EFFECTIVENESS OF AUTO EMISSION STANDARDS IN REDUCING TRANSPORTATION GHG EMISSIONS IN CHICAGO AND AT THE NATIONAL LEVEL

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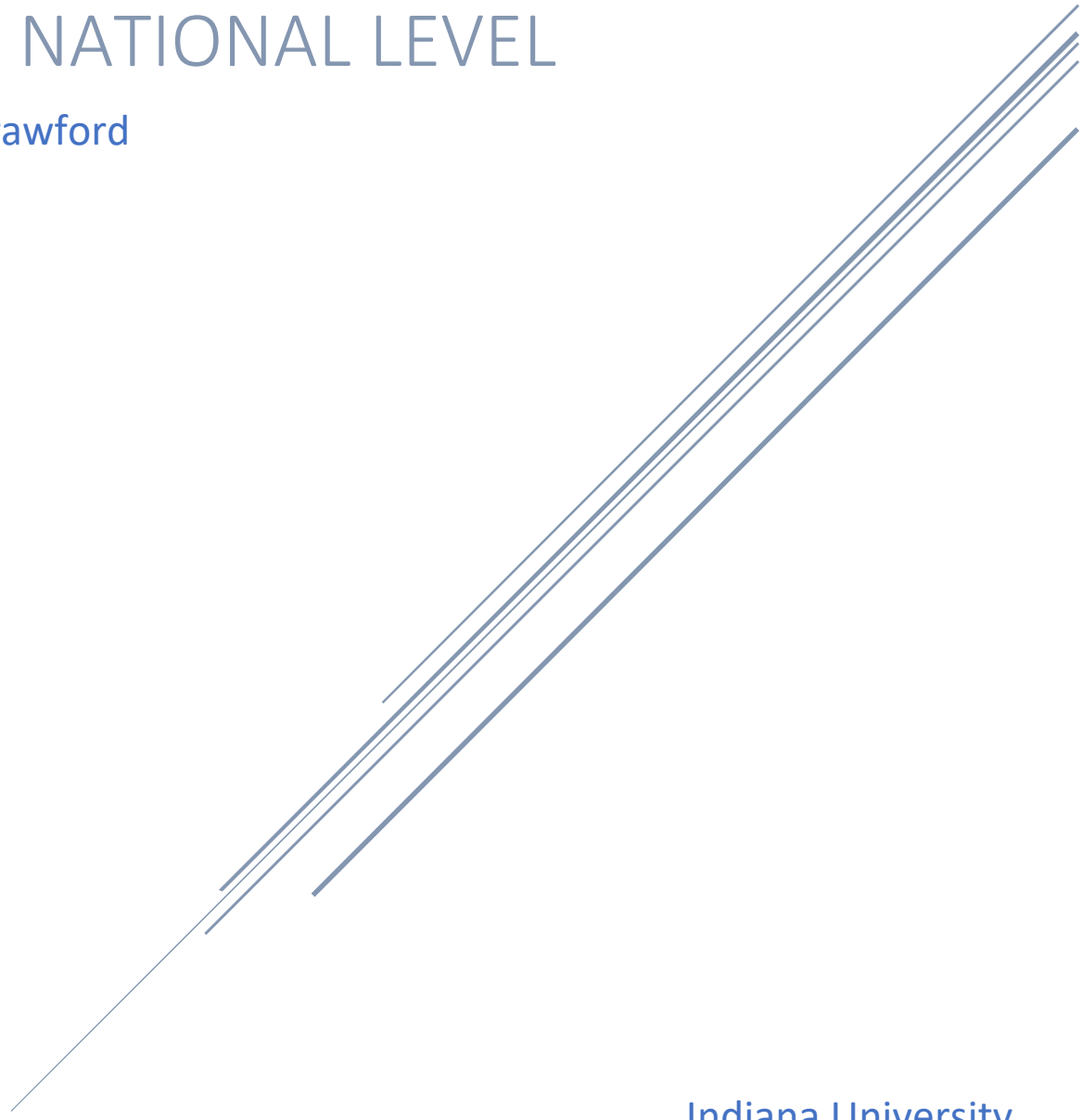

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Abstract

This paper provides an analysis of federal auto emission standards and their effectiveness in reducing Greenhouse Gas (GHG) Emissions levels in the transportation sector, specifically on-road transportation, or mobile sources. These standards are set by the U.S. Environmental Protection Agency (EPA) and are required by the Clean Air Act. Emission trends were analyzed at the national level, for the City of Chicago, and its surrounding region. Emission trends were analyzed from 2000 to the closest year available, including GHG emission levels from Tier 2 standards for model years 2004-2009 as well as emission standards for model years 2012-2016. This data is provided by the city of Chicago, the EPA and other sources. These transportation GHG emission trends will be compared to national and city levels. Not all trends in the transportation sector result from emission standards set at the federal level. Research will include how these policies standardize vehicle emission levels, how vehicles are tested for emission requirements and trends in GHG emissions for the transportation sector. Research was conducted to properly assess the effectiveness of these standards in reducing transportation GHG emissions.

Introduction

The Clean Air Act has given the Environmental Protection Agency vast authority in implementing regulations to reduce the United States' overall carbon footprint and protect public health. To do this, the EPA specifically targets certain sectors of emission sources, such as transportation. Other areas of focus include agriculture, electricity, commercial/residential, industry, and land use/forestry. For the purposes of this paper, regulation on transportation will be analyzed. Specifically, the effectiveness of auto emission standards in reducing transportation greenhouse gas emission (GHG) levels at the national level and at the city level in Chicago.

The Clean Air Act itself required regulation in the transportation sector, but the amendments of 1990 created specific targets in reducing emissions from motor vehicles, both in the form of gasoline content and emission standards. The EPA regularly revises auto emission standards focusing on model years, including Tier 2 Standards focusing on model years 2004-2009 and emission standards for model years 2012-2016. These standards are set at the national level and implemented by the states, but some cities, like Chicago, have taken their own initiatives toward reducing their GHG emissions. Both at the city level and national level there has been relative success in reducing GHG emissions from the transportation sector, but there are certain societal and economic factors that have led to recent increases in emission trends in the transportation sector.

