Presentation To
Pennsylvania Public Utility Commission

Alternative Fuel Vehicles Forum
Electric Vehicles Panel

May 31, 2012

Calvin M. Davenger, Jr., C.M., P.E.
Deputy Director of Aviation
Philadelphia International Airport
Presentation Overview

✓ PHL Characteristics
✓ Emission Reduction Program at PHL
  ✓ Current Initiatives
  ✓ Future Initiatives
✓ Funding
  ✓ VALE
  ✓ AFIG
  ✓ DERA
✓ Obstacles and Lessons Learned
PHL Characteristics

Facts
✓ 448,129 aircraft operations in 2011 - Ranked 10th in North America*
✓ 30.8M passengers in 2011 (includes 4.4M international passengers)
✓ Seven terminal buildings, 126 boarding gates
✓ Municipal Run Airport System (2,370 acres)

*Source: 2011 ACI-NA, Top 50 Airports Ranking
eGSE Statistics

- 83 pieces of eGSE currently in operation
- 58 scheduled for delivery in Summer 2012
- 232 Electric Charging Ports
- 2 Airlines using eGSE (US Airways and United)
- Emissions Reductions over Equipment Lifetime:
  - 715 tons NO\(_x\)
  - 805 tons CO
  - 45 tons PM\(_{2.5}\)
- Airline Fuel Savings per year: 255 Gallons
PHL Emissions Reduction Program

Existing Initiatives

- Baggage Tractors: $41,192 ea.
- Belt Loaders: $50,156 ea.
- eGSE Rechargers: $28,866/dual port
- Hybrid Vehicle Fleet: $29,200 ea.
- US Airways COBUS Shuttle: $540k ea.
PHL Emissions Reduction Program

Potential Future Projects

CNG Station

Source: Clean Energy

EV Charging Stations

Source: ChicagoTribune.com

Alternative Fuel Shuttles, Taxis

Source: freedom-taxi.com

Driving a world of difference in a light-duty electric vehicle.

Source: azuredynamics.com

Electric Vehicles

Source: azuredynamics.com
## Life Cycle Costs for Baggage Tractors

<table>
<thead>
<tr>
<th>Fuel Type</th>
<th>Purchase Cost</th>
<th>Rebuild or Replacement Costs</th>
<th>Fuel Costs</th>
<th>Reduced Maintenance Costs</th>
<th>Total Costs If Reduced Maintenance</th>
<th>Total Costs If Same Maintenance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gasoline</td>
<td>$17,000</td>
<td>$2,568</td>
<td>$59,481</td>
<td>$47,089</td>
<td>$126,139</td>
<td>$126,139</td>
</tr>
<tr>
<td>Diesel</td>
<td>$22,000</td>
<td>$1,351</td>
<td>$27,386</td>
<td>$47,089</td>
<td>$97,826</td>
<td>$97,826</td>
</tr>
<tr>
<td>LPG</td>
<td>$19,000</td>
<td>$2,568</td>
<td>$49,072</td>
<td>$37,176</td>
<td>$107,816</td>
<td>$117,729</td>
</tr>
<tr>
<td>CNG</td>
<td>$21,000</td>
<td>$2,568</td>
<td>$65,058</td>
<td>$37,176</td>
<td>$125,802</td>
<td>$135,715</td>
</tr>
<tr>
<td>Electric</td>
<td>$30,000</td>
<td>$5,147</td>
<td>$5,574</td>
<td>$15,696</td>
<td>$56,418</td>
<td>$87,810</td>
</tr>
</tbody>
</table>

Assumptions: 16 year equipment life; 6 year engine replacement interval for gasoline, LPG, and CNG; 8 year engine rebuild interval for diesel; 5 year battery life for electric; $2,500 unit cost for all rebuilds; $4,500 unit cost for all battery replacements; equipment used 8 hours per day for 350 days per year; idle is 40 percent of operating day; gasoline use is 3.2 gallons per hour at $0.75 (after tax credits) per gallon; diesel use is 1.7 gallons per hour at $0.65 (after tax credits) per gallon; LNG use is 3.3 gallons per hour at $0.60 per gallon; CNG use is 3.5 gallons per hour at $0.75 per gallon (including the cost of refueling facility operation and amortization); electric use is 8.33 kilowatts per operating hour; maintenance costs are $1.90 per hour for gasoline and diesel; maintenance costs are $1.50 per hour for LPG and CNG under a reduced maintenance scenario or $1.90 per hour under a “same maintenance” scenario; maintenance costs are $0.63 per hour for electric under a reduced maintenance scenario or $1.90 per hour under a “same maintenance” scenario.

