Exempt Hybrids from the Congestion Charge
Technical Memorandum

Congestion Mitigation Commission
Technical Analysis

Exempt Hybrids from the Congestion Charge

prepared for
New York City Economic Development Corporation
New York City Department of Transportation

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List of Acronyms

AT-PZEV – Advanced Technology Partial Zero Emission Vehicle
CAFÉ – Corporate Average Fuel Economy
CARB – California Air Resources Board
CAV – Clean Air Vehicle (a California state program)
CNG – Compressed Natural Gas (an alternative fuel source)
CPZ – Congestion Pricing Zone
FFV – Flexible Fuel Vehicle
GHG – Greenhouse Gas
GVWR – Gross Vehicle Weight Rating
HEV – Hybrid Electric Vehicle
HOV – High Occupancy Vehicle
ICE – Internal Combustion Engine (for purposes here, a non-hybrid or non-low-emission vehicle)
LEV – Low-Emission Vehicle
LPR – License Plate Readers
PZEV – Partial Zero Emission Vehicle
SOV – Single Occupant Vehicle
SULEV – Super Ultra Low Emission Vehicle
TLEV – Transitional Low Emission Vehicle
ULEV – Ultra Low Emission Vehicle
USEPA – United States Environmental Protection Agency
VMT – Vehicle Miles Traveled
ZEV – Zero Emission Vehicle
Executive Summary

On any given workday, the Manhattan Central Business District hosts nearly two million workers from around the region, hundreds of thousands of tourists, and several hundred thousand residents. Streets are congested with cars, trucks, buses, taxis, pedestrians, and cyclists. The saturated roadways slow bus service, cause emergency vehicles to lose valuable response time, and contribute to the region’s air pollution problems. Congestion pricing has been proposed to address these issues.

One incentive that could be considered to help meet the goal of improving air quality is to allow hybrid or other types of low-emissions vehicles to enter the congestion pricing zone without paying a fee. Similar incentives have been adopted in locations throughout the United States and elsewhere. These incentives are credited with spurring growth in alternative fuel vehicle sales in these regions. Is there a possibility, however, that the incentives are working too well? By eliminating driver fees or other restrictions for a set of vehicle types and thereby pushing up demand for those vehicle types, could the congestion-related benefits of traffic control that the restrictions were initiated to achieve be compromised?

CLEAN VEHICLE MARKET

Vehicles that are fueled by alternative fuel sources or that simply emit low amounts of air pollutants while operating on conventional fuels, collectively referred to as “clean vehicles,” are making their presence known in the marketplace. Driven by increasingly stringent government emissions and fuel economy standards, and responding to consumer demands for vehicles that pollute less and require fewer trips to a fueling station, automobile manufacturers have been introducing many new clean vehicle models, particularly hybrid electric vehicle (HEV) models, to the market. Additional incentives such as Federal and state tax rebates also have helped to fuel the HEV market. Nationally, hybrid-electric vehicles represented 0.1 percent of registered vehicles. According to New York State Department of Motor Vehicle data, hybrid-electric vehicles represent 0.2 percent of registered vehicles in the areas of the New York City metropolitan region within New York State (New York City, Nassau, Suffolk, Putnam, Dutchess, Rockland, Orange, and Westchester). Industry experts predict that HEVs will increase their light duty passenger
vehicle market presence in coming years, from 1.5 percent of new vehicle sales in 2006 to 4.5 percent or more by 2012.¹

**CASE STUDIES**

An additional incentive have been adopted in 10 states, which allows clean vehicle motorists to access High Occupancy Vehicle (HOV) facilities without meeting minimum occupancy requirements. These states have established varying emissions and fuel economy criteria that vehicles must meet to qualify. States such as New York have very stringent qualification criteria, while Virginia allows many more vehicle models to participate in its program. Three state programs have been selected for examination: New York’s Clean Pass Program, Virginia’s Clean Special Fuels license plate program and California’s Clean Air Vehicle program. Additionally, a look at a recent addition to London’s congestion pricing scheme, the institution of emissions-related charges, could inform a similar policy scheme in New York City.

**New York Clean Pass Program.** New York State implemented the Clean Pass Program on the Long Island Expressway in 2006. The program has strict qualification criteria (only three vehicle models presently qualify). Within the first nine months of the program, NYSDMV issued 2,100 Clean Pass decals and clean vehicles accounted for between one and six percent of vehicles traveling in HOV lanes on the Long Island Expressway.

**Virginia Clean Special Fuels Program.** Virginia’s program has much less stringent qualification criteria, allowing many HEV models to participate. In the first five years of the program’s existence, more than 8,500 vehicles enrolled. Clean Special Fuel Vehicles accounted for 25 percent of HOV utilization on Interstate 95, causing the lanes to operate beyond capacity. Virginia recently restricted clean vehicle use of HOV lanes on Interstates 95 and 395.

**California Clean Air Vehicle Program.** California’s program has perhaps the highest level of participation in the country. More than 85,000 vehicles have Clean Air Vehicle decals and are qualified to travel in HOV lanes without meeting minimum occupancy requirements. Although HOV lane performance in the State has deteriorated in recent years, California officials have blamed population and VMT growth, not HEVs, for the growing lane utilization.

**London Emissions-Related Charges.** London has implemented emissions-related charges in its congestion charge zone. The emissions-related charges

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offer a 100 percent discount to the lowest emission vehicles, standard charges for most standard passenger car models, and additional fees for inefficient vehicles. A Transport for London study found that this policy will likely have a minor effect on vehicle fleet composition, traffic congestion, and environmental and air quality.

NEW YORK CITY IMPLEMENTATION SCENARIOS

Three scenarios for potential clean vehicle exemptions in the proposed New York City congestion pricing zone have been developed to determine potential effects on traffic congestion and air quality.

The “no special provision” scenario assumes that the congestion pricing scheme will be implemented according to the previous proposal, and that no exemption is offered to clean vehicles. Clean vehicles will grow in number according to market trends, though this will not have an effect on crossings into the Manhattan congestion zone. The number of vehicle trips and anticipated vehicle miles traveled (VMT) will be the same as what is presented in the PlaNYC congestion pricing proposal. With the implementation of congestion pricing, vehicle trips ending in the Congestion Pricing Zone (CPZ) are expected to decrease by 111,000 and VMT is expected to fall by 6.3 percent.

Alternative 1 assumes that the strict standards of the New York Clean Pass program are adopted for a Manhattan clean vehicle exemption, and only select clean vehicle models qualify. This scenario could result in the addition of 1,350 daily vehicle trips that end in the Congestion Pricing Zone (CPZ) above the congestion pricing scenario envisioned in PlaNYC. Vehicle miles traveled (VMT) in the CPZ for passenger vehicles also would increase, by more than 9,000, from 4.03 million in the baseline scenario to 4.04 million VMT daily in the Alternative 1 scenario. This represents a reduction in total VMT (including commercial and transit vehicles) over the precongestion pricing baseline of 6.2 percent. Table 4.1 on page 4.7 provides details on VMT and vehicle trip calculations.

Alternative 2 assumes that the qualification criteria are less stringent, similar to the Virginia Clean Special Fuels program. This scenario could result in the addition of approximately 13,000 daily vehicle trips into the congestion pricing zone above the PlaNYC congestion pricing proposal scenario level. Daily VMT for passenger vehicles would likely increase by 43,000 vehicle-miles relative to the PlaNYC proposal. This represents a reduction in VMT of 5.5 percent over the precongestion pricing baseline.

Figure ES.1 shows the anticipated effect each scenario will have on VMT in the CPZ. Assuming total VMT will drop by 6.3 percent in the first year after congestion pricing is implemented, 4.75 million VMT (precongestion pricing) will be reduced to 4.45 million VMT (postcongestion pricing). The implementation of Alternative 1 would add 9,000 VMT back into the zone, as
indicated by the dark blue bar. Alternative 2 would add 43,000 VMT back into the zone, as indicated by the orange bar.

CONCLUSION

The experiences of other states show that the addition of incentives that save motorists time and money can result in a significant level of program participation. This participation meets the goals of programs geared toward changing vehicle purchasing and travel habits. The evidence does not suggest, however, that such fee and occupancy exemptions contribute to lowering traffic congestion. In fact, the opposite may be true. An incentive program that becomes popular for thousands of drivers may result in a lessening of the congestion reduction benefits of the congestion pricing scheme.

**Figure ES.1 Daily Total Vehicle Miles Traveled within the CPZ**

*Pre- and Post-Implementation Scenarios*

![Graph showing daily total vehicle miles traveled within the CPZ before and after congestion pricing implementation. The graph compares baseline, PlanNYC proposal, and alternative scenarios.](image-url)
1.0 Introduction

On any given workday, the Manhattan Central Business District hosts nearly two million workers from around the region, hundreds of thousands of tourists, and several hundred thousand residents. Streets are congested with cars, buses, taxis, pedestrians, and cyclists. The saturated roadways slow bus service, cause emergency vehicles to lose valuable response time, and contribute to the region’s air pollution problems.

According to Texas Transportation Institute’s Urban Mobility Report, New York City ranks second in the nation in terms of annual delay. The majority of the delay is spent during the peak hour, with travelers experiencing 46 hours of annual delay (per traveler) in 2005, up from 34 hours in 2000, a 35 percent increase. This congestion costs the City and its residents over $7 billion in 2005, costing each peak traveler approximately $888.

