Los Angeles County
Metropolitan Transportation Authority

Moving Towards Sustainablity:

2010 LACMTA Sustainability Report

Metro®

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Acknowledgement

This document was prepared by ICF International under contract through Metro's Sustainability Program administered by Metro's Environmental Compliance and Services Department. Technical input was provided by staff in the following Metro departments:

Contract Services, New Business Development, Systems Engineering, Rail MOW Engineering, Resource Management, Environmental Compliance and Services Department, ECSD, Maintenance Administration, Facilities and Property Maintenance, Governmental Accounts, Quality Assurance, Long Range Planning, Operations Systems Integration, Purchasing, Vehicle Technology and Support, Building Services, General Services Administration

Abbreviations and Key Terms

APTA	American Public Transportation Association
Boarding	A passenger boarding a Metro revenue vehicle
Criteria Pollutants	Six pollutants designated by the EPA as indicators of air quality
CO	Carbon Monoxide
CO2	Carbon Dioxide
CO2e	Carbon Dioxide Equivalent
CNG	Compressed Natural Gas
GHG	Greenhouse Gas
GHGe	Greenhouse Gas Emissions
GWP	Global Warming Potential
HC	Hydrocarbons
HFC	Hydrofluorocarbons
KWH	Kilowatt hours
LADWP	Los Angeles Department of Water and Power
LEED	Leadership in Energy and Environmental Design
MSIP	Metro Sustainability Implementation Plan
MT	Metric Ton
NTD	National Transit Database
NOx	Nitrous Oxide
PFC	Perfluorocarbons
PM	Particulate Matter
Purchased Transportation	Metro transit service provided through contract service
ROG	Reactive Organic Gas
SCE	Southern California Edison
VMT	Vehicle Miles Traveled

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Executive Summary

This sustainability report analyzes Metro's 2009 environmental performance and economic cost of its core activities and presents historical performance data to identify significant trends and issues. The purpose of this report is to provide an update to the previous year's report by presenting sustainability data for calendar year 2009. It compares the positive or negative trends, focusing on the comparison between the previous year's report data (2008) and this year's report data (2009), to monitor and analyze the increases or decreases in environmental impacts and assess Metro's progress towards sustainability. This trend analysis can then be used to identify causes, set targets, direct resources, and improve performance and sustainability in a cost effective way for future years.

The Metro Board adopted the Metro Sustainability Implementation Plan (MSIP) in June 2008. The MSIP contains short-term projects and general guidelines that serve as the basis for specific long-term sustainability project development. An ongoing task is the reporting of Metro's environmental sustainability performance. This report focuses on our activities for fiscal year 2009, and meets that requirement by comparing and analyzing trends over

the course of previous years in environmental performance across five key areas: ridership, energy, emissions, water use, and waste. From these five key areas, twelve indicators were selected to be used on an annual basis to evaluate Metro's sustainability progress. The indicators used in this report were derived using The Global Reporting Initiative (GRI) sustainability reporting framework. Indicators were chosen that are common to most organizations in relation to energy, water, materials, emissions, effluents, and waste, as well as impacts to biodiversity.

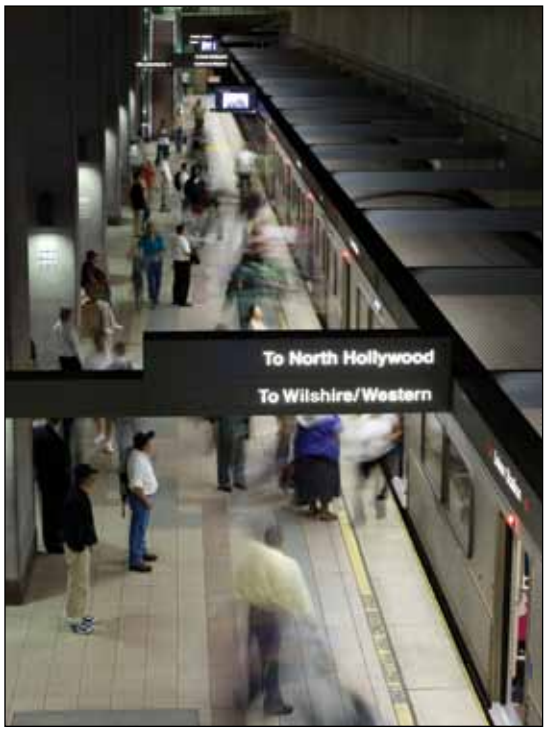
This report has two goals: 1) to provide information that we can use to improve Metro's sustainability performance and 2) to inform the public on Metro's sustainability performance. This report not only demonstrates Metro's proactive approach to meeting the sustainability goals of this region, but more importantly demonstrates Metro's commitment to meet social, financial, and environmental goals.

The three essential components of a sustainability program are performance goals, program implementation, and performance monitoring. This report strengthens Metro's sustainability program in all three areas. By providing annual information, it 1) enables our Board to adopt informed performance targets, 2) provides information necessary to implement plans to meet those targets, and 3) creates a structure that can be used to regularly monitor progress. A brief summary of performance in each of the twelve indicator areas is presented in the following section.

Ridership

1 This report analyzes transit ridership as a means to improve the environmental performance of our operations. Transit service is measured using ridership boardings and revenue hours. Revenue hours are the sum total of hours that each bus and train carries passengers.

In 2009, bus boardings remained the majority of Metro boardings. More than four times as many trips were taken by bus in 2009 as by rail, largely due to the fact that there is a much larger bus service area. However, of all modes, rail has seen the fastest ridership growth. Increasing transit ridership can reduce regional VMT and the associated GHG emissions. Although this may increase Metro's transit GHG emissions, these emissions will be offset by an overall regional reduction of GHG.



Fuel Use

2 Metro uses three types of fuel to power its vehicles: Compressed Natural Gas (CNG), diesel, and gasoline. Total fuel use, measured in gasoline gallon equivalents (GGE), rose an average of 2% annually since 2002. However, our use of diesel continues to decrease through Metro's conversion to CNG, a cleaner burning fuel.

The fuel intensity of Metro's service, as measured in GGE per boarding, increased by nearly 10% from 2002-2009. This trend is due to revenue hours rising faster than ridership during that period.

After rising consistently from 2002-2008, prices of all fuels dropped sharply in 2009. Still, after adjusting for inflation, diesel prices are 80% higher than in 2002. Gasoline prices and CNG prices are 60% and 8% higher, respectively. CNG is the lowest priced fuel per GGE.

Rail Propulsion Power[1]

3 In 2009, 74% of the electricity used by Metro was to power the rail system (Blue, Green, Gold, Red, and Purple lines). Since rail ridership is growing at a faster rate than rail electricity use, the amount of power used per boarding is becoming more efficient over-time. The efficiency of the rail line when measured in kilowatt hours (KWH) per rail boarding improved 12% between 2005 and 2009.

[1] Due to a lack of sub-meters, propulsion power figures encompass the electricity used at rails stations and connected facilities for lighting, not just powering the trains. This additional facility use is a small percentage of propulsion power.

Facility Electricity Use

4 The cost of electricity used to power Metro's facilities is steadily increasing. In 2009, Metro spent $7.3 million on facility electricity, which was 8% more than the amount spent in 2008 (adjusted for inflation). The increase in cost occurred despite the fact that Metro actually used 8% less electricity than it used in 2008. This is due to an increase in electricity supplied by SCE, which charges more per KWH than LADWP.

Water Use

5 Metro's water use is growing at a faster rate than increases to transit service measured in revenue hours. This is a concern because water resources statewide are dwindling while water costs are simultaneously increasing. In 2009, although Metro's revenue hours increased by only 6%, water use increased by 10% from 2008 and 25% from 2002. Moreover, water costs increased nearly 28% (adjusted for inflation) from 2002–2009. We spent more than $1 million on LADWP water in 2009. Because average water costs are increasing, Metro must reduce water consumption in order to stabilize the associated annual cost.

Greenhouse Gas Emissions

6 Metro emitted 483,000 metric tons of carbon dioxide equivalents (CO2e) in 2009, about the same amount as in 2008 and 2007. Ninety percent of Metro's emissions are from our transit system that moves passengers. While Metro's operations create GHG emissions, the transit service helps to reduce regional emissions by reducing regional VMT and traffic congestion, and by creating denser, more pedestrian-friendly land use patterns. When the effects of Metro's service on VMT, congestion, and land use are considered, Metro prevents more GHG emissions than it produces.

Air Quality

7 Metro bus and rail operations continue to achieve significant reductions in criteria air pollutants.

Between 2008 and 2009, Metro was able to reduce overall air pollution emissions associated with bus and rail operations by 5%. Importantly, Metro reduced emissions of harmful diesel particulate matter pollution by 22%. This reduction is a significant achievement as emissions of fine particulate matter in vehicle exhaust have serious health effect consequences.

The reduction in diesel particulate matter is directly tied to Metro's continued efforts to modernize its bus fleet using state-of-the-art technologies. Metro began the transition to clean, compressed CNG years before regulation required the use of alternative fuel-powered vehicles. Today, Metro operates the nation's largest fleet of low-emission clean fuel CNG buses, as well as providing commuter rail service fueled by electricity that offers zero "tailpipe" emissions.

Waste

8 9 10 11 12 Metro has been and will continue to actively work on reducing waste. Metro has implemented several internal programs to divert waste from landfills. Amongst these programs are the bus battery, tire, construction, small battery, printer cartridge, and office recycling programs.

Forty-four percent of all solid waste produced in 2009 was recycled. Also, total solid waste decreased by 1,025 tons from 2008 to 2009.

Further improvements to existing recycling programs are expected to further increase diversion rates and waste reduction targets will be implemented to improve overall waste production.

Summary of Conclusions

While the actions taken by Metro have decreased the environmental impact of core activities, these impacts remain significant and their unit cost is rising. Metro's sustainability projects offer an opportunity to demonstrate environmental leadership, improve economic efficiency, and most importantly, create a safe and healthy environment for all employees, clients, and customers. In order to be effective, these efforts should be strategic and based on strong and comprehensive information. These data, analysis, and corresponding recommendations are documented in this report.

Summary Graphs

FIGURE 1 **Changes in Ridership (1997-2009)**

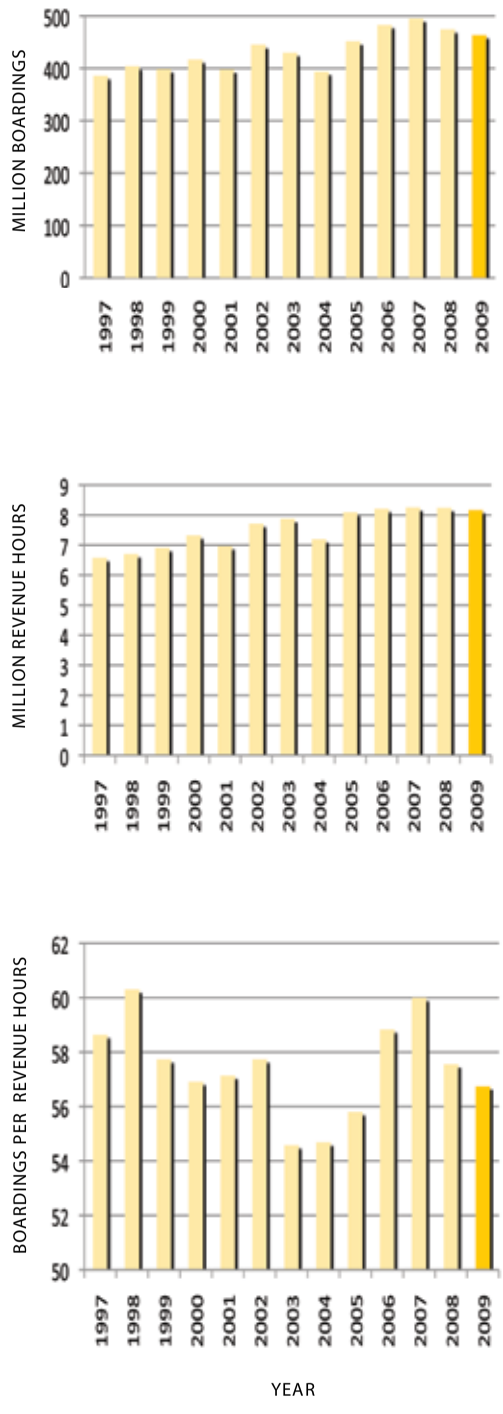
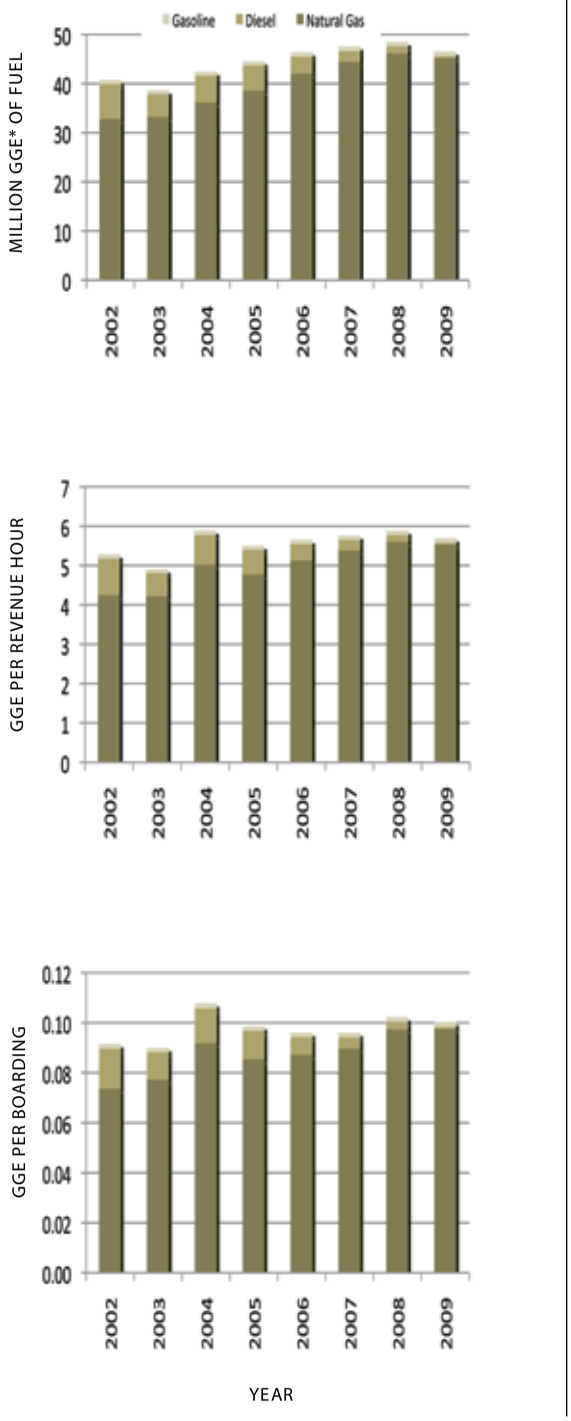


FIGURE 2 **Changes in Fuel Use (2002-2009)**



*GGE = gallons of gasoline equivalent (the amount of fuel it takes to equal the energy content of one liquid gallon of gasoline)

Summary Graphs

FIGURE 3 Changes in Rail Propulsion Power (2005-2009)

