CITY OF HOUSTON
FLEET OVERVIEW
AND
HYBRID VEHICLE INITIATIVE

Mayor Bill White
January 2005

PURPOSE OF REPORT

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This report was prepared in response to Mayor Bill White's initiative to procure low emission vehicles, especially hybrid vehicles, for the City civilian-duty fleet wherever possible. The report contains an overview of the City's entire fleet, which places the hybrid vehicle initiative in context and reveals other opportunities for improvements in fleet management. The hybrid analysis is comprehensive; the overall fleet analysis addresses readily apparent issues relating to fleet management, but is not intended to be a comprehensive analysis of the topic.

ACKNOWLEDGEMENTS

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EXECUTIVE SUMMARY

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FLEET OVERVIEW - As of March 31, 2004, the City fleet consisted of 11,243 units acquired at a cost of $330.6 million. These units are categorized as on-road (9,243) and non-road (2,000) vehicles, and specialty (7,689) and non-specialty (3,554) vehicles. Specialty vehicles are those with a specific application such as emergency vehicles and trash trucks; non-specialty vehicles are standard cars, pickup trucks and Sport Utility Vehicles (SUVs). The fleet travels over 100 million miles annually, consuming approximately 10 million gallons of fuel, and costing approximately $31.7 million annually to maintain and operate.

Most of the City fleet has an estimated life expectancy of 100,000 miles and/or 7 years, with mileage being the primary replacement criteria. However, due to funding constraints in past years or lack of vehicle use (miles driven), the fleet has not been replaced in accordance with the City guidelines. The current average age of vehicles is 6.9 years, which is 3.7 years, or 86% over the ideal average age. Many vehicles in the fleet are driven substantially less than the 14,285 annual miles necessary to reach a concurrent 7-year/100,000 mile replacement threshold; in fact, many are driven less than 5,000 miles annually. There is an opportunity to reduce the number of City vehicles in use in the Central Business District from 383 to 267 by consolidating them into a centralized motor pool. This would enable the City to reduce the number of owned vehicles, which would lower operational costs and allow for more efficient use of City assets.

In 1994, the City's fleet management software system, GEMS2000, was installed to track and maintain data related to the City's fleet equipment inventory and associated operations. However, the system is lacking in data integrity, and in the ability to transfer, track and manipulate pertinent data. Some of its shortcomings require intensive manual data review and adjustment prior to interpretation for fleet related issues. Additionally, it limits management's ability to provide a quick assessment of fleet operations and costs for possible improvement. Funding is available in the current FY05 budget and should be appropriated to significantly upgrade or replace GEMS2000.

HYBRID VEHICLE INITIATIVE - The Toyota Prius gasoline/electric hybrid vehicle is comparable in size to the City acquired conventional gasoline-fueled, mid-size Chevrolet Malibu sedan and slightly smaller than a full-size Chevrolet Impala. Over a 5-year, 70,000 – 75,000 mile period, industry projections show that despite the higher incremental cost of the Prius, this cost is virtually recovered through higher resale value, and lower operating and maintenance costs when compared to the Malibu, and provides a net benefit of almost $1,900 as compared to the life-cycle cost of the Impala.

According to the EPA, the Prius generates 65% less in smog-forming emissions than the Malibu and 40% less than the Impala, equating to a reduction of 0.21 and 0.08 tons per 1 million miles traveled, respectively. At this emissions output level, it would take

571 Prius vehicles to generate the same emissions as only 202 or 345 of the Malibu and Impala vehicles, respectively, traveling the same distance. City non-specialty civilian vehicles travel approximately 26.5 million miles annually. Assuming equivalent emissions reductions from comparable hybrid vehicles for these vehicle types, the City can potentially reduce vehicle emissions by 2 to 5.6 tons-per-year at little to no additional cost.

