Clean Fuel Advanced Technology (CFAT) 2010-2012 Phase: Hybrid Electric Vehicle Impact Summary

Clean Fuel Advanced Technology (CFAT) Project 2006-2012:

Administered by the NC Solar Center at NC State University, CFAT is a six (6) year project running from 2006 through 2012. The project objective is to reduce transportation related emissions in NC counties designated as non-attainment and maintenance areas for air quality standards in accordance with the federal Clean Air Act. Twenty-four (24) counties were identified by the NC Department of Environment and Natural Resources as eligible areas. Figure 1 shows the current designated non-attainment and maintenance areas. Partial or entire counties included are: Cabarrus, Catawba, Chatham, Davidson, Davie, Durham, Edgecombe, Forsyth, Franklin, Gaston, Granville, Guilford, Haywood, Iredell, Johnston, Lincoln, Mecklenburg, Nash, Orange, Person, Rowan, Swain, Union, and Wake.

The project was funded by $2.6 million in federal Congestion Mitigation Air Quality funds through the NC Department of Transportation. The NC Division of Air Quality and State Energy Office contributed an additional $200,000 each. Local sub-award recipients contributed $1.8 million for a project total of $4.8 million. Funding provided up to 80% of project costs for alternative fuel vehicles, refueling infrastructure, idle reduction technologies, heavy duty and light duty hybrid electric vehicles, and diesel retrofits. CFAT project education and outreach are supported through sub-
Hybrid Electric Vehicle (HEV) Purchases 2010-2012 Phase:

Twenty-three (23) HEV’s were purchased through the CFAT project 2010-2012 phase across the NC non-attainment and maintenance areas. The vehicle breakdown is 12 Ford Escapes, 6 Toyota Prii, 4 Ford Fusions, and 1 Honda Civic at a project contribution cost of $341,651. (For an HEV purchase summary, see Figure 2 below.) With sub-award recipients’ cost share of $291,710, the HEV total spend was $633,361. Based on reported usage, the average annual miles driven per vehicle is approximately 15,500 (cumulative total of approximately 356,500 miles per year). The estimated petroleum displacement of the deployed HEV’s is calculated using reported fuel consumption for miles driven compared to the replaced vehicle driving the same miles. The resulting average annual fuel savings is 417 gallons per vehicle (cumulative total 9,593 gallons per year). With an expected service life of ten years for each vehicle, the project’s HEV deployment is expected to displace more than 95,000 gallons of gasoline.

HEV Overview:

As of December 2011, the US led the world in cumulative HEV sales with 2.16 million of the 4.5 million sold. (www.hybridcars.com) The main components of most HEV configurations are an internal combustion engine, electric motor, transmission and battery pack. There are varying degrees of hybridization and ways in which the major components function to propel the vehicle. However, the common objective is to seamlessly increase fuel economy and reduce emissions.

Where maximizing fuel economy in HEV’s is a primary objective, the combustion engine is typically a smaller displacement, lower number of cylinder engine. Furthermore, integration methods to achieve increased efficiencies in a HEV strategy include regenerative braking, a stop-start system, a motor-generator set, cylinder deactivation and variable valve timing.

There is very little compromise to styling and driving performance in HEV’s. Switching and performance is designed to be seamless to the operator. In most cases, the HEV is offered in the same body and chassis configuration as their gas counterparts. Selection in the marketplace has a full complement that is growing with each model year. Light-duty HEV vehicle options include compact, sport, luxury, sport utility and pick-ups.
CFAT 2010-2012 Phase HEV Emissions Benefit Summary:

Using emissions data from the U.S Environmental Protection Agency, the estimated annual emissions benefit of deployment of the 23 HEV’s is shown in Table 1 (to right). Figure 3 (below) shows what this translates to as a percentage of emissions reduction the HEV fleet achieves versus the baseline replaced fleet. The emissions reductions achieved by deployment of the newer more fuel efficient and cleaner HEV vehicles are significant.

For comparison, emissions for an average 2012 and 2000 sedan driving 15,500 (the average annual mileage of the CFAT 2010-2012 HEV fleet) versus the per vehicle average deployed HEV is shown in Table 2 (to right). Referring back to the deployment reductions of Table 1 (above) and looking at NOx, the primary criteria pollutant in NC, for a average 2000 sedan in Table 2, the deployment of the HEV fleet compared to the baseline replaced fleet has a net effect of removing twenty-two (22) average older sedans from the roads.

<table>
<thead>
<tr>
<th>Emission Gas</th>
<th>HEV Reduction (KG/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NOx</td>
<td>209.75</td>
</tr>
<tr>
<td>CO</td>
<td>1,845.43</td>
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<tr>
<td>PM</td>
<td>6.73</td>
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<tr>
<td>NMOC</td>
<td>94.30</td>
</tr>
<tr>
<td>CO2</td>
<td>85,916.93</td>
</tr>
</tbody>
</table>

Table 1: Average Annual CFAT HEV Deployment Emissions Reductions

Table 2: Average Annual Emissions Comparison

Note: Average sedan estimates are based on EPA emission numbers averaged for the Chevrolet Malibu, Ford Taurus, and Honda Accord. Sources: www.fueleconomy.gov & www.epa.gov/greenvehicles.
City of Cherryville Example:

The City of Cherryville in Gaston County was one of the CFAT sub-award recipients. They purchased six (6) Ford Escape hybrids for use by the public works and police departments. The vehicles that were replaced had less fuel efficient V6 and V8 engines and ranged from model year 1984 through 2003. Deployment of the HEV vehicles has cut their fuel consumption in half, saving an annual average of $900-$1,000 per vehicle. In addition, they have reduced their maintenance costs through reduced oil changes. Further maintenance cost savings is expected with increased brake life, due to regenerative braking. Public Works Director, Brandon Abernathy, reports, “The vehicles have been great with no problems, and the project has been a great cost savings. Furthermore, the project has served to demonstrate the effectiveness of alternative fuel vehicles.”

CFAT Project Summary:

The six year CFAT project supported 48 projects including participants from 18 counties in the non-attainment and maintenance areas. See Figure 4 for a bar chart showing project breakdown. An added benefit is that through exposure and experience with the alternative fuel CFAT project purchased vehicles, sub-award recipients, as well as their employees have purchased an additional 20 to 25 plug-in electric, hybrid electric and propane vehicles.

![City of Cherryville 2011 Ford Escape HEV](image)

![Centralina COG 2010 Honda Civic HEV](image)

![Figure 4: Project Participation by County](image)

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