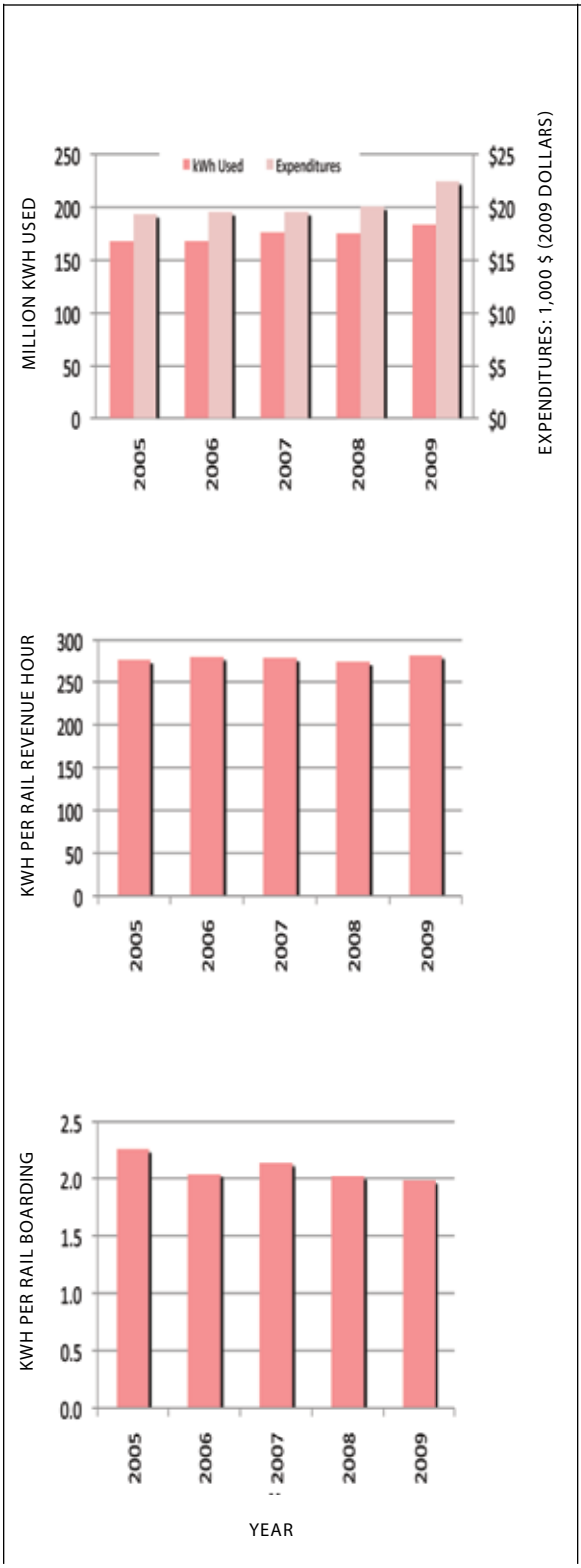
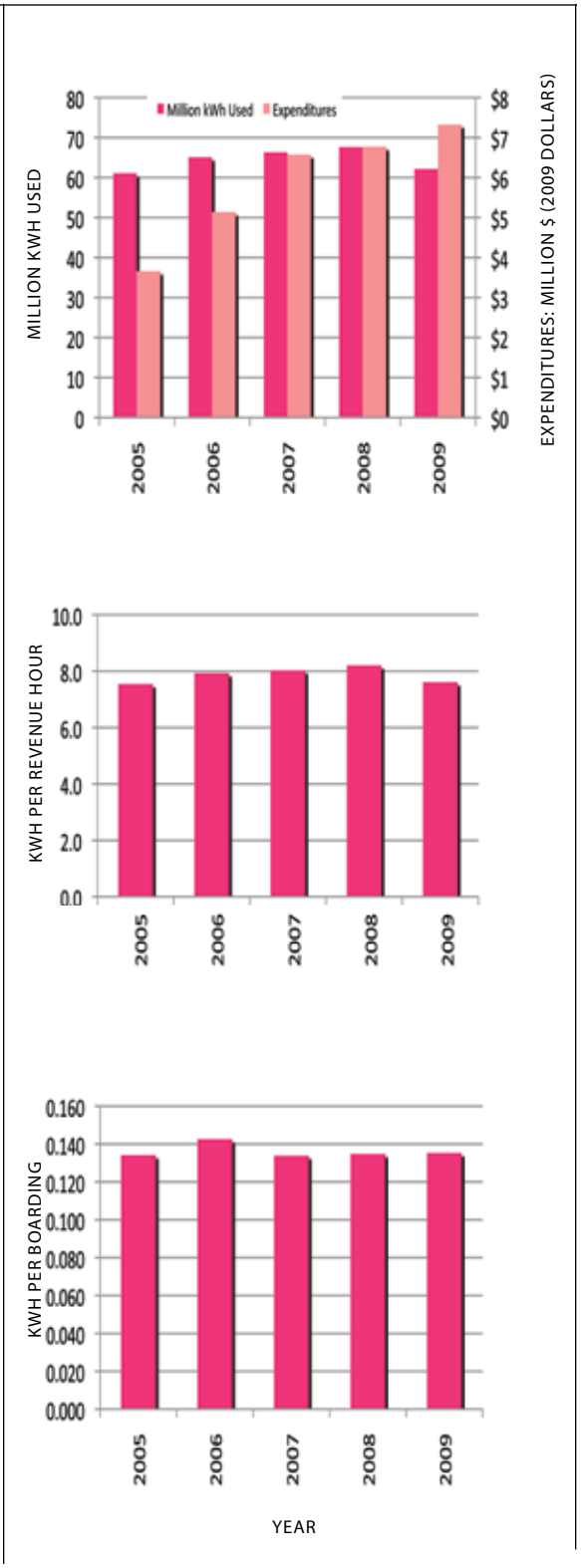


FIGURE 4 Changes in Facility Electricity Use (2005-2009)



Summary Graphs

FIGURE 5 **Changes in Water Use (2002-2009)**

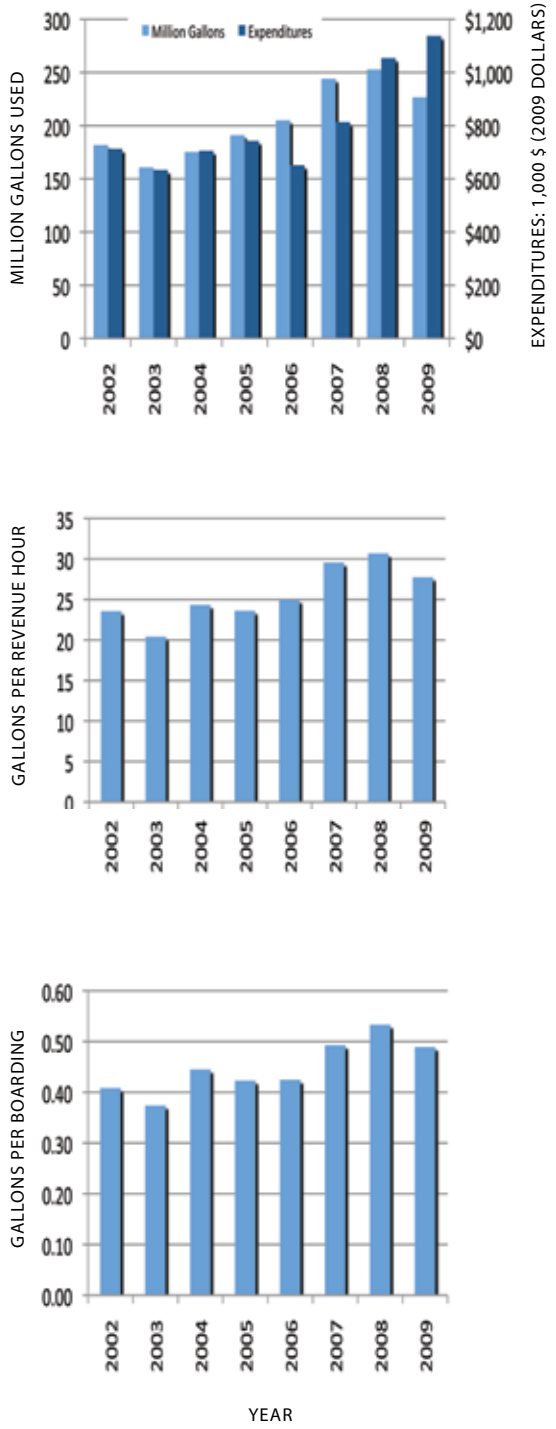
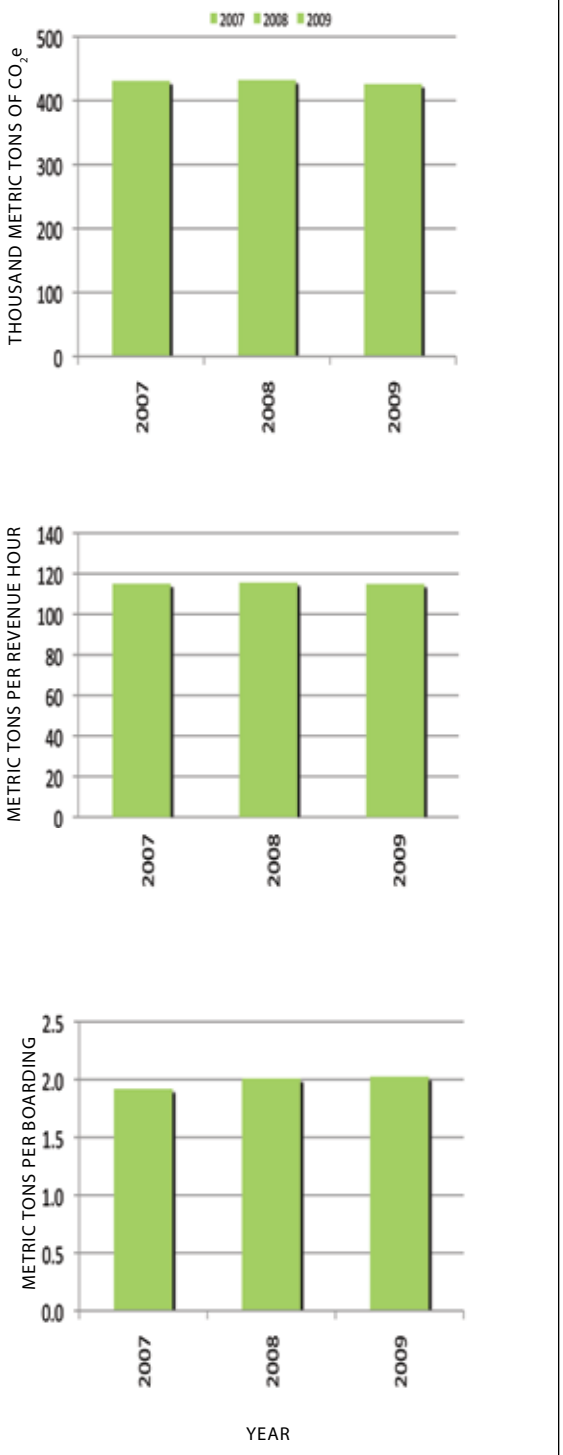


FIGURE 6 **Changes in Greenhouse Gas Emissions (2007-2009)[2]**



[2] When the effects of Metro's service on VMT, congestion, and land use are considered, Metro prevents more GHG emissions than it produces.

Summary Graphs

FIGURE 7 Changes in Air Quality (1990-2009)

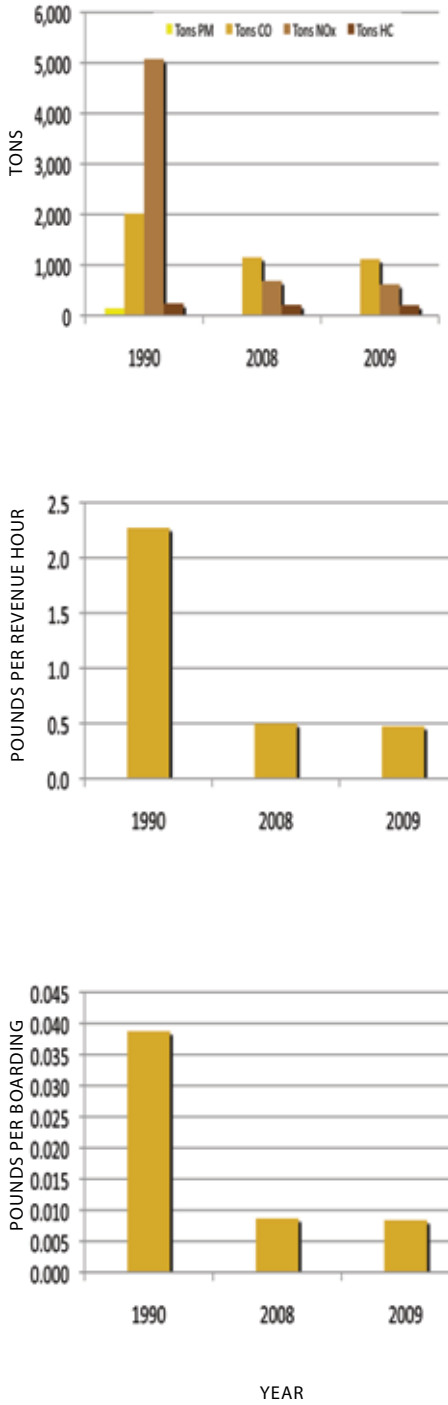
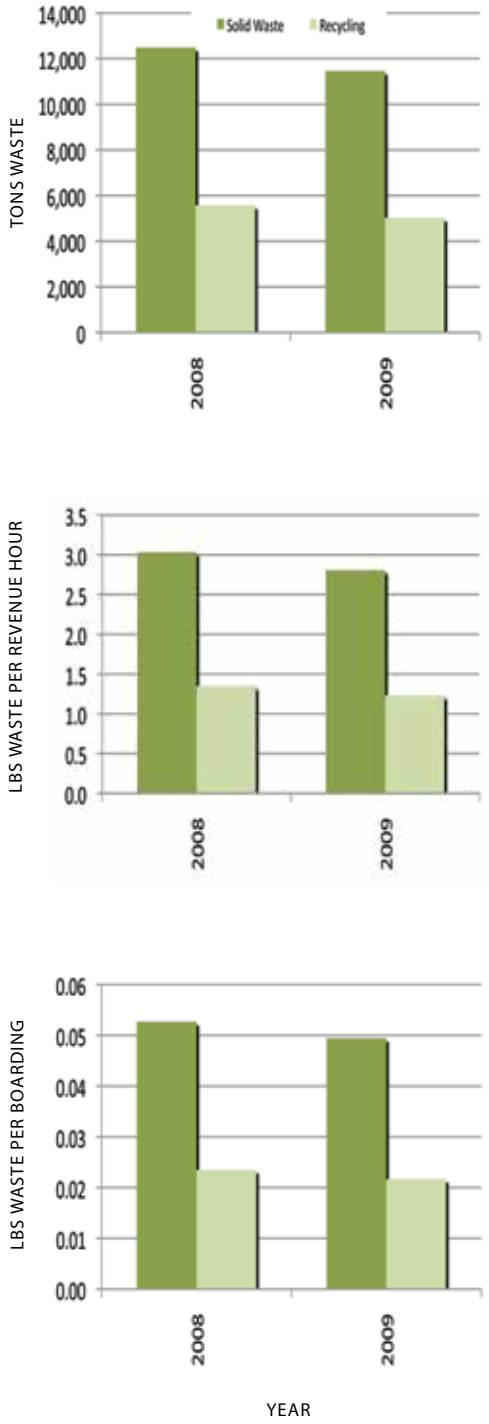


FIGURE 8 Changes in Solid Waste and Recycling (2008-2009)



Summary Graphs

FIGURE 9 **Changes in Used Oil Waste (2002-2009)**

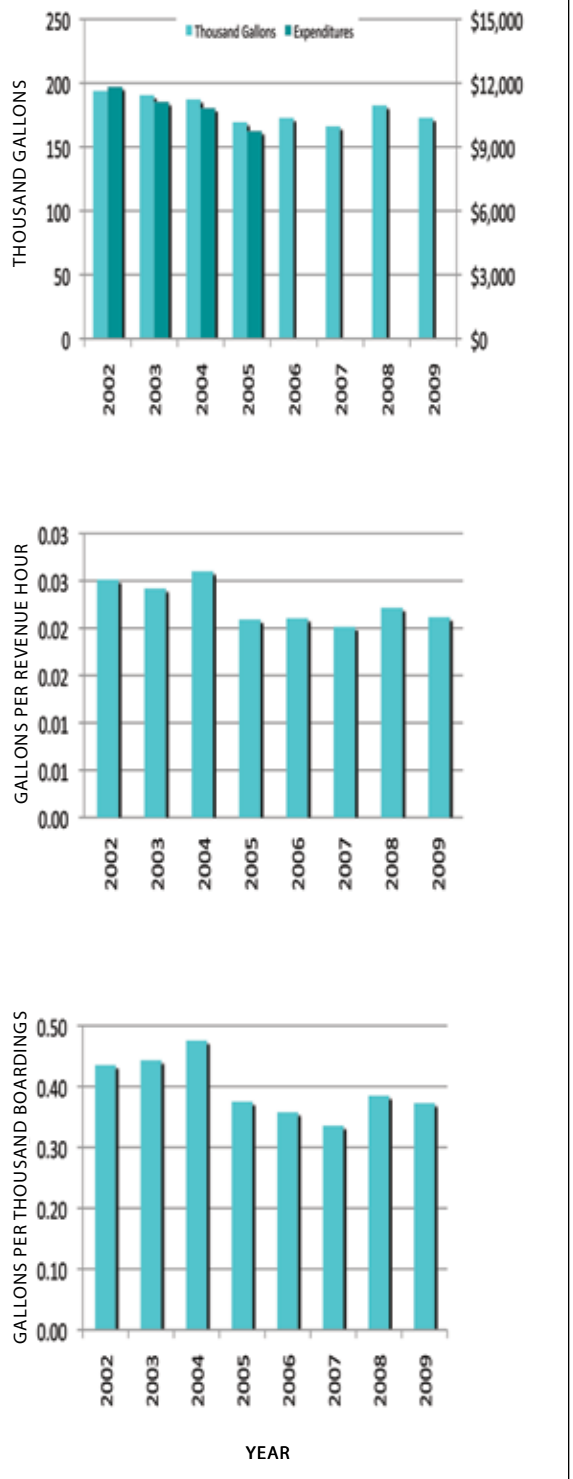
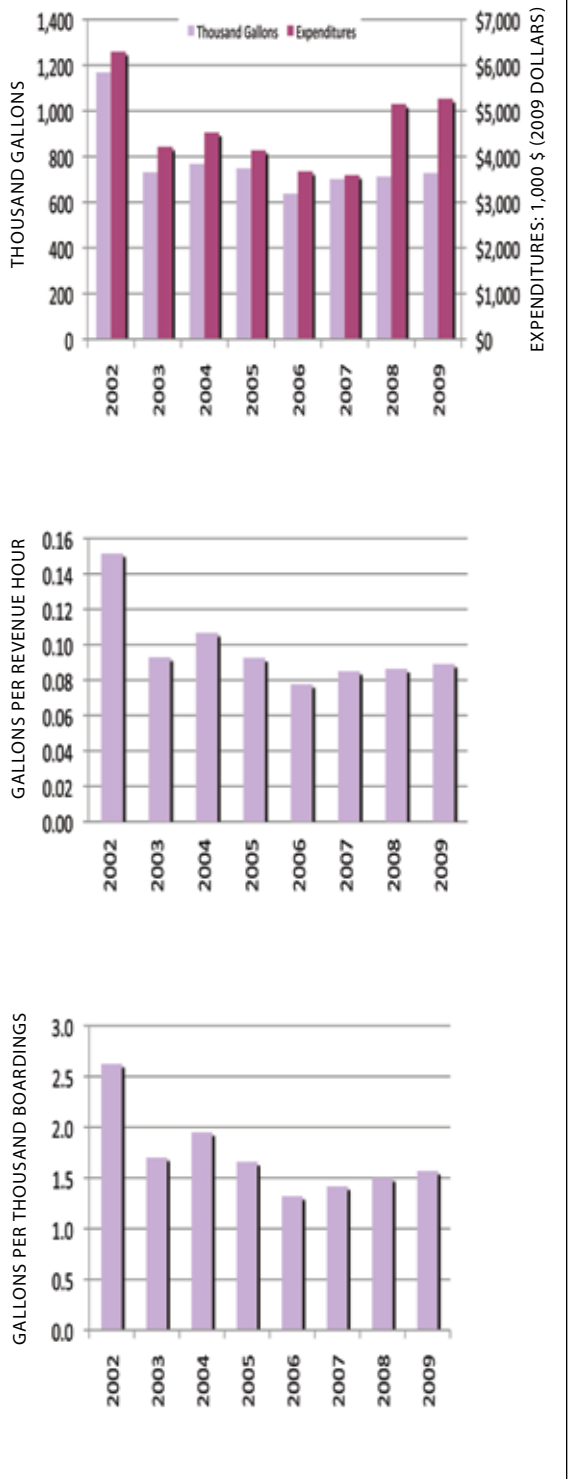


