



**Metro**

Los Angeles County  
Metropolitan Transportation Authority

One Gateway Plaza  
Los Angeles, CA 90012-2952

213.922.2000 Tel  
metro.net

**JUNE 30, 2014**

**TO: BOARD OF DIRECTORS**

**THROUGH: ARTHUR T. LEAHY** *ATL*  
**CHIEF EXECUTIVE OFFICER**

**FROM: BRYAN PENNINGTON** *BP*  
**EXECUTIVE DIRECTOR, ENGINEERING & CONSTRUCTION**

**SUBJECT: 2014 METRO ENERGY AND RESOURCE REPORT**

### ISSUE

Metro reports its sustainability performance on an annual basis to compare data with previous years in order to track our progress towards achieving our agency's sustainability goals. The 2014 Metro Energy and Resource Report (E&R Report) provides an update to the 2013 Metro Energy and Resource Report by presenting sustainability data for calendar year 2013. This report provides Metro decision-makers with information that can be used to improve the agency's overall sustainability and environmental performance under a framework of continual improvement.

### BACKGROUND

Sustainability has long been central to Metro's mission of continually improving the effectiveness and efficiency of Los Angeles's transportation system. In 2007, sustainability became a formal part of Metro's structure with our Board's adoption of our Sustainability and Energy Policy and the formation of our Ad Hoc Sustainability and Climate Change Committee. In the summer of 2008, the Board adopted the Metro Sustainability Implementation Plan (MSIP), which outlined specific actions to reduce our contribution to climate change and to further increase our sustainability. The MSIP has been the cornerstone of our sustainability activities and provides overall guidance in our effort to implement projects in the most cost-effective and efficient manner.

Metro has released several documents in the past six years to account for our operational greenhouse gas emissions footprint. These documents include "Greenhouse Gas Emissions and Reduction Opportunities, 2007 Baseline Year" (December 2008), "Towards a Sustainable Future: June 2009 Baseline Sustainability Report," (January 2009); and succeeding sustainability reports re-titled Metro Energy and Resource Report in 2013.

## DISCUSSION

The 2014 Metro E&R Report analyzes sustainability data for calendar year 2013 to understand and compare Metro's environmental performance, the economic cost of its core activities, and presents historical performance data to identify significant trends and issues. It compares agency-wide environmental and economic trends, focusing on the comparison between the previous year's report data (2012) and this year's report data (2013); critical to monitor and analyze the improvements or regressions 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.

As in the past, report indicators were derived using The Global Reporting Initiative (GRI) sustainability reporting framework and were selected based on APTA's Recommended Practice and from indicators common to most organizations in relation to energy, water, materials, emissions, effluents, and waste, as well as impacts to biodiversity.

The following are highlights from the report:

- Metro used 407 million gallons of water across all of its providers, which is 47 million *more* gallons than the agency used in 2012. The increase in consumption may be attributed to an increase in Metro's services (boarding and passenger revenue miles), fleet size, construction-related activities, and recently extended rail lines. With the increased water consumption noted in 2013, Metro has initiated several projects that aim to reduce the agency's water usage. These initiatives include:
  - Efforts to expand the use of a Linear Kinetic Cell (LKC) system that both reduce water usage and spotting residue on the buses after drying. The current LKC system located at Division 6 has been proven effective and additional pilot installations at Divisions 15 and 18 are being considered.
  - Implementing water quality enhancement and reduction in irrigation activities through stormwater capture technologies at the Metro Orange Line and Division 13.
  - Initiating a permeable pavement pilot study at Division 4 that will increase non-structural stormwater treatment and enhance groundwater recharge.
  - Working with LADWP on the use of recycled water in lieu of potable water at landscaped locations. Most recently, LADWP has partnered with our agency on a pilot to install recycled water meters to service the Vesper and Sepulveda segment of the Orange Line.

- Implementing facility-specific improvements through the use of sub-metering data installed in the last year. For example, the Central Maintenance Facility will see an upgrade of the air scrubber equipment in Building 5 to reduce and recycle water.
- Metro bus and rail operations continue to achieve significant reductions in criteria air pollutants. Metro's 2013 fleet experienced the following changes in criteria air pollutants emissions:
  - Reactive Organic Gases (ROC) emissions *reduced* by 15%;
  - Oxides of Nitrogen (NOx) emissions *reduced* by 6.6%;
  - Particulate Matter (PM) emissions *increased* by 3.6%; and
  - Carbon Monoxide (CO) *increased* by approximately 11%.

The reductions in ROC and NOx are attributed to a reduction in transit bus miles and Metro's continued procurement of new state-of-the-art compressed natural gas (CNG) engines. The increase in CO emissions is due to higher emission levels associated with the Cummins ISLG natural gas engines that are being used to repower Metro's buses. However, as the current level of CO emissions is well under the limit established for the Los Angeles region, Metro is effectively prioritizing reductions in other critical emissions from its operations.

- Metro emitted approximately 462,000 metric tons of CO<sub>2</sub>e from the planning, operation, maintenance and servicing of its transit service. This value is approximately 3% lower than in 2012. This reflects Metro's update of its emissions factors utilized from last year's report (which reflects a slight modification in overall emissions); and more importantly, reflects an improvement in Metro's efforts to curb its emissions.

Based solely on mode shift, Metro's operations *displaced* nearly 475,000 metric tons of CO<sub>2</sub>e that would have been emitted by passenger cars if Metro service was not available. These emissions factors have also been updated since last year's report, and reflect an additional 2% of emissions displaced in 2013 as compared to 2012.

*In effect, Metro's net carbon emissions for this reporting year is -13,000 metric tons of CO<sub>2</sub>e.*

- Metro's rail system consumed approximately 223 million kilowatt hours (kWh) of electricity, which is an 11% *increase* from 2012. This increased energy use is attributable to the first full operational year of the Expo Line, as well as extended operating hours for all lines.
- The consumption of electricity to power Metro's facilities *decreased* by approximately 9% (from 97 million kWh to 89 kWh) between 2012 and 2013.

Upgrades in facility fixtures – including lighting retrofits – are largely attributable for the decrease in facility electricity use.

- Metro experienced a 6.5% increase in overall total solid waste, with a 51% increase in solid waste output and a 42% decrease in recycled waste collected from Metro facilities. Consequently, Metro is channeling additional efforts to reset and enhance its waste and recycling program, which will assist the agency in achieving LEED Silver accreditation for its operating facilities.
- The following is the amount and percent change in the amount of used oil, hazardous liquid, non-hazardous liquid, and anti-freeze waste that Metro produced in 2012:
  - Used Oil Waste = produced approximately 147,260 gallons, represents a 4% increase from 2012;
  - Hazardous Liquid Waste = produced approximately 658,986 gallons, represents a 1.3% decrease from 2012;
  - Non-Hazardous Liquid Waste = produced approximately 476,918 gallons, represents a 5.6% decrease from 2012;
  - Anti-Freeze Waste = produced approximately 81,405 gallons, represents a 2.4% increase from 2012;
- Metro's operating expenses per boarding increased from \$2.72 in 2012 to \$2.78 in 2013.
  - Metro's unlinked passenger trips (also known as boardings) increased from 472.7 million in 2012 to 476.3 million in 2013. For boarding and operation costs per boarding, NTD data added a new category for rapid bus this year; thus, this update is reflected in the provided data for 2012 and 2013.

As an added achievement for this year, Metro now requires the development of a Sustainability Plan for each of our major and capital improvement projects to ensure that our transit expansion is built in the least impactful and sustainable way possible.

Our internationally certified Environmental Management System (EMS) continues to be an effective tool in reducing our environmental challenges; and assures us of safe, reliable, and environmentally compliant operations. There are currently nine locations (i.e., Divisions 7, 9, 10, 11, Division 21, Division 22, Red Line Yard/Division 20, Central Maintenance Facility, Gateway Headquarters) that are ISO 14001:2004 certified. However, all of our other divisions have been made aware of EMS benefits through various avenues. These remaining divisions will be ISO 14001:2004 certified in the next year and half.

Our EMS is prominently discussed in this year's E&R report as it has become another national model for other transit agencies.

**NEXT STEPS**

We will continue to report on Metro sustainability indicators annually. The follow-up to this report is to be submitted to our Board in June 2015.

**ATTACHMENT**

- A. 2014 Metro Energy and Resource Report

Los Angeles County  
Metropolitan Transportation Authority

# 2014 Metro Energy and Resource Report



## ACKNOWLEDGEMENTS

This document was prepared by AECOM under contract through the Los Angeles County Metropolitan Transportation Authority (Metro) 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, Maintenance Administration, Facilities and Property Maintenance, Governmental Accounts, Quality Assurance, Long Range Planning, Operations Systems Integration, Purchasing, Vehicle Technology and Support, Building Services, and General Services Administration. The Better World Group, Inc. prepared the Air Quality Pollutant Emissions section. Special thanks to management at Division 9 for contributing information on bus maintenance and transportation activities for the division profile.



# Table of Contents

<b>Executive Summary</b> .....	1
<b>About Metro</b> .....	15
<b>Introduction</b> .....	19
<b>Environmental Management System</b> .....	23
<b>Reporting Methodology</b> .....	31
<b>Accomplishments</b> .....	37
<b>How Did We Do?</b> .....	47
Vehicle Miles Traveled Per Capita .....	48
Unlinked Passenger Trips .....	52
Operating Expenses.....	56
Water Use .....	60
Energy Use .....	66
Waste and Recycling.....	76
Criteria Air Pollutant Emissions.....	90
Greenhouse Gas Emissions .....	94
Greenhouse Gas Displacement.....	100





# List of Figures

Figure 1: Indicator Area Summary for 2013, Compared to 2012 ..... 3

Figure 2: Los Angeles County Annual VMT per Capita and Population Trends ..... 4

Figure 3: Unlinked Passenger Trips ..... 4

Figure 4: Historic Operating Expense Efficiency ..... 5

Figure 5: Historic Total Water Consumption ..... 5

Figure 6: Fuel Use Efficiency ..... 6

Figure 7: Rail Propulsion Power Use by Rail Line ..... 7

Figure 8: Facility Electricity Use in Kilowatt Hours ..... 7

Figure 9: Historic Waste Production ..... 8

Figure 10: Used Oil Waste Efficiency ..... 8

Figure 11: Historic Hazardous Liquid Waste Produced ..... 8

Figure 12: Nonhazardous Liquid Waste Efficiency ..... 9

Figure 13: Historic Anti-Freeze Waste ..... 9

Figure 14: Historic Criteria Air Pollutant Emissions ..... 10

Figure 15: Percentage of Total Greenhouse Gas Emissions by Source (2013) ..... 10

Figure 16: Annual VMT per Capita (1,000) ..... 49

Figure 17: Historic Boarding by Transit Mode ..... 53

Figure 18: Boarding by Transit Mode ..... 54

Figure 19: Unlinked Passenger Trips per Capita ..... 54

Figure 20: Historic Operating Expense Efficiency ..... 57

Figure 21: Boarding by Transit Mode ..... 57

Figure 22: Operating Expenses by Transit Mode ..... 57

Figure 23: Operating Cost per Boarding ..... 58

Figure 24: Operating Cost per Revenue Mile ..... 58

Figure 25: Vanpool Ridership and Operating Expenses ..... 59

Figure 26: Passenger Miles Traveled per Trip ..... 59

Figure 27: Operating Expenses per Passenger Miles Traveled by Mode ..... 59

Figure 28: Metro Water Supply Source ..... 61

Figure 29: Historic Total Water Supply ..... 61

Figure 30: Historic Water Cost ..... 62

Figure 31: Historic Average Water Cost ..... 62

Figure 32: Water Efficiency Trend ..... 62

Figure 33: Major Facilities and Other Facilities Water Use ..... 63

Figure 34: Water Usage by Major Facility Type ..... 63

Figure 35: Major Facilities Water Use ..... 63

Figure 36: Average Daily Water Expenditure by Major Facilities ..... 64



Figure 37: Historic Fuel Consumption for Metro-Operated Bus Services..... 67

Figure 38: Historic Fuel Cost for Metro-Operated Bus Services..... 67

Figure 39: Historic Price of Fuel ..... 67

Figure 40: Metro-Operated Bus Fuel Use Efficiency ..... 68

Figure 41: Historic Rail Propulsion Power Use by Provider..... 69

Figure 42: Rail Propulsion Power Use by Rail Line ..... 69

Figure 43: Rail Propulsion Power and Expenditures..... 70

Figure 44: Rail Propulsion Power Efficiency..... 70

Figure 45: Facility Electricity Use vs. Rail Propulsion Use in 2013 ..... 72

Figure 46: Facility Electricity Use by Provider..... 73

Figure 47: Facility Electricity Use and Expenditures ..... 73

Figure 48: Facility Electricity Use Efficiency ..... 74

Figure 49: Facility Electricity Use by Major Facilities..... 74

Figure 50: Historic Waste Production ..... 77

Figure 51: Solid Waste and Recycling Production Efficiency per Revenue Hour ..... 78

Figure 52: Solid Waste and Recycling Efficiency per Boarding..... 78

Figure 53: Historic Used Oil Waste..... 81

Figure 54: Used Oil Waste Generated by Major Facilities ..... 81

Figure 55: Used Oil Waste Efficiency..... 82

Figure 56: Historic Hazardous Liquid Waste ..... 83

Figure 57: Hazardous Liquid Waste Produced by Major Facilities..... 83

Figure 58: Hazardous Liquid Waste Costs..... 83

Figure 59: Hazardous Liquid Waste Efficiency..... 84

Figure 60: Historic Nonhazardous Liquid Waste..... 85

Figure 61: Nonhazardous Liquid Waste Produced by Major Facilities..... 85

Figure 62: Nonhazardous Liquid Waste Costs ..... 86

Figure 63: Nonhazardous Liquid Waste Efficiency ..... 86

Figure 64: Historic Anti-Freeze Waste..... 87

Figure 65: Anti-Freeze Waste Produced by Major Facilities ..... 87

Figure 66: Anti-Freeze Waste Efficiency..... 88

Figure 67: Historic Criteria Air Pollutant Emissions ..... 92

Figure 68: Percentage of Total Greenhouse Gas Emissions by Source..... 95

Figure 69: Historic Greenhouse Gas Emissions ..... 95

Figure 70: Greenhouse Gas Efficiency..... 97

Figure 71: Greenhouse Gas Intensity by Service Mode ..... 97



# List of Tables

Table 1: Net Greenhouse Gas Emissions from Metro Operations, 2013 .....	11
Table 2: Historic Boarding by Transit Mode .....	53
Table 3: Comparison of 2013 Fleet Emissions Levels to 2012 Levels.....	92
Table 4: Greenhouse Gas Intensity by Service Mode in 2013 .....	96
Table 5: Net Greenhouse Gas Emissions from Metro Operations, 2013.....	101