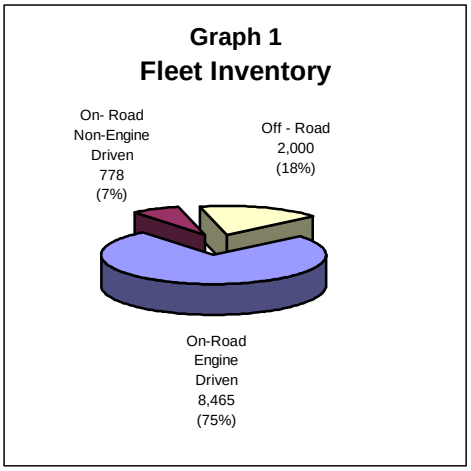
A variety of hybrid vehicle models should be available for purchase over the next few model years that will include sedans, pickup trucks and SUVs. This will allow even greater emissions reductions if these vehicles meet City needs.

With the implementation of a City policy to buy hybrid vehicles for the non-specialty civilian fleet when available, by year 2010, more than 50% of this portion of the overall fleet, and 80% of purchases could consist of hybrid technology vehicles.

FLEET REPORT

FLEET COMPOSITION

The City fleet is composed of equipment valued at $5,000 or more that is designed to transport passengers or cargo, or which may be attached to equipment meeting this criteria. As of March 31, 2004, the City's fleet consisted of 11,243 units purchased at a cost of over $330,000,000. As is shown in *Exhibit: Fleet-1*, 9,243 of these units are on-road vehicles that are licensed to operate on City streets and thoroughfares.



As shown in *Graph 1*, "Fleet Inventory" , 8,465 units, or 75% of the fleet, consists of on-road, engine driven vehicles. Two thousand units are for non-road or off-road use (e.g. construction equipment, forklifts) and the remainder of the fleet is on-road, but non-engine driven, (e.g. trailers).

The current fleet size is a reduction of 1,347 units or 11% from that of the January 2000 inventory.

In addition to mode of travel as depicted by on-road/off-road designations, the Finance and Administration Department Budget Office developed another way of classifying these units, by equipment application, as in Specialty and Non-specialty designations as is depicted in *Graph 2,* "Departmental Fleet Breakout by Equipment Type". The F&A Budget Office uses these designations to prioritize funding requests for equipment replacements. Specialty equipment is unique in the function that it is designed to perform, or has a specific purpose or application. Examples include police and fire department emergency vehicles, trash trucks, off-road and construction vehicles. Non-specialty vehicles are those typically found in the public domain such as standard sedans, pickup trucks, vans and SUVs. Typically, specialty vehicles, which comprise approximately two-thirds (2/3) of the City fleet, receive higher priority for funding than non-specialty vehicles.

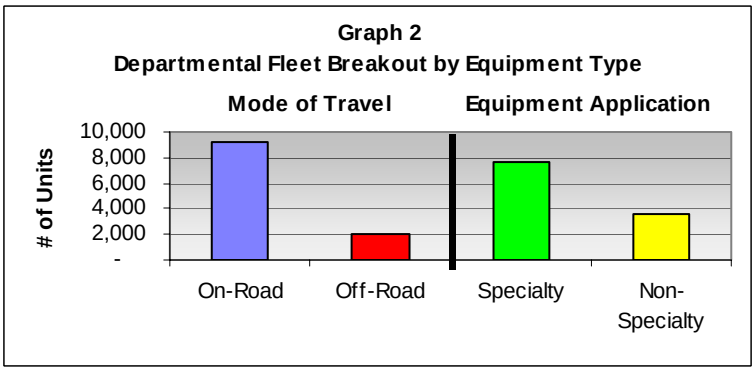


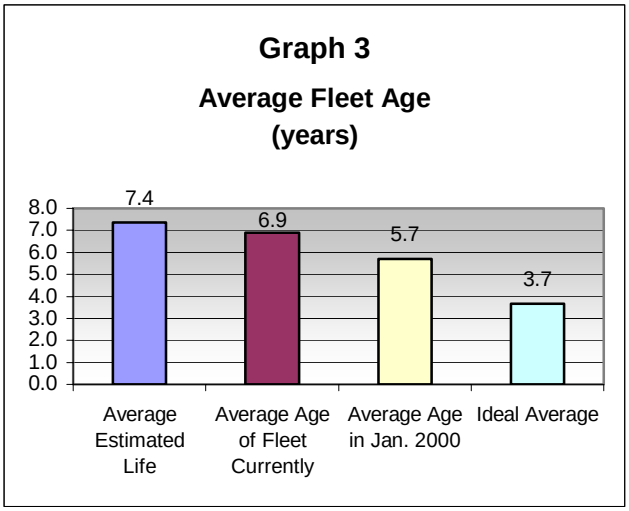
Exhibit: Fleet-2 provides a breakout of the fleet by department. Six (29%) of the City's 21 departments, Aviation, Fire, Parks, Police, Public Works and Solid Waste, own 95% of the units which also equates to 95% of the acquisition cost of the fleet.