Policy

The EPA regularly presents reports to Congress on the need for further regulation on emission levels. The EPA conducts these reports and recommendations with consideration of the technological ability of manufacturers to meet these standards, as well cost-effectiveness of the standards compared to other methods to reducing emissions[1]. Other methods may include the market, as society advances consumers will push for more efficient and environmentally friendly vehicles.

Clean Air Act Requirements

Chicago was among the highest nonattainment zones identified by the Clean Air Act Amendments of 1990[2]. The amendments required the city to sell reformulated gasoline, which

[1] McCarthy, J. E., Copeland, C., Parker, L., & Schierow, L. (2011). Clean Air Act: A Summary of the Act and Its Major Requirements. Retrieved from https://fas.org/sgp/crs/misc/RL30853.pdf. Page 8
[2] *Id.* At 9

was designed to reduce emissions of volatile organic compounds and toxic air pollutants. This focus on a reformulated and oxygenated gasoline began to fade in 2005 with the Energy Policy Act of 2005, which began the new focus on renewable fuels.

Tier 2 Standards

Tier 2 Standards for vehicles apply to model years 2004-2009 and are phased-in during this same time period. These standards worked to reduce emissions from vehicles by placing requirements on both vehicle exhaust emissions and gasoline. Cars and light trucks were required to have emission reductions ranging from 77% to 95%, and a greater than 90% reduction in the sulfur content of gasoline[3]. Beginning in 2004, refiners and importers of gasoline had to meet a corporate average gasoline standard of 120ppm with a cap of 330ppm. In 2006, these standards became much more stringent, with a required average of 30 ppm and an 80ppm sulfur cap[4]. These standards were not required for all refiners and importers, a small category of smaller scale refiners through 2007 had less stringent standards applied to them, as well a limited geographic area in the western United States from 2004 to 2006.

Tier 2 Standards require a standard fleetwide average of NO_x at 0.07 g/mi for all vehicle weight classifications. They use a three-tiered compliance strategy to ensure compliance before production, during production, and after production when the vehicle has been used for several years.

Tier 2 Standards are structured into 11 certification bins for model years 2004-2009, there are 8 permanent bins and 3 temporary bins. The temporary bins are less stringent but expire after

[3] McCarthy, *supra* note 1, at 9
[4] United States: Cars and Light-Duty Trucks: Tier 2. (n.d.). Retrieved from https://www.dieselnet.com/standards/us/ld_t2.php

the 2008 model year. Manufacturers can classify vehicles to certification bins as they wish. Every bin has a different level of stringency and stringency increases every year. By the time the standards are completely phased in by 2009, the temporary bins are removed, forcing manufacturers to comply with the fleetwide value of 0.07 g/mile of NO_x.

Certification bin standards are broken into a vehicle's intermediate useful life and full useful life. Intermediate and full useful life are broken into measurements of miles or years, depending on what occurs first. Intermediate useful life is defined 50,000 miles or 5 years. Light-duty vehicles and Light light-duty trucks have a full useful life is 120,000 miles of 10 years. Heavy-duty light-duty trucks and Medium-duty passenger vehicles have the full useful life of 11 years or 120,000 miles.

Manufacturers have flexibility with Tier 2 standards, having the option to certify to emissions standards for 150,000 miles to gain NO_x credits, allowing them to opt out of the intermediate life standards. If they choose to do so, the useful life is 15 years or 150,000 miles. Vehicles that manufacturers register as interim non-Tier 2 Light-duty vehicles or Light light-duty trucks have a useful life of 10 years or 100,000 miles[5].

Model Years 2012-2016 Standards

The emission standards for motor vehicles were updated by the EPA to have emission standards for vehicles whose model years are within the range of 2012 and 2016. These are not Tier 3 standards, which are for model years 2017-2025. Rather than requiring the same emission levels for all vehicle classifications, these new standards are based on a CO_2 emissions-footprint

[5] United States, *supra* note 4

curve. Vehicles are assigned their emission compliance according to their footprint, related to the size of the vehicle[6]. So, the larger the vehicle footprint, the more stringent CO_2 emissions target. Similar to the Tier 2 standards, each car manufacturer has its own fleet-wide standard, depending on the type of vehicles they produce. Also, standards become more stringent every year.

These new standards are also unique due to the fact they have two sets of parallel standards. The first set are the Corporate Average Fuel Economy (CAFE) standards, the second set are Greenhouse Gas emission standards adopted by the EPA. These standards apply to vehicles with a GVWR of less than or equal to 10,000 pounds and sold by a manufacturer in the United States. Each year standards become more stringent, requiring more efficient vehicles through their GHG emissions as well as MPG.

Model year 2012-2016 standards also set emission caps for tailpipe emissions of Nitrous Oxide (N_2O) of 0.010 grams per mile and for Methane (CH_4) with a cap of 0.030 grams per mile. These standards are always passed with consideration of the cost-effectiveness and technology abilities of manufacturers, making it economically feasible for manufacturers to reduce fleet-wide emissions. Measurement of Nitrous Oxide emissions is not mandatory through the 2016 model year, instead manufacturers may use compliance statements containing a default value of 0.010 grams per mile[7]. Manufacturers have the option to not comply with N_2O and CH_4 standards and can instead comply with the Carbon Dioxide equivalent. If they choose to do so, the Nitrous Oxide and Methane are added to CO_2 emissions by giving each an equivalence factor[8].

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[6] United States: Light-Duty Vehicles: GHG Emissions & Fuel Economy. (n.d.). Retrieved from https://www.dieselnet.com/standards/us/fe_ghg.php

[7] *Id.*

[8] *Id.*

Emission Standards for model years 2012-2016 also give manufacturers flexibility. There is a system of Averaging, Banking, and Trading (ABT) credits and manufacturers receive credits based on their fleet average CO_2 performance. Manufacturers and companies may trade their credits among all manufacturer products, such as cars and light trucks.

Manufacturers can also earn CO_2 equivalent credits, named Air Conditioning Improvement Credits, for improvements in their air conditioning (A/C) systems. They would earn these credits for various improvements, such as reduced refrigerant leakage by using better parts and using alternative refrigerants characterized by a lower global warming potential. There is also a system of Advanced Technology Credits, these are a temporary program to encourage the use of more advance technologies. Credits are given to manufacturers that produce cars using advanced technology, such as electric vehicles, plug-in hybrid electric vehicles, and fuel cell vehicles. These credits allow manufacturers to give the first 200,000 vehicles sold in model year 2012-2016 a 0 gram per mile CO_2 value. For manufacturers that sell 25,000 vehicles or more in model year 2012, they can give the first 300,000 vehicles this value.