# List of Acronyms and Abbreviations

<b>AGM</b>	absorbed glass mat	<b>LEED-EBOM</b>	Leadership in Energy and Environmental Design—For Existing Buildings, Operations and Maintenance
<b>APTA</b>	American Public Transit Association	<b>LEED-NC</b>	Leadership in Energy and Environmental Design—For New Construction and Major Renovations
<b>ARB</b>	Air Resources Board	<b>LEED-ND</b>	Leadership in Energy and Environmental Design—For Neighborhood Development
<b>ARFVT</b>	Alternative and Renewable Fuel and Vehicle Technology	<b>LKC</b>	Linear Kinetic Cell
<b>BRT</b>	Bus Rapid Transit	<b>L RTP</b>	Long Range Transportation Plan
<b>CAAP</b>	Climate Action and Adaptation Plan	<b>Metro</b>	Los Angeles County Metropolitan Transportation Authority
<b>CH<sub>4</sub></b>	methane	<b>MOW</b>	Maintenance of Way
<b>CMF</b>	Central Maintenance Facility	<b>MSIP</b>	Metro Sustainability Implementation Plan
<b>CNG</b>	compressed natural gas	<b>MT</b>	metric tons
<b>CO</b>	carbon monoxide	<b>MT CO<sub>2e</sub></b>	metric tons carbon dioxide equivalent
<b>CO<sub>2</sub></b>	carbon dioxide	<b>N<sub>2</sub>O</b>	nitrous oxide
<b>CO<sub>2e</sub></b>	carbon dioxide equivalent	<b>NO<sub>x</sub></b>	oxides of nitrogen
<b>DI</b>	deionized	<b>NTD</b>	National Transit Database
<b>ECSD</b>	Environmental Compliance and Services Department	<b>OCS</b>	Overhead Catenary System
<b>EMS</b>	Environmental Management System	<b>PEV</b>	plug-in electric vehicle
<b>EPA</b>	Environmental Protection Agency	<b>PFC</b>	perfluorocarbon
<b>ETI</b>	Environmental Training Institute	<b>PM</b>	particulate matter
<b>FTA</b>	Federal Transit Administration	<b>PMT</b>	passenger miles traveled
<b>FY</b>	fiscal year	<b>PSM</b>	produced seat miles
<b>GGE</b>	gallons of gasoline equivalent	<b>PV</b>	photovoltaic
<b>GHG</b>	greenhouse gas	<b>PWP</b>	Pasadena Water and Power
<b>GIS</b>	geographic information system	<b>QA</b>	Quality Assurance
<b>GWP</b>	Global Warming Potential	<b>ROG</b>	reactive organic gases
<b>HFC</b>	hydrofluorocarbon	<b>RVL</b>	revenue vehicle length
<b>HID</b>	high-intensity discharge	<b>SCE</b>	Southern California Edison
<b>HPMS</b>	Highway Performance Monitoring System	<b>SF</b>	square feet
<b>HVAC</b>	heating, ventilation, and air conditioning	<b>SF<sub>6</sub></b>	sulfur hexafluoride
<b>ISO</b>	International Standards Organization	<b>SOP</b>	Standard Operating Procedure
<b>kW</b>	kilowatt	<b>TOD</b>	transit-oriented development
<b>kWh</b>	kilowatt hour	<b>UPT</b>	unlinked passenger trips
<b>LADWP</b>	Los Angeles Department of Water and Power	<b>VMT</b>	vehicle miles traveled
<b>lb</b>	pound	<b>VRH</b>	vehicle revenue hours
<b>LCFS</b>	Low Carbon Fuel Standard	<b>VRM</b>	vehicle revenue miles
<b>LED</b>	light-emitting diode	<b>WESS</b>	wayside energy storage substation
<b>LEED</b>	Leadership in Energy and Environmental Design		





# EXECUTIVE SUMMARY

This Energy and Resource Report analyzes Metro's 2013 environmental performance and the economic cost of its core operational activities, and presents historical performance data for the identification of significant trends and issues. The purpose of this report is to provide an update to the previous year's report (2013 Metro Energy and Resource Report) by presenting sustainability data for calendar year 2013. The report compares trends, focusing on the previous year's report data (2012) and this year's report data (2013), to monitor and analyze the increases or decreases in environmental impacts and assess Metro's ongoing progress toward sustainability. This trend analysis can then be used to identify causes, direct resources, and improve performance toward sustainability in a cost-effective manner 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, including Metro receiving Platinum recognition in 2012 from the American Public Transit Association (APTA) for leadership in sustainability as a signatory of the APTA Sustainability Commitment. This report focuses on Metro's activities for calendar year 2013 and meets the 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 management.

From these five key areas, nine indicators and eight subindicators are used to evaluate Metro's sustainability progress, as shown in Figure 1. The indicators in this report were derived using the Global Reporting Initiative 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 on biodiversity. The format and other aspects of the 2014 report continued to improve from previous sustainability reports to reflect the development of the *Recommended Practice for Quantifying and Reporting Transit Sustainability Metrics* prepared by the APTA Standards Sustainability Metrics Working Group.

This report has two goals: 1) to provide information that can be used to improve Metro's sustainability going forward; 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 meeting social, financial, and environmental goals.

The three essential components of a sustainability program are:

- > Performance goals
- > Program implementation
- > Performance monitoring

This report strengthens Metro's sustainability program in all three areas. By providing annual information, this report: 1) enables the Metro 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 nine indicator areas follows.

**THIS REPORT  
DEMONSTRATES  
METRO'S  
COMMITMENT TO  
MEETING SOCIAL,  
FINANCIAL, AND  
ENVIRONMENTAL  
GOALS.**

FIG 1

Figure 1: Indicator Area Summary for 2013, Compared to 2012

INDICATOR	← REGRESSED		IMPROVED →	
	Compared to 2012		Compared to 2012	
Vehicle Miles Traveled Per Capita			0.4%	33 Miles Less Traveled
Unlinked Passenger Trips			0.8%	3.6 Million More Boardings
Operating Expenses		2%		6 Cents More Per Boarding
Water Use	13%			47.9 Million More Gallons Consumed
Energy Use			0.3%	FUEL: 0.2 Million Gallons Saved
<ul style="list-style-type: none"> <li>&gt; Fuel Use</li> <li>&gt; Rail Propulsion Power</li> <li>&gt; Facility Electricity Use</li> </ul>	12%		8%	RAIL: 24.5 Million kWh More Used ELECTRICITY: 8 Million kWh Less Used
Waste and Recycling		7%		SOLID WASTE & RECYCLING: 600 Tons More
<ul style="list-style-type: none"> <li>&gt; Solid Waste and Recycling</li> <li>&gt; Used Oil Waste</li> <li>&gt; Hazardous Liquid Waste</li> <li>&gt; Nonhazardous Liquid Waste</li> <li>&gt; Anti-Freeze Waste</li> </ul>		4%		USED OIL: 6,000 Gallons More
			1%	HAZARDOUS LIQUID: 9,000 Gallons Less
			5%	NONHAZARDOUS LIQUID: 27,000 Gallons Less
			2%	ANTI-FREEZE: 40 Gallons More
Criteria Air Pollutant Emissions		2.8%		23 Tons More
Greenhouse Gas Emissions			2.6%	12,000 Tons Less Emitted
Greenhouse Gas Displacement			2%	Increase in Metric Tons of CO <sub>2</sub> e Displaced from Metro Operations

 Co-benefit achieved (other environmental benefits achieved due to change in resource consumption)



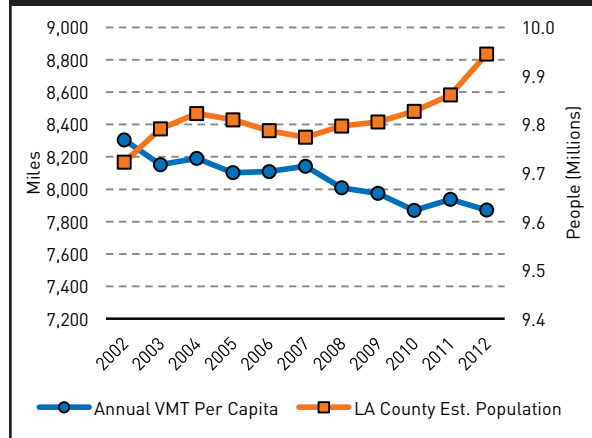


## VEHICLE MILES TRAVELED PER CAPITA

Vehicle miles traveled (VMT) has been on a downward trend since 2007, despite the increasing population (**Figure 2**). The total population of Los Angeles County increased 2.3% between 2002 and 2012, from 9.72 million to 9.94 million; however, 221.2 million vehicle miles were traveled daily in 2002 within Los Angeles County, which decreased to 214.5 million in 2012. This reduction in VMT per capita is attributable to a number of factors, including Metro's increasing focus on improving transit service efficiency and convenience. The expansion of transit services provides increased opportunities for mobility and accessibility for the general public, while also providing alternative transit options for single-occupant vehicle drivers.

FIG 2

**Figure 2: Los Angeles County Annual VMT per Capita and Population Trends**

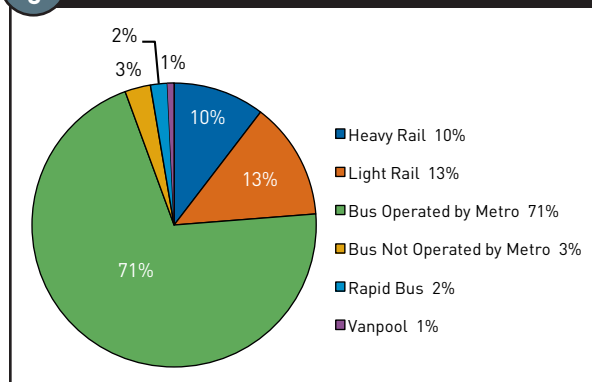


## UNLINKED PASSENGER TRIPS

In 2013, Metro continued to expand its service to the greater Los Angeles region. The overall ridership increased 1% compared to 2012. This constitutes a third straight year of consistent increase in ridership since 2011. Metro-operated bus trips constitute 71% of unlinked passenger trips (UPT) in 2013 (**Figure 3**). The largest increase in ridership can be seen in light rail and bus rapid transit, each of which experienced an increase of over 15% from 2012. Metro-operated bus service is the only transit mode that has seen a reduction in ridership of 3%.

FIG 3

**Figure 3: Unlinked Passenger Trips**



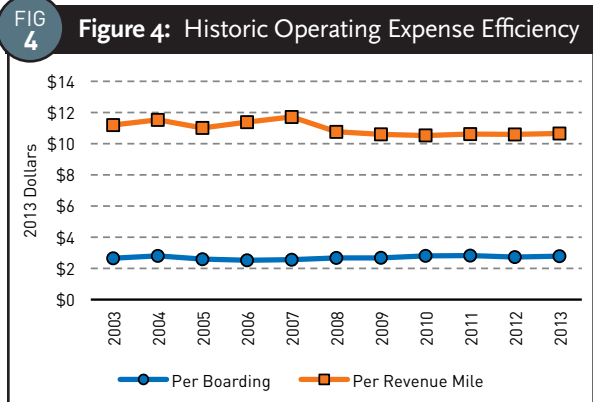
The trend for vehicle revenue hours shows an increase of 3% from 2012. This constitutes the first increase in vehicle revenue hours in the last three years. The most significant increase in revenue hours occurs in light rail service and bus rapid transit services, with increases of over 20% as compared to 2012. The trend for vehicle revenue hours has generally followed the ridership trend, so this increase is consistent with the increase in ridership.

Historically, data for UPT per capita show that ridership increased rapidly despite the decrease in regional population between 2005 and 2007. The ridership per capita kept steady at 46-48 trips per capita in the last four years, despite the 1% population growth pace.



## OPERATING EXPENSES

Overall boarding and passenger miles traveled for all transit modes have increased 4.5% and 5.3% since 2011, respectively. In 2013, Metro's operating expenses were approximately \$2.78 per boarding, which represents a 2.1% increase (6 cents) from 2012 after adjusting for inflation (**Figure 4**). Operating expenses per revenue mile have improved since 2007 and kept steady at around \$10.60 per mile over the last five years. Overall trends for both operating expense per boarding and per revenue mile have remained steady in recent years with less than 5% fluctuation.

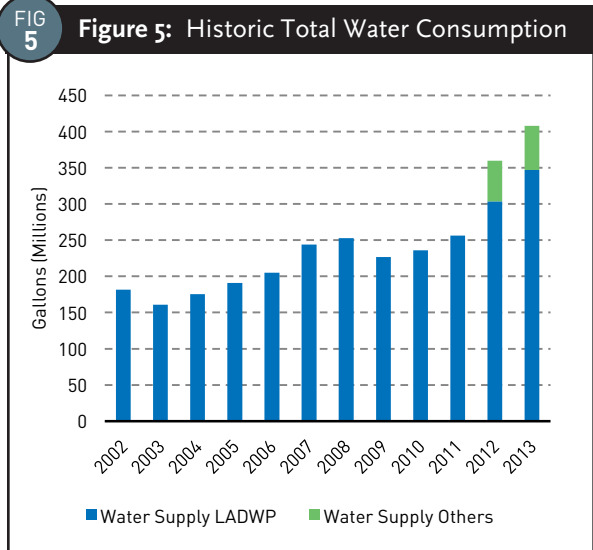


Over 67% of Metro's operating expenses were spent on bus service, which accounts for 71% of total Metro ridership in 2012 (**Figure 3**). In 2013, a new category was added for Metro-operated rapid bus transit, which constitutes approximately 2% of the overall boarding and operating expenses. Light rail continues to be the only transit mode whose portion of ridership contribution is less than its portion of operating expenses. This may be attributed to the opening of the Expo line in 2012, which requires time to build up ridership to its designed level of use.



## WATER USE

Water is an integral part of Metro's operations. Similar to previous years, 85% of Metro's water is supplied by the Los Angeles Department of Water and Power (LADWP), with the remaining 15% supplied by California Water Services, Golden State Water Company, and other municipal water providers. It is worth noting that 2013 is the second year that other providers in addition to LADWP were included and analyzed. Compared to 2012, total LADWP consumption increased by 14% (**Figure 5**), which is a reduced amount compared to the changes from 2011 to 2012 (18%). Other providers combined also showed an 8% increase in water usage in 2013. The increase in consumption may be attributed to an increase in Metro's services (boarding and passenger revenue miles), fleet number, construction-related activities, and recently extended lines. Overall, water consumption experienced an increase that outpaced transit service growth, which leads to a decrease in water efficiency in 2013.



Metro's major facilities<sup>1</sup> account for approximately 38% of Metro's overall water footprint in 2013. In 2013, the major facilities consumed 14.4 million gallons less than 2012, which represents a 9% improvement in water conservation. This accomplishment may be attributed to the proactive conservation programs and strategies implemented at several key major divisions, such as recycling water at the bus washers.

1. Metro has four types of major facilities based on functionality and operations: rail yards, bus divisions, other maintenance, and administrative buildings. A total of 21 locations are considered as major facilities including Divisions 1,2,3,4,5,6,7,8,9,10,11,15,18,20, 21,22,30,34,60,66,and 99.



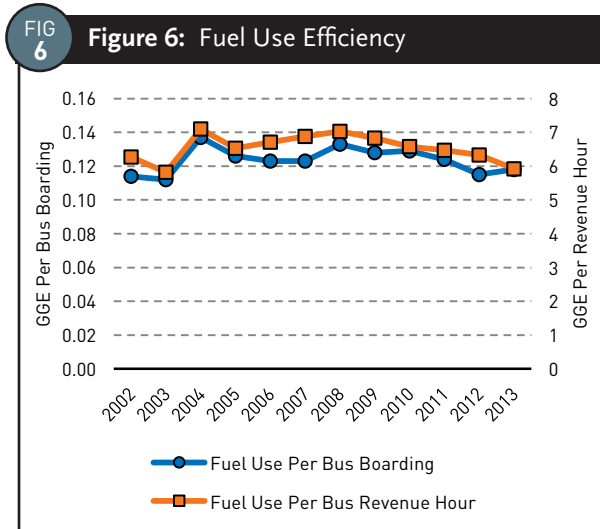
## ENERGY USE



APTA's recommended guidelines include energy usage as a key indicator of operational efficiency and environmental responsibility. In support of APTA's recommended guidelines, Metro identified additional subindicators for analysis: Fuel Use, Rail Propulsion Power, and Facility Electricity Use.

### Fuel Use

In 2013, Metro's fleet, excluding vanpool services, used 40.6 million gallons of gasoline equivalent (GGE) fuel, which is a slight decrease of 0.5% from 2012. This decrease may be attributed to the reduced Metro-operated bus services, since the total revenue miles in 2013 from Metro's bus operations were reduced by 4% as compared to 2012, and the total boardings were reduced by 3%. Compressed natural gas (CNG) continues to be the primary fuel type used by Metro, accounting for more than 97% of total fuel used. This reflects Metro's transition to a 100% CNG-powered bus fleet for its directly operated bus services. The overall fuel use efficiency has slightly improved from 2012 by 7%, with GGE per revenue hour decreasing from 6.3 to 5.9 (Figure 6). The improvement on GGE per revenue hour has been seen over the past five years.