Exhibit: Fleet-3 provides a department breakout by Equipment Type.

FLEET OPERATIONS

An overview of all the vehicles that were in the City fleet during any part of the 2003 fiscal year, including those in-service for only a portion of the year due to their being acquired or sold during the period, is provided in *Exhibit: Fleet-4*. The fleet traveled approximately 100,000,000 miles, consumed 9.8 million gallons of fuel, and cost more than $31 million to maintain and repair.

As depicted in *Graph 3*, "Average Fleet Age", the fleet is old and getting older. Most vehicles, (e.g. light duty vehicles such as cars, pickup trucks, etc.) are targeted for replacement after 7 years or 100,000 miles. Many larger vehicles and off-road equipment (e.g. construction equipment, fire trucks, etc.) are targeted for replacement after 10 or more years or 100,000 miles. *Appendix A* provides a list of the various types of equipment in the fleet and their associated replacement criteria. Based on these criteria and the existing fleet composition, the average estimated life of the fleet is 7.4 years. Currently, the average age of the fleet is 6.9 years, up from 5.7 years in January 2000. The ideal average fleet age is 3.7 years, or one-half of the estimated life.



Issues related to owning older vehicles include higher maintenance costs per mile of travel, less reliability, higher emissions relative to new vehicle models, and depending on whether parking under cover or outside, a general degradation in overall appearance and integrity.

FLEET REDUCTION – DOWNTOWN MOTOR POOL

Aside from the need for a fleet management system that can provide accurate data, one potential for operational efficiency regarding vehicle use came to light in the development of this report.

Upon review of the Non-Specialty Vehicle Operating Data shown in *Exhibit: Fleet-5*, many departments have vehicles that are driven on average less than 5,000 miles per year. Using the City's current replacement criteria, many of these vehicles will be in the fleet more than 20 years before attaining the 100,000-mile replacement threshold.

Examples of departments based within the Central Business District (CBD) that operate these vehicles include Affirmative Action, Convention and Entertainment, Finance and Administration, Information Technology, Legal and the Mayor's Office. A breakout of all

on-road powered vehicles in *Exhibit: Fleet-6* shows 383 vehicles assigned parking within the CBD. Further analysis in *Exhibit: Fleet-7* shows that 349 vehicles, or 90%, are designated as non-specialized vehicles and 280, or 80%, have a day use or pooled vehicle designation. These designations indicate that they are not assigned to an individual or for a specific application. The final breakdown of the types of vehicles, shown in *Exhibit: Fleet-8*, shows that there is a potential for 267 units to be consolidated into a central downtown motor pool.

A more detailed analysis conducted by the Finance and Administration Department, found in *Appendix B,* readily identified a reduction potential from 75 pool cars to 38. Dr. Philip Scheps, former Director of the Finance and Administration Department, had developed a program to implement the motor pool but on December 22, 2003 deferred its implementation in order to allow Mayor White, who took office in January 2004, to formulate a decision regarding whether to proceed.

With consolidation, many of the vehicles could be made accessible on a first-come, first-served basis or through a reservation system to all employees within the CBD. It is likely that many vehicles could be sold or reassigned without significantly affecting the operation of departments provided the motor pool system is properly designed and operated so as to insure that a vehicle is conveniently available when needed. Anticipated cost savings will be realized from reduced parking expenses, disposition of older, higher maintenance vehicles and the reallocation of underutilized assets.

Clearly more analysis and discussion could be presented on the City's fleet operations. However, before such a review can be undertaken, consistent and reliable data must be made available in order to quantify and maximize the benefits associated with the outcome of such an assessment.