Manufacturers also can receive Early Credits for model years 2009-2011, Flex-fuel and Alternative Fuel Vehicle Credits, and Off-Cycle Innovative Technology Credits. Off-Cycle Innovative Technology Credits are for innovative technologies that reduce CO_2 emissions that wouldn't be measured in the regulatory test cycle. The regulatory test cycle for Tier 2 and Model Years 2012-2016 are in the next section.

Testing Vehicles for Emission Levels

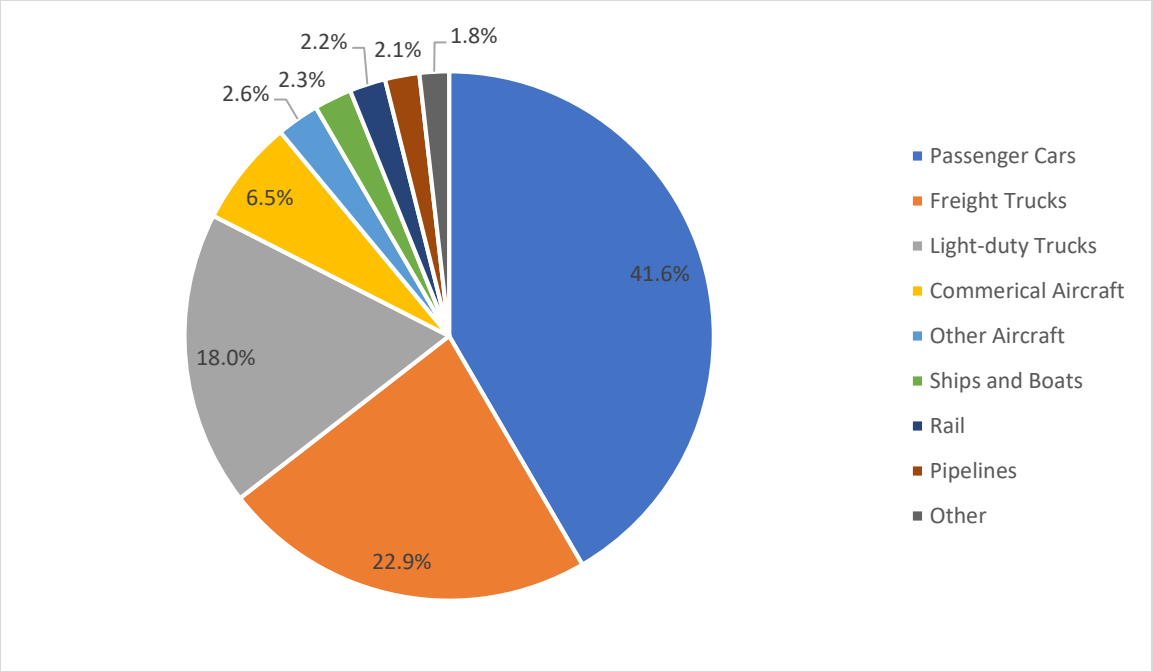
The EPA began to use a 5-cycle testing method in 2008 to ensure manufacturer compliance with emission standards. This 5-cycle method includes the use of the FTP-75 tests, one regular and one cold temperature test, HWET, US06, and SC03. Until 2007, the FTP-75 test was used to determine a vehicles city rating, and HWFET was used to determine a vehicles highway rating. Now these five tests are used to determine the EPA on-road fuel economy rating. US06 and SC03 were used to address shorting comings in aggressive driving (US06) and to address the use of air conditioning (SC03).

United States Transportation Greenhouse Gas Emissions

In 2016, GHG emissions from transportation accounted for 28.5% of total US Greenhouse Gas emissions[9]. Total transportation-related Greenhouse Gas emissions totaled to 1,857.6 MMT CO_2 Eq., this stands for Million Metric Tons of Carbon Dioxide Equivalent. Of the total transportation emissions, on-road transportation accounted for 1556.2 MMT CO_2 Eq., or 83.774% of total transportation GHG emissions. On-road vehicles refer to passenger cars, light-duty trucks, medium- and heavy-duty trucks, buses, and motorcycles. Below is a chart describing the breakdown of the largest sources for transportation GHG in 2016 by category[10].

[9] Sources of Greenhouse Gas Emissions. (2018, April). Retrieved from https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions

[10] Environmental Protection Agency. (2018, April 12). *Inventory of U.S. Greenhouse Gas Emissions and Sinks, 1990-2016*. Retrieved from EPA Website: https://www.epa.gov/sites/production/files/2018-01/documents/2018_complete_report.pdf. Page: Trends 2-31