By 2030, nearly a million more residents, 750,000 more jobs, and millions more visitors are expected to further strain the City’s transportation system. The current system cannot handle the anticipated increase in traffic and meaningful infrastructure-based solutions are challenging, costly, and lengthy to implement. A comprehensive and innovative set of strategies must be implemented to make a profound change in travel behavior.

One incentive that could be considered to help meet the goal of improving air quality is to allow hybrid or other types of low-emissions vehicles to enter the congestion pricing zone without paying a fee. Similar incentives have been adopted in locations throughout the United States and elsewhere. In Long Island, New York and California, alternative fuel vehicles that meet strict state and Federal emissions and fuel economy restrictions are permitted to travel in High Occupancy Vehicle (HOV) lanes without meeting minimum occupancy requirements. In Virginia those restrictions are less stringent, allowing a wider array of alternative fuel vehicles to access HOV lanes. In the United Kingdom, clean fuel vehicles that meet strict European standards are exempt from paying the congestion fee in Central London. These incentives are credited with spurring growth in alternative fuel vehicle sales in these regions. Is there a possibility, however, that the incentives are working too well? By eliminating driver fees or other restrictions for a set of vehicle types and thereby pushing up demand for those vehicle types, could the congestion-related benefits of traffic control that the restrictions were initiated to achieve be compromised?

This memorandum explores the regulatory environment that has driven and will continue to influence the alternative fuel vehicle market and engages in a discussion of alternative and clean fuel vehicle standards and types in Section 3.0. The section concludes with an examination of existing and forecasted future markets for these vehicles. Section 4.0 introduces four case
studies that examine alternative fuel incentives that have been implemented in the United States and the United Kingdom along with the effects on traffic congestion and air quality that have been observed or predicted. Section 5.0 presents three potential scenarios for the implementation of fee exemptions for alternative fuel vehicles in the Manhattan congestion pricing zone. Section 6.0 presents conclusions based upon the discussion of the scenarios.
2.0 Alternative Fuel and Low-Emissions Vehicle Types and Markets

The types of policies that promote the use of alternative fuels, energy efficiency, and reduced emissions can embrace a wide variety of vehicle and engine types. Some policies set eligibility requirements based on the emissions rating of a vehicle model. Other governments have based eligibility requirements on the engine type, regardless of the rated level of emissions or energy efficiency of the vehicle model. Prior to addressing special facilities access incentives throughout the world, it is necessary to understand the various types of low-emissions and alternative fuel vehicles and existing state and Federal emissions policies and standards. This section of the report establishes the context for alternative fuel, clean fuel and low-emissions vehicles, defines vehicle classifications, and provides examples of vehicle models available on the market. This section concludes with a discussion of current and anticipated market penetration of various vehicle types.

2.1 POLICY CONTEXT: GOVERNMENT EMISSIONS STANDARDS AND RATINGS SYSTEMS

The United States Federal government has been responsible for regulating air quality since 1970. The passage of the Clean Air Act (CAA) and subsequent amendments have established standards for reducing air pollution by regulating mobile and stationary sources of pollutants. The CAA and amendments have led to the establishment of Federal low-emissions vehicle standards and special provisions for stricter standards in the State of California. New York, along with seven other states in the Northeast have adopted aspects of the California standards. Six additional states have or are considering adopting similar measures. The following paragraphs discuss the policy contexts that have resulted in the development of the alternative fuel and low-emissions vehicles that currently are available on the market.

Federal Clean Air Act and Amendments, 1963 to 1990

Federal efforts to reduce air pollution and improve air quality stem from the CAA, originally drafted and passed through Congress in 1963. The CAA initially called for the development of air quality control agencies in each of the states. Federal involvement was limited to addressing pollution issues on the interstate highway system.
In 1970, the CAA was extended and amended to establish a Federal standard and policy for addressing air quality issues. The amendments required the newly established U.S. Environmental Protection Agency (USEPA) to develop and enforce air quality regulations for the sake of protecting human health. Three programs of regulations and standards were developed by the USEPA to address various types of pollutants and sources: 1) the New Source Performance Standards prescribe the level of pollution that a new stationary source may emit; 2) the National Ambient Air Quality Standards (NAAQS) were established to protect human health and the environment from harmful air contaminants and target six air contaminants, including Ozone (O₃), particulate matter (PM), carbon monoxide (CO), sulfur dioxide (SO₂), nitrogen oxides (NOₓ), and lead (Pb); and 3) the National Emissions Standards for Hazardous Air Pollutants (NESHAP) were established to achieve the maximum reduction of emissions of pollutants that are not regulated by NAAQS, yet may cause increases in fatalities, or serious or irreversible illness.

The 1970 Amendments called for the enforcement of these standards by the USEPA in all states except California, which was exempt due to particularly acute air quality problems and that state’s efforts in pioneering strict standards of its own. The other 49 states for which USEPA is responsible were given the option to take on the responsibilities of regulation and securing compliance themselves, with funding assistance from the USEPA. States that elect to engage in regulation themselves are required to develop a USEPA-approved State Implementation Plan.

In 1990 the CAA received another set of significant amendments, which are the most recent alterations to the CAA. The 1990 amendments address ozone layer depletion, toxic pollutants, and acid rain. With regard to mobile sources of air pollutants, the 1990 amendments require automobile manufacturers to produce cleaner engines; refiners to produce cleaner, less-evaporative fuels; and non-attainment areas to establish passenger vehicle inspection and maintenance programs that regulate vehicle emissions. The amendments encourage the development of alternative and renewable fuels.²

**Corporate Average Fuel Economy (CAFÉ) Standards**

In response to the oil embargo of 1973-74, Congress passed the Energy Policy Conservation Act in 1975. Title V of the Act, titled “Improving Automotive Efficiency,” established a set of fuel economy standards that automobile manufacturers who sell vehicles in the United States would be required to meet. The standards were applicable to passenger car and light truck (under 8,500 lbs GVWR) fleets. The National Highway Traffic Safety Administration (NHTSA) is responsible for establishing, amending, and enforcing CAFÉ standards. The

USEPA has the duty of calculating the average fuel economy for each manufacturer’s fleet, either by confirming manufacturer fuel economy test data or by testing vehicles at the USEPA’s facility in Michigan.

Manufacturers that fail to meet the CAFÉ standards for their fleets are subject to fines of $5.50 for every tenth of a mile per gallon short of their target, multiplied by the number of vehicles produced. In lieu of fines, manufacturers can develop fleets that exceed the CAFÉ standards the following year for which they develop credits to use to “pay off” shortcomings in other years.³

**Federal Low-Emissions Vehicle Standards**

The CAA defined two sets, or tiers, of standards for light-duty vehicles. The standards require that vehicles in each subcategory maintain an acceptable level of emissions for each of the following pollutants: THC, NMHC, CO, NOₓ, and PM.

**Tier 1 Standards**

Tier 1 standards were drafted in 1991 and phased in between 1994 and 1997. The standards applied to all light-duty vehicles under 8,500 pounds Gross Vehicle Weight Rating (GVWR). These light-duty vehicles are separated into three subcategories: passenger cars, light-duty trucks below 6,000 pounds GVWR, and heavy light-duty trucks between 6,000 pounds and 8,500 pounds GVWR. Standards for each vehicle type were developed and then measured using the Federal Test Procedure (FTP 75). In 2000, an additional test procedure, the Supplemental Federal Test Procedure (SFTP) was developed to determine emissions levels during more rigorous conditions such as urban driving and driving while a vehicle’s air conditioning system is in operation.⁴

**Tier 2 Standards**

In 1999, a second tier of Federal emissions standards was adopted and began being implemented in 2004. The phasing in of the Tier 2 standards is scheduled to be completed in 2009. Unlike Tier 1, Tier 2 standards include regulations applicable to large passenger vehicles over 8,500 pounds GVWR, up to 10,000 pounds GVWR. Tier 2 evaluates vehicle models’ compliance at three stages of a vehicle’s life – prior to assembly line production, on the assembly line, and an in-use evaluation to ensure emissions levels are maintained after several years of

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use. Tougher requirements for fuel quality and cleanliness also are part of the Tier 2 standards.

Vehicle manufacturers may certify their vehicle models into one of 11 “certification bins.” Each bin corresponds to a level of strictness of the standards, with Bin 1 having the toughest clean fuel requirements and Bin 11 having the most relaxed requirements. Bins 9 through 11 are temporary bins, and will expire after Model Year 2008. In 2009 the entire vehicle fleet sold by each manufacturer must meet an average NOx emission standard of 0.07 grams per mile.5

National Low-Emission Vehicle Standards

During the late 1990s, the transitional period between Tier 1 completion and the phasing-in of Tier 2, the USEPA established a voluntary National Low-Emission Vehicle (NLEV) program, which resulted from an agreement between Northeastern states and auto manufacturers. The program sets forth more stringent standards than the Tier 1 or Tier 2 programs, requiring emissions reductions that are nearly equivalent to the California Low-Emission Vehicle Program. Participating auto manufacturers achieve compliance by adhering to schedules for bringing certain percentages of their vehicle fleets to increasingly cleaner standards. NLEV was implemented in the Northeastern states in 1999 and nationally in 2001. It applies to light-duty vehicles, excluding heavy light-duty vehicles greater than 6,000 pounds GVWR.6

California Emissions Standards

The CAA allowed the State of California to establish its own emissions standards due to the severity of air quality challenges in that state, and the efforts the State had made in pioneering restrictive standards to improve air quality. The California Air Resources Board oversees research and establishes the California standards. Historically, California’s low-emission vehicle standards have been stricter than USEPA standards. Like the USEPA standards, California’s standards have developed under two iterations.