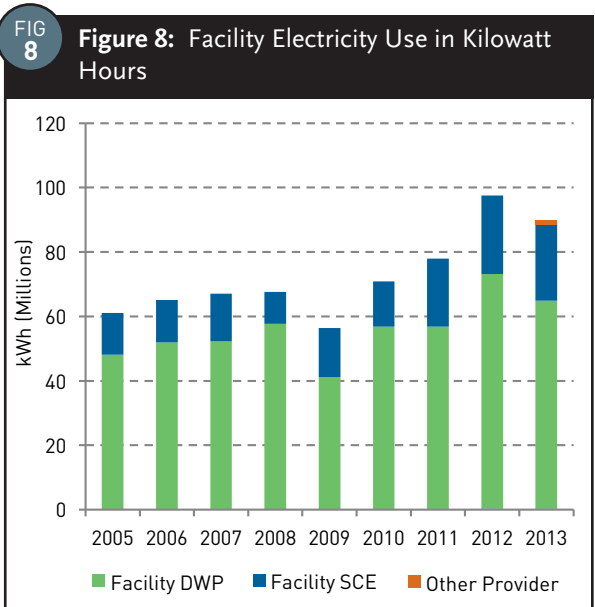
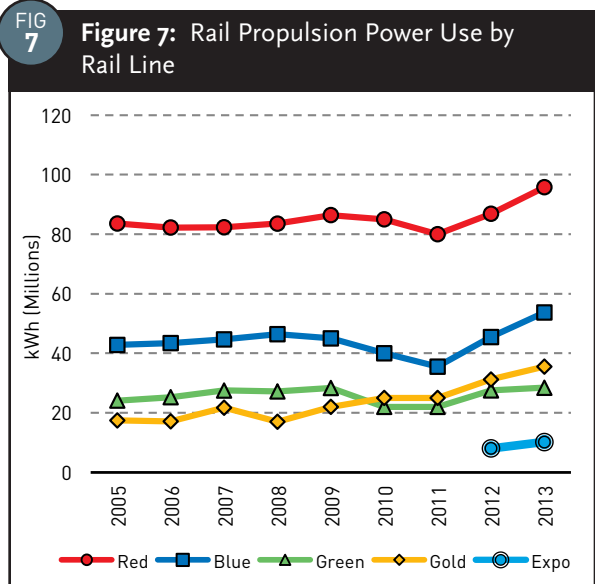


**Rail Propulsion Power**

Overall, rail propulsion power consumed 223 million kilowatt hours (kWh) in 2013, a 12% increase from 2012. LADWP continues to be the major provider of rail propulsion power, accounting for 65% of total rail propulsion power. Similar to previous years, the Red Line is the largest consumer of rail propulsion power compared to other transit lines at 43% of total consumed rail propulsion power (Figure 7). This increase in rail propulsion power is directly tied to Metro’s continuous expansion of rail services.

**Facility Electricity Use**

Electricity plays a major role in Metro’s everyday operations. In 2013, Metro used 313 million kWh of electricity, which is a 5.7% increase from 2012. In 2013, 29% of electricity consumption was attributed to meeting facility energy demand and 71% was used for rail propulsion. Compared to 2012, less electricity was used for facilities, with 35% of electricity in 2012 being used for facilities and 65% for rail propulsion (Figure 8). This shift in the share of electricity used for facilities and the electricity used for rail propulsion from 2012 to 2013 may be the result of increased rail usage as well as a variety of electricity conservation programs and measures that have been implemented across Metro and at specific facilities. For example, over 6,700 solar panels were installed at Location 30 (Central Maintenance Facility [CMF]) and approximately 4,000 lighting fixtures were replaced with energy-efficient lighting. Overall electricity efficiency has improved since 2012, due to a decrease in facility electricity use coupled with Metro experiencing a 0.8% increase in revenue hours and a 1.6% increase (3.6 million) in unlinked passenger trips in 2013.





# WASTE AND RECYCLING

## Solid Waste and Recycling

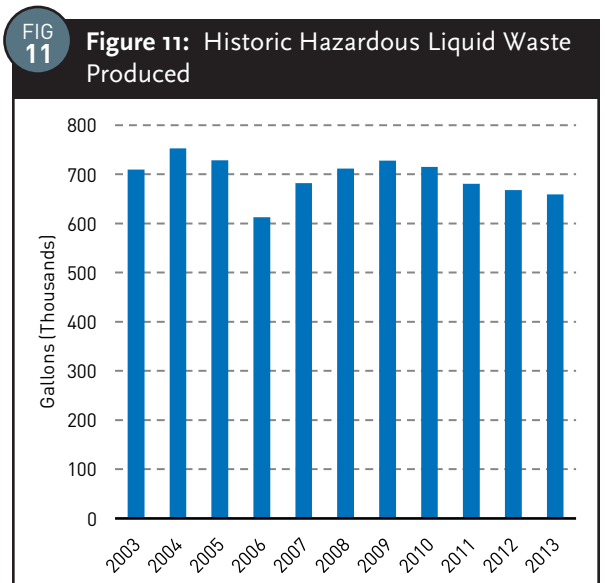
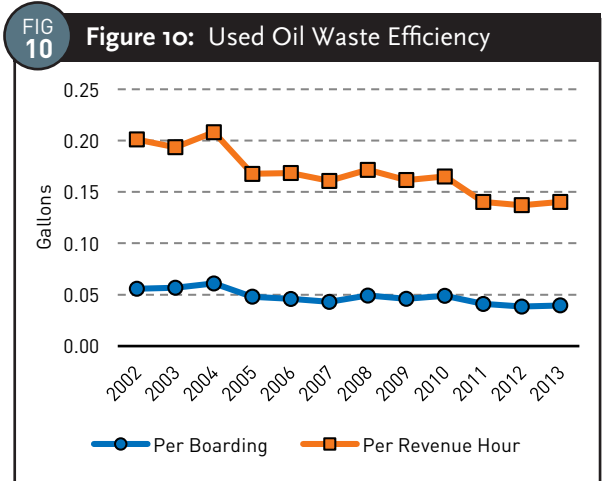
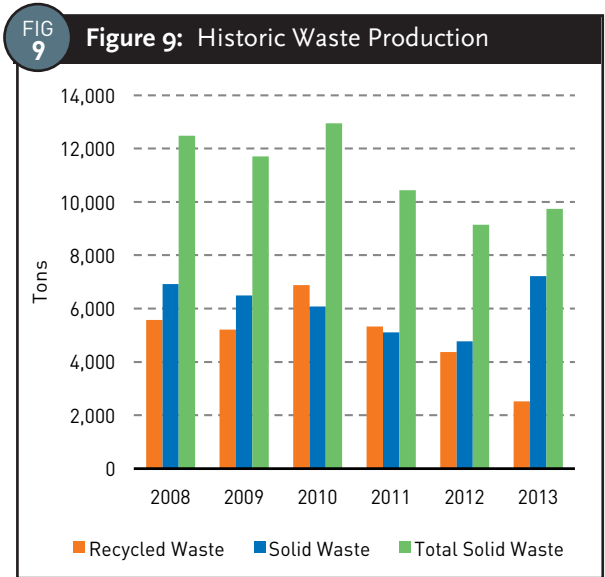
Overall, solid waste output has decreased since 2008, from approximately 12,500 tons in 2008 to 9,700 tons in 2013 (Figure 9). However, there was a 6.5% increase overall in total solid waste from 2012 to 2013, with a 51% increase in solid waste output and a 42% decrease in recycled waste collected from Metro facilities (Figure 9). Since waste activities have remained steady for Metro, this drastic change in reported solid waste and recycled waste may be attributed to different waste collection and accounting methods employed by Republic Services, Inc., Metro’s new waste hauling contractor. Metro continues to actively work on reducing waste and expanding recycling efforts. Improvements to existing recycling programs and implementation of waste reduction targets will continue to reduce overall waste production and increase diversion rates.

## Used Oil Waste

Overall, Metro has seen a 24% decrease in gallons of used oil from 2002 to 2013, which can generally be attributed to the increased use of synthetic oil. During 2013, Metro produced approximately 147,000 gallons of used oil, which represents an increase of 3.9% from 2012. The bus divisions continue to be Metro’s main producers of used oil waste at approximately 91% of the total. Overall, used oil waste efficiency has increased since 2002 with the decrease in the amount of used oil produced per revenue hour and boarding (Figure 10).

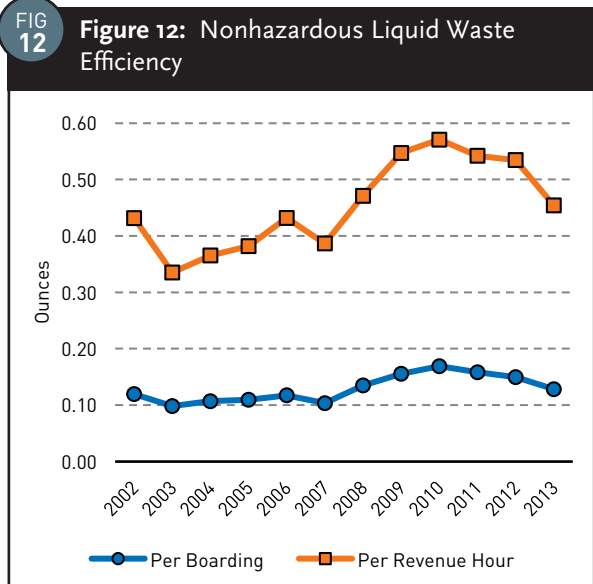
## Hazardous Liquid Waste

Hazardous liquid waste is mainly generated by Metro’s bus maintenance divisions and repair centers. Metro produced approximately 659,000 gallons of hazardous liquid waste in 2013, which represents a 1.3% decrease from 2012 and 7.1% decrease from 2003 (Figure 11). Similar to previous years, over 52% of the hazardous liquid waste was produced by Bus Divisions 1, 8, 15, and 18, and CMF, with Divisions 18 and the CMF being the highest producers of hazardous liquid waste. This is mainly attributed to the servicing of bus fleets and repair work at these divisions. Hazardous liquid waste efficiency has been increasing since 2009, with a slight decrease in the amount of hazardous liquid waste produced per revenue hour and boarding.



### Nonhazardous Liquid Waste

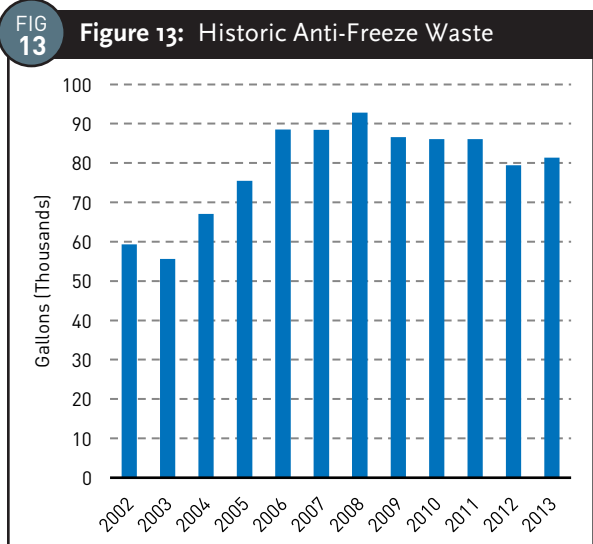
Nonhazardous liquid waste includes storm sewer, catch basin and sanitary sewer clean-out residue, grease trap clean-out residue, industrial wastewater, uncontaminated precipitation removed from secondary containment structures, wash waters, and some off-specification commercial chemical products. Metro produced approximately 477,000 gallons of nonhazardous liquid waste in 2013, which represents a 13.7% decrease from 2012 but an overall 14.6% increase from 2002. This gradual increase in nonhazardous liquid waste can be attributed to the increase in the number of bus washers between 2007 and 2010. After the peak in 2010, nonhazardous liquid waste continued on a downward trend, due in part to efforts by Metro to reduce wastewater runoff. In general, nonhazardous liquid waste efficiency has increased since 2010, with a decrease in the amount of nonhazardous liquid waste produced per revenue hour and boarding (Figure 12).



### Anti-Freeze Waste

Anti-freeze is mainly used in Metro's bus maintenance facilities. Metro produced approximately 81,000 gallons of anti-freeze waste in 2013, a slight increase of 2.5% from 2012 (Figure 13). Since 2008, anti-freeze waste production has been trending downward, which may be partly attributed to enhanced recycling efforts and programs. The slight increase in 2013 may be due to a slight increase in bus fleet size, from 2,254 buses in 2012 to 2,262 buses in 2013.

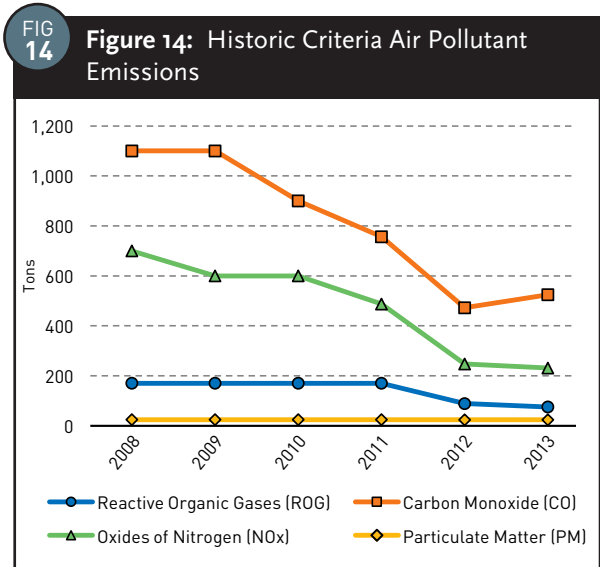
Anti-freeze waste efficiency has overall increased since 2011, with a decrease in the amount of anti-freeze waste produced per revenue hour and boarding. However, in 2013, there was a slight decrease in efficiency due to the increase in anti-freeze waste production, with 1.24 ounces of anti-freeze waste produced per revenue hour, which is a 0.9% increase from the 1.23 ounces produced in 2012.





## CRITERIA AIR POLLUTANT EMISSIONS

Metro’s bus and rail emissions in 2013 reflect Metro’s expansion of rail service and continued modernization of the bus fleet. The 12% increase in rail propulsion electricity consumption in 2013 as compared to 2012 was a significant factor in Metro fleet emissions levels; overall, Metro’s rail electricity consumption has increased approximately 27% from 2008 levels. Increased rail electricity consumption, and its impact on fleet emissions, was offset by a reduction in transit bus VMT and the continued modernization of the Metro transit bus fleet. Transit bus VMT was approximately 1.3% lower in 2013 as compared to 2012, and 17.1% lower as compared to 2008. Additionally, the ongoing transition of the Metro transit bus fleet to cleaner fuels and more modern technology has resulted in a significant reduction in ozone precursor and toxic air contaminant emissions. As Metro continues to replace and repower our buses with the newest technology engines, emission reductions associated

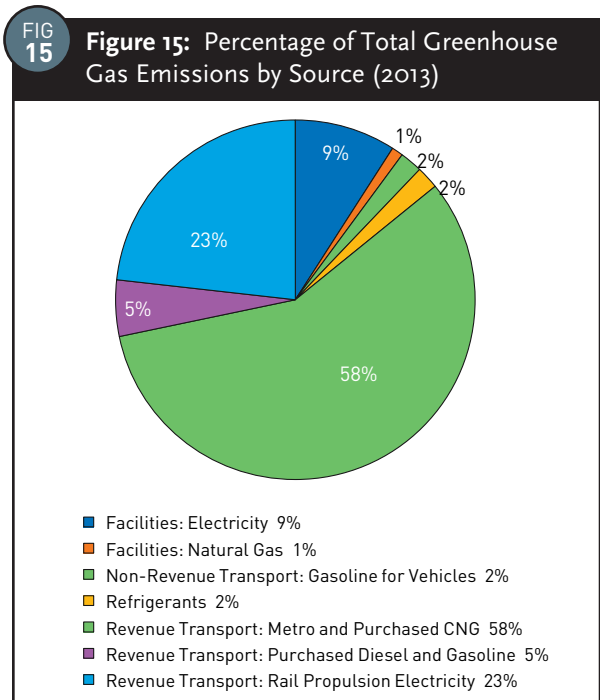


will continue and eventually taper once all the older, higher emitting buses are replaced or repowered with state-of-the-art engines (Figure 14).