FIGURE 10 **Changes in Hazardous Liquid Waste (2002-2009)**



Summary Graphs

FIGURE 11 Changes in Non-Hazardous Liquid Waste (2002-2009)

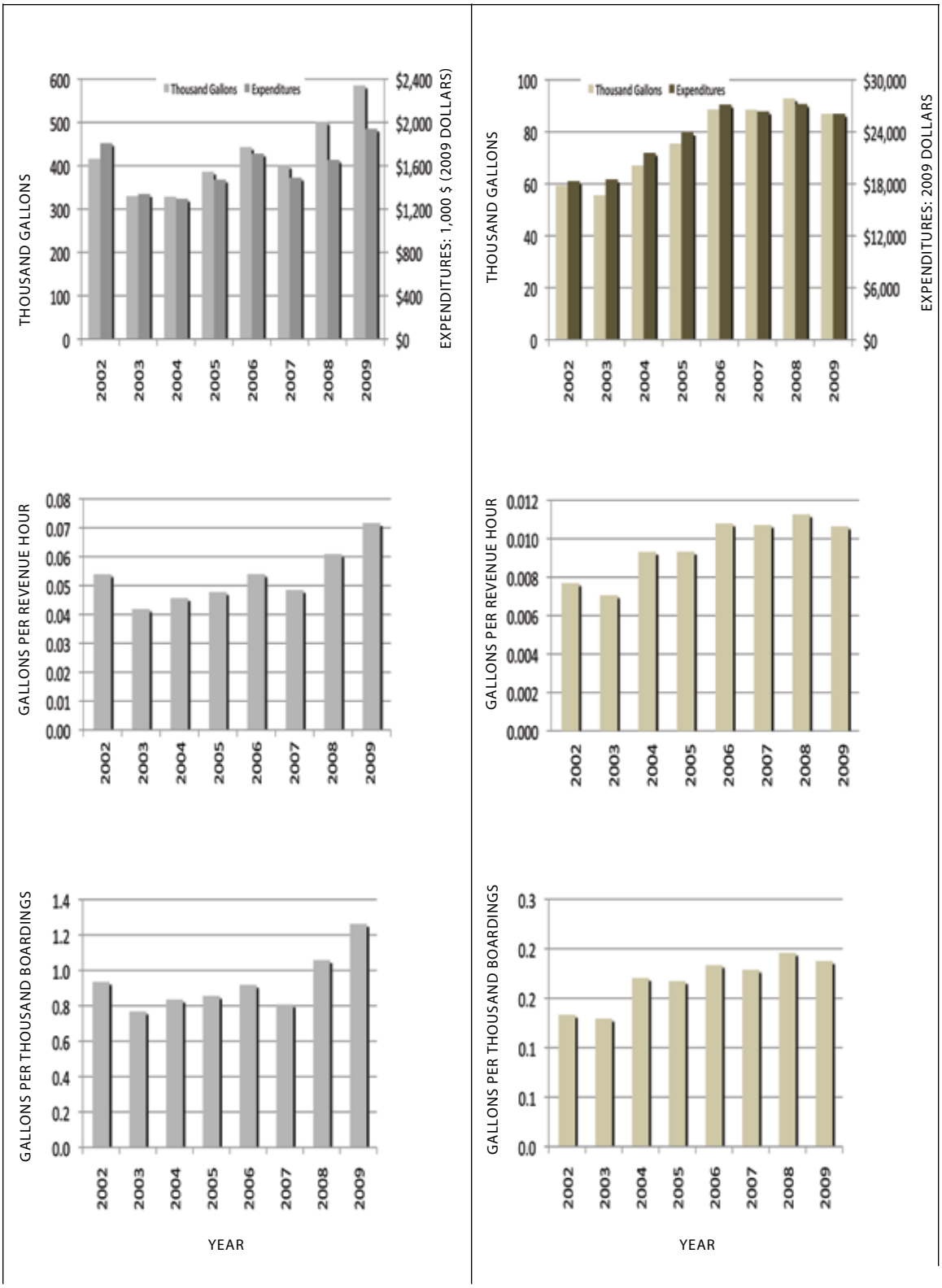


FIGURE 12 Changes in Anti-Freeze Waste (2002-2009)

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Introduction

The purpose of this report is to provide an update to the previous year's report by presenting sustainability data for calendar year 2009. Additionally, this report is intended to provide Metro's decision makers with information they can use to improve Metro's sustainability performance. The report first describes accomplishments within each indicator area that were achieved during 2009, and then presents and discusses data specific to each of the twelve indicator areas.

Additionally this report discusses the methodology used to obtain and analyze data, including how the different indicators were chosen; how efficiency is measured within the specific indicator; and potential weaknesses in the data. Accuracy within the data is essential; therefore, we used the best available data as of March 2010 and the most reliable sustainability guidelines to develop this report.

The indicator areas selected for historic and ongoing analysis include the following:

1. Ridership
2. Fuel Use
3. Rail Propulsion Power
4. Facility Electricity Use
5. Water Use
6. Greenhouse Gas Emissions
7. Air Quality
8. Solid Waste and Recycling
9. Used Oil Waste
10. Hazardous Liquid Waste
11. Non-Hazardous Liquid Waste
12. Anti-Freeze Waste

A detailed discussion of each indicator area is presented according to the following structure:

- **Indicator Area Definition –** Including relevance, description of linkages to other indicators, etc.
- **Accomplishments –** Significant actions or programs that impacted the indicator during the calendar year.
- **Data and Analysis –** Data graphs are provided along with analysis summaries.
- **Next Steps –** Specific actions that Metro is considering for future implementation; these include discussion of each indicator area as well as a discussion of general next steps for the organization.

In addition to the specific issues discussed in the indicator sections, Metro has developed and implemented broad policies, goals, and standards in an effort to demonstrate our commitment to apply sustainable strategies throughout the planning, construction, and operation of various projects. Specifically, all Metro projects shall comply with all local, state and federal codes, ordinances and regulations, and applicable Federal Transit Administration (FTA), Federal Highway Administration (FHWA), and American Public Transit Association (APTA) guidelines. Furthermore, we consider at a minimum the following strategies to achieve a sustainable approach to our projects:

- Reducing waste, reusing materials, recycling, and procuring environmentally friendly products;
- Including "green" and sustainable features through planning, design, construction, and operation of facilities and services; and
- Increasing the use of alternative energy solutions such as renewable energy sources.

Using Environmental Management System (EMS) principles as a tool, Metro is further identifying environmental issues of significant concern, proactively addressing those issues, implementing specific solutions to those issues as those solutions are developed, and continuously engaging management to ensure continuous improvement. EMS is a tool identified in our Environmental Policy to ensure the implementation of sustainable principles in all of our planning, construction, operations, and procurement activities.

Accomplishments

Throughout 2009, Metro was actively pursuing sustainable and efficient strategies in an effort to maximize transportation efficiency, access, safety, and performance while minimizing energy use, consumption, pollution, and the generation of waste. Those efforts and sustainable strategies that were suggested in the previous sustainability report and the accomplishments achieved throughout 2009 are provided and discussed by indicator area. Each accomplishment is a confirmation that Metro is committed to increasing our sustainability, efficiency, and environmental performance.

On April 23, 2009, the Metro Board adopted the Metro Environmental Policy, which signified our commitment to ensuring environmental protection through the use of an EMS as a core tool for implementation. At this time, an EMS has been initiated through various programs, such as the Division 10 Pilot and Capital Improvement Program, the Environmental Information Management Information Systems Pilot Program, and the FTA-Assisted Red Line Yard Environmental Management Systems Program. Through the Red Line Yard EMS Program, the 80 most pressing environmental issues were identified and processes were developed to address the top 5 priorities: Underground Storage Tanks, Above Ground Storage Tanks, Stormwater and Wastewater, Battery Management, and Rail Car Washing.

In late 2008, Metro hired a Transportation Sustainability Energy Manager (TSEM), and in 2009 a Transportation Sustainability Policy Manager (TSPM) to provide insight and policy direction for the organization. Policy development has been achieved through the implementation of the Metro Environmental Liabilities policies, and the Environmental Reduction and Reporting Policy; Metro Water Conservation Policy, and inclusion of sustainability principles in the Metro Design Criteria. Current and projected cost-saving estimates for the sustainability related projects implemented by the EMS process are estimated to be approximately $2 million a year.

Other accomplishments in 2009 include the sustainable construction design efforts made at the Division 3 Maintenance Annex, the Bauchet Street Warehouse and Shop, Division 13, and the Orange Line Canoga Extension. Additionally, Metro's Sustainability Awareness Training was recognized by the National Training Institute as a Model National Program for other transit properties across the nation. We have also been recognized nationwide by the U.S. Department of Transportation (USDOT), FTA, and APTA as a model effort to be followed. Metro's efforts will be featured as a United Nations International Case Study for sustainability implementation by a transit agency.

Ridership

1 Metro ridership growth outpaced county population growth by 7% between 1997 and 2009. During that time, boardings grew by 20.2%, while county population grew 13.6%.

Metro has been actively providing resources to commuters throughout Los Angeles County in an effort to promote carpooling and the use of transit as an alternative to driving alone. For our employees, Metro provides transit subsidies that provide an additional incentive to take alternative commuting to and from our offices. Additionally, Metro has purchased approximately 100 45-foot composite fiberglass buses as of May, 2010. These buses accommodate an additional 7 passengers compared to the standard 40-foot buses but still have the same fuel economy due to the lighter weight of the bus. This effort effectively increases Metro's passenger capacity without increasing fuel consumption.

Fuel Use

2 As of today, Metro has nearly 100% of its bus fleet running on CNG.[3] There remains only 14 buses that have yet to be transitioned to CNG. Metro now operates the largest CNG bus fleet in North America.

Rail Propulsion Power

3 Metro has performed a feasibility study for a Wayside Energy Storage System (WESS) that uses stationary electricity storage devices to capture energy generated when a rail car unit decelerates, releasing the energy back into the system when required. This pilot project is funded through a $4.5 million TIGGER grant from the FTA. This system will help to reduce the overall amount of rail electricity and power consumed from the grid.

[3] Statement by John Roberts, DEO, Operations. Maintenance Administration. Metro. Metro Support Services Center. Los Angeles, CA. 2010

Facility Electricity Use

4 Metro has been steadily increasing the use of solar panels throughout the organization. In 2009, Metro installed a 1 MW solar panel on the roof of the Metro Support Service Center. Metro did not incur any capital costs, and was able to develop the project from private bank loans, a power purchase agreement with the project developer, Chevron Energy Solutions, and utility rebates.

Water Use

5 In July of 2009 Metro adopted a policy statement to conserve the use of potable water resources at its facilities in the most cost-effective and efficient manner. To comply with this, Metro has been making introductory installation of waterless urinals, low-flow toilets, and high efficiency faucets at several divisions and its headquarters. Metro continues to install conservation features as part of standard retrofits and has taken several steps to proactively reduce water consumption throughout all of its operations.

Greenhouse Gas Emissions

6 The efforts made in Ridership, Fuel Use, and Facility Electricity Use have all resulted in GHG reductions. Growth in Metro's ridership has reduced VMT and associated GHG emissions.

Since completion of the last report, APTA greenhouse gas quantification protocols[4] have been finalized. These protocols now include methodology for quantifying how Metro's service reduces greenhouse gas emissions. As discussed in the APTA guidance, there are three ways that Metro's service reduces greenhouse gas emissions:

1. Mode shift – Metro reduces the amount of VMT on Los Angeles County's roads by getting people out of their cars and onto buses and trains.

2. Congestion reduction – By reducing the number of vehicles on the road and smoothing the flow of traffic, Metro reduces emissions from cars that operate in congested traffic conditions.

3. Land use impacts – Over time, Metro's rail stations and other major transit hubs attract denser, pedestrian-friendly development patterns to their immediate vicinities. These development patterns allow people that live and work in the area to travel shorter distances and to walk and bike more, even if they do not ride Metro.

The first effect is the most easily understood and the most commonly calculated. In 2009, passengers riding Metro buses, trains, and vanpools kept nearly 391,000 metric tons of CO2e out of the atmosphere through mode shift. Considering only this mode shift effect, Metro's net greenhouse gas emissions in 2009 were 92,000 metric tons of CO2e.

When the effects of Metro's service on congestion and land use are considered, Metro prevents more greenhouse gas emissions than it produces. A study from CALPIRG estimated Metro's net emissions, considering emissions from buses, trains, and vanpools, and emissions reduced through mode shift, congestion mitigation, and the land use multiplier: Metro generates a net reduction of 862,000 metric tons of CO2 per year.[5]

[4] American Public Transportation Association, "Recommended Practice for Quantifying Greenhouse Gas Emissions from Transit" (2009).

Air Quality

7 Metro has been actively pursuing efforts to modernize our bus fleet using state-of-the-art technologies. Metro began the transition to clean CNG years before regulation required the use of alternative fuel-powered vehicles. Today, Metro operates the nation's largest fleet of low-emission clean fuel natural gas buses, as well as providing rail service fueled by electricity that offers zero "tailpipe" emissions.

Waste

8 9 10 11 12 Metro is working to reduce its chemical usage and its associated waste. Metro has developed a Chemical Committee which oversees compliance with the State's Green Chemistry principles as they relate to reductions in chemical use and waste. Through the use of an electrolyzer Metro was able to significantly reduce the amount of chemicals being used at the Gateway Building. Metro's EMS Core Team has proactively identified and begun the process of mitigating significant environmental issues at its EMS pilot sites.

[5] Baxandall, Phineas Tony Dutzik, and Joshua Hoen Frontier Group, A Better Way to Go: Meeting America's 21st Century Transportation Challenges with Modern Public Transit, California's Public Interest Research Group (CALPIRG) Education Fund, 2008

Indicator Analysis

Metro's environmental performance throughout 2009 is assessed by our performance in each of the twelve indicator areas. This analysis provides the data that Metro uses both to track progress from year to year, and to set new targets, strategies, and goals for future years. Each indicator section provides a discussion of subject definitions and general indicator information followed by 2009 accomplishments. Specific indicator data is provided in graph form followed by an analysis discussion. Finally, next steps suggested for future implementation are provided.

How the Indicators Were Chosen

The indicators used in this report were derived using the GRI sustainability reporting framework. GRI is considered to be the gold standard in sustainability reporting and is used by entities throughout the world to report environmental performance. The flexibility and comprehensive nature of GRI's standard make it a good reporting tool for Metro.