CA LEV-I, or Low-Emission Vehicle (LEV) established standards for vehicles in six different categories, ranked from least to most stringent: CA LEV-I,  

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Transitional Low-Emission Vehicles (TLEV), Low-Emission Vehicles (LEV), Ultra Low-Emission Vehicles (ULEV), Super Ultra Low-Emission Vehicles (SULEV), and Zero Emission Vehicles (ZEV). CA LEV-I requires that manufacturers produce a certain percentage of vehicles that fit into a certain category, and then progressively develop vehicles in increasingly more stringent categories over time, according to schedules that are built based on the manufacturer’s preexisting fleet characteristics. Tier I expired in 2003.

CA LEV-II, the second tier of California emission standards, went into effect in 2004 and will be completely phased-in by 2010. CA LEV-II initiated a reclassification (phased in by 2007) of vehicles below 8,500 pounds GVWR in a manner that requires most pick-up trucks and SUVs to meet passenger car emission standards. In addition, the NOX and PM emission standards were tightened and the TLEV category was eliminated. Vehicles therefore require advanced emission control technologies in order to meet the CA LEV-II emission standards.7

New York State Air Quality Standards

New York is one of eight Northeastern states that are members of the Coalition of Northeast Governors (CONEG) and Northeast States for Coordinated Air Use Management (NESCAUM), which defines itself as the CAA of the Northeast States. The participating states have adopted the CA LEV-II standards. New York is also one of many states that have adopted the impending California Greenhouse Gas (GHG) standards. These standards, if upheld in court, will establish limits on the emission of greenhouse gases and other pollutants. They will effect automobile manufacturers in the 2009 model year and require a 30 percent reduction in emissions by 2016. The GHG standards would likely result in the introduction of higher quantities of low-emission vehicles, particularly those that make use of cleaner fuels, into the market in New York State.

2.2 ALTERNATIVE FUEL, FLEXIBLE FUEL AND HYBRID ELECTRIC VEHICLE TYPES

Alternative fuel vehicles refer to any motor vehicle that uses a fuel source other than conventional gasoline or diesel gasoline. Alternative sources include compressed natural gas (CNG), liquid nitrogen, ethanol, battery electricity, hydrogen fuel cells, and solar power. Vehicle engines that operate on each of

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these sources are in various stages of development and availability on the market.

Battery electric and CNG vehicles have been developed and adopted into government vehicle fleets. Governments in some locations have purchased government vehicles, transit buses, and public works vehicles that operate on these fuel sources. Liquid nitrogen, hydrogen, and solar powered vehicles have not yet developed far beyond prototype models. Ethanol has become a popular alternative fuel source in recent years. Most vehicles in the existing consumer fleet are capable of operating well on fuel that includes a 10 percent blend of ethanol. Conventional vehicle engines can be modified to receive fuel blends with higher proportions of ethanol, such as E-85 (85 percent ethanol) fuel. Automobile manufacturers have introduced flexible fuel vehicles onto the market which can operate well on E-85 fuel.8

Flexible Fuel Vehicles (FFV)

Many of the popular clean fuel vehicles are flexible fuel vehicles (FFV) which alternate between two fuel sources. FFVs may qualify for several different California emissions rating categories, depending on the technologies used and resulting emissions. Popular examples of an FFV type include models that are capable of receiving E-85 ethanol. Manufacturers such as Daimler Chrysler, Ford/Lincoln, GM, Isuzu, Mazda, Mercedes-Benz, Mercury, and Nissan have produced vehicle models capable of receiving high proportions of ethanol fuel. Combined, these manufacturers have produced a total of 25 ethanol FFV vehicle models available in 2007.9

Currently, there are few fueling stations in the United States that offer E-85 fuel. Of the 1,200 stations nationwide approximately 80 percent are located in the Midwest or Northern Plains states.10 In New York State there are three fueling stations that offer E-85 fuel, while no stations currently offer E-85 ethanol in New Jersey or Connecticut.11 Due to its scarcity, FFVs operating in the Tri-State region are likely operating on conventional fuel sources at most, if not all, times. FFVs are unlikely candidates for clean fuel or low-emission vehicle incentive benefits because of the fact that these vehicles can, and quite often do, operate on conventional petroleum fuel.

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11 “E85 Stations.”
Hybrid Electric Vehicles (HEV)

Hybrid electric vehicles (HEV) which use a conventional combustion engine and a battery and electric motor, are another example of a popular type of FFV. These vehicles are capable of operating with improved fuel economy and lower emissions, however not all HEVs are developed for those purposes alone, and hence some models do not meet some of the more stringent emission category requirements.12

2.3 **LOW-EMISSION VEHICLE RATINGS, VEHICLE TYPES AND EXAMPLES**

Existing consumer market-ready applications of LEVs will be presented according to the emission category established by the California Air Resources Board for which they qualify.

Low-Emission Vehicles

As of 2004, all new cars sold in California, and states that have adopted California Air Resources Board (CARB) standards, including New York, are required to meet LEV II emission ratings. LEV II is the least stringent rating new vehicles are permitted to obtain in California and states that have adopted the California rating system. Most LEV IIs are equipped with conventional internal combustion engine (ICE) technologies. Some hybrid vehicles fit into this category as well, unable to qualify for stricter emission ratings. This is due to the fact that their hybrid technologies are aimed at improving engine performance while maintaining the same fuel economy and emissions rating as standard ICE models. The 2007 models of the GMC Sierra Hybrid and Chevrolet Silverado Hybrid, for example, received the same USEPA fuel economy rating (LEV II) as the standard 2007 GMC Sierra and 2007 Chevrolet Silverado. The hybrid versions of both vehicle models, however, included a 5.8-liter, eight-cylinder engines which offer the consumer better performance than the 4.3-liter, six-cylinder standard models. The hybrid versions of the Sierra and the Silverado offer a slim one to two mile-per-gallon fuel economy savings compared to the standard models.13 Table 2.1 provides a fuel economy and emissions rating comparison of some LEV-rated vehicle models in the U.S.

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Table 2.1 Fuel Economy and Emissions Rating Comparison of Select LEV-Rated Vehicle Models

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<tbody>
<tr>
<td>Chevrolet Silverado C1500</td>
<td>4.3L 6, auto</td>
<td>16 mpg</td>
<td>21 mpg</td>
<td>LEVII</td>
</tr>
<tr>
<td>GMC Sierra Classic C1500</td>
<td>4.3L 6, auto</td>
<td>16 mpg</td>
<td>21 mpg</td>
<td>LEVII</td>
</tr>
<tr>
<td>Chevrolet Silverado C1500 Hybrid</td>
<td>5.3L 8, auto</td>
<td>18 mpg</td>
<td>21 mpg</td>
<td>LEVII</td>
</tr>
<tr>
<td>GMC Sierra Classic C1500 Hybrid</td>
<td>5.3L 8, auto</td>
<td>18 mpg</td>
<td>21 mpg</td>
<td>LEVII</td>
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Ultra Low-Emission Vehicles (ULEV)

ULEVs emit 50 percent fewer pollutants than LEVs. A wide variety of conventional gasoline engine cars, SUVs, and pick-ups currently available on the market meet ULEV standards. Popular 2007 sedan models such as the Toyota Corolla and Yaris, Honda Sonata, Mazda MX-5 Miata, BMW X3, and the six-cylinder Nissan Altima qualify for a ULEV rating. Older versions of the Honda Insight, Honda Civic Hybrid, and Toyota Prius met ULEV standards, though most current hybrid vehicle models on the market aim for SULEV, PZEV, and AT-PZEV ratings, which are discussed below.

Super Ultra Low-Emission Vehicles (SULEV)

SULEV is the cleanest emission standard achievable by gasoline-powered vehicles. These vehicles emit between 76 percent and 97 percent fewer pollutants than USEPA Tier 1 requirements, and are 90 percent cleaner than LEVs. SULEV subcategories have been added to the California list of emissions categories. Partial zero emissions vehicles (PZEV) represent vehicles that meet SULEV requirements, have zero evaporative emissions from its fuel system, and have a 15-year, 150,000-mile warranty on its emission control components. PZEVs give automobile manufacturers a partial credit toward meeting ZEV requirements without the need to produce ZEVs. The second new category includes advanced technology partial zero emission vehicles (AT-PZEV). AT-PZEVs use hybrid electric vehicle systems or CNG components to improve fuel efficiency, but otherwise meet PZEV/SULEV emissions requirements.

