UTA

Environmental Improvement Project Results

Project #1: UTA Air Emission Reduction Project

Measurements:

1) Reduction of UTA’s bus fleet NOx and particulate matter (PM) emission rate through the acquisition of 23 new CNG buses in 2015 to replace older existing buses manufactured in 1999 and previous years.

UTA developed a 6 year plan, beginning in 2009, to acquire new buses as replacements for older buses that will reduce Particulate Matter (PM) and Nitrogen Oxides (NOx) emissions.

Particulate Matter (PM)

The following table lists the federal emission standards for particulate matter (PM) from heavy-duty diesel engine exhaust in urban buses.

<table>
<thead>
<tr>
<th>Model Year</th>
<th>g/bhp-hr</th>
<th>CF bhp-hr/mi</th>
<th>g/mi</th>
</tr>
</thead>
<tbody>
<tr>
<td>1991 – 1992</td>
<td>0.25</td>
<td>4.68</td>
<td>1.17</td>
</tr>
<tr>
<td>1993</td>
<td>0.1</td>
<td>4.68</td>
<td>0.468</td>
</tr>
<tr>
<td>1994 – 1995</td>
<td>0.07</td>
<td>4.68</td>
<td>0.3276</td>
</tr>
<tr>
<td>1996 – 2006</td>
<td>0.05(1)</td>
<td>4.68</td>
<td>0.234</td>
</tr>
<tr>
<td>2007 –</td>
<td>0.01</td>
<td>4.68</td>
<td>0.0468</td>
</tr>
</tbody>
</table>

UTA’s fixed route and express route bus fleet travels 17 million miles annually. Scheduling newer more efficient buses to accumulate more miles than older buses reduces the emissions of PM from UTA’s bus fleet. UTA has set a goal of a 10% reduction for the total pounds of PM emitted each year.

<table>
<thead>
<tr>
<th>Model Year</th>
<th>2014 Miles</th>
<th>PM (lbs)</th>
<th>2015 Miles</th>
<th>PM (lbs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1991 – 1992</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1993</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1994 – 1995</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1996 – 2006</td>
<td>5,537,622</td>
<td>2,854</td>
<td>4,959,329</td>
<td>2,556</td>
</tr>
<tr>
<td>2007 –</td>
<td>10,352,648</td>
<td>1,067</td>
<td>11,511,355</td>
<td>1,187</td>
</tr>
<tr>
<td>CNG Bus</td>
<td>909,981</td>
<td>6</td>
<td>955,740</td>
<td>6</td>
</tr>
<tr>
<td>Total</td>
<td>16,800,251</td>
<td>3,921</td>
<td>17,426,424</td>
<td>3,743</td>
</tr>
</tbody>
</table>

Based on the annual miles and the age of UTA’s fleet in 2007, the estimated PM emissions were 6.23 tons. By acquiring new buses that meet the 2007 Federal PM standards to replace older buses, PM emissions were reduced to 1.96 tons in 2014 and 1.87 tons in 2015. UTA reduced its PM emissions from 2014 to 2015 by 4.6%.
Nitrogen Oxides (NO\textsubscript{x})

For NO\textsubscript{x} emission calculations EPA sites an 8% compliance margin from manufacturers based on historical certification data. Therefore, for a NO\textsubscript{x} standard of 5.0 g/bhp-hr, a level of 4.6 g/bhp-hr is used as the emission level. The following table illustrates the differing emission standards of NO\textsubscript{x} for diesel engine exhaust from urban buses.

<table>
<thead>
<tr>
<th>Model Year</th>
<th>g/bhp-hr</th>
<th>CF bhp-hr/mi</th>
<th>g/mi (8% margin)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1991 – 1997</td>
<td>5.0</td>
<td>4.68</td>
<td>21.53</td>
</tr>
<tr>
<td>1998 – 2001</td>
<td>4.0</td>
<td>4.68</td>
<td>17.22</td>
</tr>
<tr>
<td>2002 – 2006</td>
<td>2.2</td>
<td>4.68</td>
<td>9.47</td>
</tr>
<tr>
<td>2007 – 2009</td>
<td>1.2</td>
<td>4.68</td>
<td>5.17</td>
</tr>
<tr>
<td>2010 –</td>
<td>0.2</td>
<td>4.68</td>
<td>0.86</td>
</tr>
</tbody>
</table>

Based on the annual miles and the age of UTA’s fleet in 2007, the estimated NO\textsubscript{x} emissions were 340 tons. By acquiring new buses that meet the 2010 Federal NO\textsubscript{x} standards to replace older buses, NO\textsubscript{x} emissions were reduced to 110 tons in 2014 and 103 tons in 2015.

<table>
<thead>
<tr>
<th>Model Year</th>
<th>2014</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Miles</td>
<td>NO\textsubscript{x} tons</td>
</tr>
<tr>
<td>1992 – 1997</td>
<td>80,476</td>
<td>2</td>
</tr>
<tr>
<td>1998 – 2001</td>
<td>2,259,462</td>
<td>43</td>
</tr>
<tr>
<td>2002 – 2006</td>
<td>3,197,684</td>
<td>33</td>
</tr>
<tr>
<td>2007 - 2009</td>
<td>4,664,624</td>
<td>27</td>
</tr>
<tr>
<td>2010 –</td>
<td>5,688,024</td>
<td>5</td>
</tr>
<tr>
<td>CNG Bus</td>
<td>909,981</td>
<td>&lt;0.25</td>
</tr>
<tr>
<td>Total</td>
<td>16,800,251</td>
<td>110</td>
</tr>
</tbody>
</table>
UTA reduced its NOx emissions from 2014 to 2015 by 6.4%.