## GREENHOUSE GAS EMISSIONS

Increased levels of greenhouse gas (GHG) emissions are causing global climate change, which has impacted the Los Angeles region, and will continue to do so in the future. In 2013, Metro emitted approximately 462,272 metric tons of carbon dioxide equivalents (MT CO<sub>2</sub>e). Approximately 85% of Metro’s GHG emissions during 2013 were related to fuel from moving passengers (Figure 15).





## GREENHOUSE GAS DISPLACEMENT

Metro plays a large role in sustainability and reducing GHG emissions in the region. By providing transit options, Metro is reducing GHG emissions that would otherwise have occurred from passenger vehicles, increased congestion, and potentially more sprawl. When combined effects of these factors are considered, Metro prevented more GHG emissions than it produced.

In 2013, Metro achieved GHG displacement of approximately 475,269 MT CO<sub>2</sub>e by shifting passengers from vehicular travel to transit (**Table 1**). This alone results in more GHG emissions displaced by passengers not driving than by all of Metro's operational emissions. Congestion relief and land use GHG displacement estimates have not yet been applied as they require more detailed modeling, but would demonstrate even greater emissions avoidance and Metro's central role in creating a more sustainable region.

TAB  
1

**Table 1: Net Greenhouse Gas Emissions from Metro Operations, 2013**

SOURCE	QUANTITY OF EMISSIONS DISPLACED (MT CO <sub>2</sub> E)
Total Emissions Displaced from Mode Shift	(475,269)
Emissions from Metro Operations	462,272
<b>NET EMISSIONS FROM METRO OPERATIONS</b>	<b>(12,997)</b>



## MESSAGE FROM THE CHAIRMAN

As stated in our mission, Metro is “responsible for the continuous improvement of an efficient and effective transportation system for Los Angeles County.” In order to make these continuous improvements, we are committed to enhancing and expanding the region’s transit systems while simultaneously reducing our impact on the environment and managing our resources in all of our planning, construction, operations, and procurement activities. Both responsibilities are essential to support the region’s changing nature and critical transportation needs.



From the beginning of Metro’s comprehensive sustainability program in 2008, our agency has made rapid strides to improve cost efficiencies, upgrade technology, and implement policies that reduce our environmental impact, both throughout our fleet and at our facilities. Since 2011 we have maintained a 100% alternatively fueled bus fleet. Our sustainable bus fleet has nearly eliminated our consumption of diesel fuel, roughly halved our fuel costs, and reduced our vehicle emissions by over 37%. The number of Metro-owned Leadership in Energy and Environmental Design (LEED) certified facilities continues to grow through our dedication to environmental stewardship. These include the El Monte Transit Center that holds a LEED Gold Certification and the LEED Silver Certified Division 10 bus facility. Metro projects such as 15 completed energy projects pertaining to LEED, lighting retrofits, and solar generation are estimated to reduce electricity consumption by almost 13 million kWh per year, with projected savings of more than \$2.1 million annually.

These actions are only part of an ongoing commitment to make Metro and Los Angeles County more sustainable. We seek to provide integrated services for residents of Los Angeles County traveling on all modes of transportation. Our Congestion Management Program is helping to improve the flow of traffic on freeways and reduce automobile emissions, while our efforts in active transportation are enabling greater connectivity for bicyclists and pedestrians to the region’s larger transportation system. The complex passenger rail system that Metro has worked to put together throughout the county provides patrons with a sustainable zero-emission way to travel. As a result of these innovative and comprehensive efforts, Metro was awarded the “Galaxy” Star of Energy Efficiency Award by the Alliance to Save Energy, making it one of the first public agencies to receive this prestigious recognition. We also continue to be a leader in the transit industry as we strive to uphold our Platinum Recognition to the APTA Sustainability Commitment. All of these efforts are catered to our patrons and the communities we serve in order to make Los Angeles a cleaner, healthier, and more resilient place to live, work, and play. At Metro, we believe that each and every one of us is part of the solution.

Yours Truly,

A handwritten signature in black ink that reads "Diane DuBois". The signature is fluid and cursive.

Diane DuBois  
Chair, Board of Directors

## MESSAGE FROM THE CEO

Los Angeles is committed to building a world-class transportation system; one that is safe, clean, reliable, on-time, and courteous. All of these actions are done in ways that are as sustainable as possible to conserve energy and resources.

Energy and resource management at Metro are inherently connected to the management of all environmental aspects of our operations. Air quality, water management, energy and fuel consumption, emissions, and recycling and waste management are some elements that characterize Metro's efforts in this field.



Recent successes include:

- > Metro receiving the “Galaxy” Star of Energy Efficiency Award from the Alliance to Save Energy for our 100% CNG fleet, nearly halving our fuel costs due to a reduction in fuel usage, and energy efficiency projects at our facilities, which are estimated to save a combined \$2.1 million annually.
- > Installation of 20 electric vehicle charge stations at Union Station, Sierra Madre Villa Station, Willow Station, Universal City Station, and El Segundo Station.
- > International Standards Organization (ISO) 14001:2004 Certification of four new Metro divisions, with recertification of Division 10 and Red Line Yard for upholding Metro's Environmental Management System (EMS).
- > A continuing commitment to achieve LEED Silver Certification standards on new construction projects and existing buildings.

Metro is dedicated to integrating energy and resource management into all aspects of planning, construction, operations, and procurement to ensure that environmental impacts are reduced, cost savings are realized and maintained, while fulfilling our mandate to provide efficient and effective service to our patrons. This is why Metro serves as an example for the region and for the nation.

I congratulate our staff and partners in their work of influencing the changing nature of Los Angeles and working toward a more sustainable region.

Sincerely,

A handwritten signature in black ink that reads "Arthur T. Leahy". The signature is written in a cursive, flowing style.

Arthur T. Leahy  
Chief Executive Officer





# ABOUT METRO

The Los Angeles County Metropolitan Transportation Authority (Metro) strives to be responsible for the “continuous improvement of an efficient and effective transportation system in LA County.” Metro’s role is unique among the nation’s transportation agencies by serving as transportation planner and coordinator, designer, builder, and operator for one of the country’s largest, most populous counties. More than 9.6 million people—nearly one-third of California’s residents—live, work, and play within Metro’s 1,433-square-mile service area.

In the last 25 years, Metro has developed an extensive mass rapid transit system consisting of almost 80 miles of urban rail, two very successful Bus Rapid Transit (BRT) routes, and the nation's largest fleet of more than 2,500 very low emissions buses. Metro operates 180 bus routes to accommodate more than 444.3 million annual boardings.

Metro's rail system includes the Red and Purple subway lines and the Blue, Green, Gold, and Expo light rail lines. The Red and Purple Lines equal a combined 17 miles in length, include 16 stations, and averaged a total of 46.5 million annual boardings in fiscal year (FY) 2013. Combined, the four light rail lines are 70.3 miles long, include 67 stations, and averaged 58.2 million annual boardings in FY2013.

Metro's Long Range Transportation Plan (LRTP) calls for investments to expand the region's rail system to 185 miles—with over 150 stations—and to add 170 more miles of carpool lanes to our freeways. Planning and construction work continues on several corridors to develop additional light and heavy rail transit. Projected benefits from Measure R Projects include the creation of 160,000 new jobs and annual reductions in 208 million VMT and 10.3 million gallons of gasoline used, as well as an increase of more than 77 million annual transit boardings. These investments, in combination with a statewide mandate to better coordinate land-use planning with the transportation system, *Senate Bill 375: The Sustainable Communities and Climate Protection Act* of 2008, will transform Los Angeles' urban landscape over the next 30 years, reduce demand for single-occupancy travel, reduce per capita GHG emissions, and further improve air quality.

Metro also encourages transit oriented development (TOD) on Metro-controlled property near transit facilities to facilitate walking and bicycle improvements as well as enhance the utilization of, and connectivity to, the region's transit system. Current TOD projects underway include One Santa Fe, a mixed-use development with 20% affordable housing units in the Downtown

## IN THE LAST 25 YEARS, METRO HAS DEVELOPED AN EXTENSIVE MASS RAPID TRANSIT SYSTEM, FOR A TOTAL OF 444 MILLION ANNUAL BOARDINGS.

Los Angeles Arts District, which is adjacent to Metro's Red Line Rail Yard and a forthcoming Red Line terminus station. Taylor Yard, a mixed-use development with 253 affordable family and senior units, is also under construction.

Planning, developing, and operating the region's transportation system is an energy-intensive endeavor. To reduce the consumption of natural resources and the associated emission of pollutants and GHG, Metro has implemented several initiatives and policies to operate more efficiently and to be better stewards of the environment. Specifically, Metro has committed to:

1. Constructing all new facilities to LEED Silver standards; four buildings have received a LEED Gold rating, including the newly renovated and expanded El Monte Transit Center.
2. Assessing its existing facilities to determine the feasibility of achieving a LEED-Existing Building Operations and Maintenance (EBOM) Certification. Metro's Gateway Headquarters Building has received a LEED-EBOM Gold rating, and Division 10 recently received LEED Silver Certification. LEED-EBOM efforts are underway on two facilities and 15 other facilities are currently being assessed.



3. Adopting and implementing an agency-wide EMS. Currently, six Metro divisions are certified to the ISO 14001:2004 Standard, making Metro a leader in the transit industry in working to monitor and mitigate its impact on the environment.
4. Adopting Metro's Renewable Energy Policy to incorporate renewable energy into Metro facilities. Solar panels have been installed at four Metro facilities for a combined two megawatts of energy, and solar is planned for new facilities currently in design.
5. Adopting Metro's Green Construction Equipment Policy to reduce emissions from construction activities by requiring the use of clean, green construction equipment on all Metro construction projects.
6. Adopting Metro's Energy Management and Conservation Plan, which provides a blueprint to direct Metro's overall energy management and use in a sustainable, cost-effective, and efficient manner.

These policies and programs are inherently linked to Metro's mission—the responsibility to provide an efficient and effective transportation system—and its effort to do so in a sustainable manner. Ultimately, these efforts ensure that the agency continues to balance a growing presence in the region while seeking to reduce its overall impacts on the environment.





# INTRODUCTION

Since 2009, Metro has produced an annual sustainability report to summarize the agency's continual efforts in achieving higher sustainability performance through the implementation of planning, construction, operations, and maintenance activities. This 2014 Metro Energy and Resource Report is a continuation of this effort and reflects the agency's sustainability performance for calendar year 2013. The report will continue to bring visibility to Metro's sustainability efforts and help explore new ways to manage environmental impacts, while maintaining Metro's commitment to providing quality transit services to the region.





The purpose of this report is to compare data with previous years to track Metro's progress toward our goals for sustainability, and provide an update on Metro's resource use and contribution to the reduction of pollutant emissions and GHG emissions. Additionally, this report provides Metro's decision-makers with information they can use to improve Metro's sustainability performance.

This report describes the methodology used to obtain and analyze the data, including how the different indicators were chosen, how efficiency is measured within the specific indicators, and identifying potential weaknesses in the data. Data accuracy is essential; therefore, the best available data as of April 2014 were used along with the most reliable sustainability guidelines to develop this report. Additional data constraints are discussed in the Reporting Methodology.

Data are organized according to indicator area, with each area focusing on a resource or economic cost by which Metro can analyze the effectiveness of its sustainability strategies over time. This report reflects the Recommended Practice for Quantifying and Reporting Transit Sustainability Metrics, as developed by APTA. The indicator areas selected for historic and ongoing analysis are as follows:

- > Vehicle Miles Traveled per Capita
- > Unlinked Passenger Trips per Capita
- > Operating Expenses
- > Water Use
- > Energy Use
  - Fuel Use
  - Rail Propulsion Power
  - Facility Electricity Use



- > Waste and Recycling
  - Solid Waste and Recycling
  - Used Oil Waste
  - Hazardous Liquid Waste
  - Nonhazardous Liquid Waste
  - Anti-Freeze Waste
- > Criteria Air Pollutant Emissions
- > Greenhouse Gas Emissions
- > Greenhouse Gas Displacement

This report includes a detailed discussion of each indicator area according to the following structure:

- > **Accomplishments:** Significant actions or programs that affected the indicator during the 2013 calendar year.
- > **Data and Analysis:** Analytical summaries and data graphs.

- > **Next Steps:** Specific actions and general next steps that Metro is considering for future implementation.

In addition to the specific issues described in the indicator area sections, Metro has developed and implemented broad policies, goals, and standards to demonstrate a commitment to apply sustainable strategies throughout the planning, construction, and operation of various projects. Specifically, Metro projects will comply with all local, state, and federal codes, ordinances, and regulations, and applicable Federal Transit Administration (FTA), Federal Highway Administration, and APTA guidelines.

Case studies are also provided throughout this report to highlight specific sustainability achievements of Metro.





# ENVIRONMENTAL MANAGEMENT SYSTEM

As Los Angeles County's largest transportation provider, Metro is responsible for a comprehensive list of services, including transportation planning and coordination, along with the designing, building, and operating of transit systems. As part of its day-to-day activities, Metro is taking ownership of its impact on the environment, and working to integrate sustainability practices to reflect the inherent values of the agency. One example is through the compilation of best practices to streamline maintenance and operations in a more environmentally friendly manner. For Metro, this led to the design and implementation of an Environmental Management System (EMS). As described in Metro's Environmental Policy (2009), Metro's EMS is "a set of operational procedures, based on an adopted Environmental Policy, to ensure compliance with federal, state, and local environmental regulations, as well as to facilitate environmental stewardship."



### A BRIEF HISTORY OF EMS

In August 2007, Metro was one of eight transit agencies across the country selected by the FTA to participate in a pilot project to implement an EMS in their organization. In December that same year, Metro was one of seven agencies participating in the Second Round of FTA-assisted EMS training, with the intention to utilize and certify the agency's applicable facilities to the ISO 14001:2004 Standard.

During the fall of 2008, Metro began its EMS program with the Red Line Yard as the pilot site, which houses rail maintenance and operations for Division 20 and Maintenance of Way (MOW). In January 2011, the Red Line Yard received ISO 14001:2004 Certification. Following the well-earned success at the Red Line Yard, Division 10, one of Metro's bus facilities, was selected for enrollment in the EMS program. The program has since expanded to include six facilities in total: Division 9, Division 10, CMF, Division 11 (Blue Line Yard), Division 20 (Red Line Yard), and Division 21 (Gold Line Yard). The agency continues an aggressive schedule of enrolling the remaining bus and rail divisions with the intention of having all of Metro facilities involved in the EMS program, and ISO Certified, by 2016.

### INTRODUCTION TO EMS

Metro has adopted an agency-wide EMS, meaning that all of its major facilities will eventually be included in the program. Metro's current EMS includes operational activities and involves employees from Operations and Maintenance. An EMS Administrative Team was established to manage the documentation and implementation of the overarching EMS program. The EMS Facility Core Teams were created to address site-specific environmental impacts, with support from the EMS Administrative Team.

**EMS Administrative Team:** Oversees the agency-wide implementation of EMS, and addresses programmatic issues and initiatives to streamline the program's efforts across the divisions. The EMS Administrative Team consists of representatives from the Environmental Compliance and Services Department, Quality Assurance, Corporate Safety, Facilities Maintenance, and Bus and Rail Maintenance and Transportation.

**EMS Facility Core Team:** Oversees the specific issues and environmental activities at the division level. The EMS Facility Core Team typically consists of Maintenance and Transportation Management, along with key supervisors, leads, and front line staff dedicated to the division's environmental performance.