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14 Driveclean CA.
There currently are dozens of SULEV models available on the market. Auto manufacturers such as Ford, Chevrolet, Honda, Lexus, Mazda, Mercury, Nissan, and Toyota have developed SULEV, PZEV, and AT-PZEV models that are gaining popularity and traction in the marketplace. SULEV vehicle models available in 2007 include the Hyundai Elantra GLS and the BMW 3 Series four-door sedan. The 2007 models of the Volkswagen Jetta, Toyota Camry Sedan, Subaru Forester, Pontiac G5, Ford Fusion, and Nissan Altima qualify as PZEVs. Hybrid vehicles such as the Toyota Prius, Honda Insight, and Honda Civic Hybrid are AT-PZEVs due to the advanced technology used to meet tough emissions standards. It is important to note that due to clean fuel requirements in place in California, New York, and Connecticut, a vehicle that qualifies as PZEV in those states may not burn as clean and therefore qualify as a SULEV elsewhere in the country.

Zero Emission Vehicles

ZEVs have zero tailpipe emissions and are 98 percent cleaner than LEVs. Battery electric vehicles, fuel cell vehicles, hydrogen vehicles, and solar powered vehicles qualify as ZEVs. Currently, there are no ZEV models being mass-produced by the major automobile manufacturers, nor are any models widely available on the market. The CA LEV-II program sets ZEV quotas for automobile manufacturers. Manufacturers unable to produce their quota of ZEVs have the option to produce Advanced Technology Partial Zero Emission Vehicles (AT-PZEV) to receive partial ZEV credits. This arrangement is one of the major motivating factors driving the production of AT-PZEVs and HEVs.

2.4 ALTERNATIVE FUEL AND LOWER EMISSIONS VEHICLE MARKET PENETRATION AND FORECASTS

Alternative fuel and lower emissions vehicles have been taking on a larger share of the new vehicle market in recent years. In particular, HEVs have been gaining traction in the marketplace. Since Honda introduced the Insight hybrid in 1999 and Toyota’s Prius premiered in 2000, consumer demand for hybrids has grown tremendously. These models, and those that have arrived on the market in more recent years, offer consumers physical appearance and performance similar to conventional automobiles.

Despite higher sticker prices than comparable internal combustion engine (ICE) vehicle models, the incentives available to hybrid buyers, including Federal income tax credits and various state and local incentives may reduce to some degree the perceived pricing disparity. The Federal income tax credit, which can be worth up to a few thousand dollars, is available to the original purchasers of hybrid vehicles during the year of purchase. The credits are applicable on a given vehicle model until the manufacturer sells a total of 60,000 units of that vehicle model. Additional incentives available in some states and municipalities include additional tax credits, vehicle emissions inspection waivers, preferred
and/or free or discounted parking, and special access to facilities such as HOV lanes without meeting minimum occupancy requirements.

These incentives have contributed to the popularity of HEVs nationwide, but also in specific areas where the incentives are greater. In 2005, over one quarter of all HEV sales in the U.S. occurred in California where strict emissions standards, state tax credits, and HOV lane privileges are present. Virginia, which began offering HOV lane privileges to single-occupant HEVs in its highly congested northern suburbs in the 1990s, was the second largest HEV market in the nation until traditionally larger consumer markets in Florida, Texas, and New York surpassed Virginia’s sales in 2005.¹⁷

Nationwide, HEV sales have increased significantly in each year since 2000. Between 2000 and 2006 new HEV registrations increased by an average of 85 percent annually. Despite a tremendous jump in HEV registrations between 2004 and 2005 (an increase of over 125 percent), 2006 experienced much slower growth. As of 2006, HEVs comprised only 1.5 percent of new light-duty vehicle registrations, but when compared to almost 0.0 percent of new light-duty vehicle registrations in 2000, and 0.5 percent in 2004, significant growth has been achieved. In the first half of 2007, HEVs comprised 2.3 percent of the light duty market.¹⁸ United States HEV registrations between 2000 and 2006 are illustrated in Figure 2.1.


HEV Market Forecasts

Since the 1990s all of the major automobile market watchers have been speculating on the potential growth in the HEV and other lower emissions markets. In developing market forecasts, these firms, such as J.D. Power and Associates, ABI Research, and Booz Allen, take dozens of factors into consideration. The following production factors contribute to the development of market and sales forecasts:

- Vehicle rollout schedules, production capacity, technological advancements;
- Regulation factors such as anticipated fuel economy and emissions requirements, the status of government incentives such as tax credits available to consumers who purchase specific models; and
- Consumer factors such as consumer market purchasing power and consumer demands.

There is a lot of speculation and disagreement among forecasters regarding the rate of growth HEVs will experience in the marketplace over the next five to 10 years.19

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According to some well-respected forecasters such as J.D. Power and Associates (JDP) and Energy and Environmental Analysis (EEA), HEVs will continue to grow in numbers on the market, but their growth, though continuing to be strong, will slow down relative to the rapid growth observed in 2004 and 2005. This anticipated slowing of momentum for HEVs is expected due to public disappointment with the actual fuel economy of HEVs, and predictions that HEV fuel economy will improve only marginally beyond 2012, while the fuel economy of ICEs is expected to improve.

JDP indicates that HEVs will likely achieve a 4.6 percent share of the new vehicle market by 2010, up from 1.5 percent in 2006, and a doubling of the 2.3 percent market share HEVs achieved in the first half of 2007. EEA predicts that HEVs will achieve 4.5 percent of the market by 2012 and as much as 7.5 percent by 2020. The EEA forecasts anticipated higher growth for hybrids if government-sponsored fee-bates for automobile manufacturers are offered as incentives to produce HEVs. Growth could be greater still with technology subsidies to consumers who purchase HEVs. A $5,000 subsidy would result in a market share of over 60 percent, while 30 percent could be achieved with a subsidy of $2,500 by 2025. Though EEA suggests that such subsidies are not sustainable, this scenario indicates that consumers are very responsive to large incentives. Figure 2.2 illustrates HEV market forecasts produced by some of the most reputable firms in the nation.20

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The black curve represents a continuation of the current trend in HEV growth. Many firms have predicted growth at an accelerated rate. JDP, one of the most well-respected forecasting firms in the world, is predicting much slower growth in the HEV market, however. A study conducted by the Institute of Transportation Studies at the University of California-Davis used the trend line in the above figure to find that hybrid vehicles will likely account for 1.2 percent of all light duty vehicle travel in the United States by 2010.21 Growth could be greater than the national average in states such as New York, where stricter emissions standards are bringing more HEVs to the market.

2.5 **Government Incentive Programs**

In order to encourage consumers to purchase and drive cleaner vehicles, a Federal tax credit and a number of state and local government incentives have been implemented. The current Federal tax credit, which went into effect

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January 1, 2006, applies to new vehicles purchased and delivered on or after that date. Qualifying vehicles must have been purchased for the purpose of using the vehicles, not reselling them. The credit amount varies from $400 to $3,400 depending upon the fuel economy and emissions rating of each qualifying vehicle model. The full credit value is available until the conclusion of the quarter in which the automaker sells 60,000 units of the vehicle model. Vehicles purchased in the following two quarters will be eligible for 50 percent of the original credit amount. The third and fourth quarter after 60,000 units have been sold, purchasers may receive a credit worth 25 percent of the original credit value, and beyond the fourth quarter, the credit becomes unavailable.

Many state and local governments throughout the country offer additional incentives to encourage consumers to purchase cleaner vehicles. These incentives range from tax credits and rebates to free parking in neighborhood parking lots. A summary of state and local incentives available to private consumers in the New York, New Jersey, and Connecticut Tri-State region is presented in Table 2.2.
Table 2.2  State and Local HEV Incentives Available in the New York Metropolitan Region

<table>
<thead>
<tr>
<th>Program</th>
<th>State</th>
<th>Program Description</th>
<th>Vehicle Qualifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>State Sales Tax Exemption</td>
<td>Connecticut</td>
<td>The State’s six percent sales tax is waived for qualifying vehicles</td>
<td>USEPA fuel economy rating of 40 mpg purchased prior to July 1, 2008</td>
</tr>
<tr>
<td>New Haven, Free Parking</td>
<td>Connecticut</td>
<td>Free parking for HEVs at metered parking spots throughout the City of New Haven</td>
<td>HEVs registered in New Haven</td>
</tr>
<tr>
<td>Clean Pass</td>
<td>New York</td>
<td>Access to HOV lanes without meeting minimum occupancy requirements</td>
<td>SULEV or pre-2005 ULEV and USEPA fuel economy rating of 45 mpg</td>
</tr>
<tr>
<td>Green Pass</td>
<td>New York</td>
<td>10 percent toll discount on New York State Thruway Authority facilities</td>
<td>SULEV or pre-2005 ULEV and USEPA fuel economy rating of 45 mpg</td>
</tr>
<tr>
<td>Green Car Tax Incentives</td>
<td>New York</td>
<td>Offers tax credits of up to $3,000 and a tax exemption for purchasing new hybrid electric vehicles (HEVs), alternative fuel vehicles (AFVs), and/or install clean fuel vehicle refueling equipment. The maximum value of the incentive is $5,000 for vehicles weighing less than 14,000 pounds (lbs.) gross vehicle weight rating (GVWR).</td>
<td>SULEV or pre-2005 ULEV and USEPA fuel economy rating of 45 mpg in service before December 31, 2006</td>
</tr>
<tr>
<td>Westchester County, Free Commuter Parking</td>
<td>New York</td>
<td>Free parking for HEVs at two commuter parking lots in North White Plains, a savings of $75/month</td>
<td>HEVs</td>
</tr>
</tbody>
</table>

3.0 Case Studies

In addition to Federal and state tax rebates, 10 state governments have offered travel incentives to encourage clean vehicle ownership and ease traffic burdens on over utilized general purpose lanes. These states have established varying emissions and fuel economy criteria that vehicles must meet to qualify. States such as New York have very stringent qualification criteria, while Virginia allows many more vehicle models to participate in its program. Three state programs have been selected for examination: New York’s Clean Pass Program, Virginia’s Clean Special Fuels license plate program and California’s Clean Air Vehicle program. Additionally, some lessons can be taken from an overseas example. In London, a city which has implemented congestion pricing, emissions-related charges have been introduced as an incentive for motorists to change their vehicle purchasing habits.