The GRI framework is structured to include the inputs (energy, water, materials) and the outputs (emissions, effluents, and waste) that are common to most organizations, as well as impacts on biodiversity. The framework was designed to be usable by any organization, which allows for intra-industry and inter-industry benchmarking. The GRI suggests a wide range of indicators. Reporters choose the indicators most relevant to their operations for which accurate data is available. Using this process 12 indicators were established. They are: 1) Ridership, 2) Fuel Use, 3) Rail Propulsion Power, 4) Facility Electricity Use, 5) Water Use, 6) Greenhouse Gas Emissions, 7) Air Quality, 8) Solid Waste and Recycling, 9) Used Oil Waste, 10) Hazardous Liquid Waste, 11) Non-Hazardous Liquid Waste, and 12) Anti-Freeze Waste. Indicators 8 through 12 are collectively referred to as the "Waste" indicators.

Measuring Efficiency: Comparing Changes in Ridership to Changes in Environmental Impacts

One of Metro's principal roles is to provide efficient and effective transit service to the Los Angeles region. Metro's transit service creates net sustainability benefits in the region through decreased congestion and VMT and increased mobility. As Metro increases our service capacity, the environmental impacts of our operations will grow. Efficient expansion of Metro's services will ensure that environmental impacts do not outpace the benefits to the region. By comparing the change in environmental impacts to the changes in service and ridership, the efficiency of growth can be estimated. This is not a perfect science, but it does provide added depth of information to decision makers.

Why We Measure Efficiency with Boardings and Revenue Hours

This report uses boardings and revenue hours to measure Metro's transit ridership and transit service. These statistics are reported annually by all transit agencies to the National Transit Database (NTD) and thus enable cross-agency benchmarking.

Boardings

The purpose of transit is to move people from one place to another, in other words, to enable travel. This report measures ridership in boardings. Boardings are defined as persons getting on a bus or train. It is an unlinked trip versus a linked trip.

Revenue Hours

Revenue hours measure the number of hours that all Metro revenue vehicles serve customers, but do not include the time that buses operate out of service. Measuring revenue hours enables us to see if increasing impacts are correlated to increased service. This is important because, as a transit agency. Metro must both anticipate and induce travel demand. For this reason, the ridership benefits of transit projects might not be realized until several years after the projects are implemented.

Measuring revenue hours can help to understand increased environmental impacts before they have translated into increased ridership.

Weaknesses in the Data

Analyzing the environmental performance of an agency as large and complex as Metro involves large amounts of data from many sources. We used the best data available as of March 2010 for this report and determined that these data provide an accurate analysis of Metro's performance. There were a few shortcomings in the data, however, that should be addressed in future reports.

1. *Lack of Sub-Meters:* Because a few of Metro's current utility meters monitor several buildings within a Division (for example), it is difficult to accurately identify the source of increasing or decreasing energy usage within a specific Division.
2. *Lack of Water Utility Data:* Data was not obtained from the small municipal water departments in a timely manner. This report thus analyzes LADWP accounts only. LADWP is the majority of Metro's water use. In addition, based on utility bills examined, it is apparent that LADWP does not always check meters on a monthly basis, making it difficult to understand the causes for increases and decreases in water use.

3. *Lack of Data:*
   - *Facility Electricity & Solid Waste and Recycling* – data was not available back to 2002. In these instances, all data that was available was used for analysis.
   - *Rail Propulsion Electricity* – rail propulsion electricity data is not available before 2005.
4. *Water Meter Issues:* water billing and electricity use was provided by meter address, which does not always match up to a specific location/division.
5. *2008 Fuel Consumption Estimation Errors:* there was a disaggregation of revenue and non-revenue fuel consumption in the 2008 sustainability report that was based on miles per gallon (MPG) and not on actual revenue vs. non-revenue fuel consumption. This error was not present in the 2009 data but does affect the analysis between 2008 and 2009 data.

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Definition: Measures annual Metro ridership.

Units: Boardings and revenue hours

Relevance: Transit ridership increases economic production, social equity, and environmental integrity in the region and is Metro's main service as an agency.

Regulation: None

Linkages: All

Description of Linkages: Increasing service is likely to increase Metro's environmental impacts. In order to be sustainable, we should strive to not increase impacts faster than increasing service. Transit ridership can also reduce regional environmental impacts by reducing VMT.

Information Source: National Transit Database

Accomplishments

- **Continued to provide a variety of services and product offerings to commuters in LA County to promote carpooling and transit as alternatives to driving alone.**
- **Continued to provide a transit subsidy to Metro employees to encourage the use of alternative commuting.**

Data & Analysis

The Majority of Transit Riders Take the Bus

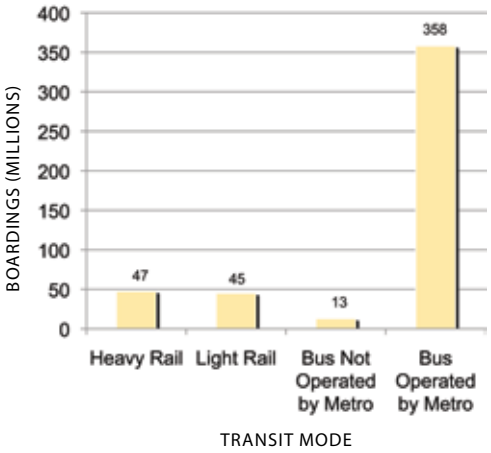


FIGURE 13 **Boardings by Mode (2009)**

Bus riders make up the majority of Metro ridership. In 2009, more than four times as many boardings were made on Metro buses than on the Metro rail. From 1997–2009, our customers boarded Metro bus service 4.8 billion times and Metro rail only 842 million times. This is largely due to the fact that Metro's bus service is far more extensive than its rail service.

Ridership is Increasing in the Long Term

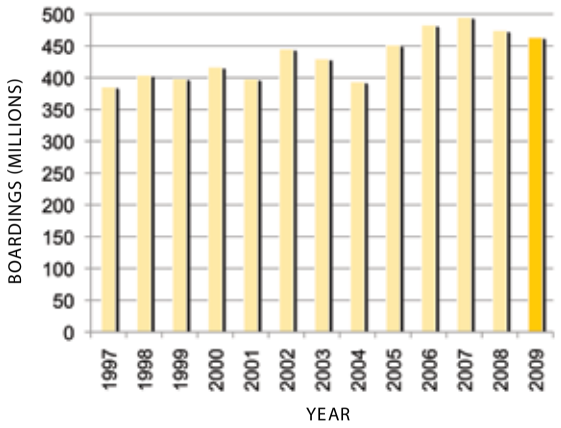


FIGURE 14 **Total Boardings (1997-2009)**

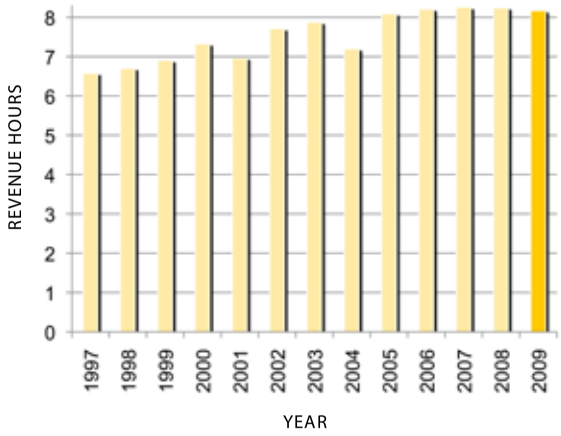


FIGURE 15 **Total Revenue Hours (1997-2009)**

In 2009, 464 million boardings were made on Metro's transit system. While this is approximately 2% lower than 2008, over the last 12 years ridership has trended upward. Lower boarding totals in 2009 are likely due to the regional economic downturn and rising unemployment. The most boardings, 495 million, were made in 2007. The fewest, 386 million, were made in 1997. Overall, boardings increased 20% between 1997 and 2009, outpacing population growth in Los Angeles County by seven percentage points.[6]

Rail Ridership is the Fastest Growing Mode

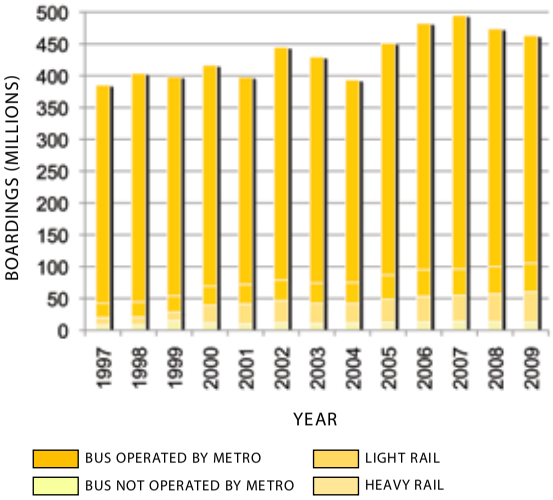


FIGURE 16 **Boardings by Mode (1997-2009)**

Between 1997 and 2009, 58 million, or 75%, of all new transit boardings were rail boardings. In this same period, bus revenue hours increased by 1.2 million, while rail increased by only 370,000. For every increased rail revenue hour, rail gained 158 new boardings, while bus gained only 16 new boardings for each increased bus revenue hour.

Next Steps

R1	Continue ridesharing and transit pass programs for Los Angeles Employers.
R2	Continue to provide a Metro Employee Transit Subsidy Program.
R3	Support and plan Transit Oriented Development in strategic Metro-owned properties and locations.
R4	Expand rail and BRT systems.
R5	Continue to expand the number of 45-foot composite fiberglass buses used by Metro.

[6] Source: California Department of Finance Population Estimates (http://www.dof.ca.gov).

Definition: Measures fuel used to power Metro's directly operated fleet (purchased transit not included).

Units: Gallons of Gas Equivalents (GGE)

Relevance: Fuel is made from limited natural resources and thus its use should be reduced whenever possible. In addition, fuel represents a significant cost to Metro.

Regulation: California Fuel Standards

Linkages: Ridership, Criteria Pollutants, Greenhouse Gas Emissions

Description of Linkages: Increasing Metro service and ridership is likely to increase the amount of fuel used. The type and amount of fuel used also directly impacts Metro's criteria pollutants and greenhouse gas emissions.

Limitations: This indicator does not include fuel used for purchased transit services.

Information Source: Fuel Use Records and M3.

Accomplishments

- **Metro has almost reached the goal of having 100% of its bus fleet operating on CNG. Only 14 diesel buses remain, these are soon to be transitioned to CNG.**
- **Evaluated potential emission mitigation provided by newer vehicle technology.**
- **Implemented CNG Compressor Electrification program to reduce fugitive emissions associated with gas powered compressors.**

Data & Analysis

Overall Use is Increasing, Diesel and Gasoline Use is Decreasing

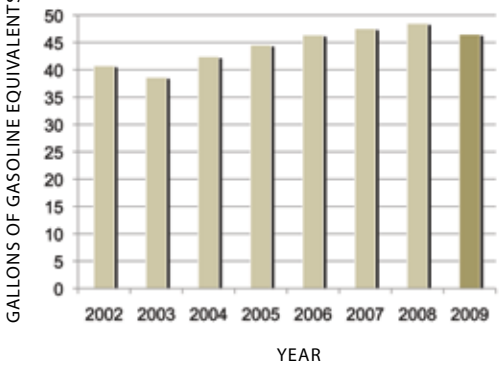


FIGURE 17 **Total Fuel Used in GGEs (2002-2009)**

In 2009, Metro's fleet used 47 million GGE of fuel, 6 million more GGEs than was used in 2002 (the earliest year recorded). This equates to a 2% annual increase.

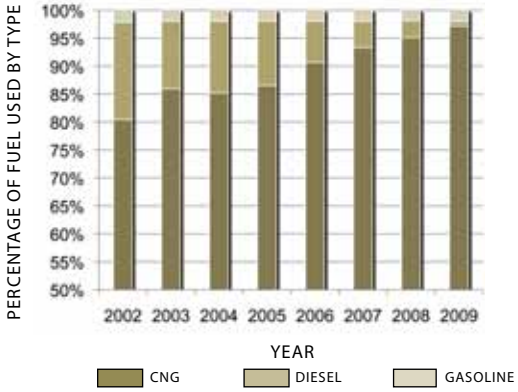


FIGURE 18 **Percentage of Fuel Used by Fuel Type (2002-2009)**

Due to Metro's conversion from diesel to CNG, diesel consumption has decreased by 95%. Gasoline consumption decreased by 9% between 2002 and 2009. Metro's fleet used 12.4 million more GGEs of CNG in 2009 than in 2002, a 38% increase. The dip in fuel usage in 2003 is likely due to the strike that year. Fuel usage dipped again in 2009 due to service cuts.

Fuel Efficiency is Fluctuating

FIGURE 19 Total GGEs per Boarding (2002-2009)

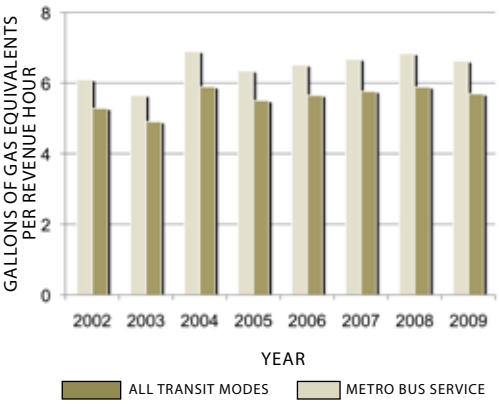


FIGURE 20 Total GGEs per Revenue Hour (2002-2009)[7]

GGEs per system-wide boarding and per directly operated bus boarding were trending downward after 2004, but then increased again in 2008 and remained at the same level for 2009. This increased level is at least partially due to the dip in ridership in 2008 and 2009. Also, increases in traffic congestion and excessive idling decrease vehicle fuel efficiency, which may be reflected in this trend.

Fuel Costs Decreased in 2009

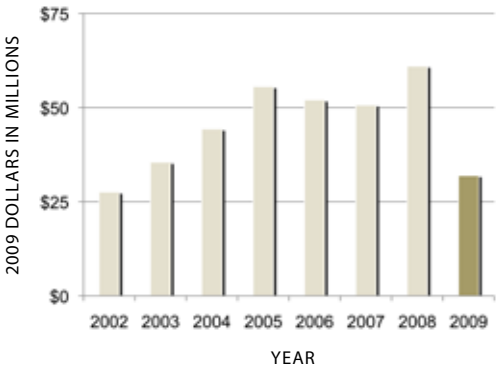


FIGURE 21 Total Estimated Fuel Expenditures in Millions - 2009 Dollars (2002-2009)

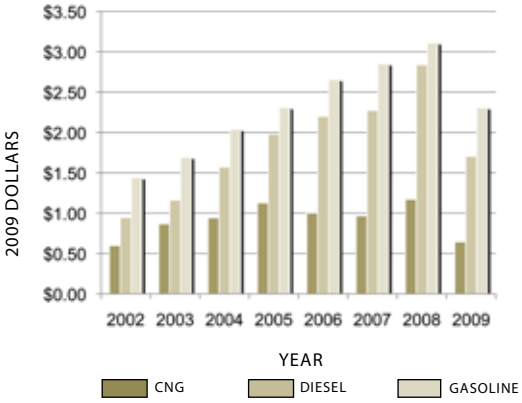


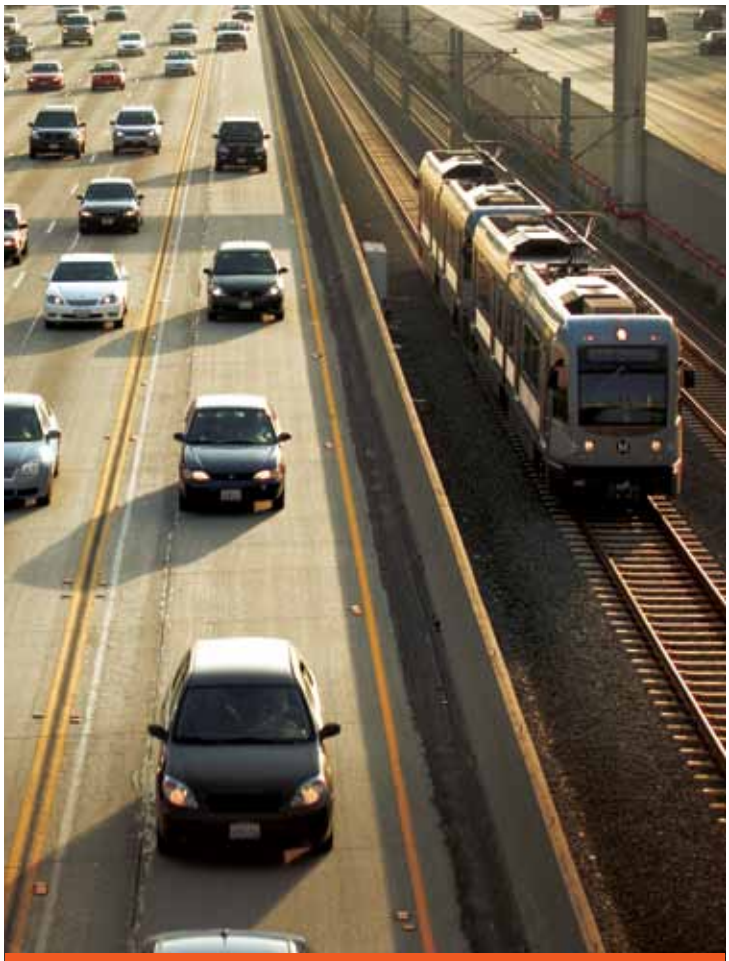
FIGURE 22 Average Cost per GGEs - 2009 Dollars (2002-2009)

Metro spent $32 million on fuel in 2009, nearly half of the amount spent on fuel in 2008. This is a sharp reversal of the trend from 2002-2008, when fuel expenditures rose by 121% (after adjusting for inflation). This decrease is in large part due to Metro's transition to a 100% CNG powered bus fleet. Prices of all three fuels fell dramatically from 2008 to 2009, an average of 45%. Additionally, the cost of CNG remains significantly lower than that of the other fuels.