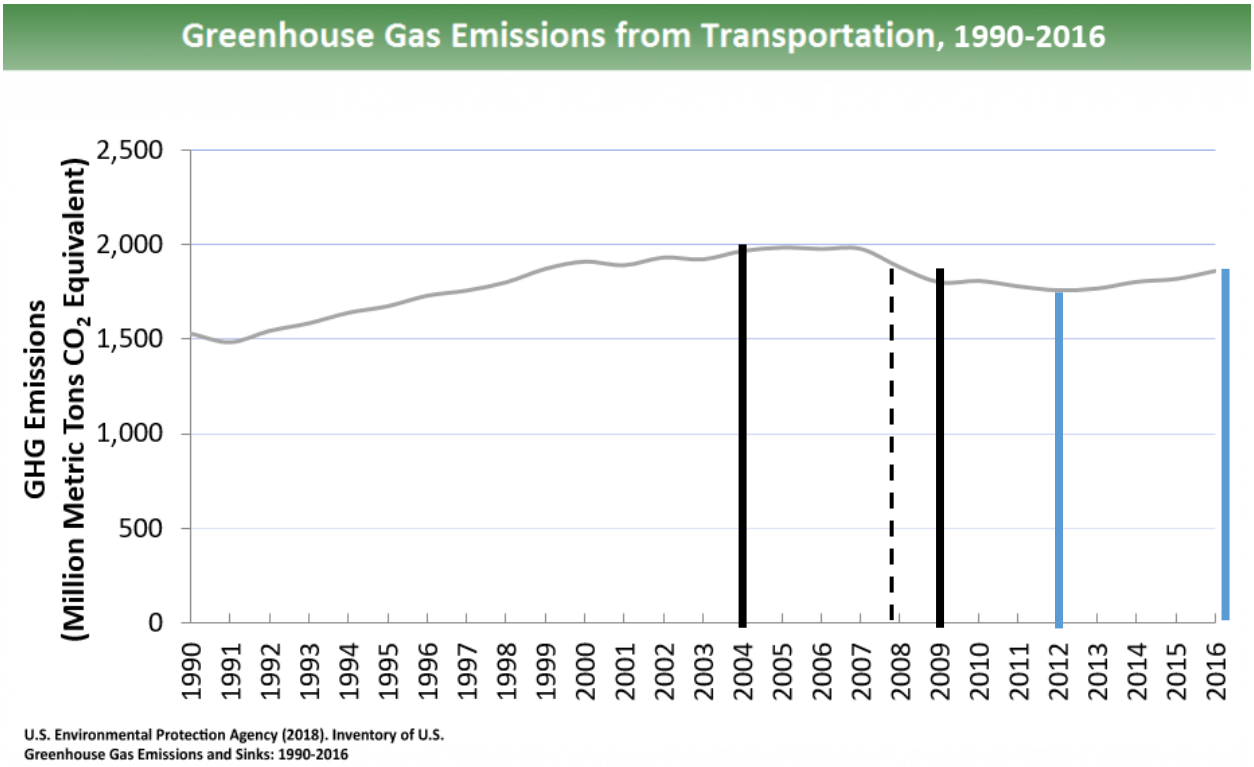
Trends

Although there have been emissions standards placed on vehicles, transportation emissions from fossil fuel combustion have continued to rise. Transportation emissions from fossil fuel combustion have risen 19% from 1990 to 2016[11], but not necessarily from vehicles being 'dirtier'. In fact, newer vehicles are roughly 99% cleaner than model year 1970 vehicles[12]. There has been an increase in GHG emissions is primarily due to an increased demand for travel, Vehicle Miles Travelled (VMT) for light-duty vehicles has increased 44% since 1990. Factors behind this include growth in the population and economy, urban sprawl, and periods of low fuel prices[13]. The increase in emissions was not unique to only light-duty vehicles, medium- and heavy-duty trucks have experienced an 82% increase in Carbon Dioxide emissions from 1990 to

[11] Environmental, *supra* note 10, at Energy 3-21
[12] History of Reducing Air Pollution from Transportation in the United States. (2018, April 19). Retrieved from https://www.epa.gov/transportation-air-pollution-and-climate-change/accomplishments-and-success-air-pollution-transportation
[13] Environmental, *supra* note 10, at Energy 3-20

2016, coupled with an increase of 100% VMT[14]. Motor vehicles have become more efficient despite this trend, since 2004, when Tier 2 standards were being phased in, average new fuel economy has increased.

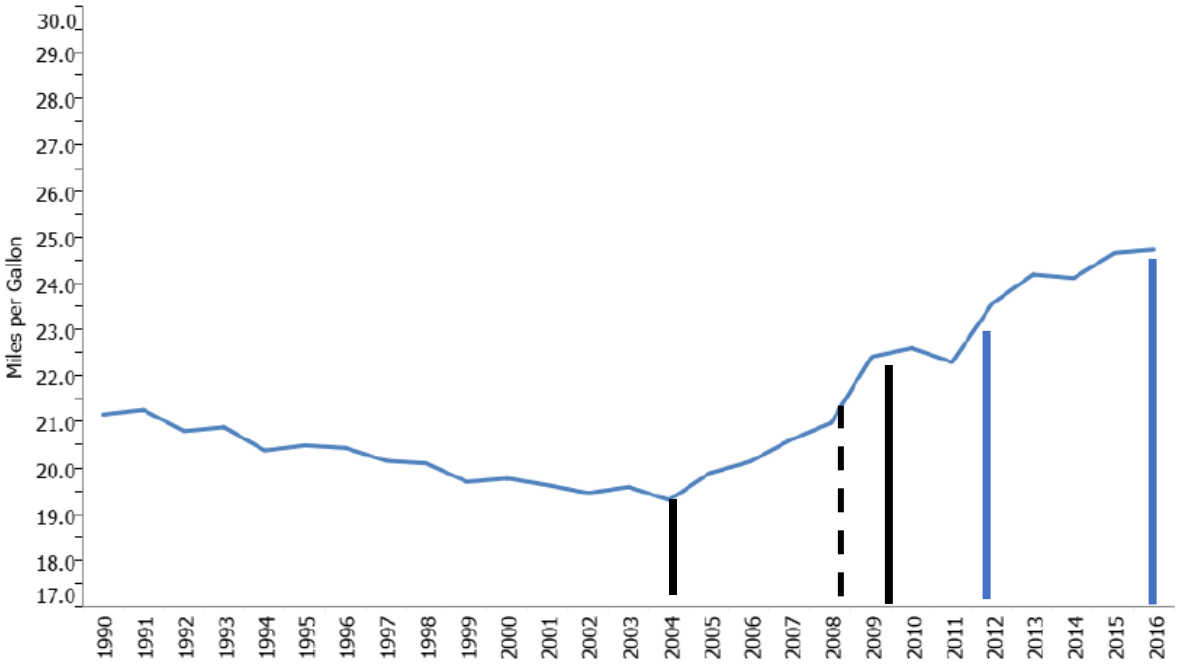
CO_2 emissions for passenger cars peaked in 2004 at 1,150.6 MMT CO_2 Eq., since Tier 2 standard implementation, there has been a decline in CO_2 emissions of about 8%[15]. This decrease indicates that Tier 2 standards were successful in reducing GHG emissions in motor vehicles. Below is a graph provided by the EPA showing trends in transportation GHG emissions since 1990[16].