3.1 NEW YORK STATE PROGRAMS

New York State Clean Pass Program

Clean Pass is a multiagency pilot program which has partnered the New York State Department of Transportation (NYSDOT), the State Department of Motor Vehicles (DMV), and State Department of Environmental Conservation (DEC). The program was begun in March 2006 as part of Governor Pataki’s Strategic Energy Action Plan. The goals of the program are to encourage the use of low-emission, energy efficient vehicles for the sake of improving air quality and the natural environment and reducing dependence on foreign sources of energy.

Vehicle Eligibility

Clean Pass allows motorists whose vehicles meet the California SULEV emissions standards, or ULEV emissions standards for pre-2005 vehicle models, and achieve a USEPA fuel economy rating of 45 miles per gallon to use the HOV lanes on the Long Island Expressway (LIE) without meeting minimum occupancy requirements. Vehicles that meet these standards include clean-burning alternative fuel vehicles and some models of hybrid vehicles. Hybrids that meet the EPA fuel economy standards include the Toyota Prius (model years 2001 to 2007), the Honda Civic Hybrid (model years 2003 to 2007), and the Honda Insight Hybrid (model years 2000 to 2004). Currently, no other hybrid vehicles on the market meet the EPA 45 miles per gallon fuel economy standard.
Motorists who wish to participate in the program submit an application to the DMV. If their vehicles meet the necessary standards, four Clean Pass decals are issued for each vehicle. One decal must be placed on each of the vehicle’s four sides (front, rear, driver side, passenger side) to assist law enforcement officials in enforcing HOV restrictions. HOV lanes on the LIE are enforced by Nassau County and Suffolk County police departments.

Current Status of the Clean Pass Program

The Clean Pass pilot program on the LIE was intended to last for one year, during which time the effects of the program on traffic congestion and travel speeds in the HOV lanes were monitored. The program is still in its pilot phase as the partnered state departments await the USEPA’s determination on establishing criteria for vehicle eligibility for programs such as Clean Pass. Currently, Clean Pass decals are still being issued to the vehicles initially identified as eligible, although NYSDOT admits that changes in eligibility may result once the EPA makes a determination. By the end of 2006, nine months after the program was begun, more than 2,100 Clean Pass decals had been issued, 68 percent of them to Long Island residents.22

With regard to traffic congestion, NYSDOT has stated that although HOV lanes on the LIE were determined to have significant excess capacity prior to the program’s initiation, there has been a “degradation” of HOV lane performance since.23 NYSDOT traffic counts conducted in October 2006, seven months after the program’s inception, show that Clean Pass vehicles compose one percent to six percent of vehicles using the HOV lanes on the Long Island Expressway during morning and evening peak-periods.24 The degree to which HOV lane performance deteriorates will factor into future decisions on whether to continue the Clean Pass program in its current form or introduce stricter vehicle eligibility requirements.


24 “HOV Lanes,” FHWA.
New York State Green Pass Program

The New York State Thruway Authority’s Green Pass Program, which went into effect on April 1, 2006, offers a 10 percent toll discount to qualifying automobiles on New York State Thruway Authority facilities. The qualifications for Green Pass program match those of the Clean Pass program. Vehicles must meet California SULEV emissions standards, or ULEV emissions standards for pre-2005 model vehicles, and achieve a USEPA fuel economy rating of 45 miles per gallon. Qualifying vehicle models are currently limited to model year 2000 to 2004 Honda Insight, model year 2001 to 2007 Toyota Prius, and model year 2003 to 2007 Honda Civic Hybrid vehicles. Applicants whose vehicles meet the criteria receive a Green Pass E-ZPass transponder to place within their vehicles.

All E-ZPass transponders are intended for use in the vehicle to which they are issued. Although this policy is not always strictly enforced, this policy is particularly important for transponders that are intended to offer discounts for specific types of vehicles. Transponder colors assist enforcement, with the green color of the Green Pass and blue color of government vehicle E-ZPass transponders, for example, allowing for easy identification of special-use transponders. The ease with which transponders can be moved from one vehicle to another, however, creates a significant enforcement challenge. Active and thorough enforcement of Green Pass and similar special-use transponder programs would require significant enforcement supplements such as police and/or electronic surveillance.

3.2 **VIRGINIA CLEAN SPECIAL FUEL HOV PROGRAM**

Virginia is one of the nine states in the country that allow access to HOV facilities to alternative fuel vehicles without meeting minimum occupancy requirements. Virginia is the only state, however, that extends that privilege to nearly every model of hybrid vehicle. The Commonwealth’s Clean Special Fuel program has become tremendously popular, especially since hybrids have acquired traction in the automobile market in recent years. The level of participation in the Virginia program has resulted in HOV lanes operating above capacity in some areas. Virginia transportation officials and lawmakers are seeking solutions that will reduce congestion while preserving the clean special fuel program.25

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Virginia Clean Special Fuel Program, 1993 to 2000

In 1993, the Virginia General Assembly passed legislation that established unique license plates for clean special fuel vehicles. Clean special fuel vehicles were defined as those making use of any product or source of energy which, compared to conventional or reformulated gasoline, result in lower emissions of nitrogen oxides, volatile organic compounds, carbon monoxide or particulates, or any combination thereof. Fuel sources such as compressed or liquefied natural gas, liquefied petroleum gas, hydrogen, hythane, and electricity were included in the clean special fuels definition. Vehicles that met the clean special fuel standards and obtained clean special fuel license plates from the Virginia Department of Motor Vehicles were allowed to use HOV lanes in the Northern Virginia and Hampton Roads regions without meeting minimum passenger occupancy requirements. Between 1994, when the program was implemented, and 2000, only 32 vehicles had obtained clean special fuel license plates.26


In 2000 the General Assembly expanded the definition of clean special fuel vehicles to include HEVs and vehicles that operate exclusively on alternative fuels. As evident in Figure 3.1, the expansion of the qualifications for clean special fuel license plates resulted in an almost immediate explosion in participation. By April 2003, 2,500 clean special fuel plates had been issued in Northern Virginia. By the end of 2004, 6,800 hybrid vehicles were registered with the special plates. According to the Virginia Department of Motor Vehicles, 8,500 of Virginia’s 11,600 hybrid vehicles were registered in Northern Virginia in 2006.

Figure 3.1  Clean Special Fuel Program Participation in Northern Virginia  
2000 to 2006

Virginia quickly became the second-largest market for hybrid vehicles in the U.S., behind California, until 2005. At this time Florida, Texas, and New York, all traditionally much larger consumer markets than Virginia, registered higher numbers of HEVs. The HOV lane incentives are believed to be one of the primary reasons for the popularity of HEVs in Virginia. According to a Northern Virginia automobile dealer interviewed by the Washington Post, “I’d say 95 percent of the people who buy a Prius say it’s to get into the HOV,” said Jay Taye, sales manager at Ourisman Fairfax Toyota. “They talk about the tax break and the HOV, and once in a while they say they prefer it for the gas mileage as well.”

Indeed the incentive is tremendous, as shown in Table 3.1. Compared to travel time in general lanes, drivers who use HOV lanes in Northern Virginia can reduce their travel time by 55 percent on a trip from Quantico to Washington via Interstates 95 and 395, or by 33 percent on a trip from Manassas to Washington via Interstate 66.
Table 3.1  HOV Time Savings in Northern Virginia
2003

<table>
<thead>
<tr>
<th>Facility</th>
<th>Start Point</th>
<th>End Point</th>
<th>HOV Travel Time</th>
<th>Non-HOV Travel Time</th>
<th>Percent HOV Time Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>I-95/395 Quanitco Creek</td>
<td>14th and C Street</td>
<td>29 minutes</td>
<td>64 min</td>
<td>54.7%</td>
<td></td>
</tr>
<tr>
<td>I-66 Route 234</td>
<td>23rd and Constitution</td>
<td>63 minutes</td>
<td>94 minutes</td>
<td>33.0%</td>
<td></td>
</tr>
<tr>
<td>Dulles Toll Road</td>
<td>Route 28</td>
<td>I-66</td>
<td>12 minutes</td>
<td>13 minutes</td>
<td>7.7%</td>
</tr>
</tbody>
</table>


Effects of Increased Eligibility on HOV Lane Performance

Since 2000, the Virginia HOV Task Force has been monitoring HOV lane performance throughout Northern Virginia. In fall 2003, hybrid vehicles accounted for between two and 12 percent of peak-period HOV lane volumes. One year later, hybrids had increased their share of peak-period HOV lane volume to between 11 and 17 percent. By 2005, an estimated 25 percent of the vehicles using HOV lanes in Northern Virginia were hybrid vehicles with special clean fuel license plates. The number of hybrid vehicles using the HOV lanes has exceeded the percentage of so-called “cheaters,” drivers who use HOV lanes but do not meet clean special fuel or minimum occupancy requirements, who make up 15 percent of HOV users in Northern Virginia. This growing population of clean special fuel vehicle drivers who use HOV lanes now account for over one percent of all inbound automobile trips from outer portions of Northern Virginia to the region’s core areas of Arlington County and the District of Columbia.