Next Steps

F1	Create a plan to reduce idling.

[7] During the development of the 2010 report, an error was found in the 2008 data. The error was corrected in the 2009 data.



Definition: Measures electricity used to power Metro rail.

Units: Kilowatt Hours (KWH)

Relevance: Propulsion power is 18% of Metro's carbon footprint and a significant cost to Metro. At the same time rail has the potential to significantly reduce regional GHG.

Regulation: None

Linkages: Ridership, Criteria Pollutants, and Greenhouse Gas Emissions

Description of Linkages: Increasing Metro rail service and ridership will increase propulsion power. This directly impacts Metro's criteria pollutants and greenhouse gas emissions. Increasing rail ridership increases the efficiency of the rail system per boarding.

Limitations: Propulsion power reports were not available before 2005, and there was some trouble verifying the accuracy of Gold Line power consumption for 2004 and 2005.

Information Source: Agency Propulsion Power Records

Accomplishments

- **Received grant to implement Wayside Energy Storage System.**

Data & Analysis

Propulsion Power Growing Slightly

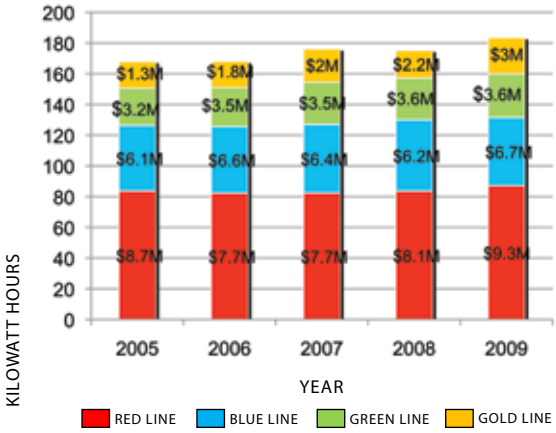


FIGURE 23 **Kilowatt Hours of Propulsion Electricity Use by Rail Line - 2009 dollars (2005-2009)**

Metro rail consumed 184 million KWH of electricity in 2009, 9% more than in 2005. The cost of powering the trains grew 16% in that period, from $19.3 million to $22.4 million. In every year the Red Line consumed more power than any other line. An increase in KWH consumed coupled with an increase in the price of electricity pushed the Red Line's electricity costs higher by more than $1 million from 2008 to 2009. The increase in consumption of KWH is attributed to the increased amount of rail hours throughout Metro rail lines. An additional reason for the increase is partially attributable to Metro's Gold Line, which was recently completed and began operation in 2009.

Rail Rider Efficiency is Improving

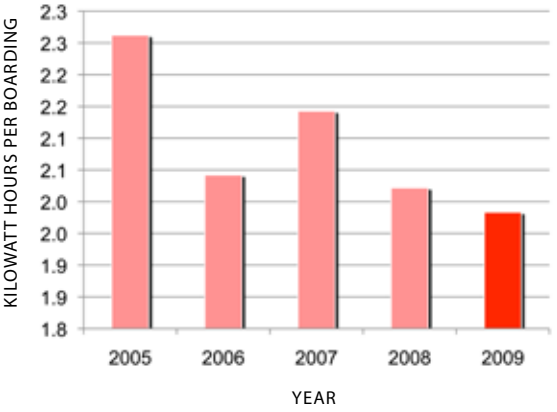


FIGURE 24 **Kilowatt Hours of Propulsion Electricity per Boarding (2005-2009)**

Rail Car Efficiency is Fluctuating

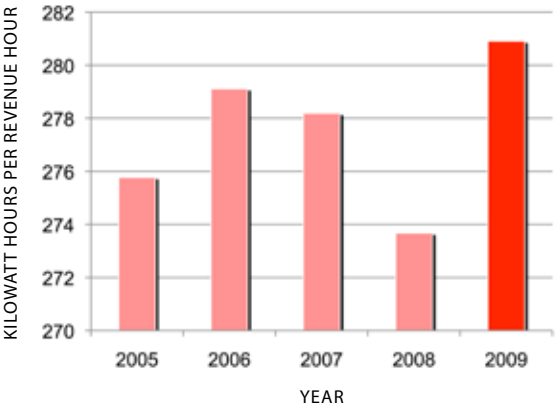


FIGURE 25 **Kilowatt Hours of Propulsion Electricity per Rail Revenue Hour (2005-2009)**

Rail ridership (boardings) is increasing faster than consumption of propulsion power. In 2009, Metro used 1.98 KWH of electricity per rail boarding compared to 2.26 KWH in 2005. This is a 12% increase in efficiency. Since 2005, the efficiency of rail car operations has fluctuated between 276 and 281 KWH per vehicle revenue hour, a difference of just 2%.

LADWP Provides Majority of Power

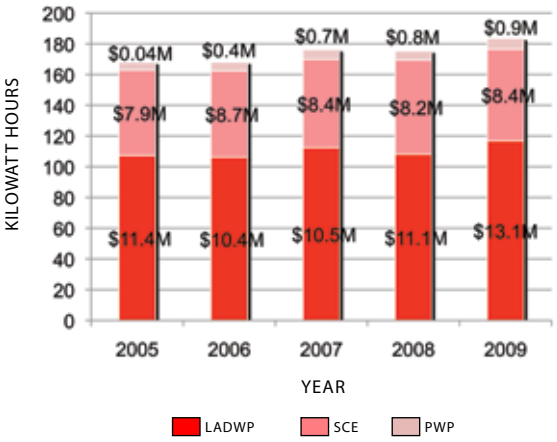


FIGURE 26 **Kilowatt Hours of Propulsion Electricity Use by Provider - 2009 dollars (2005-2009)**

Historically, LADWP provides more than 50% of Metro rail's propulsion power. LADWP power is cheaper than Southern California Edison (SCE), but also more carbon intensive than the private utility.[8] Pasadena Water and Power (PWP) provided only a fraction of power each year.

Next Steps

RP1	Implement Wayside Energy Storage System (WESS) and/or on-board storage technology to capture the electricity and energy produced by dynamic braking.
RP2	Research the On-board Storage of Regenerative Braking Energy Strategy.
RP3	Install sub-meters to measure electrical use specific to rail propulsion and facilities.
RP4	Develop an energy management and conservation plan that includes assessing the impacts of the 30/10 Plan on Metro's electrification plan.

[8] Source: LADWP has plans to reduce the carbon intensity of their power generation in coming years.

Definition: Measures Metro's annual agency-wide electricity use for facilities (does not include KWH used to power trains).

Units: Kilowatt Hours (KWH)

Relevance: Electricity costs Metro millions of dollars every year and contributes to Metro's carbon footprint.

Regulation: None

Linkages: GHG Emissions, Air Quality

Description of Linkages: Approximately 8% of Metro's carbon footprint is attributed to the electricity our facilities use. Electricity use causes air pollution at the power generation site.

Limitations: Reports on electricity prior to 2005 combine rail propulsion and facility electricity use. Thus, we could only analyze facilities electricity use for the years 2005-2008. A lack of sub-metering makes it difficult to understand usage and effectively target reduction projects.

Accomplishments

- **Completed energy audits at Divisions 1, 10, and 20.**
- **Completed energy retrofits and solar panels at Metro Support Services Center.**

Data & Analysis

Gateway Headquarters and the Metro Service Support Center use the Most Electricity

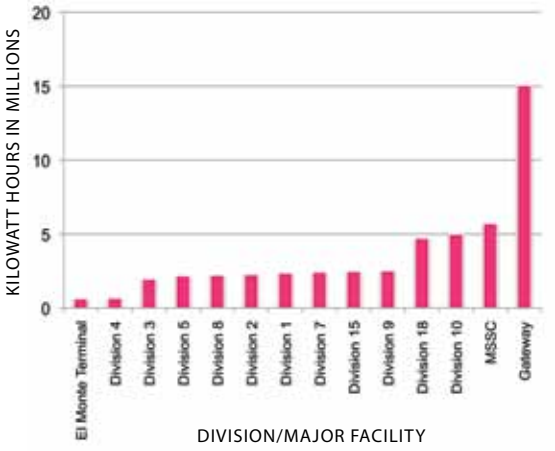


FIGURE 27 **Electricity Use by Major Facilities (2009)**

In 2009, the largest users of electricity were Gateway Headquarters (15.0 million KWH) and the Metro Support Services Center (5.7 million KWH). The combined electricity use at these facilities accounted for 33% of Metro's total facility electricity use in 2009.

Electricity Use Decreased in 2009

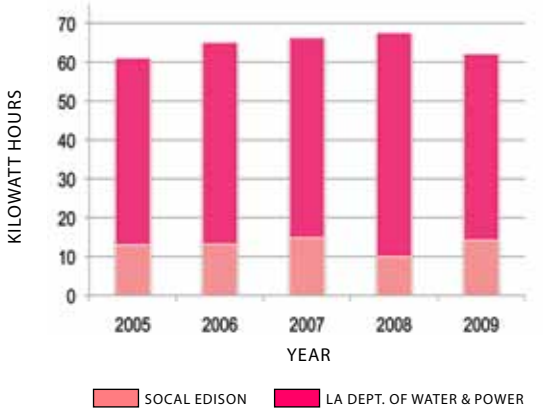


FIGURE 28 **Facility Electricity Use in Kilowatt Hours (2005-2009)**

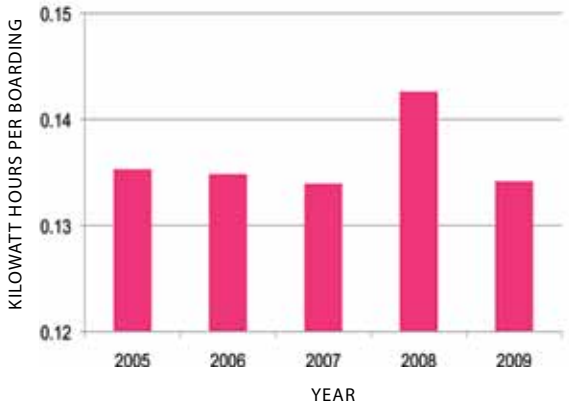


FIGURE 29 **Facility Electricity Use in Kilowatt Hours per Boarding (2005-2009)**

In 2009, Metro facilities used 62 million KWH hours of electricity. Electricity use rose between 2006 and 2008 then dropped significantly (by 5.4 million KWH) in 2009. The decrease comes entirely from LADWP territory, where consumption decreased 17% (9.6 million KWH) compared to 2008. This decrease was offset by an increase in consumption of 42% (4.1 million KWH) in SCE territory. Despite a decrease in Metro ridership (boardings), in 2009 Metro facilities used 6% less KWH/boarding than in 2008. This decrease is due to the significant decrease in overall facility electricity use. 2009 exhibits the lowest facility electricity use since 2005. A significant portion of this decrease was due to the Metro Support Services Center energy retrofit, which lowered electricity use at that facility by 4.9 million KWH. The successful implementation of recommendations from previous sustainability reports has facilitated the reduction in facility electricity use exhibited in 2009.

Electricity is a Significant and Growing Cost

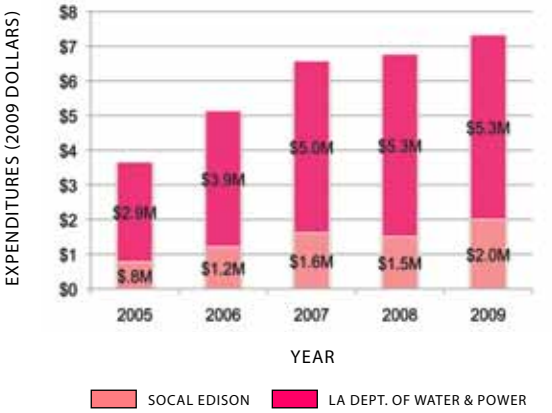


FIGURE 30 **Facility Electricity Cost by Provider (2005-2009)**

In 2009, Metro spent $7.3 million for facility electricity, $0.55 million more than in 2008. Facility electricity expenditures increased by 8% in real dollars, while electricity use actually decreased by 8% compared to 2008. The reason for this is the decrease in LADWP-supplied electricity use (at an average of $0.11/KWH) and the increase in SCE-supplied electricity use (at an average of $0.14/KWH). The average cost per LADWP-supplied KWH rose 14% compared to 2008, while the average cost per SCE-supplied KWH increased 3%. In 2009, SCE on average charged 27% more for electricity than LADWP. Efficiency projects in SCE territory will thus have a quicker payback and higher return on investment.

Next Steps

FE1	Replace existing lighting and other energy end-use equipment in Metro facilities with more efficient and cost-effective equipment.
FE2	Provide adequate funding for energy retrofits.
FE3	Provide sub-meters at each facility so funding can be properly directed and results accurately tracked.
FE4	Invest in energy management systems to properly track energy usage.
FE5	Track energy efficiency upgrades and measure their success, so the most successful projects can be repeated.
FE6	Do a project life-cycle cost analysys at the beginning of every new construction or major renovation project so that the future savings over time of efficiency upgrades can be taken into account.
FE7	Begin retrofitting of lighting in the Red Line Tunnel.
FE8	Develop an Energy Conservation and Management Plan that will provide additional programs and strategies to further reducing facility electricity use, so that projects can benefit from economies of scale and bulk discounts, instead of project-by-project retrofits.
FE9	Aggressively pursue renewable energy sources, and, where feasible, take advantage of rebates and subsidies for energy and water conservation, and implement energy conservation measures.
FE10	Construct all new facilities and projects using energy-efficiency and conservation strategies.
FE11	Complete full implementation of the Environmental Management System at the pilot sites.
FE12	Obtain ISO 14001 certification at Red Line Yard Facility.
FE13	Complete additional facility energy audits.
FE14	Develop additional renewable sources other than photo-voltaics.
FE15	Begin implementation of solar panels on transportation infrastructure.

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Definition: Measures Metro's annual agencywide water use.

Units: Gallons

Relevance: Water is a critical issue in Los Angeles' arid climate and future water restrictions are likely. Water is a large Agency expense.

Regulation: None

Linkages: Ridership, GHG Emissions

Description of Linkages: A large proportion of Metro's water is used to wash buses and train cars, thus water use is directly related to vehicle revenue hours. Water conservation is a critical part of climate change adaptation.

Limitations: The small municipal water agencies were not able to provide data in time to be incorporated into this report, thus the analysis is of LADWP accounts only. These accounts make up the vast majority of Metro's water use. LADWP does not always check meters regularly. Thus, water use is not necessarily recorded in the period it is used. This creates challenges in tracking the causes for changes in consumption and the benefits of efficiency upgrades.

Information Source: LADWP Water Bills

Accomplishments

- **Adopted and implementing a policy statement to conserve the use of potable water resources at its facilities in the most cost-effective and efficient manner.**
- **Strengthened stormwater and wastewater programs to capture and reuse water for operations.**

Data & Analysis

Water is a Significant and Rising Cost

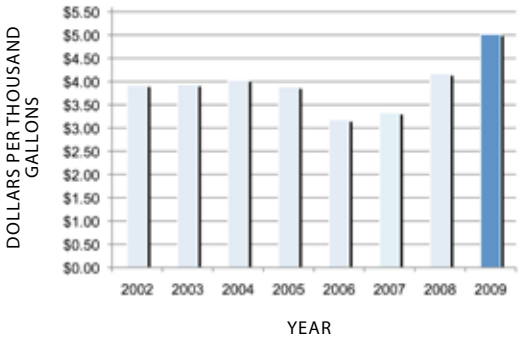

FIGURE 31 **Average LADWP Water Cost per Thousand Gallons - 2009 Dollars (2002-2009)**

Between 2002 and 2009, the average water cost per gallon grew about 28%, and overall water use increased by only 25%, resulting in a total water expenditure increase of 60%. Sewer expenditures increased 10% in that time. In 2002, Metro spent $713,000 on water and $539,000 on sewer (adjusted for inflation). In 2009, Metro spent more than $1 million on water and $590,000 on sewer. This is a real dollar increase of $425,000 on water and $51,000 on sewer. This added cost is due both to Metro's growing consumption and the increasing cost of water. After adjusting for inflation, the average cost of water grew 28% between 2002 and 2009 (does not include sewer costs). Water costs are expected to continue to increase.