EMS relies on a continual improvement process to identify best practices and ways that Metro can reduce its impact on the environment. This is aided by the engagement and empowerment of Metro employees, who are encouraged to voice their opinions on environmental challenges. EMS relies on a “Plan-Do-Check-Act” model, which represents the four critical stages in the process:



### 1 Plan

At the agency level, “Objectives and Targets” are developed to set goals for the program. At the division level, each division evaluates all of its ongoing activities that may impact the environment (which are referred to as “Environmental Aspects”) and creates Action Plans to address those impacts that they identify as significant.

### 2 Do

Action Plans are developed to assign tasks and responsibilities for meeting the goals of reducing an activity’s impact on the environment. Regular meetings, at the agency-wide level and the division-level, are scheduled to track progress and keep records of these efforts.

### 3 Check

The “Check” phase focuses on monitoring and measuring Metro’s EMS activities. Internal and external auditors are tasked to ensure that procedures are followed and the agency’s environmental goals are being met. Metro has chosen to conform to, and has successfully achieved, the ISO 14001:2004 Certification for its EMS. This ISO Certification provides an internationally recognized framework for EMS that formalizes the continual improvement process. Metro has elected to certify all of its facilities that are enrolled thus far in its EMS program, which currently includes six facilities, with two more under review.

### 4 Act

On an annual basis, Metro’s EMS executives are briefed in a management review of the program. This offers opportunities for senior management to ask critical questions to determine the progress and success of the program. In addition to the management review, the EMS Administrative Team and the Facility Core Teams also evaluate the program’s accomplishments from the past year, and identify new environmental challenges to address. Therein lies the continual improvement process of EMS, and the cycle begins again.

## PROGRAM BENEFITS

### Improved Environmental Compliance

EMS helps each facility identify key areas of improvement relating to its environmental performance. For example, Metro's Quality Assurance (QA) group performs audits of the facilities each month. The QA group has structured its monthly environmental compliance reports to target areas with environmental concerns that can be addressed through the EMS program. As a result, those targeted environmental issues have been significantly reduced. As new issues arise, the program utilizes the continual improvement process to address additional areas each year.

### Employee Awareness

The program is invested in increasing employee awareness of environmental issues, both in the workplace and at home. Extensive training is offered through the Environmental Training Institute (ETI), which includes topics such as general EMS awareness; regulatory-required trainings; and general sustainability trainings on energy, waste, and recycling. These trainings increase employee awareness and provide the tools for staff to make improvements in their daily responsibilities.

### Sharing of Best Practices

As an agency-wide program, EMS seeks to capitalize on the existing best practices at bus and rail maintenance facilities, and to share those with other EMS facilities. For example, maintenance staff at Division 10 developed an end-of-shift checklist to focus on general housekeeping and environmental due diligence. This checklist proved successful for the division when going through the EMS audit process. As a result, the checklist was shared with other bus facilities, and a checklist for Metro rail facilities was developed as well.

Other best practices include both formal and informal procedures that effectively mitigate and manage environmental impacts. The development and dissemination of Standard Operating

Procedures (SOPs) have been enhanced and are formally referenced in EMS documents. These SOPs serve as a guide on proper procedures for various activities impacting the environment. With divisions developing specific SOPs for their facilities, those relevant to the EMS program have been shared and adapted to fit the needs of the agency-wide program.

### Capital Project Assistance

In conjunction with Metro's energy, water, waste and recycling, and climate initiatives, EMS provides additional resources to facilities to implement innovative pilot and full-scale projects and resource-saving measures. These measures are designed to assist the agency in reducing its overall environmental impact and operational cost. Through both fiscal and project management assistance, EMS staff coordinate with various Metro departments to highlight critical issues and opportunities for improvement, seek funding for these projects, and implement these projects in a timely manner.

Metro's Environmental Compliance and Services Department (ECSD) oversees EMS implementation. It works with a variety of Metro departments, including General Services, Facilities Maintenance, Quality Assurance, Engineering, Corporate Safety, and Operations, to identify and implement such projects.

Projects that have been developed through the EMS program include:

1. Ventilation system in the brake lathe room in Division 10.
2. Water Recycling System for the Division 9 Steam Bay.
3. Sealed Coolant Recovery System (pilot)—Development of a sealed coolant recovery system to demonstrate the capability to capture and reuse anti-freeze from buses. An estimated \$300,000 in coolant costs will be saved annually with this system.
4. LEED-EBOM Silver Certification for Division 10.



5. Lighting Retrofits at Division 22—Replaced old, inefficient light fixtures in the vehicle shop with energy-efficient fixtures, reducing energy use by 1.4 million kWh, saving approximately \$165,000 per year.
6. Renewable Energy Inventory—Developed to determine the potential for installing solar panels to generate renewable energy and reduce energy costs at Metro facilities.
7. Sub-Meter Design and Installation at Division 20 —Completed as part of Metro’s effort to achieve LEED-EBOM Certification of its facilities.
4. Renewable Energy Procurement—The FY14 Bus Division Energy Efficiency and Renewable Energy Project included funds for the installation of solar power at several facilities. Based on the Renewable Energy Inventory, several facilities will be analyzed to identify appropriate locations for this project.
5. LEED-EBOM Certifications at Divisions 7 and CMF —The performance period to obtain LEED-EBOM Certification was started at Divisions 7 and CMF.
6. Sub-Meter Design and Installations at Divisions 1, 4, 5, 6, 8, 9, 11, 15, 18, 21, and 22—Required as part of the LEED-EBOM Certification effort.

## FUTURE INITIATIVES ▼

Metro’s EMS program continues to evolve and expand. As it is an agency-wide system, all of Metro’s major facilities will be enrolled in the program by 2016. Specific projects for future implementation include:

1. Energy Opportunity Assessments at Divisions 3, 7, 9, 11, 15, and 22—Will be conducted as part of the FY14 Bus and Rail Energy Efficiency Capital Project to analyze facility energy usage and identify potential energy conservation measures.
2. Lighting Retrofits at Division 11—Will replace old, inefficient light fixtures in the vehicle shop with energy-efficient fixtures. When completed, the project will reduce energy consumption by 1.2 million kWh and save approximately \$150,000 per year.
3. Retro-Commissioning, Energy Efficiency Improvements, and Lighting Retrofits at Divisions 7 and 9—FY14 Bus Division capital funds will be used to implement selected energy conservation measures.
7. Sealed Coolant Recovery System Procurement—Following the success of the pilot system, a capital project was established to purchase several sealed coolant recovery systems for each bus maintenance division.
8. Metro Orange Line Recycled Water Project —Will install recycled water lines for landscape irrigation for a portion of the Metro Orange Line. The use of recycled water is estimated to reduce water consumption by 12.4 million gallons per year, saving almost \$60,000 annually.
9. Division 13 Solar Power Project—FY14 Bus Division capital funds will be allocated to the Division 13 project to restore the installation of solar panels that were value engineered out of the project.
10. Division 13 Cistern Project—Sustainability capital funds were allocated to Division 13 for the installation of a 270,000-gallon cistern to capture stormwater for use in the bus wash and for irrigation. An estimated 2.8 million gallons of water will be collected, saving approximately \$25,000 per year.



## SOCIAL SUSTAINABILITY OUTREACH



The concept of sustainable mobility incorporates the three pillars of sustainability: the economy, the environment, and society. Within Metro, much work has been done to articulate and implement the environmental and economic pillars of sustainability, while the social pillar of sustainability is an emerging effort with increasing attention. Within the past year, Metro has taken the initiative to begin to define the social pillar of sustainability. Metro's framing of social sustainability takes into account:

engaging the public; 2) supporting community initiatives; 3) ensuring the health and safety of public transportation customers and the broader community; 4) recognizing the social impacts of projects and policies; and 5) fostering socially responsible procurement. These guidelines were created through a working group with APTA.

As Metro's commitment to social sustainability continues to evolve, Metro's social media blog, *The Source*, is covering topics related to social sustainability. *The Source* articles currently showcase Metro's social sustainability and public engagement efforts with the community.

As the initiative grows, *The Source* articles will cover a full range of topics relating to Metro's framework of social sustainability. *The Source* articles can be viewed at <http://thesource.metro.net/category/social-sustainability>.

## CASE STUDY

## EL MONTE IRRIGATION SYSTEM SMART CONTROLLERS



### CHALLENGE

Many of Metro's activities, from bus washing to landscaping, require large amounts of water. Oftentimes, because of the vastness of the system, disruptions in water service due to leaks or valve breakages can lead to excessive water waste. In light of increasing pressure on water resources within the region, Metro has taken steps to increase its water use efficiency and minimize any extraneous water loss.

### ACTION

Beginning with the construction design decision for the El Monte Busway Terminal Project in August 2010, Metro decided to install a real-time water controller system to better manage the landscape irrigation system. Since the opening of the El Monte station in October 2012, Metro has used this software to monitor and regulate how often and how long the plants are watered, as well as what type of irrigation system is being used. Additionally, Metro's landscape team conducts day-to-day monitoring of nighttime watering to ensure the irrigation infrastructure is intact and operating properly. By using the real-time water controller system, Metro can adjust watering schedules for seasonal changes and monitor the irrigation stations to ensure they are operating smoothly. If the water controller system detects any issues with the valves or timers, it notifies Metro by sending an automated message with details about the issue and its location.

### OUTCOME

Through the use of this real-time water controller system, Metro has increased its water efficiency through close monitoring of water use. When Metro receives an automated message regarding a problem in the system, Metro can address the issue immediately and avoid excessive water loss. Without the system, these leaks could persist for multiple hours or days until reported to Metro. Additionally, Metro can modify irrigation when

necessary to help new drought-resistant plants establish healthy roots while also staying within the allowable water limits set by LADWP. Metro's real-time water controller system allows for more efficient water use and management.



center

M

OPEN  
SATURDAY

metro.net

Metro



# REPORTING METHODOLOGY

As a founding member of the APTA Sustainability Commitment, Metro follows the guidance provided by APTA to report and track key indicators of sustainability. APTA's Recommended Practice of Quantifying and Reporting Transit Sustainability Metrics provides the framework and methodology for the 2014 Energy and Resource Report and provides guidance for reporting and tracking key indicators of sustainability. This Recommended Practice identified nine sustainability performance metrics to be reported on an annual basis, as follows: 1) Vehicle Miles Traveled per Capita; 2) Unlinked Passenger Trips per Capita; 3) Operating Expenses; 4) Water Use; 5) Energy Use; 6) Waste and Recycling; 7) Criteria Air Pollutant Emissions; 8) GHG Emissions; and 9) GHG Displacement.



## NORMALIZATION FACTORS ▼

APTA also recommends that a transit agency select normalization factors that “tell its story” by providing context for its operations. The eight possible normalization factors are: 1) passenger miles traveled (PMT); 2) vehicle revenue hours (VRH); 3) vehicle miles, 4) vehicle revenue miles (VRM); 5) unlinked passenger trips (UPT); 6) produced seat miles (PSM); 7) revenue vehicle length (RVL); and 8) per capita in service area of operation. As one of the nation’s largest transit agencies, Metro’s service area encompasses more than 1,400 square miles of Los Angeles County, with an estimated average weekday ridership of over 1.5 million (bus and rail). It is Metro’s core mission to provide efficient and effective transit service to the Los Angeles region. This report focuses on PMT, VRH, and UPT as the primary normalization factors to measure Metro’s sustainability performance and examine the balance between Metro’s service expansion and sustainability impact.

### Passenger Miles Traveled (PMT)

PMT is the sum of the distances traveled by all passengers of Metro. This metric directly shows the potential VMT and associated GHG emission reductions. It highlights Metro’s operational efficiency and effectiveness as they relate to GHG reductions.

### Vehicle Revenue Hours (VRH)

VRH refers to the total number of hours that Metro’s vehicles are in revenue service (including vehicles that operate in fare-free service). This metric captures the effectiveness of the transit service. Measuring Metro’s sustainability performance through VRH helps to reveal how its overall sustainability performance is impacted by the transit service expansion. This metric enables the comparison of sustainability efficiency year-to-year, regardless of the service size and scale.

### Unlinked Passenger Trips (UPT)

UPT, also called boardings, is defined as the total number of times passengers board public transportation vehicles, regardless whether the boarding results in one trip or multiple trips. This metric captures the scale and effectiveness of Metro’s transit service. It helps to reveal the relationship between Metro’s efforts to attract passengers and increase service productivity and the resulting impact on the sustainability performance brought on by such efforts.

## DIVISION-LEVEL ANALYSIS ▼

Major facilities at Metro deliver high-quality public transit services to Los Angeles County. At the same time, they also account for a large portion of Metro's overall environmental and resource footprint. Measuring Metro's sustainability performance at the major facility level in terms of water and electricity has been included in Metro's annual sustainability report in the last few years. Sustainability performance and an efficiency comparison analysis have been expanded in this report by major facilities (divisions) for all metrics with available data. This division-level performance measurement and analysis tie the performance of a division's operation to its fulfillment of sustainability goals and objectives.

## GHG METHODOLOGY ▼

Emissions of all applicable GHGs have been accounted for in this report. Given that each GHG has a different Global Warming Potential (GWP), total emissions were reported in units of metric tons of carbon dioxide-equivalent (MT CO<sub>2e</sub>), which are derived by multiplying the mass of individual GHGs by their respective GWPs. GHG emissions are specific to certain types of activities. For example, burning fossil fuels produces emissions of carbon dioxide (CO<sub>2</sub>), nitrous oxide (N<sub>2</sub>O), and methane (CH<sub>4</sub>). On the other hand, GHGs such as sulfur hexafluoride (SF<sub>6</sub>), perfluorocarbons (PFCs), or hydrofluorocarbons (HFCs) are used as end-products in equipment for their insulating, fire-suppressing, or refrigerating properties, and it is only when these substances leak into the atmosphere that they are accounted for in GHG inventories. If Metro's future operations result in emissions of additional GHGs, they will be included in future inventory reports as applicable.

The GHG emissions calculations for the years 2012 and 2013 use the same methodology as recommended by APTA. The GHG emission calculations for years prior to 2012 may have used a different methodology. For the years prior to 2012, the following discrepancies may exist:

- > Omissions of CH<sub>4</sub> and N<sub>2</sub>O emissions from Metro-owned revenue-generating vehicle fleet.
- > Omissions of CH<sub>4</sub> and N<sub>2</sub>O emissions from contracted revenue-generating vehicle fleet.
- > The use of slightly different emission factors for CH<sub>4</sub> and N<sub>2</sub>O emissions from electricity, diesel, and gasoline consumption.
- > The use of slightly different conversion factors for units of fuel quantities.
- > Omissions of GHG emissions associated with water services-related electricity consumption.
- > The use of slightly different average vehicle fuel economy factors for calculating GHG displacement.
- > The use of slightly different emission factors for CH<sub>4</sub> and N<sub>2</sub>O emissions for GHG displacement calculations.
- > Potential overcounting of gasoline and diesel consumption of Metro's non-revenue vehicles.
- > Overcounting of emissions from refrigerants; specifically, the refrigerant R-22, also known as HCFC-22. R-22 is an ozone-depleting substance and is not required to be reported as a GHG because it is regulated by a different environmental standard.



### A NOTE ON THE DATA ▼

Analyzing the environmental performance of an agency as large and complex as Metro involves the collection of large amounts of data from many sources. The best data available as of April 2014 that provided an accurate analysis of the agency's performance were used for this report. However, the following data inconsistencies were encountered that should be addressed in future reports:

- > Limited Sub-meter Program: 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. Sub-meters are currently being installed at a number of divisions so more accurate data will be available for subsequent reports.
- > Meter Discrepancies: Water billing and electricity use were provided by meter address, which does not always match to a specific division/major facility. As part of Metro's sub-meter program, we are actively characterizing and inventorying all utility meters for more accurate reporting and verification.
- > Lack of Data:
  - At the time of publication, LADWP data for electricity and water were not available for the months of September through December for the calendar year 2013. The data for these four months were estimated based on a trend analysis conducted on the data available for the eight months of 2013 (January through August), and the data available for the 12 months of 2012.