[14] Environmental, *supra* note 10, at Energy 3-22
[15] Environmental, *supra* note 10, at Energy 3-21
[16] Sources, *supra* note 9

The two black lines indicate the time period of Tier 2 standards for model years 2004-2009, the dotted line in 2008 represents the end of the 3 temporary certification bins. The two blue lines indicate the time period of emission standards for model years 2012-2016. In 2009 Tier 2 standards were completely phased in and all Tier 2 standards were required for manufacturers. This decrease in emissions beginning after the end of the temporary certification bins indicates a success in bringing emissions down during this period. The same cannot be said for standards implemented for model years 2012-2016. Emissions from transportation have increased steadily from 2012-2016, during this same time period the percentage of light duty truck sales of total sales has increased. This occurs regardless of an improvement in MPG. The increase in emissions may also be a result of continued increases in VMT, for example the 2.7% increase in Carbon Dioxide emissions from 2015 to 2016 is due largely to an increase in VMT and gasoline consumption for LDVs and medium- and heavy-duty vehicles.

Figure 3-13: Sales-Weighted Fuel Economy of New Passenger Cars and Light-Duty Trucks, 1990–2016 (miles/gallon)



Source: EPA (2016a)

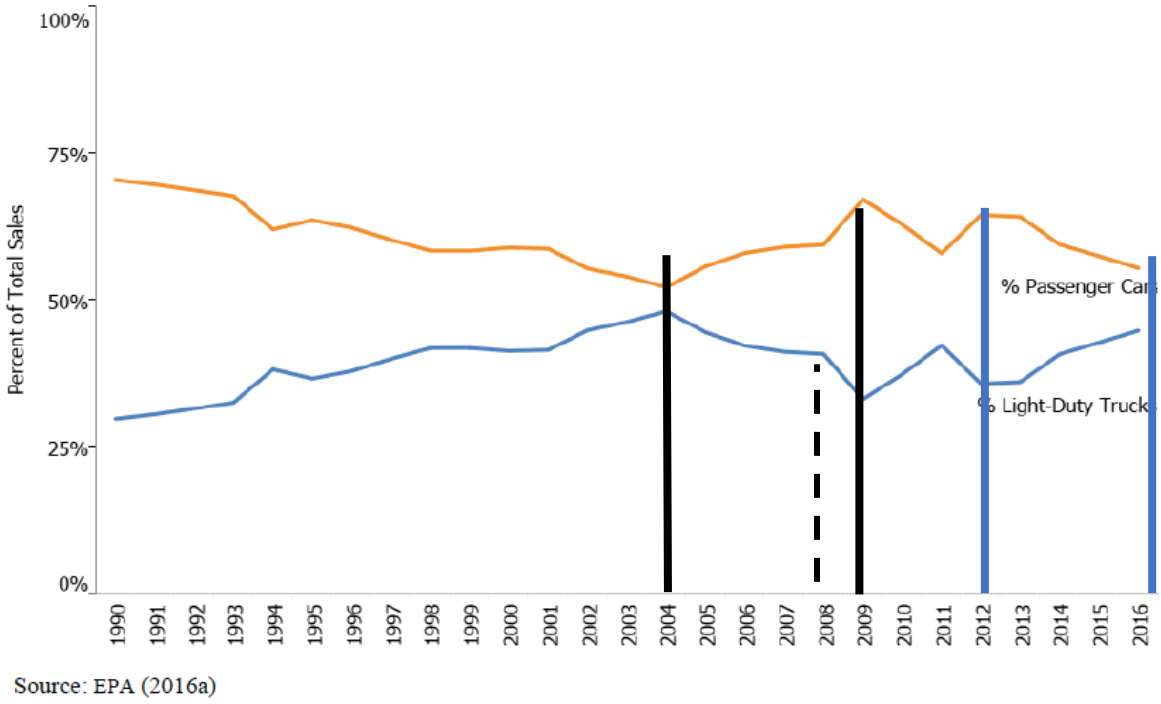
In the above graph[17] the two solid black lines indicate the time period of Tier 2 emission standards and the two solid blue lines indicate standards for model years 2012-2016. The dotted black line indicates the expiration of 3 certification bins. Miles per gallon for vehicles in 2004 reached its lowest point, the same year when CO_2 emissions peaked for cars and when Tier 2 standards were starting to be phased in. Miles per gallon for new vehicles sold increased every year since 2004 and increased sharply from 2008 to 2009. The significance about this increase following 2008 is that it occurred following the expiration of the temporary certification bins and all manufacturers were required to meet the fleetwide average standard of 0.07 g/mile of NO_x. The sharp increase in MPG from 2008 to 2009 was coupled with a decrease in GHG emissions and an increase in the percentage of total sales for passenger cars. These 'positive' results from

[17] Environmental, supra note 10, at Energy 3-23

2008 to 2009 indicate that Tier 2 Standards were effective in bringing vehicle emissions down following the termination of temporary certification bins.

Miles per gallon for new passenger cars and light-duty trucks increased during the model year 2012-2016, likely in part due to emission standards requiring better MPG for cars in these model years. Although there is an increase in MPG during this time period, GHG emissions from the transportation sector continue to increase. In 2012, passenger cars had emission levels of 745.9 MMT CO_2 Eq. compared to a 2016 value of 772.2, light-duty trucks had a 2012 value of 316.2 and a 2016 value of 334.2. Although emissions from individual vehicles have improved, there are factors driving the increase in emissions, such as the previously mentioned increase in vehicle miles travelled and an increase demand for vehicles. Other factors driving these increases may be the sale of new passenger cars and light-duty trucks, its evident that as sales increase for light-duty trucks, so do emissions.