GEMS2000

The data provided in this report was extracted from GEMS2000, the City's fleet management system. The GEMS2000 system was installed in 1994 and has had periodic hardware and software updates, the last software update being in 2001.

A brief discussion about this system is in order due to concerns regarding the quality and integrity of the data within the system. The data presented has been closely reviewed, and where appropriate, adjusted in order to provide an accurate accounting of the fleet as possible. Of particular concern are the mileage data that are subject to erroneous data entries at fleet maintenance facilities and potentially when Fuel Force, the City fuel management system, is overridden at the fuel site. The initial data download showed that the fleet traveled over 263,000,000 miles. However, after review of approximately 120,000 records and correction of obvious data entry errors, this figure was reduced by over 163,000,000 miles to approximately 100,000,000 miles.

A representative sample of data errors can be viewed in *Appendix C-1*. For example, the first vehicle in the exhibit (unit # 21278) is shown to have traveled over 37,000,000 miles in April of 2003 and another 62,000,000 miles in June. The last vehicle in the exhibit (#21831) is shown to have traveled a negative 1,292,348 miles in August of

2002. Similar data errors for maintenance and repair costs are shown in *Appendixes C-2 and 3*.

While the data for maintenance and repair costs have a much higher level of accuracy than the mileage data, some errors were also found and adjusted. Additionally, the Aviation Department contracts out to a private vendor all of its maintenance and repair services, with the exception of fire fighting equipment that is maintained by the City's Fire Department. During FY03, the Aviation Department awarded the contract to a new vendor and was unable to upload the maintenance and repair data into the GEMS2000 system. Therefore, the entire Aviation Department service contract, which may or may not be fully used, is shown as a separate line item in *Exhibit: Fleet-4*. This issue results in the Maintenance and Repair, "M&R ($/mi)" and "Total Operating Cost ($/mi)" columns not accurately reflecting the cost of the Aviation department's fleet.

Accurate mileage and maintenance data are critical for the proper maintenance and repair of the City's fleet. Mileage data alone is a useful tool for determining operational efficiencies such as cost-per-mile for fuel use and vehicle maintenance, and for comparative analysis in "best practices" case studies. Additionally, mileage is often used for scheduling preventive maintenance and vehicle replacement cycles.

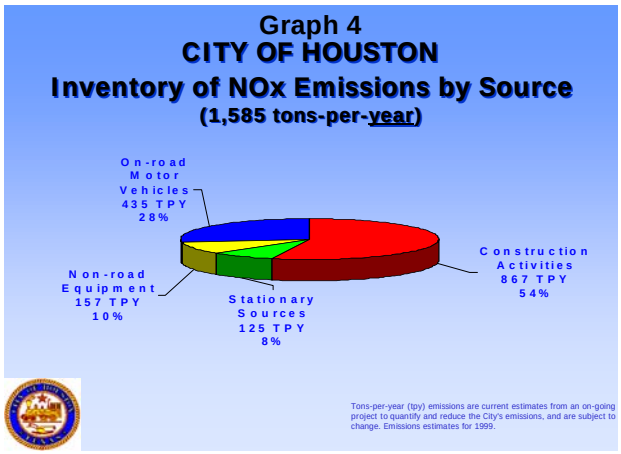
In addition to the issues noted above, the GEMS2000 system has many other weaknesses that warrant its being upgraded or replaced. Funding is in the current Equipment Acquisition Fund (Fund 113) budget as it has been for the past two budget years. A draft of a memo justifying the upgrade or replacement of the system is enclosed as *Appendix D*.

HYBRID REPORT

HYBRID VEHICLE INITIATIVE – EMISSIONS BACKGROUND

In January 2000, the City of Houston enacted Executive Order 1-45 calling for development of a plan to identify and address air emissions generated by City operations, and the formation of the Mayor's Clean Air Team.