- Prior to 2012, only water data from Metro's main water supplier, LADWP, were analyzed. Beginning in 2012, water consumption data included LADWP and other providers, which included Pasadena Water and Power (PWP), California Water Services, Park Water Company, Golden State Water Company, and other municipal providers.
  - Waste and Recycling: A new solid waste contractor was employed by Metro in April 2013; therefore, reporting data for 2013 were only available for April through December. To report a full calendar year, a monthly average for 2013 was calculated (less the highest and lowest amounts) and was applied for the months of January through March.
  - The new waste hauler has different waste/recycling accounting procedures that are being reviewed for accuracy.
  - Specific waste streams for waste and recycling were not available.
- > A new transit category of Rapid Bus was included in the National Transit Database (NTD) data for 2012 and 2013. This reflects the recently added Orange Line Extension with dedicated busway offering improvements to north-south mobility in the western San Fernando Valley and connecting the Orange Line with Amtrak and Metrolink. In addition, NTD data are reported on a fiscal year basis instead of a calendar year.
  - > All dollars presented in this report are 2013 US dollars, unless otherwise noted.







# ACCOMPLISHMENTS

Throughout 2013, Metro actively pursued sustainable programs, strategies, and action items to maximize transportation service efficiency, access, safety, and performance while minimizing energy use, consumption, pollution, and the generation of GHG and other waste. Those efforts are described by indicator area, along with the sustainable strategies recommended in the previous sustainability report and the accomplishments achieved in 2013. Many sustainable strategies are considered relevant and ongoing; therefore, they are carried forward on an annual basis. Each accomplishment is a validation of Metro's commitment to increasing sustainability, efficiency, and environmental performance. Nine key accomplishment areas for 2013 are summarized below. More details on the programs and specific strategies implemented and accomplished in 2013 are itemized in the chapters corresponding to the indicator topics.

### KEY ACCOMPLISHMENT AREA 1: CONTINUED CAPITAL IMPROVEMENT PROJECTS

Metro organized and conducted FTA compliance training on cultural resources as well as noise and vibration. Metro continues to support planning, design, environmental, archaeological, and paleontological monitoring activities on the following Metro capital projects:

- > New Bus Maintenance Facility, Division 13
- > Lankershim Train Depot
- > Metro Orange Line Pedestrian Connector
- > Universal Pedestrian Overpass
- > Crenshaw / LAX Transit Corridor
- > Regional Connector Transit Corridor
- > Westside Subway Extension
- > Wilshire BRT
- > Patsaouras Transit Plaza Renovation
- > Conducted groundwater sampling, monitoring, and reporting at Divisions 10 and 18

### KEY ACCOMPLISHMENT AREA 2: ENVIRONMENTAL MANAGEMENT SYSTEM AND ISO 14001 CERTIFICATION

Subsequent to receiving Platinum recognition from APTA for leadership in sustainability as a signatory of the APTA Sustainability Commitment in 2012, Metro continued to strive for higher standards in all aspects of its operations. Metro is proactively designing and implementing an agency-wide EMS, with a goal that all Metro facilities will be included in the program in the near future. This program offers a continual improvement process that engages operational activities at all levels to identify best practices and strategies in reducing environmental impact. Key benefits of this initiative include improved environmental compliance at the operational facilities level; improved employee awareness of sustainability issues and resource conservation needs; shared best practices; and access to additional resources to support innovative capital projects as pilot efforts.

With the implementation of Metro's EMS program, key Metro's facilities are being selected to comply with ISO 14001 Certification requirements. As a pilot site, Division 20 and Location 61 (Red Line Yard) received ISO 14001:2004 Certification in 2011. The program has since expanded to several more facilities including Division 10 (bus facility), Division 9, CMF, Division 11 (Blue Line Yard), and Division 21 (Gold Line Yard). The ISO 14001:2004 Certification is a result of Metro's successful implementation of the EMS program at the divisions, as the certification recognizes the performance of the EMS. Metro continues to implement an aggressive schedule of enrolling the remaining bus and rail divisions with the intention of having all of Metro's facilities ISO 14001 Certified by 2016.

### KEY ACCOMPLISHMENT AREA 3: INSTALLATION OF SUB-METERING SYSTEM, TIMERS, AND OTHER AUTO-CONTROL SYSTEMS

In 2013, additional practices and measures were implemented at the facility level to help understand the specific energy needs of the facility while addressing environmental awareness and resource conservation. Sub-metering systems for water and electricity have been installed at several key division locations including CMF, Division 20, and Division 21. This accomplishment allows more detailed tracking and analysis at these key locations for improved performance in the future. Sub-meter design plans have been completed for Divisions 8, 15, and 22. Preparation of new design plans is underway for Divisions 3, 4, 5, 6, 9, 11, 18, 34, and 60.

Timers and other auto-control systems were also installed to avoid unnecessary system operation during off hours. Heating, ventilation, and air conditioning (HVAC) and compressed air systems are now on timers at CMF to keep the system running during work hours only. The new light-emitting diode (LED) lighting system installed on the 15th floor at the Gateway Building and Division 7 is equipped with automated dimming controls to further minimize electricity consumption.



In 2013, a new real-time water controller system was installed at the El Monte Busway terminal. This system allows Metro to monitor and regulate watering schedules for seasonal and weather changes. Metro is able to increase its water efficiency through close monitoring of its water use. The system also effectively monitors for system defects and any issues with valves or timers, thereby avoiding excessive water loss due to unidentified leaks.

#### KEY ACCOMPLISHMENT AREA 4: DEVELOPMENT OF DIVISION-SPECIFIC PROGRAMS

More customized planning and programming were developed for major Metro facilities in 2013. The specific functions, operations, and needs at the division level were evaluated to ensure that the programs are appropriate and effective for reducing resource consumption and improving efficiency. These include:

- > A customized water recycling process for bus washing was developed for Divisions 7 and 9 to minimize water usage.
- > Formal case closures for the elimination of monitoring wells for Divisions 10 and 18 have been confirmed by the Regional Water Quality Control Board.
- > A Low Impact Development Study was completed for Division 4 to evaluate opportunities to reduce runoff and enhance groundwater supply.
- > A pilot project was completed to analyze water reduction opportunities using Linear Kinetic Cell Technology. Division 5 and 18 have been selected as a result of the study to demonstrate the application of the technology.
- > Energy opportunity assessments were completed at Divisions 7 and 22, with Divisions 9 and 11 underway.
- > A series of lighting retrofitting and upgrading projects took place at selected locations including Gateway Headquarters Building, Division 11, CMF, and Division 22.



#### KEY ACCOMPLISHMENT AREA 5: IDENTIFICATION AND CAPTURE OF RENEWABLE ENERGY OPPORTUNITIES

To further offset GHG emissions, Metro developed a more systematic renewable energy procurement plan for agency-wide application. Several solar power procurements have been initiated at key Metro facilities. Comprehensive energy efficiency upgrades also took place in 2013 at multiple bus and rail divisions, which included renewable energy installation, along with lighting and HVAC upgrades. In addition, 6,720 solar panels were installed at CMF that can generate an estimated 1 megawatt of power.

Funding has been secured including \$1.9 million for installation of photovoltaic (PV) panels as part of the new Division 13 bus maintenance facility project. Other programs, such as a feasibility study of a PV integrated structure to provide shading for buses, were completed for selected bus division yards.

#### KEY ACCOMPLISHMENT AREA 6: INCREASED LEED CERTIFIED FACILITIES

Metro continues to obtain LEED recognition for additional buildings within the current portfolio. In 2013, the inventory of LEED-rated buildings includes:

- > Gateway Headquarters—LEED-EBOM Gold
- > Division 3 Annex Building—LEED-New Construction (NC) Gold
- > Division 3 Maintenance Building Expansion—LEED-NC Certified
- > CMF Building 6 (Bauchet Street Warehouse)—LEED-NC Gold
- > Division 9 Transportation Building—LEED-NC Gold
- > El Monte Transit Center—LEED-NC Gold

Additionally, a process was initiated to pursue LEED-EBOM Certification at CMF and Divisions 10 and 7. LEED Neighborhood Development (ND) opportunities and Existing Buildings (EB) are currently being evaluated for Union Station and the Union Station Master Plan.



### KEY ACCOMPLISHMENT AREA 7: ENHANCED OUTREACH PROGRAMS AND AWARENESS EDUCATION

Metro recognizes the importance of knowledge sharing and awareness building with operational and maintenance staff to develop a more sustainable practice in the long term. These programs integrate sustainability into the day-to-day operations of the agency. As part of this effort, several rounds of energy and water conservation awareness and recycling training took place at various locations across Metro. Staff also participated in programs such as the Air Resources Board's (ARB) Low Carbon Fuel Standard (LCFS) program. Designated staff from Metro's ECSD were selected to assist division managers and teams on training, funding application, and program implementation for sustainability.

Other soft programs include the distribution of 2013 calendars to all staff agency-wide, with green facts about Metro and sustainability tips for the workplace and home. Supporting materials on EMS include recycling pocket guides, fact sheets, banners, etc., that were created to assist in employee training and communication. A new website was designed in 2013 to share information and materials on Metro's Green Construction Policy.

Metro also initiated a social sustainability outreach program in 2013 that focused on engaging the public; supporting community initiatives; ensuring the health and safety of public transportation customers and the broader community; recognizing the social impacts of projects and policies; and fostering socially responsible procurement. This initiative and relevant materials are also posted online in Metro's social media blog, *The Source*, which will continue to serve as a platform for information exchange and outreach. All of these initiatives form a strong outreach and awareness building program for the sustainability practice at Metro.



#### KEY ACCOMPLISHMENT AREA 8: ENHANCED WASTE MANAGEMENT PROGRAM

Metro continues to reinforce and expand its current waste management program to reduce its chemical, nonhazardous liquid, oil usage, and associated waste. Improvements to existing recycling programs and implementation of waste reduction targets will continue to reduce overall waste production and increase diversion rates. A new waste hauler was contracted by Metro in 2013, which allows for more detailed waste stream documentation to better assess Metro's waste production. Metro has implemented several internal programs to divert waste from landfills, focusing on products such as bus batteries, printer cartridges, scrap metal, e-waste, and other office products. In addition, specific recycling programs are being implemented in certain divisions based on their activities. Division 7, a bus maintenance division, recycles cardboard as well as non-ferrous and ferrous metal. Recycling efforts at CMF, where Metro buses are rebuilt, include re-using parts from failed buses that would otherwise be scrapped, and replacing shop equipment in fabrication shops that produces less waste material.

#### KEY ACCOMPLISHMENT AREA 9: PILOT SUSTAINABILITY DEMONSTRATION PROJECTS

Innovation and new technology breakthroughs continue to push for increased sustainability achievements. As a leader in sustainability among transportation agencies nationwide, Metro is proactively working with professionals and specialists to find opportunities for new pilot projects.

A new water conditioning system using Linear Kinetic Cell (LKC) technology is being tested at Divisions 5 and 18. The LKC system has proven to successfully generate one gallon of conditioned water using one gallon of tap water. Other water conditioning systems can use up to five gallons to create one gallon. This non-polluting system has effectively met the bus washing needs of these major divisions, while minimizing the environmental impacts and water consumption throughout the process. This again sets a new standard for Metro.



Additionally, Metro developed and tested a prototype sealed coolant recovery system for the safe storage of coolant drained from vehicles undergoing repairs. In June 2013, as a result of the successful pilot project, Metro established a capital project to purchase three sealed coolant recovery systems for each bus maintenance facility.

Associated with the EMS effort, Metro obtained an FTA grant to implement a Transit Climate Change Adaptation Pilot Program. The Pilot Program includes the development of a plan to integrate climate adaptation principles into Metro's EMS; track risks to infrastructure; develop metrics for measuring and assessing adaptation progress over time; and develop a plan to communicate these efforts internally and in the community. In 2013, to build on this effort, a Climate Vulnerability Assessment study was conducted to identify key assets vulnerable to extreme weather events and mitigation strategies.

Funded under a grant from the Alternative and Renewable Fuel and Vehicle Technology (ARFVT) Program managed by the California Energy Commission, Metro installed 20 Level 2 charge stations at five key Metro park-and-ride locations. These new charging stations have reduced about 8,500 kilograms of GHG emissions and 1,000 gallons of gasoline. The success of this pilot program has led to the planning of an additional 20 charging stations along the Orange Line BRT.



# DIVISION 9

## FACILITY PROFILE

**Maintenance Building:** 26,700 SF  
**Parking Structure:** 49,500 SF  
**Shops:** 55,000 SF  
**Total:** 131,000 SF



**Transportation staff:**  
Over 470



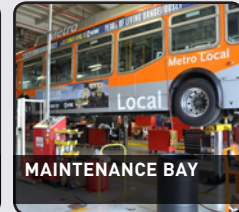
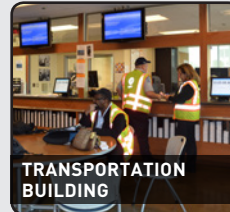
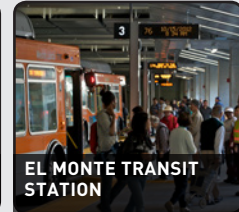
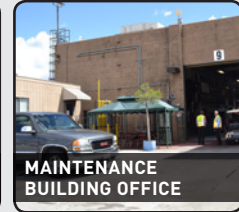
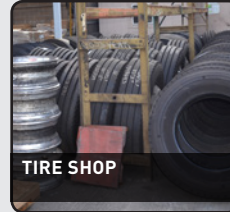
**Maintenance staff:**  
135



**Buses served:**  
257



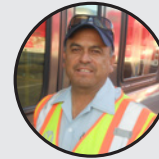
**Other on-site affiliated personnel:**  
Over 25



## ONE DAY AT DIVISION 9

### Meet Angel and Salim

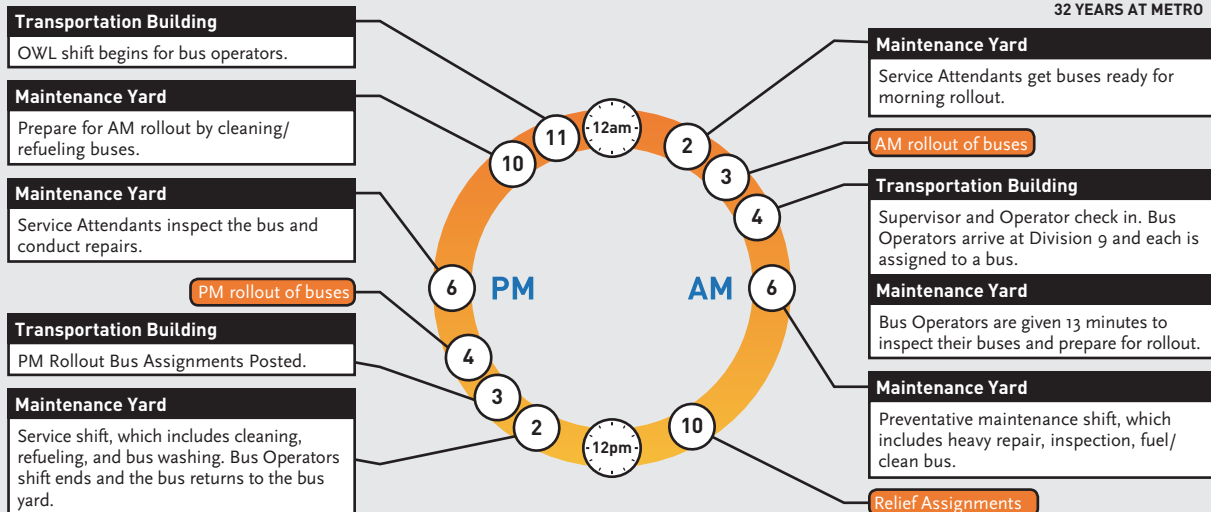
There are two main branches of Division 9: Transportation and Maintenance. The bus operators are assigned to Transportation, while mechanics and service attendants are part of Maintenance. A typical day at Division 9 involves the close coordination of personnel, equipment, and the bus fleet.



