically the largest single source of pollution at airports, exceeding the contribution of aircraft.



Electric shuttle buses are among the diverse mix of AFVs at Los Angeles International Airport.

AFVs provide the quickest, most cost-effective and least intrusive strategy available for achieving significant reductions in a broad range of pollutants. For these reasons, a national trend seems to be emerging in which regulators are placing the onus for airport pollution reductions largely upon the fleets that serve airports.

Economic benefits

Airport fleets, both GSE and landside vehicles, operate in highly competitive environments where cost containment is key to profitability. Fuel is one of the greatest and most variable operating expenses for fleets. AFVs can save high-mileage fleets thousands of dollars per vehicle each year in fuel and can reduce maintenance costs.

Los Angeles International Airport, for example, estimates that in 2000 its fleet of 42 liquefied natural gas (LNG) buses saved it almost \$185,000 in fuel and maintenance costs compared to its diesel counterparts. A variety of programs have also been implemented at the Federal, state, and local levels and through the private sector to reduce the incremental costs of vehicles and infrastructure. A growing number of airports facing air quality challenges are also requiring the use of clean operating AFVs as a criteria in awarding concessionaire contracts.

Infrastructure development

One of the hurdles to using AFVs is the lack of fueling infrastructure. Sustaining infrastructure is dependent upon dispensing adequate quantities of fuel to make facilities economically viable. Because of the dense clustering of multiple fleets in one location, airports are ideally suited as “activity centers” or anchors for the dual creation of both airport and regional fueling infrastructure. This is made possible by the fact that airports are commonly located along highly traveled interstate and regional transportation corridors providing convenient fueling locations for both the public and private fleets.

For this reason, many airports are striving to build their stations at strategically located sites easily accessible to airport ground service equipment, airport based landside fleets, and the general public.

Airport case studies: Building upon experience

Boston Logan International Airport: AFV Summary

The Massachusetts Port Authority (Massport):

- 32 natural gas transit buses
- 2 natural gas F-250 pick-ups
- 3 natural gas E-250 vans
- 1 natural gas Crown Victoria sedan
- 2 electric shuttle buses
- 8 electric Chevy S10 pick-up trucks
- 2 electric (Solectria) e-10 pick-up trucks
- 4 electric (Solectria) sedans
- 4 electric (Solectria) vans
- 9 natural gas miscellaneous light duty vehicles

Private fleets:

- 25 natural gas vans (Avis, National and U.S. Shuttle)

Airside fleets:

- 39 electric tugs, tows, and baggage conveyors (American)
- 7 electric and 4 natural gas service vehicles (Hudson General)

MassPort operates the Logan, Hanscom and Worcester Regional airports, and the Port of Boston. Logan is home to more than 100 AFVs, most of which are electric and natural gas powered. Currently, one out of every seven people accesses Logan via an alternate fueled shuttle vehicle. The impetus for Logan’s AFV program came from the need for cleaner air, the desire to expand, and state and federal energy policy that encourages the use of alternative fuels.

Because MassPort is a state entity under the Energy Policy Act (EPAct), 75% of the new vehicles purchased for its fleet must use alternative fuels. Grants and incentive programs have also played an important role in the purchase of AFVs and infrastructure. Grants have been provided through Boston Gas, the U.S. EPA, the U.S. Department of Transportation’s Congestion Mitigation and Air Quality (CMAQ) Program, and through a settlement agreement with General Motors. MassPort

PIX 09764



Several private transport providers run natural gas shuttle buses at Boston Logan International Airport.

PIX 09773



Boston Logan International Airport operates 32 natural gas transit buses.

is also using environmental permits and certificates to encourage tenants to replace their older vehicles with AFVs. For example, it is requiring Delta Airlines to use alternative fuel GSE as a condition for receiving approval to build its new Terminal A. This requirement is expected to bring as many as 100 new AFVs to the airport.

Logan currently has one 24-hour fast-fill natural gas station in operation, dispensing about 60,000 gasoline equivalent gallons of natural gas each month. A second station is also planned to support a shuttle service from the nearby Boston Seaport District. About 30 electric charging stations have been established at Logan, with additional stations planned for Hanscom and Worcester Airports.

In terms of “lessons learned,” the Boston area AFV advocates advise: 1) It is essential to have strong airport leadership and an airport-based champion; 2) Seek regulatory support through consistent air quality and energy policy directives at the state and federal levels, which can help build the momentum for AFVs at airports; 3) Funding from the government and private sector is key to making AFVs and infrastructure more

attractive to fleets; and 4) Be patient. Building a viable AFV market takes time and must be viewed as a long-term investment.

MassPort’s AFV champion is Doug Wheaton. Doug is the Director of AFV Programs and can be reached at dwheaton@massport.com 617-561-1621. The Web site for MassPort is <http://www.massport.com/logan>.