Figure 3-14: Sales of New Passenger Cars and Light-Duty Trucks, 1990–2016 (Percent)



Source: EPA (2016a)

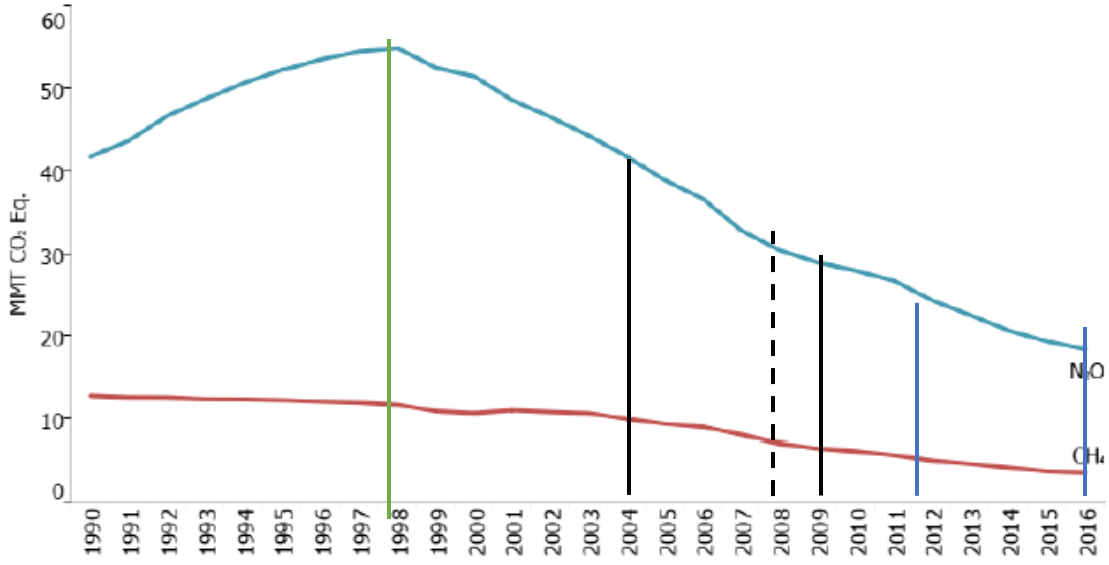
In the above graph[18] the two bold black lines once again stand for the Tier 2 standard period and the black dotted line stands for the expiration of the temporary certification bins. The two blue lines represent the time period for regulations on model years 2012-2016. Sales for light-duty trucks peaked in 2004, the same year MPG reached its lowest point and CO_2 emissions from motor vehicles peaked. Interestingly, when the sale of new passenger cars peaks in 2009, so does MPG and GHG emissions from transportation decrease. In 2008 when the temporary certification bins expire, there is a sharp increase in the sale of passenger vehicles. This is occurring at the same time when MPG for vehicles sold increases sharply and there is a decline in the overall transportation GHG emission trend. Also, when sale of light-duty trucks

[18] Environmental, *supra* note 10, at Energy 3-23

experiences a peak in 2011, the MPG of cars sold hits a trough, inferring a possible inverse relationship between percentage of light-duty trucks sold and sales-weighted MPG.

Emission standards for model years 2012-2016 also imposed emission caps for Nitrous Oxide (N_2O) and Methane (CH_4). Although they have been decreasing since their peak around 1997, it was necessary to set these standards to prevent increased Nitrous Oxide and Methane emissions. Since the peak of N_2O emissions from mobile sources in 1997, there has been a 66% decrease into 2016 and a 56% decrease compared to 1990 levels. Methane emissions from mobile sources have decreased 71% from 1990 to 2016. These decreases are a result of control technologies used in on-road vehicles[19].

Figure 3-15: Mobile Source CH_4 and N_2O Emissions (MMT CO_2 Eq.)



The figure above[20] shows the amount of N_2O (blue line) and CH_4 (red line) emitted from mobile sources. The green line indicates the peak of N_2O emissions, and the black lines indicate Tier 2 standards with the dotted black line representing the expiration of the temporary

[19] Environmental, *supra* note 10, at Energy 3-26
[20] Environmental, *supra* note 10, at Energy 3-26

certification bins. Tier 2 standards didn't explicitly target these emissions like the standards for model years 2012-2016, represented by the blue lines, did.

Chicago Transportation Greenhouse Gas Emissions

Chicago made changes to their methodological approach for measuring emission levels in their 2015 report. Their methodological approach in 2015 was changed to be compatible with the Global Protocol for Community-Scale Greenhouse Gas Emissions Inventories (GPC)[21] and guidance was given by GCoM (Global Covenant of Mayors for Climate and Energy). Chicago became a member of GCoM in 2015 after pledging to reduce emissions and a plan to switch to clean, renewable, energy. Since joining, Chicago has revised previous inventories for 1990, 2000, 2005 and 2010. When updating emission measurements, there was a lack of data for 1990 that prevented the same methods to be used that were used for 2005, 2010, and 2015. The back-casting methods used in the original 1990 inventory are not sufficient to make accurate comparisons to the updated inventories[22]. The 2015 report did not provide updated data for 2000, so comparisons to 2000 levels also cannot be sufficiently made. Due to this, 2015 emission levels are compared to 2005 levels for the city of Chicago.

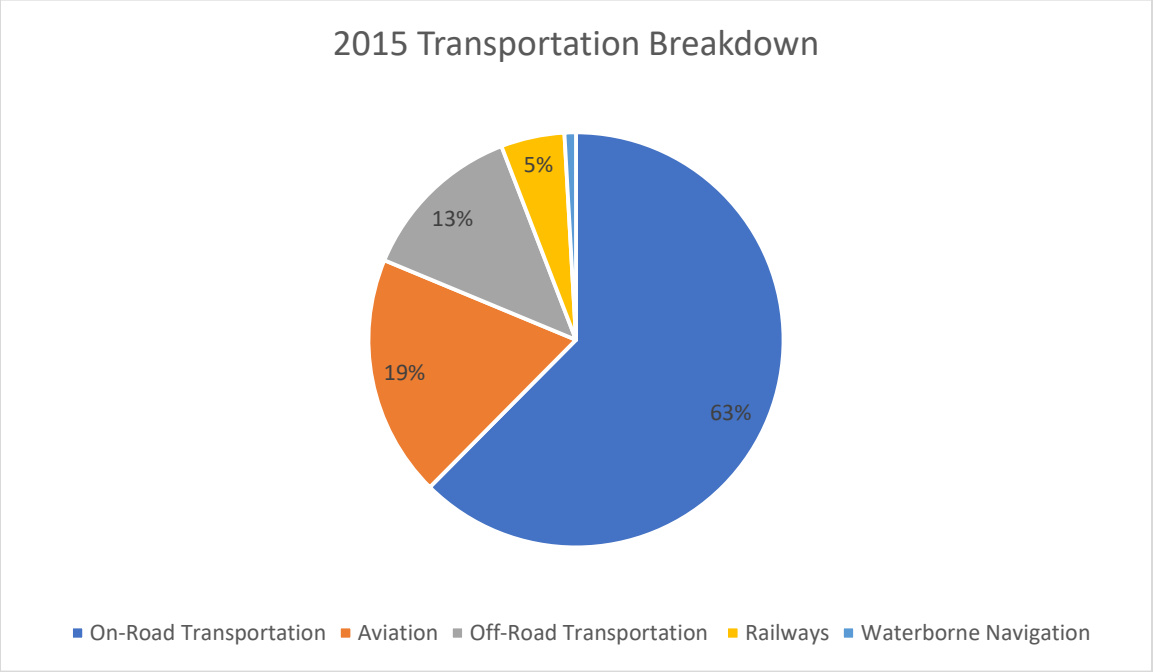
Transportation emissions accounted for 24.6% of GHG emissions for the city of Chicago in 2015, or 8,048,463 MT CO_2 eq.[23]. On-road Transportation amounted to 5,100,066 MT CO_2 Eq. which was 15.6% of total emissions, total emissions for Chicago in 2015 were 32,651,379