**Angel Ramirez**  
BUS OPERATOR  
6.5 YEARS AT METRO



**Salim Karim**  
SENIOR SERVICE ATTENDANT  
32 YEARS AT METRO

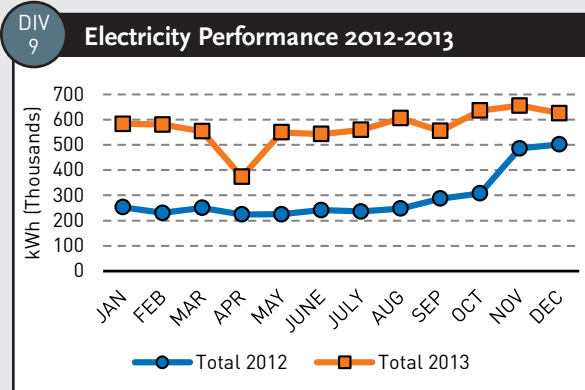
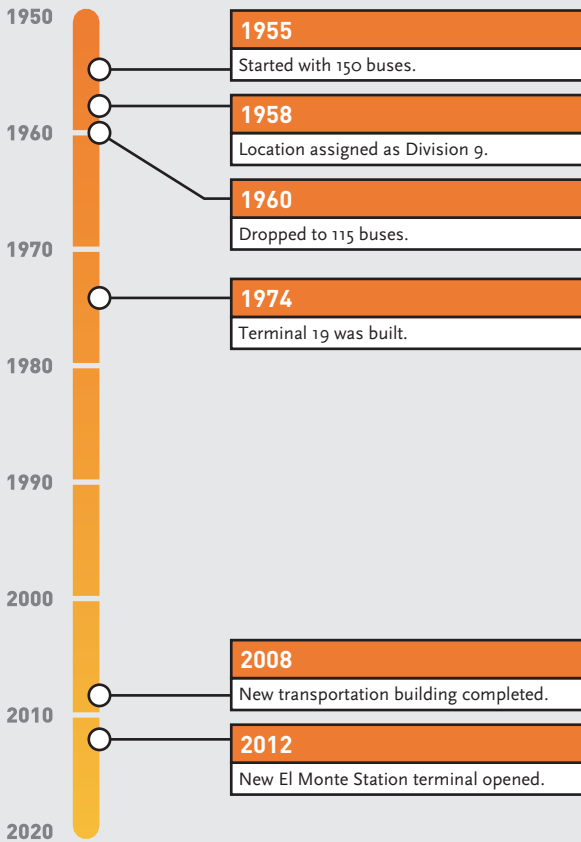


## PERFORMANCE OVER THE YEARS

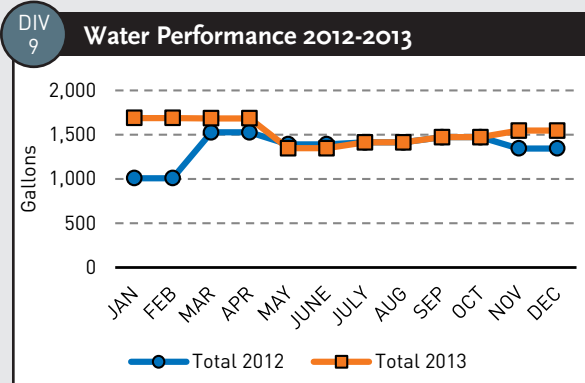
### Key Facts—Division 9

- > Metro's largest bus division
- > Most mileage at approximately 224,000 miles per week
- > Metro's most eastern division
- > Only division co-located with a transit station (El Monte Station)

### A Brief History



Electricity usage increased by 89% from 2012 to 2013, which can partly be attributed to the El Monte Station coming online in 2012 and the electrifying of the CNG compressors located on-site.



The water consumption trend for 2013 is generally consistent with 2012; however, there is an overall increase of 12% based on a lower consumption in the beginning of 2012. This may be attributed to the new El Monte Station opening in 2012. Division 9 implements a number of water conservancy efforts, such as using recycled water in the bus wash.

## EMS HIGHLIGHTS

### Lighting Retrofit



A lighting retrofit was initiated at Division 9 to improve energy efficiency. LED lights replaced older high-pressure sodium lighting in the maintenance bays. An energy assessment is currently underway.

A lighting retrofit was initiated at Division 9 to improve energy efficiency. LED lights replaced older high-pressure sodium lighting in the maintenance bays. An energy assessment is currently underway.

### Water Recycling System



Division 9 was selected as the location to demonstrate the viability of incorporating a water recycling system into its daily operation. A new water recycling system is being installed in the Division 9 Steam Bay to decrease potable water use and reduce wastewater contaminants, which will reduce the amount paid in discharge fees.

Division 9 was selected as the location to demonstrate the viability of incorporating a water recycling system into its daily operation.

A new water recycling system is





# HOW DID WE DO?

Metro's environmental performance throughout 2013 is assessed by our performance in each indicator area. This analysis provides Metro the data to track progress from year to year, as well as to set new targets, establish strategies, and recommend goals for future years. Each indicator section presents accomplishments achieved in 2013 followed by general indicator information. Annual performance data are also described and presented graphically. Finally, next steps are provided for future implementation.

INDICATOR AREA

# VEHICLE MILES TRAVELED PER CAPITA

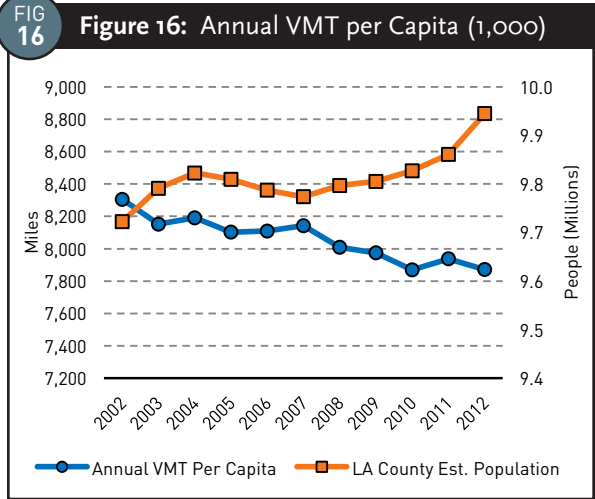




**OVERALL PERFORMANCE** ▼

According to the State Department of Finance’s adjusted annual population estimate, the total population of Los Angeles County increased 2.3% between 2002 and 2012, from 9.72 million to 9.94 million. According to the Highway Performance Monitoring System (HPMS) California Public Road Data, 221.2 million vehicle miles were traveled daily in 2002 within Los Angeles County, which decreased to 214.5 million in 2012.<sup>1</sup> This constitutes a 3% decrease in VMT compared to a 2.3% total population growth over the past 10 years. The VMT per 1,000 capita decreased from its ten-year-peak of 8,304 in 2002 to 7,872 in 2012 (**Figure 16**).

VMT has been on a downward trend since 2007, despite the increasing population. This reduction in VMT per capita is attributable to a number of factors, including Metro’s increased focus on improving transit service efficiency and convenience. The expansion of transit services provides increased opportunities for mobility and accessibility for the general public, while also providing alternative transit options for single-occupant vehicle drivers.



1. 2013 data are currently unavailable.



## PLUG-IN ELECTRIC VEHICLE (PEV) CHARGE STATION PILOT PROGRAM

### CHALLENGE

The PEV Charge Station Pilot Program had two challenges: 1) to increase Metro ridership by introducing electric vehicle charge stations at Metro park-and-ride lots; and 2) to implement first-and-last mile solutions for accessing Metro's transit system by enabling electric vehicle drivers to park and charge at these lots, while utilizing transit to commute to destinations within the city core. By providing public charge stations at end-of-the-line stations, Metro reduces downtown congestion, reduces GHG emissions in the region, and also promotes alternative fuel transportation solutions.

### ACTION

In May of 2013, 20 Level 2 charge stations were installed at five Metro park-and-ride locations, based on passenger traffic, location, and feasibility for charge station installation: Union Station, Willow Station, Universal City Station, El Segundo Station, and Sierra Madre Villa Station. After establishing an account online ([www.metro.net/ev](http://www.metro.net/ev)) and purchasing charge credits, electric vehicle drivers were issued a key fob for using at the charge stations. In turn, the charge stations provided tracking and usage data, such as total connected time, total charging time, charge station utilization, number of unique users, and total energy consumed. Additionally, an online electric vehicle customer survey was issued to users to assess whether drivers were using transit after plugging in their vehicles. This pilot program was funded under a grant from the ARFVT Program via the California Energy Commission.

### OUTCOME

Of the 359 people who signed up for the program, 248 people purchased charge credits to activate charging, and 122 people used at least one charge station during the six-month pilot program period from May to October 2013. The pilot program measured over 1,200 charge sessions with an average of 0.33 charge session per charge station per day. These charge sessions saved approximately 8,500 kilograms

of GHGs and 1,000 gallons of gasoline. From the customer survey, about 80% of respondents stated that the charge stations increased their likelihood of using Metro by at least a moderate extent. This pilot program's success has led to the planning of an additional 20 charge stations at other Metro rail park-and-ride locations and along the Orange Line BRT.





INDICATOR AREA

# UNLINKED PASSENGER TRIPS

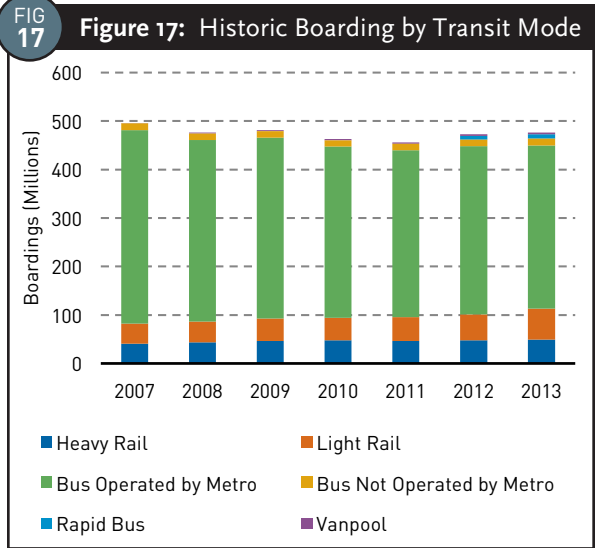




**OVERALL PERFORMANCE** ▼

In 2013, Metro continued to expand its service to the greater Los Angeles region. The overall ridership increased 1% compared to 2012, to approximately 476 million boardings. This constitutes a third straight year of consistent increase in ridership since 2011. The largest increase in ridership can be seen in light rail and bus rapid transit, each of which experienced an increase of over 15% from 2012. Metro-operated bus service is the only transit mode that has seen a reduction in ridership of 3% (Figure 17). This slight decline may also be directly correlated to the increase in rail ridership.

The trend for VRH shows an increase of 3% from 2012. This constitutes the first increase in VRH in the last three years. The most significant increase in revenue hours occurred in light rail service and BRT

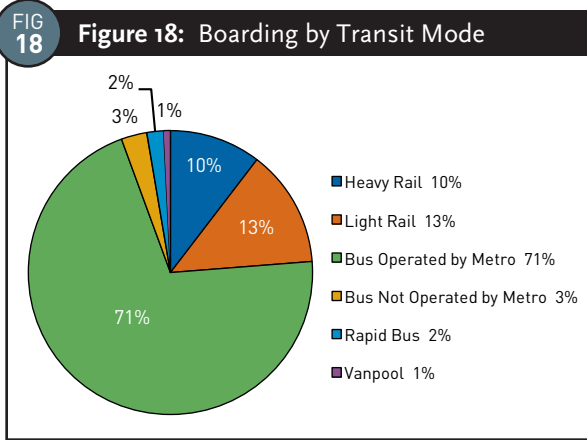


services, with increases of over 20% as compared to 2012. The trend for VRH has generally followed the ridership trend, so this increase is consistent with the increase in ridership.

**TAB 2** Table 2: Historic Boarding by Transit Mode

	2007	2008	2009	2010	2011	2012	2013
Heavy Rail	40M	44M	47M	48M	46M	48M	50M
Light Rail	41M	43M	46M	46M	49M	54M	64M
Bus Operated by Metro	399M	374M	373M	353M	344M	346M	336M
Bus Not Operated by Metro	14M	13M	13M	13M	13M	14M	14M
Rapid Bus	-	-	-	-	-	8M	9M
Vanpool	.2M	2M	2M	3M	3M	3M	4M

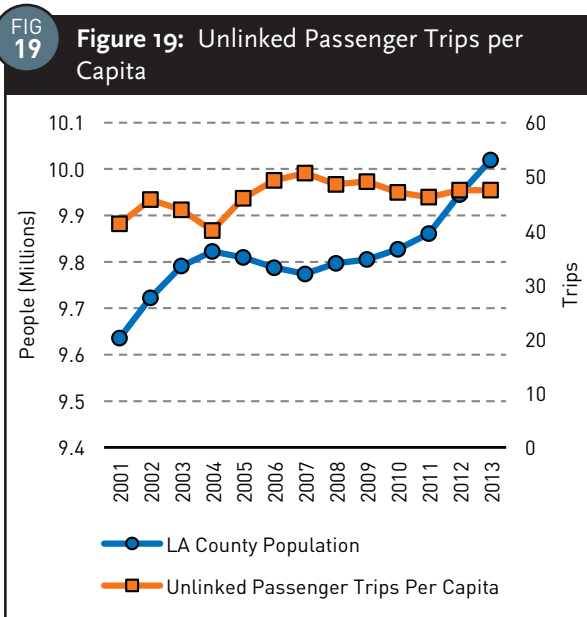
M = Million Boardings



**TRANSIT MODE**

Bus service remains the dominant transit mode among Los Angeles County’s transit rider population, with 74% of transit trips occurring by bus in 2013 (**Figure 18**). Heavy rail and light rail combined account for 23% of total transit trips.

Vanpool service experienced an 8% increase in ridership, which equates to an annual growth of approximately 10% over the last five years. With 18%, light rail became the transit service with the fastest-growing ridership in 2013. This trend aligns with Metro’s commitment to expand and enhance services by adding 12 additional mass transit projects over the next decade.



**UNLINKED PASSENGER TRIPS PER CAPITA**

Historically, data for unlinked passenger trips per capita show that ridership increased rapidly despite the decrease in regional population between 2005 and 2007. The ridership per capita kept steady at 46-48 trips per capita in the last four years, despite the 1% population growth pace (**Figure 19**).

## CASE STUDY

FARMERS MARKETS  
NEAR RAIL STOPS

## CHALLENGE

The motivation behind Metro's farmers markets is the desire to expand access to healthy foods along Metro's transit systems. A lack of fresh, healthy food has become a pressing national issue. According to the California Center for Public Health Advocacy, Los Angeles is particularly vulnerable to limited healthy food access as "there are [over four] times as many fast-food restaurants and convenience stores as supermarkets and produce vendors." Specifically, according to Community Health Councils, South Los Angeles suffers from a lack of access to fresh food, where fast-food restaurants make up more than two-thirds of the restaurants. With obesity affecting 35% of adults and 29% of children nationwide, Metro recognizes that it can provide an additional service to its transit riders by offering easy access to more fresh food options.

## ACTION

Metro discerned that the areas around the Blue Line suffer from low access to fresh food; therefore, this project evaluated the Blue Line stations as an opportunity to provide fresh food access. Metro conducted some background research on the existing Southeastern Pennsylvania Transit Authority's farmers market model and extrapolated useful information for application to its own model within its service area. Metro conducted preliminary research on existing fresh food resources for the areas along the Blue Line and farmers markets in Los Angeles County, which included gathering components of successful farmers markets; researching possible organizations for partnerships; and looking at the feasibility of hosting a farmers market at each site.