The growing share of clean special fuel vehicles has impacted the performance of HOV lanes. According to the 2005 HOV Enforcement Task Force report, the rapid increase in the number of hybrid vehicles has resulted in HOV lanes on Interstate 95 carrying over 1,900 vehicles per hour during peak-periods. This
volume is above the recommended capacity of 1,800 vehicles per hour and represents conditions that the Task Force calls “unacceptable levels of service.”

In its 2005 report, the HOV Task Force recommended that the General Assembly vote against extending the hybrid exemption privilege beyond its expiration date of July 1, 2006. The task force urged the General Assembly to consider adopting a more exclusive definition of clean special fuel vehicles, which would be limited to SULEVs; increase the registration fee required to procure clean special fuel plates; and increase HOV enforcement to limit the impact of “cheaters.”

The General Assembly took action, requiring the Department of Motor Vehicles to issue new clean special fuel license plates. Beyond July 1, 2006, HEVs would still be eligible to receive the new license plates, however vehicles with the new plates would not be permitted to travel in the HOV lanes on Interstates 95 and 395 during HOV-restricted periods without meeting the minimum occupancy requirement. All other HOV facilities in the Northern Virginia and Hampton Roads regions would be open to vehicles with the new clean special fuel plates at all times, without meeting the minimum occupancy requirement. Vehicles with the old clean special fuel plates, even hybrids, are permitted to continue using the HOV lanes on Interstates 95 and 395. The exemption is next due for renewal on July 1, 2008.

Virginia’s new and old Clean Special Fuel license plates are depicted in Figure 3.2.

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3.3 California Clean Air Vehicle Program

State of California legislation approved in 1999 allows SULEVs to use HOV lanes without meeting minimum occupancy requirements. Owners of eligible vehicles apply to the Department of Motor Vehicles, and when approved, receive a Clean Air Vehicle (CAV) decal to display on the vehicle. Between July 2000 and May 2004, approximately 5,400 vehicles registered for the CAV program. The majority of the registered vehicles are located in counties where HOV lanes exist, and over 50 percent are registered in Los Angeles County alone. In September 2004, the State legislature extended the HOV privilege to vehicles that meet AT-PZEV standards and have a 45 miles-per-gallon USEPA fuel economy rating. The addition of the USEPA fuel economy rating requirement is consistent with the New York Clean Pass qualifications. The program is scheduled to expire in January 2011, unless extended by the State legislature.

Vehicles that meet California ULEV and Federal ILEV evaporative standards receive a white CAV decal, while hybrid and alternative fuel vehicles that meet California AT-PZEV and USEPA 45 mpg fuel economy standards receive a yellow CAV decal. Possessors of both decals are exempt from minimum occupancy requirements in California HOV lanes. The California DMV no longer issues...
white decals except as replacements. The California DMV is permitted to issue a maximum of 85,000 yellow decals. The 85,000th decal was issued in January 2007.30

The legislation requires that the California Department of Transportation (Caltrans) assess CAV utilization of HOV lanes throughout the State to determine lane performance and the effects of the clean fuel exemption once 50,000 decals have been issued to hybrid-related vehicles. Key performance indicators to be examined include reduction in level of service, sustained stop-and-go service, slower than average speed than the adjacent mixed flow lanes, and consistent increase in travel time. Caltrans completed a study in June 2007 which found that segments of HOV lanes throughout the State are congested, but did not place blame on HEVs, rather on rising population and vehicle miles traveled.31

3.4 LONDON CONGESTION CHARGE ZONE EMISSIONS-RELATED CHARGES32

Currently, there is a proposal within the government of London to introduce emissions-related congestion pricing into the existing Congestion Charge zone. While the primary *raison d’être* of the congestion pricing policy in London is to reduce the number of automobiles traveling within Central London, the proposal adds a dimension aimed at accounting for each driver’s contribution to carbon emissions and climate change.

Under the proposed emissions-related charging scheme, vehicles would be charged a fee upon entry into the London Congestion Charge zone and different vehicles would be charged a different amount, based upon the vehicle’s specific level of carbon emissions. The proposal identifies three tiers of vehicle emissions and corresponding fees.

1. Cars that emit 120g/km CO₂ or less (which is equivalent to cars registered in Vehicle Excise Duty (VED) bands A and b) and that comply with the Euro 4 air quality emissions standard would be eligible for a 100 percent discount (known as the low- CO₂ discount). Commercial hybrid vehicles such as the

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Toyota Prius and Honda Civic Hybrid would barely qualify as band B automobile. Many larger-sized hybrid models would not qualify.33

2. Cars in VED bands C-E or in band F that emit between 121g/km CO₂ and 225 g/km CO₂ would be liable for the standard charge of £8.00. Additionally, cars in bands A and B that do not meet the Euro 4 emissions standard would be liable for the standard charge. Alternative and flex-fuel vehicle models in this category include the Ford Focus Hybrid, the Volvo S60 and V70 bifuel models, and the Lexus GS, RX, and LS Hybrid models. Standard engine vehicle models such as the Toyota Yaris, the non-hybrid Honda Civic, Ford Focus, Volkswagen Jetta and Golf, Chrysler Sebring, Chrysler PT Cruiser, and Jeep Compass qualify for the standard charge.34

3. Cars in VED band G that emit 226 g/km CO₂ and above would be subject to a charge of £25.00 (the higher charge). Band F cars with emissions of 226 g/km CO₂ and above, first registered on or after March 1, 2001 but before March 23, 2006 also would be liable for the higher charge. The Toyota Land Cruiser, Honda Accord Tourer, Hummer H3, Volkswagen Passat, Nissan Murano, are categorized as VED band G vehicles.35

The proposed emissions-related charges would apply to all passenger vehicles traveling into the London Congestion Charge zone except for-hire services such as taxi cabs, whose emissions will be targeted through other measures, and zone residents who drive cars that qualify for the low-CO₂ discount or the standard charge. Residents who drive vehicles that qualify for the higher charge will be responsible for paying the fee when they re-enter the zone.

In this proposed scheme, vehicles will be tracked using fixed and mobile License Plate Readers (LPRs) at the entry points to the charge zone and elsewhere within the zone. Recorded license plate numbers will be checked against a database of the vehicles’ emission categories, as assembled by the Driver and Vehicle Licensing Agency, and vehicle owners will be charged the appropriate fee. Photographs of low-emission vehicles that will not be charged will be deleted immediately.

The proposal underwent a public review phase, which terminated on October 19, 2007. TfL will produce a report to the Mayor and await his decision on whether or not to implement the proposed charges. If the proposal is adopted, TfL states


34 VCA Car Fuel Data.

35 VCA Car Fuel Data.
that low-emission vehicle exemptions would go into effect on February 4, 2008. The higher charge of £25 would go into effect on October 6, 2008.36

**Effects on Motor Vehicle Fleet**

In 2007 the results of a study commissioned by Transport for London (TfL) were published. The study examined the potential effects of the proposed emissions-related charges on the motor vehicle fleet, the environment, business and the economy, and equalities and human health. The study made use of a model developed by TfL to determine fleet composition of vehicles that access the Congestion Charge zone in two scenarios: without emissions-related charges and with the implementation of emissions-related charges. Baseline conditions were established using data retrieved from the cameras positioned at the access points to the Congestion Charge Zone and a government sponsored behavioral survey to assess vehicle owner behaviors and how government policies such as emissions-related charges may impact them.

The TfL study found that, without implementing emissions-related charges, the proportion of Band A and Band B vehicles which would qualify for the low-CO2 discount would grow from two percent of the entire fleet to four percent between 2007 and 2009. The model indicates that implementing the emissions-related charges would have a measurable effect on the composition of vehicles entering the Congestion Charge zone. Band A and Band B cars, which would qualify for the low-emissions discount, would increase in their share of the vehicle fleet from three percent to eight percent in 2009 if charges were implemented. It can be expected that Band G cars and pre-2001 vehicles with large engine capacities, which would be subject to the higher charges, would decline from 16 percent in the baseline 2009 scenario to 12 percent of the fleet of vehicles in and around the Congestion Charge zone in the emissions-related charges scenario. These anticipated changes are displayed in Figure 3.3.