Funding

Voluntary Airport Lower Emission (VALE)

- Established under the 2004 Vision 100-Century of Aviation Reauthorization Act
- Managed by FAA
- Funded through Airport Improvement Program (AIP) grants and Passenger Facility Charges (PFCs)
- Provides funding to commercial service airports in air quality nonattainment and maintenance areas
- Participants earn air emission reduction credits to meet Clean Air Act
- Finances 75% of Project Costs
Funding

Funding: Alternate Fuel Incentive Grant (AFIG)

✓ Program established under Act 166 of 1992

✓ Modified and expanded under Act 178 of 2004

✓ Managed by PA Department of Environmental Protection

✓ Goal is to reduce the Commonwealth’s dependence on foreign oil and improve air quality

ELIGIBLE PROJECTS:

✓ Convert gas powered vehicles to alternative fuel vehicles.

✓ Incremental cost of purchase of alternative fuel vehicles.

✓ Purchase & installation of necessary fueling equipment.

✓ Next phase advanced research, development, training, and demonstration of new applications or next phase technology related to AFVs

✓ Incremental cost to purchase biofuels, including biodiesel and ethanol.
Funding

Funding: Diesel Emissions Reduction Act (DERA)

- Established as part of the 2005 Energy Policy Act (2011 Reauthorization)
- Funding provided through programs such as:
  - National Clean Diesel Funding Assistance Program
  - National Clean Diesel Emerging Technologies Program
  - SmartWay Clean Diesel Finance Program
  - State Clean Diesel Grant Program

ELIGIBLE PROJECTS:
- Retrofit technologies that are certified or verified by the EPA or California Air Resources Board (CARB)
- Idle reduction technologies that are EPA verified
- Technologies from EPA's Emerging Technologies List
- Incremental costs associated with early replacement and repowering with certified engine configurations
## Schedule of Project Funding

<table>
<thead>
<tr>
<th>Source</th>
<th>Project Description</th>
<th>Project Total</th>
<th>VALE Grant Amount</th>
<th>PADEP Grants</th>
</tr>
</thead>
<tbody>
<tr>
<td>F8308</td>
<td>RECHARGERS, (10 Units for Terminal D)</td>
<td>$269,546</td>
<td>$202,160</td>
<td>* $67,386</td>
</tr>
<tr>
<td>F8708</td>
<td>RE-CHARGERS (15 for Terminals B/C)</td>
<td>$602,600</td>
<td>$451,950</td>
<td>* $150,650</td>
</tr>
<tr>
<td>F8909A</td>
<td>RE-CHARGERS, (25 Units for Terminals A-West, B/C &amp; F - Purchase)</td>
<td>$2,642,007</td>
<td>$1,981,505</td>
<td>--</td>
</tr>
<tr>
<td>F9309B</td>
<td>RE-CHARGERS, (25 Units for Terminal A-West, B/C&amp; F – Installation)</td>
<td>$6,143,640</td>
<td>$4,607,730</td>
<td># $492,200</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>^ $190,000</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>▪ $575,966</td>
</tr>
<tr>
<td>F8308</td>
<td>Hybrids Vehicles, (3 Each – Purchase)</td>
<td>$21,392</td>
<td>$16,044</td>
<td>* $5,348</td>
</tr>
<tr>
<td>TOTALS</td>
<td></td>
<td><strong>9,679,185</strong></td>
<td><strong>7,259,389</strong></td>
<td><strong>1,481,550</strong></td>
</tr>
</tbody>
</table>

* = AFIG Summer 2008, ^ = DERA Winter 2009, # = AFIG Summer 2009, ▪ = Pending
Obstacles and Lessons Learned

Partnerships with Airlines (eGSE)

Advancing the Program depends on the airlines’:

✓ Available financial resources
✓ Infrastructure and Coordination (logistics)
✓ Age of existing GSE
✓ Schedule (funding open enrollment periods)
Thank You