Denver International Airport (DIA): AFV Summary

City and County of Denver (DIA):

250 natural gas buses, shuttles, pick-ups and light duty vehicles

Private fleets:

- 75 natural gas rental car shuttles
- 1 natural gas rental bus
- 15 natural gas vans (SuperShuttle)

Ground service equipment:

- 140 natural gas tractors, tugs, and baggage conveyors (United)
- 325 electric tractors, tugs, and baggage conveyors (United)

More than 800 AFVs currently operate at DIA. About two-thirds are natural gas and the remainder are electric. DIA’s program originated in 1987 at its predecessor’s site, Stapleton Airport, to help address metro Denver’s air quality problems. Since then, the program has grown due to strong outreach between the airport and its tenant airlines, most notably United. AFV numbers have also grown as a result of numerous requirements and incentive programs implemented by Denver and the Colorado Legislature, with strong and

PIX 09785



In service vehicles and ground service equipment, the incremental costs of alternative fuels can be amortized over several years.



PIX 09781

PIX 09779



Los Angeles International Airport has incorporated three natural gas garbage trucks among more than 500 AFVs.

ongoing leadership from the region's dominant natural gas supplier. The need for AFVs was further reinforced by the desire to protect the health and safety of workers through the tunnels, which are the primary conduit for baggage, goods, and services. Only natural gas and electric vehicles are permitted to operate in the tunnels based upon their superior safety and air quality history. DIA has also integrated AFV requirements into concessionaire agreements signed with car rental companies providing shuttle service to DIA.

Eight natural gas fuel stations now operate at DIA. Two provide public access. There are also about 300 electric charging stations, primarily serving United's GSE. Due to the cleaner operation of natural gas vehicles, both DIA and United report service-interval reductions of one-half to two-thirds. They also indicate that the warranties now available on original equipment provide greater assurance of reliable operation. DIA anticipates a 50 percent increase in the number of AFVs operating in their fleet by 2003.

In terms of guidance to other airports, DIA emphasizes that a "team oriented" relationship among the airport, airlines, service-oriented fleets, and the fuel supplier has been key to working through the challenges and helping the AFV program grow. The need for cleaner air provides important impetus to encourage the expanded use of AFVs by airport fleets. Economic incentives and mandates have both played key roles in building and maintaining momentum to expand the use of AFVs at airports.

DIA's AFV champion is Terry Henry. Terry is the Director of Aviation/Fleet Maintenance and can be reached at 303-342-2885. The Web site for DIA is www.flydenver.com.

Los Angeles International Airport (LAX): AFV Summary

Los Angeles World Airports:

- 176 natural gas vans, sedans, pick-ups
- 3 natural gas garbage trucks

Private landside fleets:

- 150 natural gas vans (SuperShuttle)
- 14 natural gas vans (Xpress Shuttle)
- 11 electric vans (Xpress Shuttle)

Airside fleets:

- 174 electric tugs, tows, and baggage conveyors (United)
- 64 natural gas and propane tugs, tows, and baggage conveyors (United)
- 99 electric tugs, tows, and baggage conveyors (American)

Over 500 AFVs currently operate at LAX. The majority of these vehicles are natural gas and electric powered. There are 49 buses operating on LNG and a few vehicles operating on propane. LAX's AFV program began in the early 1990s to help address mounting air quality problems and in recognition that the airport and its tenants would likely have greater flexibility in responding to anticipated air quality requirements if they were proactive versus reactive. Their efforts to expand and increase capacity have further reinforced the need to implement programs to reduce projected emissions.

A variety of state and private sector programs have been implemented over the last decade to reduce the incremental cost of AFVs and infrastructure. In 1999, more than \$13.5 million was also made available through the Carl Moyer (state legislative) program. This is the first state-funded program in the nation explicitly earmarked for clean operating GSE. Emission credit programs have also served to make AFVs more economically attractive. SuperShuttle was the first entity to qualify for credits, which enabled it to sell the pollution reductions achieved by its AFVs to industrial sources seeking to meet their air quality obligations. To reinforce this momentum, in May 1999 LAX signed



Many airports offer public access to their natural gas fueling stations.

PIX 09787

concessionaire agreements with its three dominant shuttle providers, requiring that 50% of their vehicles operate on alternative fuels within 18 months and 100% within 42 months. SuperShuttle operates 120 natural gas vans, while Xpress Shuttle runs 11 electric vans with 50 more expected by 2003.

LAX is supported by three natural gas fueling stations. One station is public access, one is a combined natural gas/LNG station, and the third serves airside vehicles operated by the fuel supplier. There are more than 40 electric charging stations located on-site, with a quick-charge facility operated by Xpress Shuttle.

LAX stakeholders emphasize the importance of having airport leadership and building strong relationships among airports, fleets, and fuel providers. Their experience illustrates that poor air quality and even the anticipation of regulation can provide powerful impetus for the design and implementation of AFV programs to reduce vehicular emissions. Funding from state and local governments and the private sector has helped to offset the incremental costs of vehicles and infrastructure. The airport has also played a key role by designing its contractual process in a manner that compels landside fleets to convert to alternative fuels.