36 “Proposed Emissions Related Congestion Charging: Public and Stakeholder Consultation: Detailed Scheme Description and Supplementary Information.”
Traffic and Congestion Impacts

The TfL study shows that, despite instigating a shift in vehicle types within the Congestion Charge zone, the implementation of emissions-related charges would have a negligible effect on the number of vehicles that enter and circulate within the zone. Three scenarios based on driver sensitivities all show minor impacts, with the low-sensitivity scenario resulting in an 0.9 percent increase in the total number of vehicles, the high-sensitivity scenario resulting in a 0.5 percent decrease in vehicles circulating in the zone, and the middle scenario showing that the implementation of emissions charges would result in a 0.2 percent increase in the number of vehicles circulating in the zone, or approximately 300 vehicles relative to the baseline, no-emission charges scenario. The TfL report stated, however, that the potential for continued growth in Band A and Band B vehicles beyond 2009 could result in a more significant increase in vehicles traveling in the zone.

Environmental and Air Quality Impacts

Due to the anticipated negligible change in the number of vehicles entering and traveling within the Congestion Charge zone and the anticipated growth in the
share of Band A and Band B vehicles, TfL is expecting that emissions-related charging will reduce CO₂ emissions in and around the zone by 0.3 percent to 2.0 percent by 2009. Particulate matter (PM₁₀) emissions are expected to have little or no change due to the implementation of emissions-related charges. Nitrous oxide (NOₓ) emissions are expected to increase by two tonnes, or 0.01 percent in the middle sensitivity scenario. Additionally, the increasing number of Band A and Band B vehicles is expected to result in slightly lower average vehicle life-cycle emissions and fuel consumption. The report again states that if Band A and Band B automobiles develop a more significant share of the vehicle fleet beyond 2009, resulting congestion could result in more significant environmental impacts.

If implemented, the emissions-related charges in London will likely have a fairly small impact on traffic congestion, environmental air quality, economy, equality, and human health in the first couple of years. TfL will be required to monitor system performance and conduct a study in 2010 to assess the impacts of the charging scheme and recommend any necessary changes that may occur due to the changing vehicle fleet or other important factors.

### 3.5 CASE STUDY FINDINGS

The case studies show that offering high-value incentives can influence the decisions of the driving public regarding travel behavior and vehicle purchasing. The greater the incentives, whether they be dollar costs or time savings, the greater the public response. Public participation is enhanced when program requirements are easier to meet. For example, Virginia’s wide embrace of many vehicle models has resulted in a tremendous level of participation, making the State the second largest HEV market in the United States until 2005. Even with stricter qualification standards, HEV sales in California, New York and London have grown and/or are projected to grow significantly, in part due to occupancy or fee exemptions available to drivers of clean automobiles.
4.0 Application to New York City

The prospect of allowing clean vehicles to enter the New York City congestion fee zone free of charge are considered in three vehicle eligibility scenarios. The first, or baseline scenario, assumes no special provision for clean vehicles is made. The second assumes only SULEVs that meet a USEPA fuel economy rating of 45 miles per gallon, requirements similar to the existing New York Clean Pass program, are allowed to enter the zone free of charge. The third scenario would assume all varieties of alternative fuel technology vehicles, including ULEV and SULEV hybrids, would be granted access to the congestion fee zone free of charge. This third scenario is similar to the Virginia scheme.

Based upon the experiences of initiatives nationwide, market forecasts, and demographic projections, the implications of each policy scenario on the local vehicle fleet composition, traffic congestion, and air quality are theorized. Additional impacts on parking and transit operations also will be discussed. Furthermore, each scenario will present different sets of enforcement challenges that will have to be addressed.

4.1 “No Special Provision” Congestion Pricing Scenario

The “no special provision” scenario assumes that no special provision is granted to alternative fuel, lower-emissions, or other types of special fuel or special propulsion vehicle types. The conditions of this scheme match the City’s initial 2007 proposal. According to PlaNYC, the proposed congestion pricing scheme will result in a 7.4 percent reduction of vehicle trips with destinations in the Congestion Pricing Zone (CPZ) (8.7 percent when considering passenger vehicles alone). The revenues collected from the congestion charge will be applied to transit improvements throughout the region that will assist people traveling into Manhattan via alternative modes.

Daily passenger vehicle trips into and within the CPZ are expected to decline by 8.7 percent in the first year after congestion pricing is implemented. As shown in Figure 4.1, the 1.31 million passenger vehicle trips (precongestion pricing) into the core of Manhattan will be reduced to 1.20 million vehicle trips (postcongestion pricing) within one year, a reduction of 114,000 trips a day. The implementation of congestion pricing is expected to reduce passenger Vehicle Miles Traveled (VMT) in the CPZ by more than 300,000 vehicle miles.
Figure 4.1  Anticipated Impacts of No special provision and Alternative Scenarios on Passenger Vehicle Trips with Destinations in the CPZ

Daily Passenger Vehicle Trips (Millions)

<table>
<thead>
<tr>
<th></th>
<th>Pre-Congestion Pricing</th>
<th>Post-Congestion Pricing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>1.33</td>
<td>1.31</td>
</tr>
<tr>
<td>PlanNYC Proposal</td>
<td>1.27</td>
<td>1.25</td>
</tr>
<tr>
<td>Alternative 1</td>
<td>1.23</td>
<td>1.21</td>
</tr>
<tr>
<td>Alternative 2</td>
<td>1.19</td>
<td>1.17</td>
</tr>
</tbody>
</table>

Figure 4.2  Anticipated Impacts of No Special Provision and Alternative Scenarios on Vehicle Miles Traveled in the CPZ

Total Daily VMT (Millions)

<table>
<thead>
<tr>
<th></th>
<th>Pre-Congestion Pricing</th>
<th>Post-Congestion Pricing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>4.80</td>
<td>4.75</td>
</tr>
<tr>
<td>PlanNYC Proposal</td>
<td>4.70</td>
<td>4.65</td>
</tr>
<tr>
<td>Alternative 1</td>
<td>4.60</td>
<td>4.55</td>
</tr>
<tr>
<td>Alternative 2</td>
<td>4.45</td>
<td>4.40</td>
</tr>
</tbody>
</table>
4.2 **ALTERNATIVE 1, SULEV FEE EXEMPTION SCENARIO**

One option for a fee exemption scheme is to adopt the standards of the existing New York Clean Pass program and apply them to the New York City Congestion Pricing Zone. To be registered in Clean Pass, vehicles must qualify for the California Air Resource Board SULEV classification and achieve a USEPA 45-miles-per-gallon fuel economy rating. Currently, only three vehicle models qualify, including the Toyota Prius (model years 2001 to 2007), Honda Insight (model years 2000 to 2004), and the Honda Civic Hybrid (model years 2003 to 2007). The following paragraphs discuss the manner in which such a program would be enacted along with the likely implications.

The program proposed in this scenario could be implemented using the technology and infrastructure planned for in the PlaNYC proposal scenario. Vehicle owners could anticipate making payments automatically using an automatic-debit or prepaid E-ZPass account. E-ZPass transponders issued to qualifying clean vehicle owners would have to include a code that identifies the vehicle as a fee-free light-duty vehicle, similar to the existing Green Pass transponders. The E-ZPass transponders would be intended for use only in qualifying vehicles, and strict enforcement of the special Green Pass transponders would have to be implemented. Camera captures could be used as a supplement to identify fraudulent use of clean vehicle E-ZPass transponders. Vehicle owners who do not enroll with E-ZPass could be issued a decal that would be placed on the vehicle in such a position that it would be captured by the cameras that photograph license plates. LPR technologies are capable of reading additional information such as date-of-issue stickers that are attached to license plates and could possibly be developed to recognize decals placed on license plates, bumpers or elsewhere where they would be visible to the cameras.37 Discussions with LPR vendors could determine whether or not the Clean Pass decals currently issued by the State for use in HOV lanes on the Long Island Expressway could be used for this purpose. Photographs in which decals are visible and recognized would not result in invoices that request payment of the congestion fee.

Because the conditions and vehicle qualifications of this scenario are similar to the proposed London scheme, forecast models that were developed for London are useful in surmising the potential effects in New York City. The primary difference between the two cities’ conditions is the fact that no higher charge for the highest-emission vehicles is proposed in New York. Therefore extreme changes in the highly charged vehicles in London would be modified in a New

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York scenario, more closely resembling the changes in medium-emission vehicles in London. The London model predicted a growth in the local clean vehicle fleet of over 100 percent within the first two years of implementing emissions-related charges, bringing the clean vehicle share of the fleet to between three percent and eight percent of the total fleet. In New York the starting point is at a much smaller share, with HEVs constituting far less than one percent of the total light-duty vehicle fleet. Assuming a rate of growth that incorporates the absence of high-emission charges in New York, the City could develop fleet composition still under, but much closer to one percent over a similar two-year period.

In the middle scenario, the London model predicted that emissions-related charges would result in a 0.2 percent increase in daily vehicle trips into and around the Congestion Charge zone compared to the existing charge policy. A significant portion of the response in London may be attributed not only to the discount for low-emission vehicles but also to the additional charges for high-emission vehicles. Because there is no anticipated higher charge in New York, a growth factor just above 0.1 percent is more likely. This figure represents an assumption that, because New York would not have a heavy vehicle fee, heavy vehicle owners would respond in the same manner as vehicle owners who were affected by London’s standard charge for mid-level emission vehicles. This effect resulted in a 0.11 percent increase in low emission vehicle trips.