Water Efficiency Increased in 2009

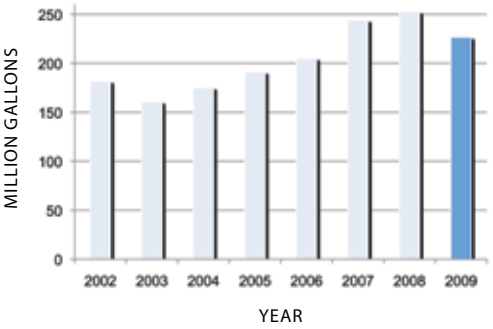

FIGURE 32 **LADWP Water Use in Million Gallons (2002-2009)**

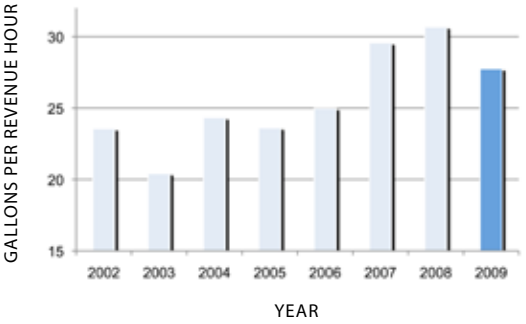

FIGURE 33 **LADWP Water Use in Gallons per Revenue Hour (2002-2009)**

In 2009, Metro purchased 227 million gallons of water from LADWP, 25% more than in 2002 but 10% less than 2008. A large portion of purchased water is used to wash buses and train cars. Thus, we expect Metro's water use to increase as service increases. Between 2002 and 2009, however, water use increased 25%, while vehicle revenue hours increased only 6%. In 2002, Metro's water efficiency was 24 gallons per revenue hour. In 2009, Metro was 18% less efficient and consumed 28 gallons per revenue hour. However, this is 10% more efficient than in 2008.

LADWP Water Consumption at Major Facilities

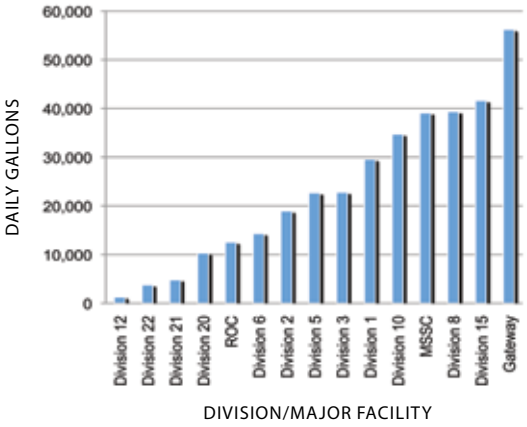

FIGURE 34 **Average LADWP Daily Water Use in Gallons by Major Facility (2009)**

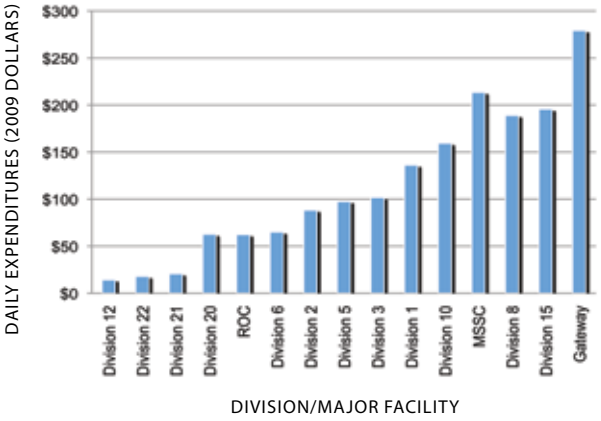

FIGURE 35 **Average LADWP Daily Water Expenditures by Major Facility (2009)**

In 2009, daily Division water use varied from a low of 1,300 gallons at Division 12, to a high of 56,000 gallons at the Gateway headquarters building. Average daily water costs varied between $14 (Division 12) and $279 per day (Gateway).

Next Steps

WU1	Substitute municipal recycled water for potable water where available.
WU2	Further increase the amount of runoff water captured at bus washing bays for recycling and re-use.
WU3	Replace existing sanitary fixtures in bus and rail facilities with more efficient fixtures.
WU4	Recycle and reuse on-site created gray-water from bus and rail facilities for other allowable applications.
WU5	Replace existing steamers with high-efficiency models.
WU6	Use recycled water for car washing throughout Metro's rail facilities.
WU7	Evaluate feasibility of using recycled water in place of potable water.
WU8	Use water conservation and efficiency guidelines outlined in applicable Leadership in Energy and Environmental Design (LEED®) reference books for all planning, procurement, design, construction, operations, and maintenance of linear and non-linear facilities.
WU9	Develop and implement a Water Action Plan.

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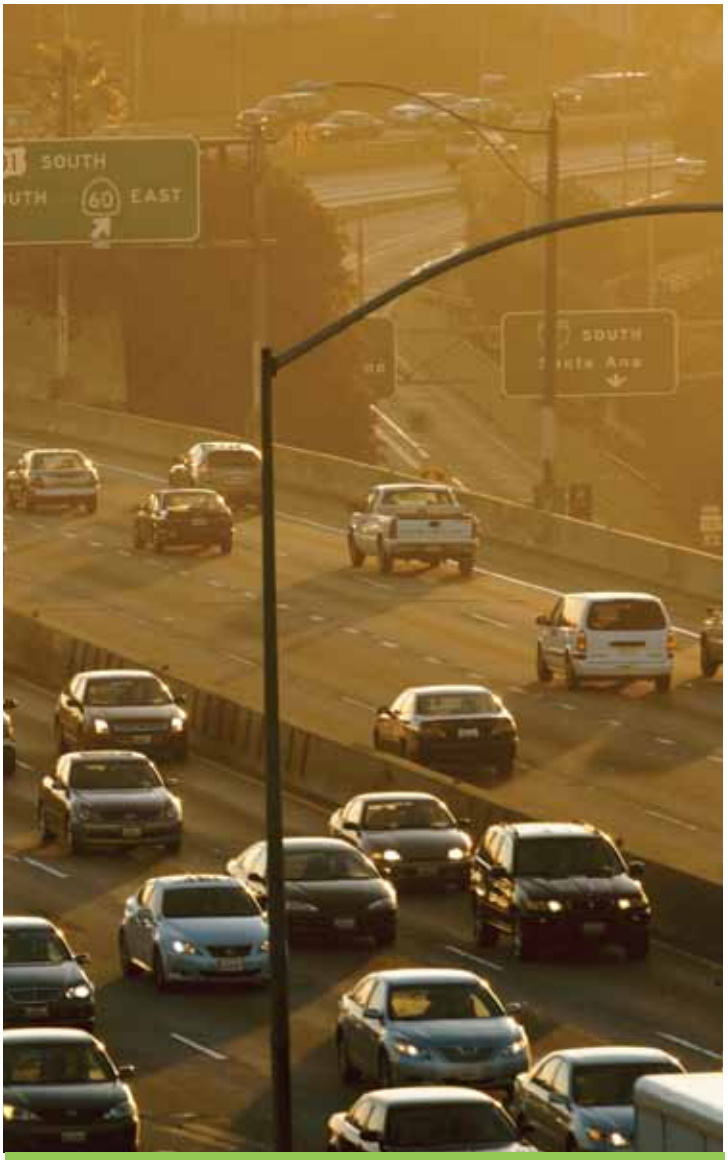

Definition: Measures Agency-wide greenhouse gas emissions.

Units: Metric Tons (MT) CO_2e

Relevance: Greenhouse gas emissions cause global climate change. Climate change will have severe environmental, economic, and social impacts in Los Angeles.

Regulation: California AB32 (no current direct regulation over Metro) and SB375 (Metro is assisting our MPO in Developing an SCS).

Linkages: Electricity, Fuel, Ridership

Description of Linkages: Electricity and fuel use directly impact Metro's level of GHG emissions. Ridership impacts Metro's carbon efficiency.

Limitations: Methane emissions from solid waste landfilling and GHG emissions from water conveyance are not included due to a lack of analysis tools.

Accomplishments

- **Continued to provide a variety of services and product offerings to employers and educational institutions in LA County to promote carpooling, vanpooling, and transit as alternatives to driving alone.**
- **Continued to provide a transit subsidy program to our employees.**
- **Placed into service 45-foot composite fiberglass buses to increase passenger capacity without increasing fuel use.**
- **Continued the use of solar panels on transportation infrastructure.**
- **Implemented a CNG Electrification Program.**

Data & Analysis

Greenhouse Gas Emissions Remain Steady

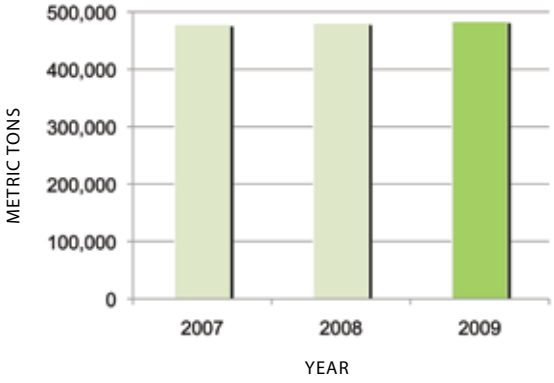

FIGURE 36 **Greenhouse Gas Emissions in Metric Tons CO_2e (2007-2009)**

The year 2007 was the first year Metro began documenting emissions. There was no significant shift in Metro's level of GHGe between 2007 and 2009. When the effects of Metro's service on VMT, congestion, and land use are considered, Metro prevents more GHG emissions than it produces.

Most Emissions Come From Transit Used to Move Passengers

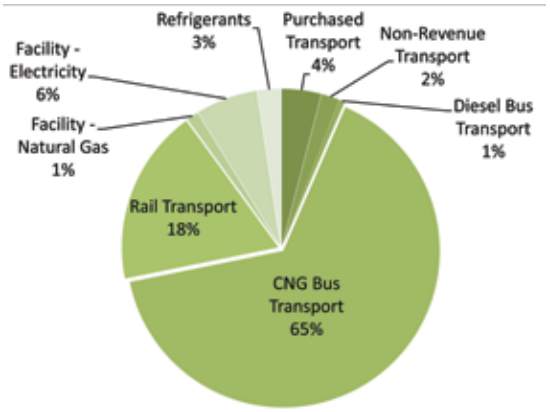

FIGURE 37 **Percentage of Total CO2e Emissions by Facility or Transport Mode (2009)**

In 2009, 90 percent of Metro's emissions were used to operate the transit system that moves Metro passengers. Refrigerant emissions of HFCs and PFCs were added to the inventory in 2009; they were not included in 2008.

Directly Operated Buses Most Carbon Efficient per Boarding

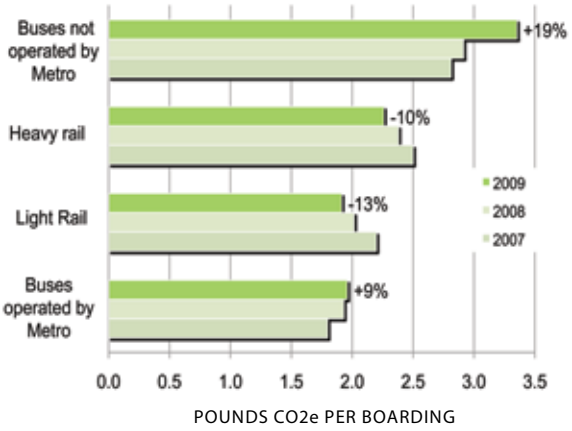

FIGURE 38 **Pounds of Greenhouse Gas Emissions per Boarding by Mode (2007-2009)**

In 2009, Metro's light rail became the most carbon efficient transit mode per boarding. Purchased transport buses were the least carbon efficient per boarding. The greatest gains in efficiency came from Light Rail and Heavy Rail.

APTA Efficiency Statistics Reveal Variety of Carbon Efficiency

Mode	CO2e/ Veh Mile	CO2e/ Rev Hour	CO2e/ Pas. Mile
Bus DO	7.15	99.88	0.48
Bus PT	5.42	87.37	0.84
Light Rail	9.40	224.28	0.26
Heavy Rail	17.09	399.48	0.47
Stationary	0.88	13.07	0.05
Total	8.77	130.35	0.51

FIGURE 39 **APTA Suggested Statistics in Pounds* of CO2e**

APTA's draft climate change standard recommends the performance statistics outlined above. In 2009, Metro's light rail system was the most carbon efficient per passenger mile, emitting just 0.26 pounds of CO2e per passenger mile (an improvement over 2008 of 0.28 pounds of CO2e per passenger mile). The light rail system, however, was the second least carbon efficient per revenue hour, emitting 224 pounds of CO2e per revenue hour. This variation underscores the fact that a variety of carbon efficiency metrics are necessary to understand Metro's climate change impacts.

*Average passenger car emits about 1.1 pound of CO2 per mile

Next Steps

GG1	Continue ridesharing and transit pass programs for Los Angeles Employers.
GG2	Continue to provide a Metro Employee Transit Subsidy Program.
GG3	Continue and expand Metro's vanpool program.
GG4	Support and plan Transit Oriented Development in strategic Metro-owned properties and locations.
GG5	Provide Bike-to-Transit commuter incentives and other bicycle amenities.
GG6	Expand rail and BRT systems.
GG7	Increase the use of hybrid vehicles for non-revenue fleets.
GG8	Research on-board storage technology to capture the energy produced by dynamic braking.
GG9	Develop pilot program for retrofitting lighting in the Red Line Tunnel.
GG10	Replace existing lighting and other energy end-use equipment in Metro facilities with more efficient and cost-effective equipment.
GG11	Conduct a bike sharing feasibility study.
GG12	Continue implementation of the WESS pilot program.

Definition: Measures Measures Metro's annual emissions of criteria air pollutants attributable to transit operations.

Units: Tons of pollution per year.

Relevance: Metro operates within the jurisdiction of the South Coast Air Quality Management District (AQMD). As a region, the South Coast AQMD suffers from the worst air quality in the nation, and has been designated as "extreme nonattainment" for ozone and "nonattainment" for particulate matter air pollution.

Regulation: Metro is obligated to honor rules adopted by both the California Air Resources Board[9] (CARB) and the South Coast AQMD[10] to purchase transit buses that use non-diesel alternative fuel.

Linkages: Compliance with National Air Quality Standards is mandated by the Environmental Protection Agency; the South Coast AQMD is obligated to demonstrate compliance with particulate matter emission levels by 2015, and the eight-hour ozone standard by 2024. Therefore, it is critical that Metro continue to demonstrate progress in reducing both oxides of nitrogen (NOx) emissions, an ozone precursor, and particulate matter emissions from transit and rail operations.

Limitations: Air pollutant emissions associated with the generation of electricity used to power Metro electric locomotives are variable and difficult to quantify. Metro staff applies default power generation factors based on data published by the U.S. Department of Energy; these values are highly conservative and tend to overestimate emissions attributable to electric rail operation.

[9] Title 13, California Code of Regulations, sections 1956.1, 2020, 2023, 2023.1 & 2023.4; Fleet Rule for Transit Agencies, Urban Bus Requirements

[10] South Coast AQMD Rule 1192; Clean On-Road Transit Buses

Accomplishments

- **Continued to modernize the bus fleet to run as low-emission, clean fuel, natural gas buses. Today, Metro operates the nation's largest fleet of CNG buses.**

Data & Analysis[11]

Metro Decreased Total Fleet Criteria Pollution by 5%

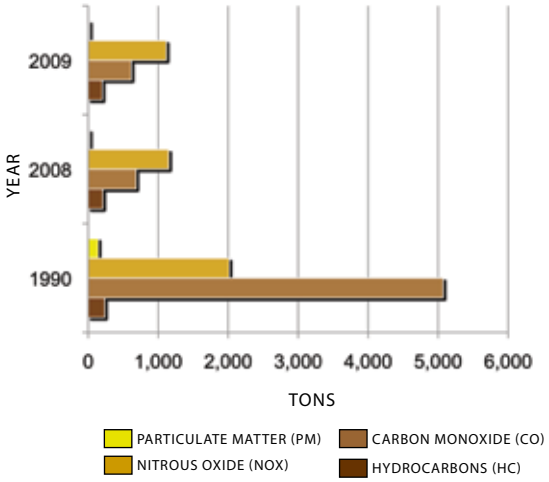

FIGURE 40 **Fleet Emission Levels (2008 - 2009)**

In comparing 2009 fleet emission levels to those previously calculated for 2008, Metro's overall fleet emission levels continue to be reduced. 2009 fleet emissions of Reactive Organic Gases (ROG), Carbon Monoxide (CO), Oxides of Nitrogen (NOx), and Particulate Matter (PM) were reduced by 4, 3, 8, and 22 percent respectively as compared to 2008 levels. Overall, total criteria pollutant emission dropped approximately 106.7 tons, or 5%, from 2008 to 2009. Emission reductions are attributed to two primary factors: 1) fleet turnover and a transition to lower-emitting bus engines, and 2) a shift from transit bus to zero-tailpipe emission rail service.