[21] AECOM. (2017, August). *City of Chicago Greenhouse Gas Inventory Report-Calendar Year 2015*. Retrieved from City of Chicago Website: https://www.chicago.gov/content/dam/city/progs/env/GHG_Inventory/CityofChicago_2015_GHG_Emissions_Inventory_Report.pdf. At page viii

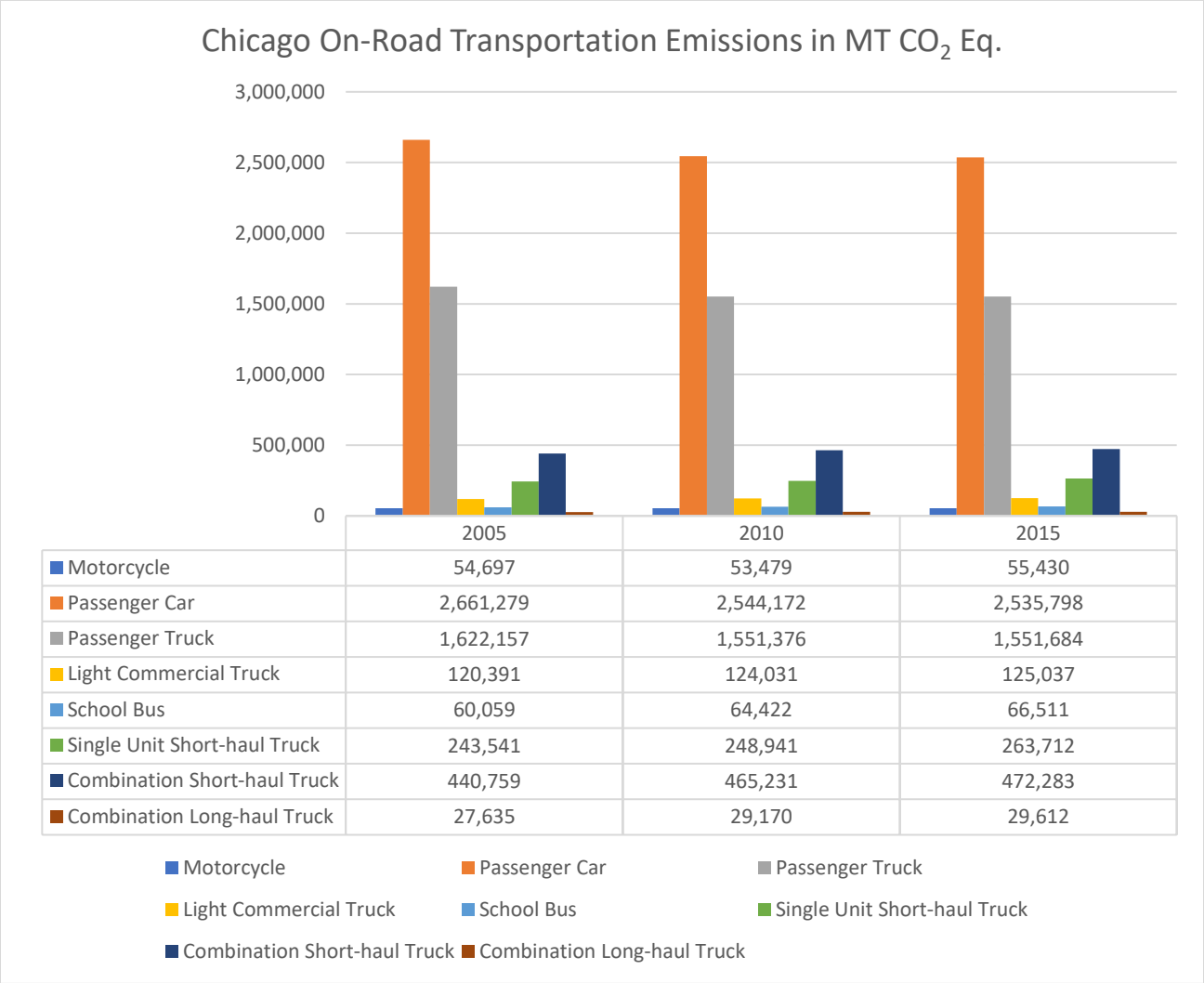
[22] *Id.* At page 2

[23] *Id.* At page ix

MT CO_2. Below is a pie chart showing a breakdown of the transportation sector emissions.



Emissions for the city of Chicago have decreased relative to 2005 levels. GHG emissions for Chicago in 2005 amounted to 36,700,027, in 2010 they amounted to 35,021,969, in 2015 they amounted to 32,651,379, measurements are made in MT CO_2 Equivalent. There have been continuous decreases in overall emissions since their peak in 2005. In fact, passenger cars and passenger trucks emissions have improved relative to total on-road transportation emissions. Of 2005 on-road transportation emissions, passenger car and trucks were responsible for 81.89%, in 2015, they were responsible for 80.14%.