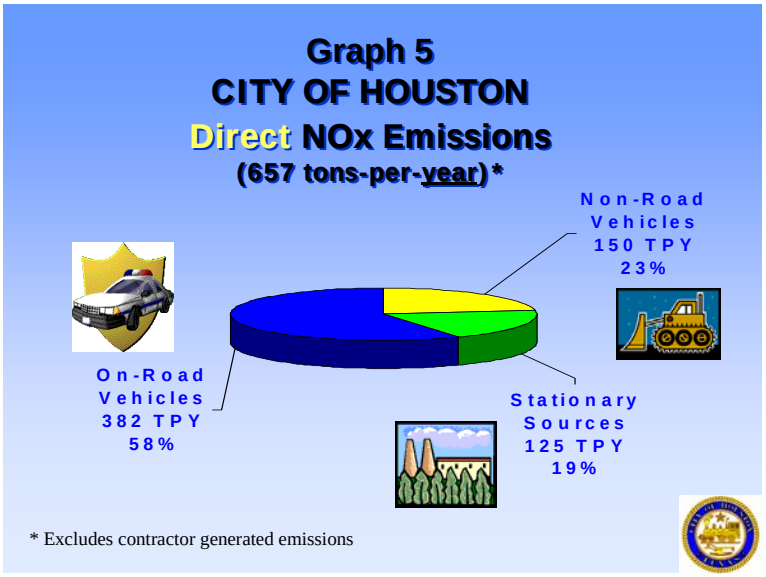
As a result of the order, the City developed the "Emissions Reductions Plan", identifying and quantifying the air emissions generated by City operations.



The Plan determined that the City generates approximately 1,585 tons-per-year (tpy) in nitrogen oxides (NOx), a precursor to ground-level ozone formation.

These emissions result from:
Contractor activities (54%);
On-road vehicles (28%);
Non-road vehicles (10%); and,
Stationary sources (8%).

Excluding contractor-generated emissions, the City produces approximately 657 tpy of NOx, 81% of which is produced by the City's vehicle fleet.



HYBRID VEHICLE OPERATION

Gasoline/electric hybrid vehicles are a relatively new technology in the automotive market. There are two configurations for systems currently available whereby an electric motor is configured in a series or parallel arrangement with a conventional gasoline engine to augment the propulsion of the vehicle. In general, both utilize a battery that provides power to an electric motor that works independently or in conjunction with the gasoline engine to propel the vehicle. Battery recharging occurs during vehicle braking or through a generator powered by the engine. The benefits derived through this technology are significant improvements in fuel economy and a reduction in emissions as a result of reduced engine run times and engine size.

HYBRID VEHICLE COMPARISON

The Mayors' Office of Health Policy was tasked with developing a program that would establish a procurement goal for the purchase of "true" hybrid vehicles, or those that show a substantial improvement in fuel economy.

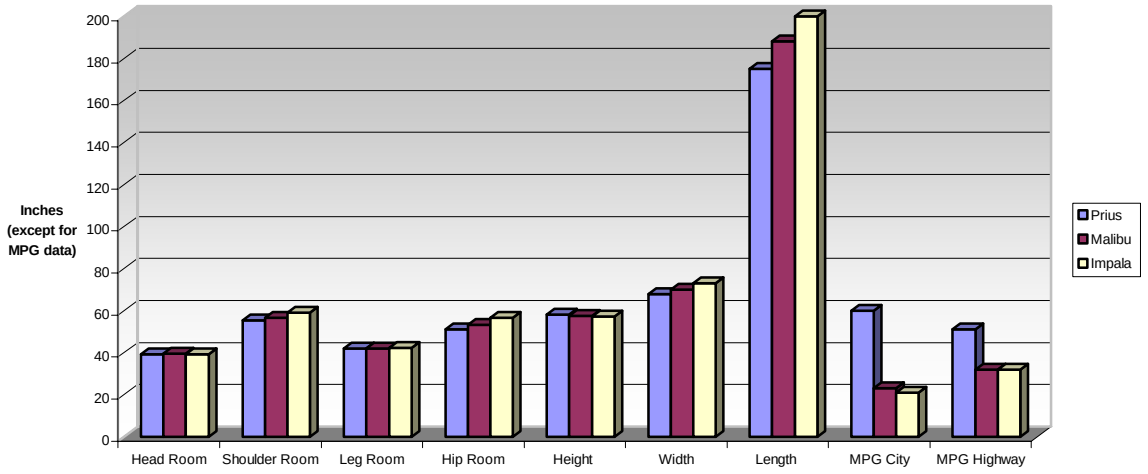
A review of the available models of gasoline/electric hybrid vehicles determined that only three vehicles currently on-market fit the criteria: the Toyota Prius, the Honda Civic and the Honda Insight. Since the City had already received bids and purchased several Prius vehicles based on low bid, this analysis focuses on a comparison of this vehicle to comparable gasoline only vehicles utilized in the City's fleet operations.