[11] Data analysis in this section is completed by Better World Group Inc.

Pollution per Vehicle Mile Continues to Decrease

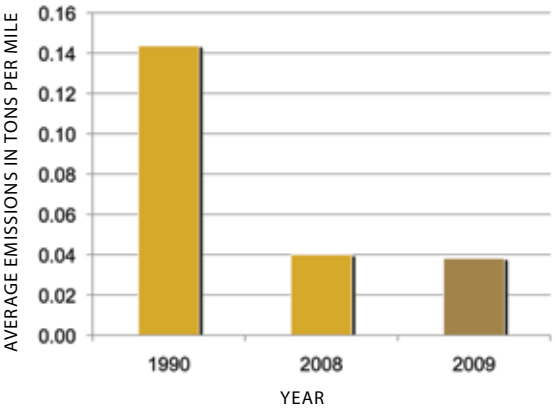

FIGURE 41 Average Criteria Pollutant Emissions per Mile in Tons (1990, 2008-2009)

The continuing switch from diesel to CNG buses and increased rail mileage (which has no "tail-pipe" emissions) means Metro was able to increase vehicle miles while simultaneously reducing total pollutant emissions. In 2009, Metro emitted approximately 5% less criteria pollutants per vehicle mile than in 2008, and approximately 74% less than in 1990.

Average 2009 Bus is Less Polluting than Average 1990 Bus

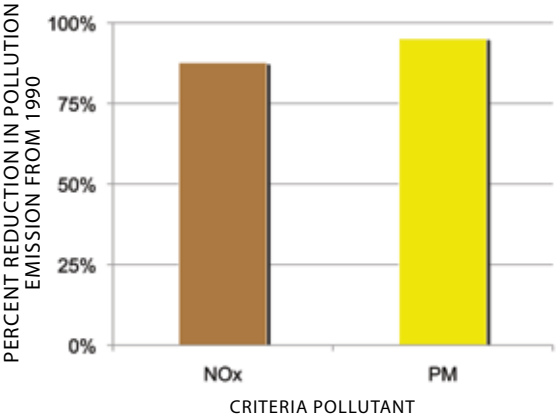

FIGURE 42 Reduction in Criteria Pollutants from the Average 2009 Bus

The average bus in 2009 emitted 88% less NOx and 95% less PM than in 1990.

Next Steps

AQ1	Continue to explore technological advancements in transit vehicles that decrease air pollution.
AQ2	Study feasibility of installing emission control systems on appropriate Metro equipment and machinery.

Definition: Measures Agency-wide garbage and recycling.

Units: Tons

Relevance: Waste represents excess cost and contributes to environmental degradation and should be minimized.

Regulation: California AB 939

Limitations: Data available for 2008 and 2009 only. No cost information was available.

Accomplishments

- **Increased deskside recycling at the Gateway building. Some facilities included bottles and cans in their deskside recycling program, increasing the average reduction of solid waste created.**
- **Installed cardboard compactors in several locations, making cardboard box recycling more practical.**

Data & Analysis

Metro Facilities Decreased Solid Waste Output in 2009

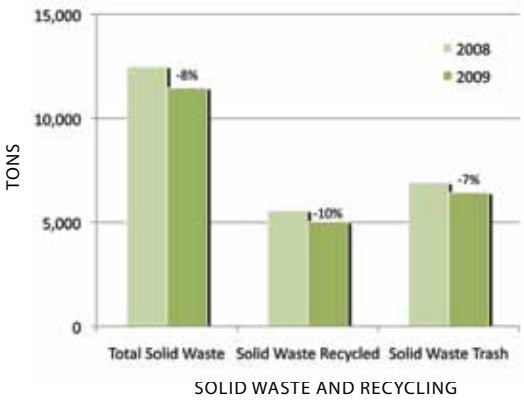

FIGURE 43 **Solid Waste and Recycling (2009)**

Metro uses a contractor to separate landfill waste from recycling. Under this agreement, the contractor must separate out all materials (paper, cans, and bottles) that can be recycled. Forty four percent of this waste was recycled in 2009. As a whole, total solid waste decreased by 1,025 tons from 2008 (12,488 tons) to 2009 (11,463 tons). Due to changes in the way data is collected, data is available for only 2008 and 2009.

Waste Production Efficiency Increased in 2009

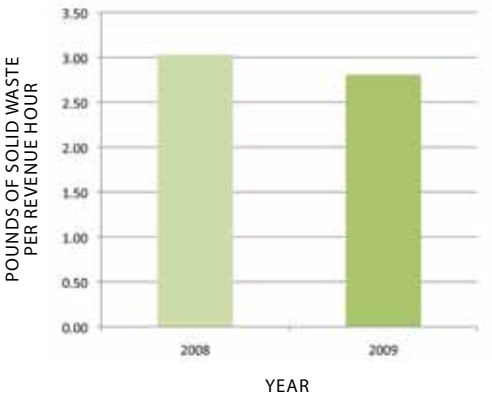

FIGURE 44 Solid Waste Production Efficiency (2008-2009)

Solid waste production efficiency increased from 2008 to 2009. Solid waste production per revenue hour decreased from approximately 3 pounds of solid waste per hour in 2008 to approximately 2.75 pounds of waste per hour in 2009.

Recycling Rates Varied Slightly Throughout 2009

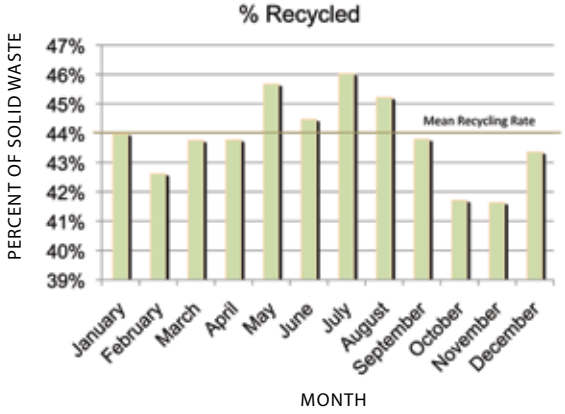

FIGURE 45 Percent Recycled by Month (2009)

Recycling rates varied between a low of 41.6% in November and a high of 46.0% in July. According to recycling data for 2008 and 2009, April through July tend to have the highest recycling rates (with the exception of November and December 2008, where recycling rates reached 47.5% and 46.5% respectively).

Next Steps

SW1	Continue to roll out desk-side paper recycling at other facilities.
SW2	Put clear instructions on recycling bins as to what content is acceptable.
SW3	As feasible, increase desk-side recycling to include bottles and cans.

Definition: Measures Metro's annual used oil waste.

Units: Gallons

Relevance: Oil waste is a highly polluting petroleum based substance. In the interest of environmental and economic efficiency waste should be reduced as much as is feasible.

Regulation: California Health and Safety Code, Chapter 6.5. Division 20 Article 13; California Code of Regulations Title 22, Division 4.5.

Accomplishments

- **Continued to strengthen underground and above ground storage tank programs.**

Data & Analysis

FIGURE 46 **Used Oil Waste in Gallons (2002-2009)**

Metro produced 173,000 gallons of used oil waste during 2009. This is a decrease of 10,000 gallons (5%) from 2008 and a decrease of approximately 21,000 gallons (11%) from 2002. Waste has continued to decrease despite an increase in revenue hours, which is likely attributable to the current use of synthetic oil as opposed to standard oil. Synthetic oil reduces the frequency of oil changes and therefore the volume of used oil generated.

Waste Varies Across Divisions

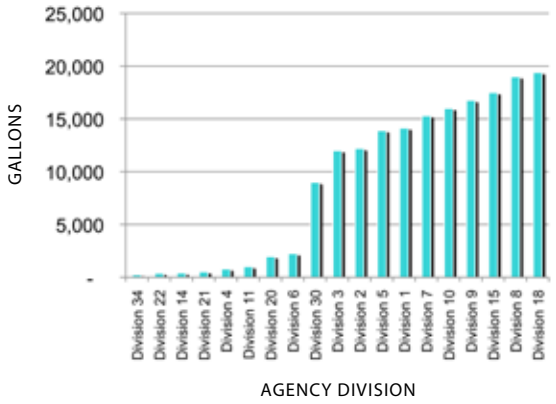

FIGURE 47 **Gallons of Used Oil Waste by Division (2009)**

The average amount of used oil waste produced in 2009 varied from a low of 250 gallons at Division 34 to a high of 19,400 gallons at Division 18. The large range of used oil produced is attributed to varying fleet sizes across divisions.

Used Oil Disposal Costs Eliminated Since 2006

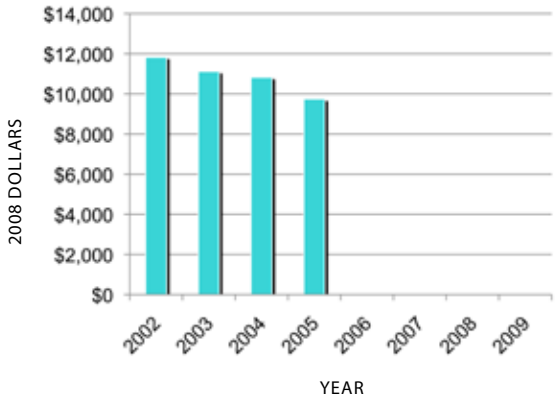

FIGURE 48 **Used Oil Waste Disposal Cost - 2009 Dollars (2002-2009)**

A no-fee service contract initiated in 2006 eliminated the cost of used oil waste disposal.

Efficiency per Revenue Hour Continues Improvement

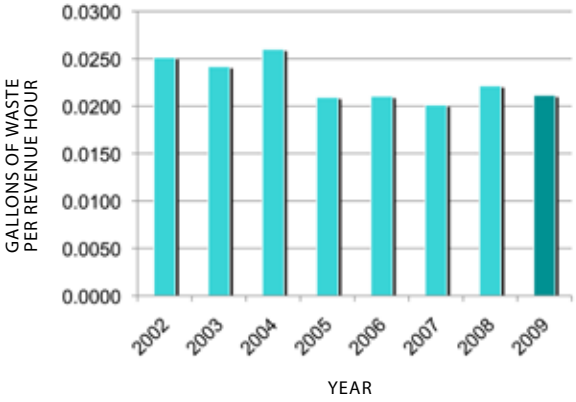

FIGURE 49 **Used Oil Waste per Revenue Hour (2002-2009)**

In 2009, 0.021 gallons of waste oil were produced per revenue hour. This is approximately a 16% decrease from 2002 and approximately a 5% decrease from 2008.

Next Steps

U01	Decrease waste as much as possible through improved technology and operational procedures.
U02	Reduce oil use whenever feasible.

Definition: Measures Metro's Annual Liquid Waste 222.

Units: Gallons

Relevance: Waste classified as 222 is hazardous oil water separation sludge. This waste comes from the servicing of fuel station clarifiers, steam rack clarifiers, chassis equipment, part washers, oil/water separators, maintenance shop sumps, etc. Waste should in general be minimized. Non-hazardous liquid waste mostly comes from the bus and train car washes.

Regulation: County Wastewater Ordinance and LA Municipal Waste Control Ordinance

Accomplishments

- **Developed the Chemical Committee with a goal to reduce hazardous waste throughout the organization.**
- **Installed an electrolyzer which successfully reduced chemical use at the Gateway Building.**
- **Developed the Green Chemical Procurement Collaboration Project.**
- **Continued to strengthen underground and above ground storage tank programs.**

Data & Analysis

FIGURE 50 **Hazardous Liquid Waste Stream in Gallons (2002-2009)**

Metro produced 728,000 gallons of hazardous liquid waste during 2009. This number reflects a 2% increase from 2008. The increase is likely attributable to the increase in frequency of servicing of chassis jet equipment at some of the divisions.

Waste Disposal Costs

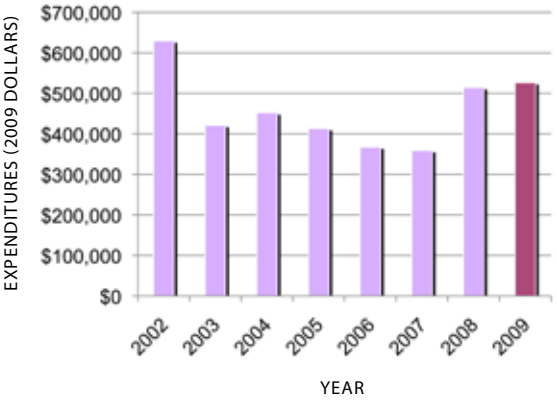

FIGURE 51 Hazardous Liquid Waste Stream Costs - 2009 Dollars (2002-2009)

In 2009, Metro paid approximately $526,000 in hazardous liquid waste disposal fees. This is approximately $103,000 less than 2002 (adjusted for inflation) but a slight increase of approximately $8,000 from 2008 (also adjusted for inflation). As of January 1, 2008, the rate for hazardous liquid waste disposal was increased.

Most Divisions Continue Lower than Average Waste Production

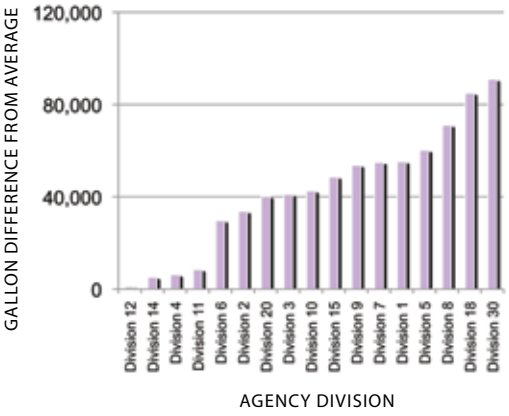

FIGURE 52 Hazardous Liquid Waste Produced by Division (2009)

In 2009, hazardous liquid waste produced by Division ranged from a low of 1,000 gallons at Division 12 to a high of 91,000 gallons at Division 30. The two largest producers of hazardous liquid waste, Division 30 and Division 18, accounted for 24% of Metro's total facility waste production in 2009. There was no hazardous liquid waste produced by Division 22, Division 21, or Division 34 in 2009.

Efficiency per Revenue Hour Continues Improvement

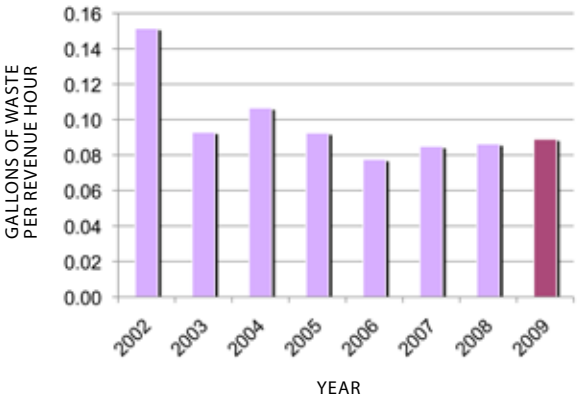

FIGURE 53 Hazardous Liquid Waste per Revenue Hour (2002-2009)

In 2009, 0.089 gallon of hazardous liquid waste were produced per revenue hour. This is a slight increase of 1% from 2008 and a substantial decrease of 38% from 2002.

Next Steps

HW1	Decrease waste as much as possible through improved technology and operational procedures.
HW2	Continue reducing hazardous and non-hazardous chemical use wherever feasible.

Definition: Measures Metro's annual non-hazardous waste.

Units: Gallons

Relevance: Waste should in general be minimized. Non-hazardous liquid waste mostly comes from the bus, non-revenue, and rail car washes. The exception to this is the Orange Line site where waste comes from stormceptors at the park-and-ride locations.

Regulation: County Wastewater Ordinance and LA Municipal Waste Control Ordinance

Linkages: Water use

Description of Linkages: The more water used to wash train and rail cars, the more non-hazardous liquid waste.

Limitations: No cost data available.

Accomplishments

- **Developed the Green Chemical Procurement Collaboration Project.**
- **Continued to strengthen stormwater and wastewater programs.**

Data & Analysis

FIGURE 54 **Non-Hazardous Liquid Waste in Gallons (2002-2009)**

In 2009, Metro produced 585,000 gallons of non-hazardous liquid waste. This number reflects approximately a 17% increase from 2008 and is a 41% increase from 2002. The increase in non-hazardous liquid waste stream has been attributed to the increase of additional bus washers at several divisions throughout the organization.