	2005	2010	2015
Motorcycle	54,697	53,479	55,430
Passenger Car	2,661,279	2,544,172	2,535,798
Passenger Truck	1,622,157	1,551,376	1,551,684
Light Commercial Truck	120,391	124,031	125,037
School Bus	60,059	64,422	66,511
Single Unit Short-haul Truck	243,541	248,941	263,712
Combination Short-haul Truck	440,759	465,231	472,283
Combination Long-haul Truck	27,635	29,170	29,612

Above is a graph showing a breakdown of Chicago's on-road transportation emissions from 2005 to 2015. Passenger cars continue to be responsible for most of Chicago's mobile source emissions but have been decreasing since 2005. Passenger trucks are the second biggest contributor to GHG emissions, and their emissions decreased from 2005 to 2010, as the market share of light-duty trucks began to decrease during Tier 2 emissions standards. Recently, the sale of light-duty trucks has increased, especially from 2012 to 2016, these increased sales are represented by a slight increase in emissions from passenger trucks from 2010 to 2015.

Emissions from vehicles categorized as trucks or as a school bus have also increased slightly relative to previous emission levels. Emission standards for passenger cars have been effective in bringing down emissions, the same cannot be said for trucks.

The decrease in passenger car emissions from 2005 to 2015 indicate that emission standards have been effective to a point at reducing transportation emissions in the city of Chicago. Nationally, there was an increase in the market sales of passenger cars from 2004 to 2009, yet emissions have decreased despite this increased market share along with an increase in VMT. This decrease in emissions is coupled with a larger market share of passenger vehicles from 2004 to 2009 show that Tier 2 emission standards were effective for passenger cars rather than trucks. Overall, passenger trucks experienced a decline from their 2005 emission levels, when GHG emissions peaked.

Despite the decrease in passenger car emissions, on-road transportation emissions have begun to trend upwards. In 2005 on-road transportation reached a level of 5,230,518 and declined to 5,081,092 MT CO_2 Eq. In 2015, on-road transportation emissions slightly increased to 5,100,066[24]. Transportation emissions have been trending upward primarily due to an increase in VMT as well as an increased demand for travel. Other causes include economic growth, urban sprawl and periods of low fuel prices. Changes in the population may also impact emissions at a city level, but Chicago as a region has also been experiencing similar trends.

Chicago 2015 Regional GHG Emissions

Chicago is more than just it's city limits, it encompasses an entire region. Due to this, Chicago measures emissions at a regional level. The Chicago region is broken into seven

[24] AECOM, *supra* note 21, at page 20

counties, Cook, DuPage, Kane, Kendall, Lake, McHenry, and Will. Developing measurements at a regional level for Chicago is helpful to understand the full extent of their emissions, the effectiveness of emission programs, and helps prepare the city for future problems from climate change.

Unfortunately, the Chicago regional report unfortunately cannot make accurate comparisons to 2000 and 2005 measurements. In 2015, transportation emissions accounted for 29% of total emissions. Of this, on-road transportation accounted for 84% of transportation emissions. Emissions have decreased 7% from 2010 to 2015 but this has been partially offset by an increase in transportation, mainly off-road transportation. In fact, on-road transportation has stayed relatively constant since 2010, decreasing by only 0.07 $MMTCO_2eq$ from 2010 to 2015[25]. VMT has increased by 2% since 2010, showing that improvements in vehicle fuel efficiency required by Tier 2 and model year 2012-2016 standards have been relatively successful in reducing emissions. The encouragement of the use of Alternative Fuel Vehicles (AFV) by credits given to manufacturers has been a large success in the Chicago region, as VMT for AFV has increased 3,740% from 2010 to 2015[26]. The increased market share of AFV's in Chicago has contributed to improvements in transportation emission levels. The encouragement of using more efficient technologies by model year 2012-2016 standards has led to increased use of Alternative Fuel Vehicles, as seen by their large increase in VMT.

[25] ICF. (2018, June). *2015 Chicago Regional Greenhouse Gas Emissions Inventory*. Retrieved from CMAP Website: https://www.cmap.illinois.gov/documents/10180/885293/2015+Chicago+Regional+Inventory_Final+Report_June+2018.pdf/03087e10-fc65-f276-3342-7059f212b9d2. At Emission Trends 3-8

[26] *Id.* At Emission Trends 3-9

Conclusion

Emission standards have been relatively effective in improving the efficiency of vehicles, but not necessarily contributing to great decreases in emissions. According to data provided by the EPA, since 2004 MPG for new passenger cars and light-duty trucks has continued to increase, despite increases in transportation GHG emissions. Although this is true, since 2004 when Tier 2 standards were being phased in, emissions have declined about 8%, but recent trends show increases in emissions. Passenger cars continue to be responsible for a majority of GHG emissions, but their emissions have steadily decreased since implementation of Tier 2 standards in 2004. Recent trends unfortunately indicate a continuous rise in vehicle emissions. Some causes of this increase include urban sprawl, periods of low fuel prices, increased demand for travel and increased VMT.

Increases in demand for travel and VMT are a result of urban sprawl. Concentrations of population in the United States over the past century and a half have changed considerably and more people are moving to suburbs. Increased income along with numerous other factors incentivize people to move elsewhere, since they can afford to travel to their job. It would be challenging to focus regulations on VMT; therefore, policymakers should focus regulation efforts elsewhere.

Data provided by the EPA shows that sales of passenger trucks in recent years have continued to increase and their market share has also increased. In 2018, passenger cars only represented 32% of vehicle sales, while SUVs and trucks made up 68%[27]. Policymakers should

[27] Krisher, T. (2019, March 20). Auto sales increased in 2018, despite rising interest rates and record new car prices. Retrieved from https://www.chicagotribune.com/classified/automotive/sc-auto-tips-0109-annual-sales-bump-20190104-7-story.html

focus efforts on trucks and SUVs, since emissions tend to increase as sales of passenger trucks do. While focusing efforts on passenger trucks, manufacturers should continue to be incentivized to use more efficient technologies and produce alternative fuel vehicles. There a variety of other potential remedies, such as effective land use planning and encouragement of using public transportation in cities. Unfortunately, it's not realistic to expect a decrease in emissions while using the same fuel source to fuel vehicles for a growing population. Not only should effort be made toward more stringent emission standards, but also toward developing alternative fuel sources that are either just as efficient or more efficient than fossil fuels.