LAX's AFV champion is David Waldner, the Assistant Chief of Airports Construction and Maintenance. David can be reached via email at dwaldner@airports.ci.la.ca.us, or at 310-646-3263. The Web site for LAX is www.airports.ci.la.ca.us.



PIX 09768

Why stop with transit? AFVs are well-suited for security and police fleets.

Guidance for Creating Successful AFV Programs at Airports

A team effort is essential for building successful programs. Key members of the team include airport management or the director of fleet operations; the dominant fuel suppliers (typically this includes the natural gas supplier and electric utility); representatives of the state energy office, DOE and the local Clean Cities coalition; and representatives of state and local air quality agencies. In those cases where airport operations are overseen by a state or local entity, that entity may also be included to the extent it can expedite decision-making. The support of airport management, air quality regulators, and the leadership of fuel suppliers is vital to success. This is because support from airport management is key to implementing AFV policy, regulators can provide a powerful impetus for the purchase of AFVs, and fuel suppliers are often the only state or local entity with quick access to the financial resources that are essential to addressing informational needs and finding solutions to minimize the incremental costs of vehicles and infrastructure.

Airports and their fleets operate in a competitive environment where cost and reliability can make or break an investment decision. To win support, Clean Cities Coalitions, with the leadership of fuel suppliers, must provide information documenting how AFVs can help airports and fleets save money by providing information on the types of vehicles available and how they can be obtained, along with clear evidence of their reliability.

New dedicated AFVs are being developed every year in growing numbers for airport GSE and landside fleets. Ford's full-sized natural gas Crown Victoria sedan is being used extensively by taxi fleets in New York City. Xpress Shuttle has purchased electric powered Chrysler Voyager vans to shuttle passengers to surrounding communities. Ford E-350 Cutaway buses are being marketed to airport shuttle fleets. Charlotte of America



PIX 09767

AFVs reduce ground-level emissions and improve air quality for travelers at Denver International Airport.

and Tug Manufacturing are producing electric, natural gas, and propane powered tugs and other GSE. And ISE Research (ISER), in partnership with United Airlines, has developed an all-electric aircraft tow tractor capable of pulling most commercial jets.

Wherever programs are available to offset the incremental costs of vehicles or infrastructure, fuel suppliers can play key roles in simplifying the application process for airport fleets and help them to obtain funding. If these programs are lacking, Clean Cities Coalitions, working with the local fuel suppliers, must lead in creating initiatives and coalescing those interests required to achieve implementation. Airports can use contractual mechanisms to help motivate fleets to transition their operations to AFVs.

Pressure exerted by regulators can provide an impetus for building successful AFV programs at airports. The greatest motivation, however, may be the simple need for cleaner air. The past successes of AFV fleets in Boston, Denver, and Los Angeles, both economically and in terms of customer acceptance, should encourage similar programs to be considered at airports large and small.

For more information on AFVs for airport operations, please contact:

Alternative Fuel Data Center
www.afdc.doe.gov

Alternative Fuels for Fleet Vehicles
www.pprc.org

Clean Cities
www.ccities.doe.gov

Cummins
www.cummins.com/na/pages/en/products/bus/ratingsalternativefuel.cfm

DaimlerChrysler
www.fleet.chrysler.com/frameset.html

DOE's site for AFV vehicle manufacturers
www.afdc.doe.gov/afv/oem.html#manu

DOE's listing of government related organizations with information on AFVs
www.afdc.doe.gov/related.html

Electric Vehicle Association of the Americas
www.evaa.org

FAA's Air 21 Program
www.faa.gov/arp/app600/600home.htm

Ford
www.ford.com/servlet/ecmcs/ford/index.jsp?SECTION=ourVehicles&LEVEL2=environmentalVehicles

General Motors
www.gm.com/automotive/innovations/altfuel/



PIX 09782

Rental-car shuttles are among the biggest operators of airport-based AFV fleets.

Honda
www.honda.com

John Deere
www.deere.com/deerecom/_Engines+and+Components/John+Deere+Power+Systems/Engines/Alternative+Fuel/default.htm

National Association of State Energy Officials
www.naseo.org

National Propane Gas Association
www.npga.org

Natural Gas Vehicle Coalition
www.ngvc.org

Solectria
www.solectria.com/vehicles.html

Toyota Prius
www.prius.toyota.com

TUG Manufacturing
www.sstug.com/products/index.html

U.S. DOE Office of Transportation Technology
www.ott.doe.gov

Weststart/Calstart
www.calstart.org

Sponsored by the U.S. Department of Energy
Energy Efficiency and Renewable Energy
Office of Transportation Technologies

Prepared in part by the Clean Airport Partnership, Inc.,
for the National Renewable Energy Laboratory (NREL).
Photos except on Page 1 from the Clean Airport Partnership.

NREL is a U.S. Department of Energy National Laboratory
Operated by Midwest Research Institute • Battelle • Bechtel

NREL/FS-540-28353
February 2001

Printed with a renewable-source ink on paper containing
at least 50% wastepaper, including 20% postconsumer waste



Neither the United States government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States government or any agency thereof.