### Benefit to the environment for year:

<table>
<thead>
<tr>
<th>Year</th>
<th>Particulate Matter</th>
<th>% Reduction</th>
<th>Nitrogen Oxides</th>
<th>% Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>6.23 tons</td>
<td>–</td>
<td>340 tons</td>
<td>–</td>
</tr>
<tr>
<td>2008</td>
<td>5.28 tons</td>
<td>15.2 %</td>
<td>313 tons</td>
<td>7.9 %</td>
</tr>
<tr>
<td>2009</td>
<td>4.33 tons</td>
<td>18.0 %</td>
<td>278 tons</td>
<td>11.2 %</td>
</tr>
<tr>
<td>2010</td>
<td>3.78 tons</td>
<td>12.7 %</td>
<td>246 tons</td>
<td>11.5 %</td>
</tr>
<tr>
<td>2011</td>
<td>3.08 tons</td>
<td>18.5 %</td>
<td>192 tons</td>
<td>21.9 %</td>
</tr>
<tr>
<td>2012</td>
<td>2.40 tons</td>
<td>22.1 %</td>
<td>134 tons</td>
<td>30.2 %</td>
</tr>
<tr>
<td>2013</td>
<td>2.12 tons</td>
<td>13.4 %</td>
<td>120 tons</td>
<td>10.4 %</td>
</tr>
<tr>
<td>2014</td>
<td>1.96 tons</td>
<td>7.5 %</td>
<td>110 tons</td>
<td>8.3 %</td>
</tr>
<tr>
<td>2015</td>
<td>1.87 tons</td>
<td>4.6 %</td>
<td>103 tons</td>
<td>6.4 %</td>
</tr>
</tbody>
</table>

### Benefit or savings for company:

The acquisition of new buses as replacements for older models reduces UTA’s investment per rider because of the improved fuel efficiency of the newer buses. In 2015 UTA added 23 CNG buses, as a part of our bus replacement 6 year plan. UTA now operates a fleet of over 500 buses that has 32 hybrid-electric buses and 47 CNG buses. Today’s technology of hybrid-electric buses is 20% more fuel efficient than their diesel bus counterparts. CNG buses offer 10 times less particulate matter emissions and 4 times less NOx emissions per mile than the EPA mandated clean diesel buses.
**Project #2: Engine Idling Reduction Program**

1) Monitor and measure the miles per gallon (mpg) of UTA’s Bus fleet.

UTA identified Fuel Consumption – Excessive Idling as one of its significant environmental aspects, using our Environmental Management System (EMS), ISO 14001. In 2008, UTA approved a policy, no. 4.4.13 Vehicle Engine Idling, to reduce air pollution and increase fuel savings by eliminating unnecessary bus idling at our maintenance facilities and at the end of the line (EOL) of our bus routes. UTA has been able to increase the mpg of our bus fleet in each subsequent year following 2008 (baseline year).

**Benefit to the environment for year:**

The UTA is a Founding member of The Climate Registry. Annually, UTA calculates its total GHG emissions, both direct and indirect, for all of our emission sources. Emissions associated with fuel consumption are considered to be direct. Reduction in CO2 emissions from UTA’s bus fleet fuel consumption in this project is summarized in the table below.

<table>
<thead>
<tr>
<th>Year</th>
<th>Bus Miles</th>
<th>Diesel Gallons</th>
<th>mpg</th>
<th>Fuel Saved</th>
<th>CO2(e) tons Saved</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>19,460,707</td>
<td>4,419,405</td>
<td>4.40</td>
<td>159,348</td>
<td>1,793</td>
</tr>
<tr>
<td>2010</td>
<td>18,989,309</td>
<td>4,258,660</td>
<td>4.46</td>
<td>209,181</td>
<td>2,354</td>
</tr>
<tr>
<td>2011</td>
<td>18,263,268</td>
<td>4,086,206</td>
<td>4.47</td>
<td>210,811</td>
<td>2,373</td>
</tr>
<tr>
<td>2012</td>
<td>17,547,585</td>
<td>3,863,712</td>
<td>4.54</td>
<td>264,918</td>
<td>2,981</td>
</tr>
<tr>
<td>2013</td>
<td>16,518,743</td>
<td>3,615,555</td>
<td>4.57</td>
<td>271,007</td>
<td>3,050</td>
</tr>
<tr>
<td>2014</td>
<td>15,890,270</td>
<td>3,361,530</td>
<td>4.73</td>
<td>377,163</td>
<td>4,245</td>
</tr>
<tr>
<td>2015</td>
<td>16,470,684</td>
<td>3,404,166</td>
<td>4.84</td>
<td>471,088</td>
<td>5,302</td>
</tr>
</tbody>
</table>

2) Fuel savings are normalized with 2008 mpg (4.25) as the baseline.
### Benefit or savings for company:

**Electrical Conservation: Year to Year Savings at UTA Bus Divisions**

<table>
<thead>
<tr>
<th>Year</th>
<th>$/diesel gallon</th>
<th>Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>$1.82/gallon</td>
<td>$290,013.36</td>
</tr>
<tr>
<td>2010</td>
<td>$2.36/gallon</td>
<td>$493,667.16</td>
</tr>
<tr>
<td>2011</td>
<td>$3.19/gallon</td>
<td>$672,487.09</td>
</tr>
<tr>
<td>2012</td>
<td>$3.23/gallon</td>
<td>$855,685.14</td>
</tr>
<tr>
<td>2013</td>
<td>$3.20/gallon</td>
<td>$867,222.40</td>
</tr>
<tr>
<td>2014</td>
<td>$3.10/gallon</td>
<td>$1,169,205.30</td>
</tr>
<tr>
<td>2015</td>
<td>$1.91/gallon</td>
<td>$899,778.08</td>
</tr>
</tbody>
</table>

1) Cost savings are based on the average price of diesel for each calendar year.