For the 2005 model year, the Prius was upgraded from classification as a compact sedan to a mid-size sedan. This placed it at par with a traditional gasoline powered Chevrolet Malibu, also purchased by the City. As a continuation of the analysis, the Chevrolet Impala, a full-size sedan, was also used for comparative purposes.

Vehicle measurements, fuel economy ratings and weight specifications for the three vehicles are provided in *Graph 6* and the associated *Exhibit: Hybrid-1*. As shown in *Graph 6*, the vehicles are comparable in interior and exterior dimensions with only 3 inches or less difference. The exception to this is the vehicle length where both the Malibu and Impala are longer by 13 to 25 inches, respectively. Additionally, the Impala, being a larger full size sedan offers more width in both vehicle size (up to 5.1 inches) and in hip and shoulder room (5.5 and 5.9 inches respectively).

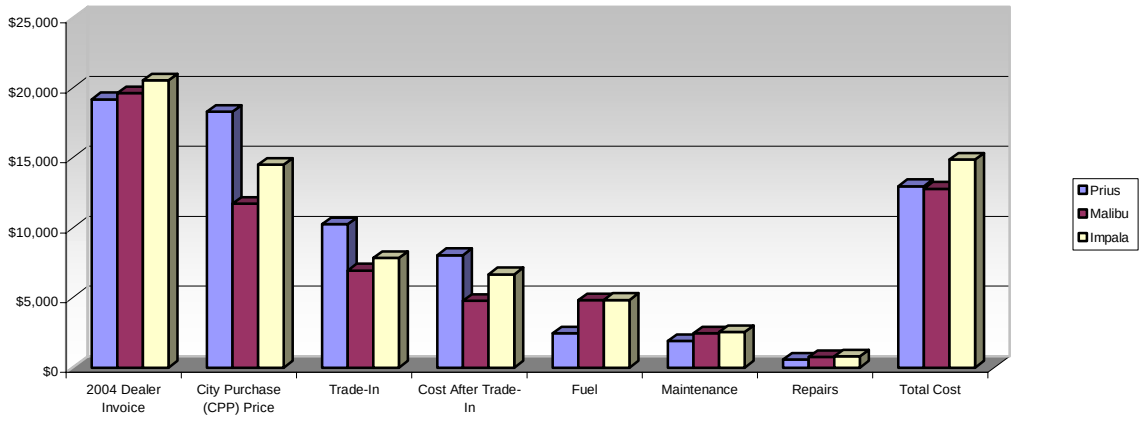
The fuel economy of the Prius compared to the two Chevrolets is almost triple the city driving economy rating and shows a 59% improvement for on-highway driving.

Graph 6
Vehicle Characteristics Comparison



Although the Prius' initial cost is substantially more than either of the other vehicles, based on a 5-year economic cost comparison shown in *Exhibit: Hybrid-2* and *Graph 7*, the two mid-size vehicles are virtually equal in cost over a 5-year period, differing by

Graph 7
5-Year Projected Cost of Ownership Comparison
(based on avg. projected costs from KBB & Edmunds)



only $175, with the full-size Impala costing almost $1,900 more to own and operate. This cost offset is due to the projected higher resale value and lower operating and maintenance costs of the Prius.

A comparison of the vehicles emissions in *Exhibit: Hybrid-3* reveals that the City can reduce its emissions by 0.21 tons for every million miles driven. Since City non-specialty vehicles drive approximately 26.5 million miles annually, the City could reduce

regional emissions by as much as 5.6 tons annually should all future vehicle purchases provide equivalent emissions reductions.