The PlaNYC congestion pricing proposal anticipates that with congestion pricing there would be 1.20 million passenger trips into and within the Manhattan CPZ. An increase of 0.1 percent above that figure results in an additional 1,350 trips into the Manhattan Congestion zone, as indicated by the thin dark blue bar in Figure 4.1. Thus, most of the reduction in traffic volume projected for the PlaNYC proposal would still be realized. Because SULEVs, PZEVs, and AT-PZEVs emit 90 percent fewer pollutants than LEVs, the air quality impact of these additional vehicles would be equivalent to that of 135 standard LEV trips.

The anticipated rate of reduction in daily vehicle miles traveled (VMT) between the baseline (existing) and the PlaNYC congestion pricing scenario, relative to the anticipated reduction in vehicle trips between the two scenarios produces a ratio that can be used to anticipate VMT in scenarios that result in differing numbers of vehicle trips. When this ratio is applied to Alternative 1, passenger VMT can be expected to top 4.04 million, relative to the anticipated 4.03 million VMT in the no special provision scenario. Total daily VMT, including buses, commercial vehicles and trucks, also would increase by approximately 9,000 vehicle-miles, for a total of approximately 4.46 million VMT.

### 4.3 **ALTERNATIVE 2, ALL-HEV Fee Exemption Scenario**

A second scenario has been developed to determine the effects of an exemption scheme that embraces a wider variety of HEVs. This scenario closely resembles
the Virginia Clean Special Fuels program. In order to be registered in such a clean fuel program, a vehicle would have to make use of hybrid technology or rely exclusively on alternative fuels. There would be no minimum emissions or fuel economy requirements. This scenario allows many more HEV models to qualify for clean fuel designation.

Like the previous scenario, the All-HEV program proposed in this scenario could be implemented using the technology and infrastructures planned for the PlaNYC proposal scenario. The combination of E-ZPass transponder and photographic license plate recording technologies could be utilized. It is unlikely that a special license plate such as those issued by the Virginia DMV could become a basis for identifying clean fuel vehicles in New York City. Because such a large number of vehicles from other states travel into New York, it would be challenging to develop and implement a license plate type that each neighboring state would adopt to their own specifications while remaining easily identifiable to photograph monitors and police.

In the case of Virginia, HEVs using HOV lanes comprised approximately one percent of all light-duty passenger vehicle trips into the metropolitan core from outer suburban areas five years after the program was implemented. Assuming that commuters in New York would reach the same level of participation in two years rather than five is not unreasonable, considering the fact that HEVs have acquired much more traction in the market now, compared to the early years of Virginia’s program, and due to the fact that free (or reduced fee if traveling through a tolled river crossing) passage into Manhattan would be a considerable incentive for many Manhattan-bound commuters to participate.

If the postcongestion pricing driving population were to grow by one percent as a result of HEV fee exemption, an additional 13,000 passenger vehicles would be on the road, as indicated by the orange bar in Figure 4.1. Whereas the PlaNYC congestion pricing scenario with no hybrid incentive would reduce passenger vehicle trips by 111,000 compared to precongestion pricing levels, this scenario would reduce vehicle trips by 98,000 in the first two years.

Because emission and fuel economy standards are less strict in this scenario than in the others, and because a larger number of vehicles in this scenario will likely have adverse effects on congestion within and around the zone, it is likely that air quality will suffer beyond the emissions contribution of 13,000 additional hybrid vehicle trips.

Passenger vehicle daily VMT in the CPZ in the Alternative 2 scenario will likely approach 4.08 million. This is approximately 49,000 vehicle-miles more than what is anticipated in the no special provision scenario. When combined with buses, commercial vehicles and trucks, approximately 4.50 million VMT can be expected, which is above the anticipated 4.45 million VMT expected in the PlaNYC congestion pricing proposal.
### Table 4.1  Daily Trips Ending in the Congestion Pricing Zone and Daily Vehicle Miles Traveled (VMT) in the Congestion Pricing Zone

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>PlaNYC (with Congestion Pricing)</th>
<th>Alternative 1&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Alternative 2&lt;sup&gt;b&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Passenger Vehicle Trips</td>
<td>1,313,000</td>
<td>1,199,000</td>
<td>1,200,000</td>
<td>1,212,000</td>
</tr>
<tr>
<td>Passenger Vehicle VMT</td>
<td>4,338,000</td>
<td>4,034,000</td>
<td>4,044,000</td>
<td>4,084,000</td>
</tr>
<tr>
<td>Ratio of Passenger VMT/Passenger Trips</td>
<td>3.30</td>
<td>3.37</td>
<td>3.37</td>
<td>3.37</td>
</tr>
<tr>
<td>Total Vehicle Trips</td>
<td>1,509,000</td>
<td>1,398,000</td>
<td>1,399,000</td>
<td>1,411,000</td>
</tr>
<tr>
<td>Total VMT</td>
<td>4,748,000</td>
<td>4,447,000</td>
<td>4,456,000</td>
<td>4,496,000</td>
</tr>
</tbody>
</table>

<sup>a</sup> Assumption: London increase in total PV trips =0.1%.

<sup>b</sup> Assumption: Virginia increase in total PV trips =1.0%.

### Table 4.2  Reduction of Vehicle Trips and VMT in Each Alternative Scenario, Relative to the Baseline Conditions

<table>
<thead>
<tr>
<th></th>
<th>PlaNYC</th>
<th>Alternative 1&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Alternative 2&lt;sup&gt;b&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number Change</td>
<td>Percent Change</td>
<td>Number Change</td>
</tr>
<tr>
<td>Passenger Vehicle Trips</td>
<td>-114,000</td>
<td>-8.7%</td>
<td>-113,000</td>
</tr>
<tr>
<td>Passenger Vehicle VMT</td>
<td>-304,000</td>
<td>-7.0%</td>
<td>-294,000</td>
</tr>
<tr>
<td>Total Vehicle Trips</td>
<td>-111,000</td>
<td>-7.4%</td>
<td>-110,000</td>
</tr>
<tr>
<td>Total VMT</td>
<td>-301,000</td>
<td>-6.3%</td>
<td>-292,000</td>
</tr>
</tbody>
</table>
5.0 Key Findings and Conclusions

The offering of incentives to encourage consumers to purchase cleaner automobiles can have a significant impact on purchasing and driving habits. Federal income tax credits and additional state credits available in some states factor into consumers’ decision to purchase clean vehicles. The fuel economy that comes with many HEV models adds to the benefits a vehicle owner may enjoy over the course of the vehicle’s lifetime. All of these cost incentives are cost savings or reductions that save money for the beneficiary. Even more effective in swaying purchasing decisions are incentives that save drivers something even more valuable – time.

Programs that offer occupancy requirement exemptions in HOV facilities or allow HEV drivers to take advantage of reduced congestion in congestion zones or HOT lanes have a history of enormous popularity in the U.S. These policies are helping to drive an HEV market that already is experiencing boosts due to public awareness of environmental issues, reactions to fossil fuel prices, and a seemingly trendy popularity status in many locations throughout the country. While a shift to cleaner automobiles is a positive change, it can be accompanied by effects such as increased congestion and increased single occupant vehicle trips which can diminish the positive emissions and air quality impacts of alternative fuel vehicles.

In New York, the aim of the congestion pricing scheme is to reduce the number of automobiles on the streets of Manhattan’s core districts. That measure alone is forecast to result in fewer single occupant vehicle trips, higher mode share for transit and other alternative modes, and opportunities for better transit, bicycle, and pedestrian systems performance. The addition of free access incentives for clean vehicles has the potential to significantly diminish the anticipated benefits of the congestion pricing scheme, depending on the eligibility criteria used.

The growth in market share that vehicles such as HEVs are experiencing and expected to experience nationwide in the next five to 10 years will result in an increasingly large population of vehicles eligible for the incentive. Furthermore, evidence suggests that the very existence of strict emission standards and incentives that save drivers time and money have induced demand for hybrid vehicles.

Because such an incentive in New York City would allow clean vehicle owners to take advantage of the street space freed up by congestion pricing, without paying any charge, it would likely be tremendously popular. It is likely that clean vehicle sales in the New York region would quickly outpace national averages and the averages of states that have adopted CARB emissions standards, as occurred in Virginia due to the significant time savings achieved in the HOV lanes there. The incentive would have a particularly great effect in
areas where motorists would receive the greatest discount. On entrances to the zone that are not currently tolled, drivers would receive a 100 percent discount, while motorists traveling from New Jersey who presently pay $5 tolls to cross the Hudson River would receive a 38 percent discount. This could create levels of program participation that vary based on motorists’ geographic proximity to free entrances. A clean vehicle discount would therefore likely pose more of a congestion burden at and near crossings into the zone that do not have pre-existing tolls, unless the City could develop arrangements with area tolling authorities to reduce the toll fee disparity.

The potential exists for qualifying vehicles to make enough trips into and within the congestion zone that roadway performance would deteriorate, lessening the congestion benefits of the pricing scheme. At that time, decisions on whether to discontinue the incentive program, or introduce more stringent qualification criteria would be required.
6.0 References and Sources of Additional Information


“National Low Emission Vehicle Program and Ozone Transport Commission (OTC) LEV,” United States Environmental Protection Agency, September 2007,
available from http://www.epa.gov/otaq/lev-nlev.htm (accessed September 20, 2007);