Non-Hazardous Liquid Waste Disposal Costs Increasing

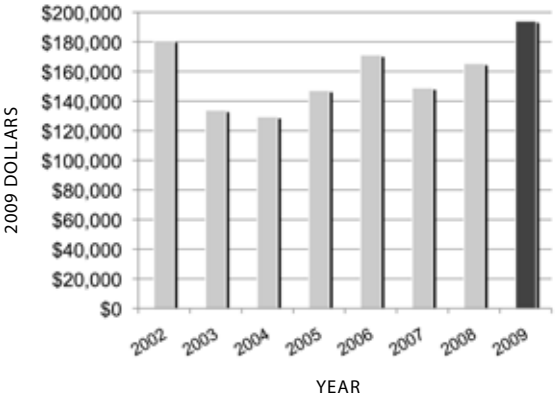

FIGURE 55 Non-Hazardous Liquid Waste Stream Costs - 2009 Dollars (2002-2009)

Metro paid approximately $194,000 in non-hazardous liquid waste disposal fees in 2009. This is the most Metro has spent on non-hazardous liquid waste disposal fees in an eight year period (2002 through 2009). This expenditure is approximately a 17% increase from 2008 (adjusted for inflation) and approximately a 7% increase from 2002 (also adjusted for inflation).

Waste Stream Across Divisions

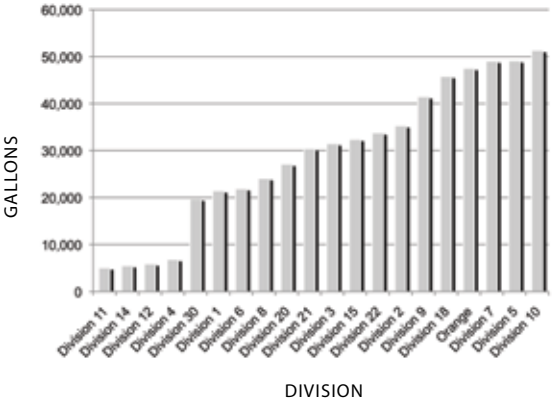

FIGURE 56 Non-Hazardous Liquid Waste by Division (2009)

Across all Divisions, non-hazardous liquid waste fluctuated slightly from 2008 to 2009. Divisions 7 and 10 had the highest increase from 2008 to 2009 at 192%, while the most significant decrease from 2008 to 2009 occurred in Division 11, approximately 27%. Divisions 5, 7, 9, and 10 all have two bus washers and therefore contribute a larger percentage of the total waste stream (8, 8, 7, and 9%, respectively).

Gallons of Waste per Revenue Hour is Trending Upward

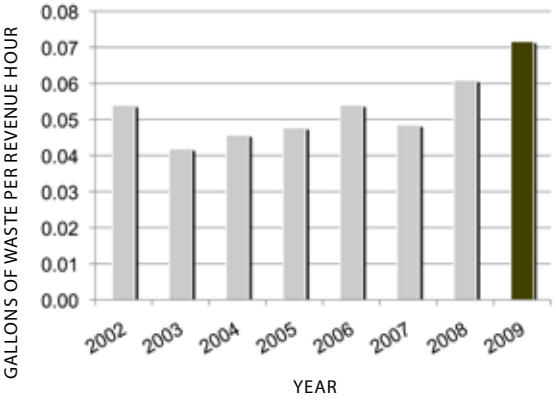

FIGURE 57 Gallons of Non-Hazardous Liquid Waste per Revenue Hour (2002-2009)

In 2009, 0.072 gallons of non-hazardous liquid waste were produced per revenue hour. This is approximately a 18% increase from 2008 and a 33% increase from 2002.

Next Steps

NW1	Decrease waste as much as possible through improved technology and operational procedures.

Definition: Measures anti-freeze waste.

Units: Gallons

Relevance: Waste antifreeze may contain heavy metals such as lead, cadmium, or chromium in high levels that make it a hazardous waste. Waste should be minimized.

Regulation: CCR 22

Linkages: None

Accomplishments

- **Developed the Green Chemical Procurement Collaboration Project.**

Data & Analysis

Anti-Freeze Use Decreased in 2009

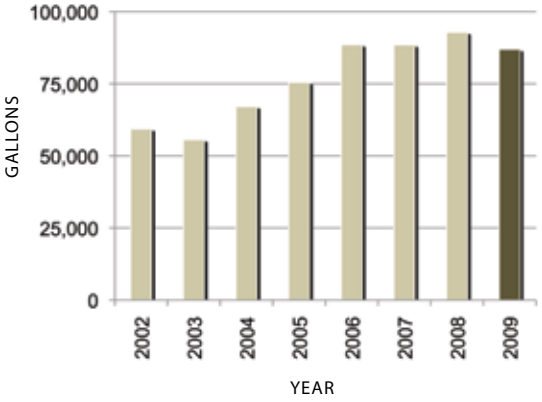

FIGURE 58 **Anti-Freeze Waste in Gallons (2002-2009)**

From 2004 to 2008, anti-freeze waste had been trending upward from year to year (with the exception of 2006 to 2007, when there was a minimal decrease of 87 total gallons). In 2009, Metro produced approximately 87,000 gallons of anti-freeze waste. This number is a decrease of 6,000 gallons from 2008.

Anti-Freeze by Division

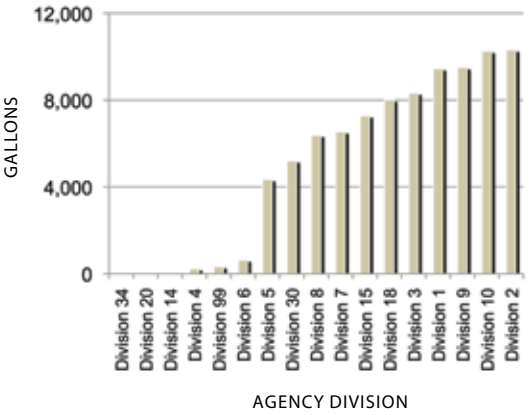

FIGURE 59 Anti-Freeze Waste in Gallons by Division (2009)

In 2009, antifreeze waste produced by Division ranged from a low of 45 gallons at Division 34 to a high of 10,000 gallons at Division 2. Divisions 1, 2, 9, and 10 contributed the largest quantities of anti-freeze waste in 2009, accounting for 46% of Metro's total facility waste production in 2009. Alternatively, Divisions 4, 14, 20, and 34 contributed the smallest quantities, accounting for only 0.4% of Metro's total facility waste production in 2009. The latter are non-revenue stops which accounts for the lower waste stream numbers.

Anti-Freeze Waste Disposal Costs Decreased Slightly in 2009

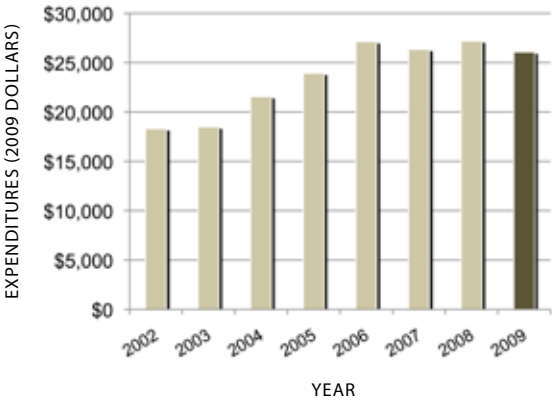

FIGURE 60 Anti-Freeze Waste Disposal Cost - 2009 Dollars (2002-2009)

In 2009, Metro spent approximately $1,500 less (adjusted for inflation) in anti-freeze disposal costs than in 2008. The disposal costs for 2009 remain a significant increase (approximately 47%) since 2002 (also adjusted for inflation).

Efficiency per Revenue Hour Improved in 2009

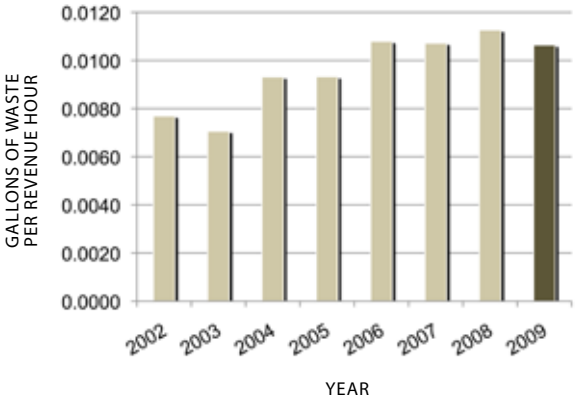

FIGURE 61 Anti-Freeze Waste per Revenue Hour (2002-2009)

In 2009, 0.011 gallons of anti-freeze waste were produced per revenue hour. This is approximately a 6% decrease from 2008. Despite the decrease in 2009, gallons of antifreeze waste produced per revenue hour continues to be higher than in 2002 (when 0.008 gallon of anti-freeze waste was produced per revenue hour).

Next Steps

AF1	Decrease waste as much as possible through improved technology and operational procedures.

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Appendix


Metro Express
We pulled out all the stops.
Metro Express Line 577X
Metro Express

Figure 62
Next Step Matrix

General

GE1	Develop sustainability targets [for Board adoption], which should, at a minimum, include greenhouse gas emissions, waste, fuel use, and water use reduction targets.
GE2	Report sustainability performance to the Board on an annual basis using the indicators outlined in this report, updating the indicator metrics as needed every three years.
GE3	Establish a staff-level "Green Team" to inform, develop, and implement policies and procedures to meet the sustainability targets.
GE4	Develop a metric to measure greenhouse gas emission reductions and the congestion relief benefits of Metro's transit system.
GE5	Improve data collection capabilities, by using the appropriate sub-metering and by aligning Metro's address data with that of the utility companies.
GE6	Improve the flow of information.
GE7	Align incentives with goals.
GE8	Consider life-cycle costs.
GE9	Give preference to recyclable and recycled products during design and construction of Metro projects.
GE10	Review all licenses and permits for landfills, recycling facilities, and similar entities that will be used for the disposal or diversion of any waste or construction and demolition projects.
GE11	Develop a Sustainability Strategies Cost-Effectiveness document to determine the most appropriate strategy to implement.
GE12	Complete Phase 2 of Metro's Headquarters' LEED-EBOM certification.
GE13	Develop and conduct Environmental Management System awareness training.
GE14	Complete EMS audio/visual media including awareness video, training video, and small and larger posters.
GE15	Include sustainability principles on projects to be constructed under the new funding mechanisms such as Measure R and the American Recovery and Reinvestment Act.

Ridership

R1	Continue ridesharing and transit pass programs for Los Angeles Employers.
R2	Continue to provide a Metro Employee Transit Subsidy Program.
R3	Support and plan Transit Oriented Development in strategic Metro-owned properties and locations.
R4	Expand rail and BRT systems.
R5	Continue to expand the number of 45-foot composite fiberglass buses used by Metro.

Fuel Use

F1	Create a plan to reduce idling.

Rail Propulsion Power

RP1	Implement Wayside Energy Storage System (WESS) and/or on-board storage technology to capture the electricity and energy produced by dynamic braking.
RP2	Research the On-board Storage of Regenerative Braking Energy Strategy.

Figure 62
Next Step Matrix

RP3	Install sub-meters to measure electrical use specific to rail propulsion and facilities.
RP4	Develop an energy management and conservation plan that includes assessing the impacts of the 30/10 Plan on Metro's electrification plan.

Facility Electricity Use

FE1	Replace existing lighting and other energy end-use equipment in Metro facilities with more efficient and cost-effective equipment.
FE2	Provide adequate funding for energy retrofits.
FE3	Provide sub-meters at each facility so funding can be properly directed and results accurately tracked.
FE4	Invest in energy management systems to properly track energy usage.
FE5	Track energy efficiency upgrades and measure their success, so the most successful projects can be repeated.
FE6	Do a project life-cycle cost analysis at the beginning of every new construction or major renovation project so that the future savings over time of efficiency upgrades can be taken into account.
FE7	Begin retrofitting of lighting in the Red Line Tunnel.
FE8	Develop an Energy Conservation and Management Plan that will provide additional programs and strategies to further reducing facility electricity use , so that projects can benefit from economies of scale and bulk discounts, instead of project-by-project retrofits.
FE9	Aggressively pursue renewable energy sources, and, where feasible, take advantage of rebates and subsidies for energy and water conservation, and implement energy conservation measures.
FE10	Construct all new facilities and projects using energy-efficiency and conservation strategies.
FE11	Complete full implementation of the Environmental Management System at the pilot sites.
FE12	Obtain ISO 14001 certification at Red Line Yard Facility.
FE13	Complete additional facility energy audits.
FE14	Develop additional renewable sources other than photo-voltaics.
FE15	Begin implementation of solar panels on transportation infrastructure.

Water Use

WU1	Substitute municipal recycled water for potable water where available.
WU2	Further increase the amount of runoff water captured at bus washing bays for recycling and re-use.
WU3	Replace existing sanitary fixtures in bus and rail facilities with more efficient fixtures.
WU4	Recycle and reuse on-site created gray-water from Bus and Rail facilities for other allowable applications.
WU5	Replace existing steamers with high-efficiency models.
WU6	Use recycled water for car washing throughout Metro's rail facilities.
WU7	Evaluate feasibility of using recycled water in place of potable water.
WU8	Use water conservation and efficiency guidelines outlined in applicable Leadership in Energy and Environmental Design (LEED®) reference books for all planning, procurement, design, construction, operations, and maintenance of linear and non-linear facilities.
WU9	Develop and implement a Water Action Plan.

Figure 62
Next Step Matrix

Greenhouse Gas Emissions

GG1	Continue ridesharing and transit pass programs for Los Angeles Employers.
GG2	Continue to provide a Metro Employee Transit Subsidy Program.
GG3	Continue and expand Metro's vanpool program.
GG4	Support and plan Transit Oriented Development in strategic Metro-owned properties and locations.
GG5	Provide Bike-to-Transit commuter incentives and other bicycle amenities.
GG6	Expand rail and BRT systems.
GG7	Increase the use of hybrid vehicles for non-revenue fleets.
GG8	Research on-board storage technology to capture the energy produced by dynamic braking.
GG9	Develop pilot program for retrofitting lighting in the Red Line Tunnel.
GG10	Replace existing lighting and other energy end-use equipment in Metro facilities with more efficient and cost-effective equipment.
GG11	Conduct a bike sharing feasibility study.
GG12	Continue implementation of the WESS pilot program.

Air Quality

AQ1	Continue to explore technological advancements in transit vehicles that decrease air pollution.
AQ2	Study feasibility of installing emission control systems on appropriate Metro equipment and machinery.

Solid Waste and Recycling

SW1	Continue to roll out desk-side paper recycling at other facilities.
SW2	Put clear instructions on recycling bins as to what contents is acceptable.
SW3	As feasible, increase desk-side recycling to include bottles and cans.

Used Oil Waste

UO1	Decrease waste as much as possible through improved technology and operational procedures.
UO2	Reduce oil use whenever feasible.

Hazardous Liquid Waste

HW1	Decrease waste as much as possible through improved technology and operational procedures.
HW2	Continue reducing hazardous and non-hazardous chemical use wherever feasible.

Non-Hazardous Liquid Waste

NW1	Decrease waste as much as possible through improved technology and operational procedures.

Anti-Freeze Waste

AF1	Decrease waste as much as possible through improved technology and operational procedures.

Figure 63
Indicator Results Matrix

	2009 Efficiency	% Change from 2002	2009 Performance	% Change from 2002	2009 Expenditures	% Change from 2002
Ridership	Not Applicable	Not Applicable	464 Million Boardings	20.2% (1997)	$144 per Revenue Hour	-6.5% (1997)
Fuel Use	0.13 Gallons per Boarding	-17%	47 Million GGE	14%	$32 Million	16%
Rail Propulsion Power	1.98 Kilowatt Hours per Rail Boarding	-12% (2005)	184 Million Kilowatt Hours	9% (2005)	$22.4 Million	16% (2005)
Facility Electricity Use	0.13 Kilowatt Hours per Boarding	-1% (2005)	62 Million Kilowatt Hours	2% (2005)	$7 Million	28% (2005)
Water Use	28 Gallons per Revenue Hour	-18%	227 Million Gallons	39%	$1 Million	54%
Greenhouse Gas Emissions	2.03 Pounds CO2e per Boarding	6% (2007)	483,000 Metric Tons CO2e	1% (2007)	Not Available	Not Available
Air Quality	0.04 Pounds per Vehicle Mile	75% (1990)	2,167 Tons	71%	Not Applicable	Not Applicable
Used Oil Waste	0.02 Gallons per Revenue Hour	-16%	173,000 Gallons	-11%	$0	-100%
Garbage and Recycling	0.02 Tons Solid Waste per Revenue Hour	-7% (2008)	6,400 Tons Trash, 5,000 Tons Recycling	-7% Trash (2008), 10% Recycling (2008)	Not Available	Not Available
Hazardous Liquid Waste	0.089 Gallons per Revenue Hour	-41%	728,000 Gallons	-38%	$526,000	-16%
Non-Hazardous Liquid Waste	0.072 Gallons per Revenue Hour	33%	585,000 Gallons	41%	$194,000	7%
Anti-Freeze Waste	0.01 Gallons per Revenue Hour	38%	87,000 Gallons	47%	$26,000	47%

*Unless otherwise noted, base year is 2002

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