Currently, vehicle manufacturer proposed gasoline/electric hybrid vehicles should address most of the non-specialty vehicle needs of the City with the exception of vans. However, since the market for these vehicles is rapidly changing, it is not unrealistic to assume that vehicle manufacturers will offer a limited variety of hybrid vans in the near future as well.

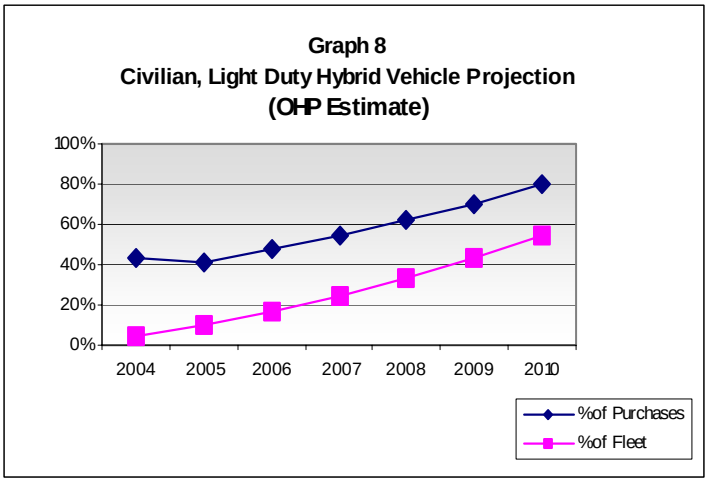
The City should be selective when choosing hybrid vehicles for purchase. Some manufacturers, such as General Motors, are plating pickup trucks with the "hybrid" designation but the vehicle operation will not necessarily meet the standard as a "true" hybrid under the City's definition. The GM hybrid basically uses the battery power reserve to operate auxiliary equipment such as the radio and air conditioner when the vehicle is at idle, instead of the engine, and to provide power to on-board electrical outlets for external applications such as to operate power tools. The result is only a minimal improvement in the fuel economy of the vehicles.

ESTABLISHING A HYBRID VEHICLE PROCUREMENT GOAL

Restricting the application of hybrid vehicles to civilian applications only, *Exhibit: Hybrid-4* provides a summary of the vehicles operated by City departments that fit this criterion, and that are anticipated to be produced by vehicle manufacturers in the near future. *Exhibit: Hybrid-5* provides a list of currently identified hybrid vehicles. The term "non-specialty vehicle" is used to identify standard vehicle types produced for the general public (e.g. cars, pickup trucks, SUVs). It excludes vehicles that are highly customized with equipment unique to City fleet operations such as emergency response vehicles.

Excluding the Police and Fire department vehicles, the City owns 2,758 vehicles that are suitable for use with currently available or proposed hybrid technology. *Exhibit: Hybrid-6* provides a projection of the number of hybrid vehicles that could potentially be purchased annually. The projection assumes: 1) that unlike its present replacement practices, the City will adhere to its 7-year replacement cycle, or approximately 14% of the fleet annually, 2) the fleet size remains constant; and, 3) the manufacturers can provide the vehicles based on the anticipated schedule.

As *Exhibit: Hybrid-6* and *Graph 8* show, the City could potentially have 41% of civilian vehicle purchases as hybrids starting in 2005, escalating to 80% by 2010. This schedule would result in this civilian portion of the fleet consisting of 54% hybrid vehicles in the year 2010. Additionally, the level of market penetration of hybrid vehicles into the Citywide fleet of 9,243 on-road vehicles



operated by the City could be further enhanced should the Fire and Police departments choose to use these vehicles in some of their operations as well. Since both the Police and Fire departments have agreed to supplant a portion of their non-emergency vehicle fleet purchases with hybrid vehicles in FY05, it is likely that the above benchmarks will be met or exceeded in the coming years.

EXHIBITS

Exhibits: Fleet 1-8
Exhibits: Hybrid 1-6

INSERT EXHIBIT PAGES

APPENDIXES

Appendix A: Equipment Classification and Replacement Criteria
Appendix B: Downtown Motor Pool F&A Analysis
Appendix C: GEMS2000 Incomplete and Data Error Samples
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