## OUTCOME

The Blue Line Farmers Market, located in the MLK Transit Center off of the Compton Station, is currently up and running due to partnering with the Mayor of Compton, Mayor Aja Brown, and the Compton City Council. According to the United States Department of Agriculture, the City of Compton meets the criteria of a 'Food Desert' since more than 15% of its residents are located 1.5 miles or more (urban or rural) from

the nearest grocery store. The Blue Line Farmers Market not only provides healthy food options for residents of the Compton community, but the market is also accessible to the over 90,000 daily Metro Blue Line riders. Metro is looking to expand and open more markets along the Blue and Red Lines.

INDICATOR AREA

# OPERATING EXPENSES



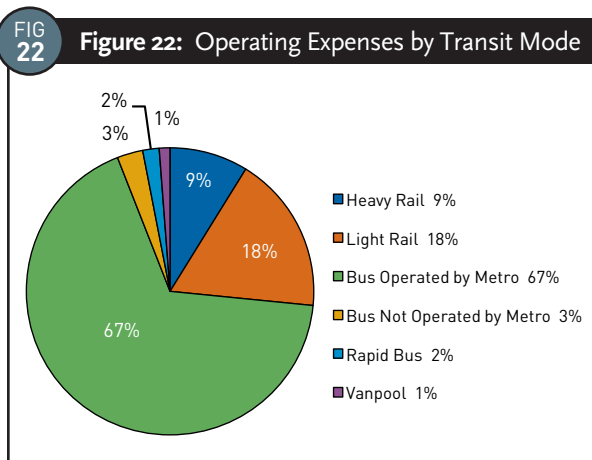
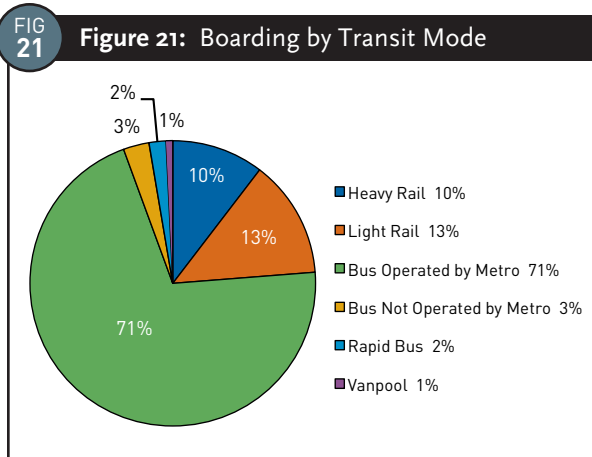
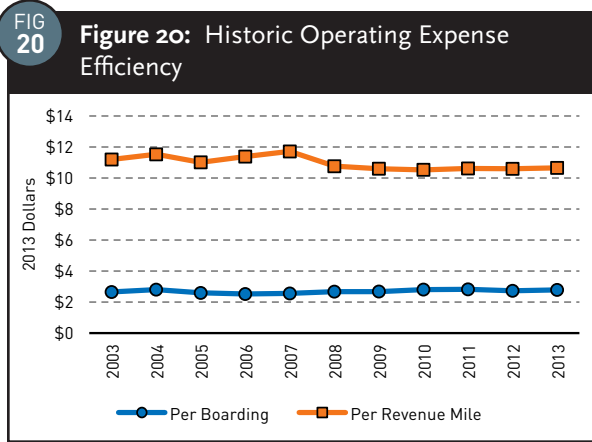
As one of the largest transportation agencies in the country, Metro is committed to deliver on the promise of providing a high-quality public transportation system to the residents of Los Angeles County. There are approximately 10 million residents in Los Angeles County today, and it is expected to grow by another 750,000 by 2024. To meet the demand of a growing community, Metro continues with ambitious transportation improvement programs while aiming for higher efficiency and minimizing environmental impacts associated with increases in boarding and passenger miles.

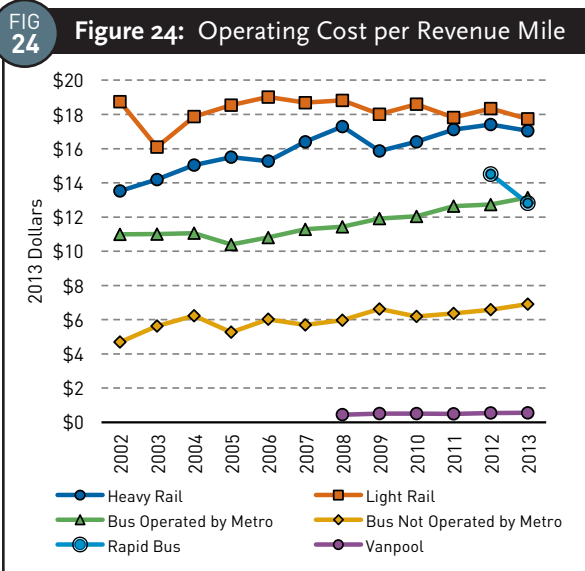
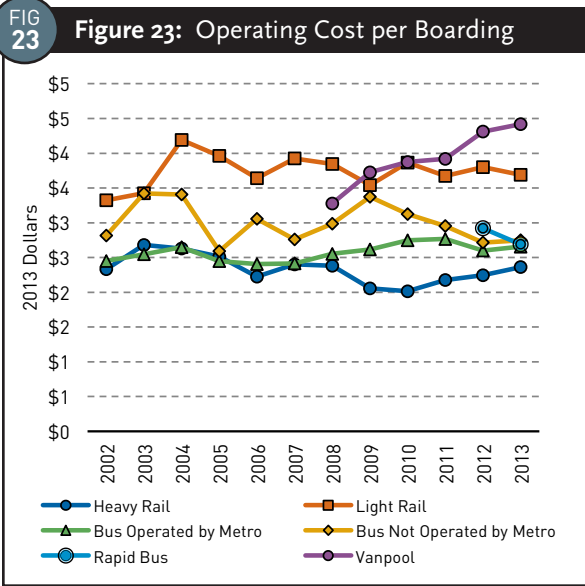
As a key component of the sustainability triple bottom line (economic, environmental, and social), operating expenses and efficiency are important indicators that reflect the agency's economic sustainability goals. This section analyzes the trend of Metro's overall operating costs and efficiency for each transit mode in 2013 when compared to previous years.

**OVERALL PERFORMANCE** ▼

Overall boarding and PMT for all transit modes have increased 4.5% and 5.3% since 2011, respectively. In 2013, Metro's operating expenses were approximately \$2.78 per boarding, which represents a 2.1% increase (6 cents) from 2012 after adjusting for inflation (**Figure 20**). Operating expenses per revenue mile have improved since 2007 and remained at approximately \$10.60 per mile over the last 5 years. Overall trends for both operating expense per boarding and per revenue mile have remained steady in recent years with less than 5% fluctuation.

Over 67% of Metro's operating expenses were spent on bus service, which accounts for 71% of total Metro ridership in 2012 (**Figure 21** and **Figure 22**). In 2012, a new category was added for Metro-operated BRT, which constitutes approximately 2% of the overall boarding and operating expenses. Light rail continues to be the only transit mode whose portion of ridership contribution is less than its portion of operating expenses. This may be attributed to the opening of the Expo Line in 2012, which requires time to build up ridership to its designed level of use.





**OVERALL BOARDING AND PASSENGER MILES TRAVELED FOR ALL TRANSIT MODES HAVE INCREASED 4.5% AND 5.3%, RESPECTIVELY.**

**Bus Service**

In 2013, Metro-operated bus service cost approximately \$2.66 per boarding, which is 6 cents more than the cost in 2012 but 9 cents less than the cost in 2010 (Figure 23). In 2013, bus service not operated by Metro cost \$2.75 per boarding. Although higher than the cost of Metro-operated bus service, it has seen an increase of 12% in operating cost efficiency per boarding since 2010. Overall, Metro continued to experience an increase in operating cost efficiency per boarding due to a reduction in operating expenses for bus service.

However, in terms of operating cost per revenue mile, it cost 41 cents more per mile to operate the bus system as compared to 2012 (Figure 24). This upward trend has been consistent since 2005, which can be attributed to Metro’s continuing expansion of its bus service, such as the Orange Line Extension, that outpaces the increase in ridership.

**Light Rail**

Operating expenses per boarding for light rail have reduced to \$3.69 in 2013 compared to \$3.80 in 2012 (Figure 23). This 3% improvement in efficiency has reversed the upward change in operating cost shown in 2012, which can be attributed to more effective management programs and less resource consumption. In terms of revenue miles, the operating cost to provide light rail services was approximately \$17.74 in 2013, which is also a 3% improvement in efficiency when compared to 2012 (Figure 24).

**Heavy Rail**

Operating expenses per boarding continued to fluctuate around \$2.20, while experiencing a slight increase of 3.5% each year over the past five years. It cost approximately \$2.36 per boarding in 2013 (Figure 23), which is an increase from \$2.25 per boarding in 2012. In terms of revenue miles, operating costs have shown a 2% reduction for the first time in five years at \$17.04 per revenue mile in 2013 (Figure 24). This notable improvement in operating efficiency may be attributed to improved heavy rail operational systems and reduced resource consumption costs.

**Rapid Bus**

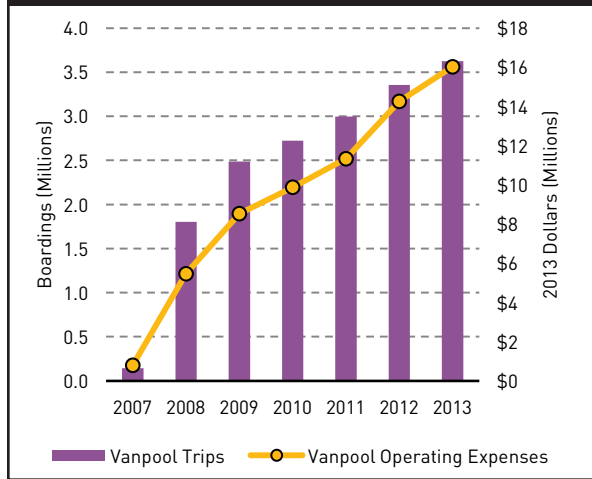
As a new transit category item for 2012, Metro-operated rapid bus constitutes approximately 2% of overall boarding and expenses. In general, the operating cost efficiency for rapid bus is comparable to the overall bus service provided by Metro. In 2013, operating expenses per boarding decreased by 8% compared to 2012, leading to an increase in efficiency (Figure 23). Similarly, operating expense per revenue miles decreased by 11% compared to 2013, leading to an increase in efficiency (Figure 24). This improvement in efficiency could be attributed to the process of reporting on a new transit service and would need to be validated over a longer period of time.

**Vanpool**

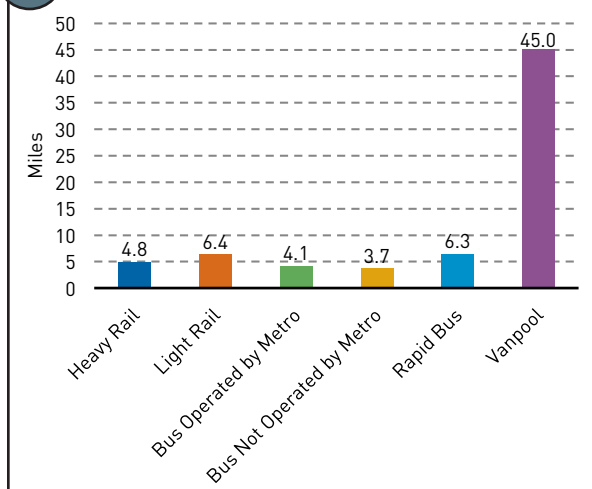
The vanpool operating data continue to validate that vanpool services are an effective transit mode for serving a longer distance radius, especially for areas that are underserved by more conventional transit modes. Metro started its vanpool services in 2007 and, after the initial setup period, the operating cost per boarding has steadily increased (Figure 25). In 2013, it cost \$4.42 per boarding for the vanpool, which is 66% higher than Metro’s bus service and 20% more expensive than Metro’s light rail service. However, when capturing PMT, vanpool becomes a much more effective means of travel. In 2013, PMT for vanpool was 45 miles compared to other transit modes that range from 3.7 miles per trip (Figure 26).

Therefore, operating expenses for PMT show that the vanpool program is a significantly cheaper option (10 cents per PMT) than other transit modes (Figure 27). As a sustainable travel option compared to single-occupant vehicles, the vanpool program plays a key role in reducing traffic and associated GHG emissions.

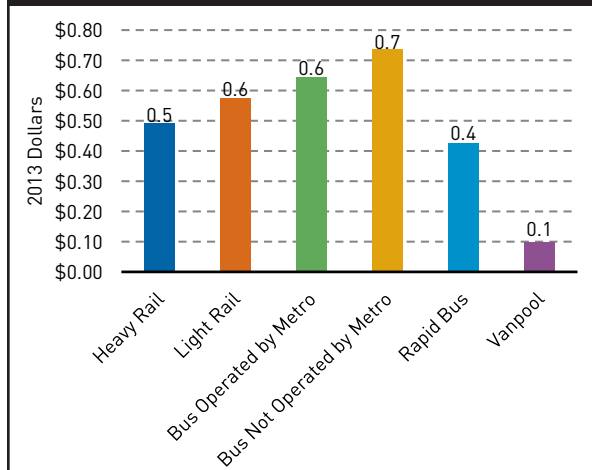
**FIG 25** Figure 25: Vanpool Ridership and Operating Expenses



**FIG 26** Figure 26: Passenger Miles Traveled per Trip



**FIG 27** Figure 27: Operating Expenses per Passenger Miles Traveled by Mode





INDICATOR AREA

# WATER USE



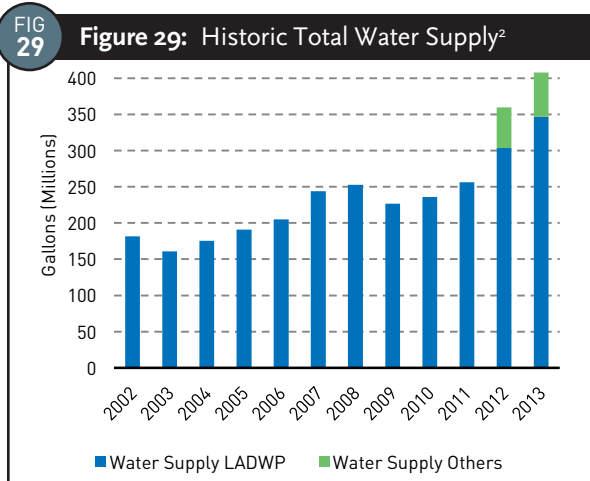
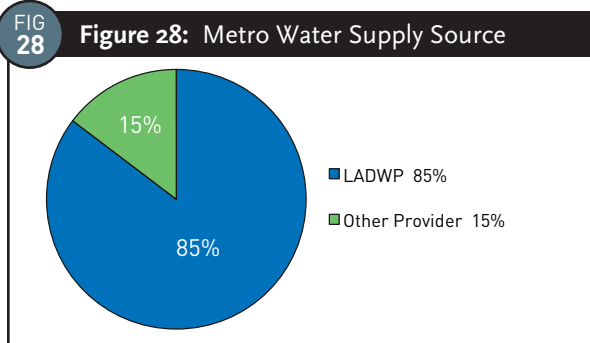
## DATA AND ANALYSIS

One of the key elements of Metro's MSIP is to reduce water consumption and improve efficiency while meeting the growing transit needs of the local residents. The increase in consumption is inherent in Metro's growing operation as new extension lines, service programs, and fleets are added to the Metro portfolio, all of which can increase water usage. Metro has conducted various studies such as Metro's Water Action Plan to identify effective water conservation strategies.

In 2013, Metro operations expended over 407 million gallons of water, an increase of 13.3% from 2012. Daily water use includes bus and rail car washing, maintenance operations, daily water use by employees, and facility landscape irrigation. Similar to previous years, 85% of the water consumed by Metro was provided by LADWP,<sup>1</sup> with the remaining 15% supplied by PWP, California Water Services, Park Water Company, Golden State Water Company, and other municipal providers (**Figure 28**).

It is worth noting that 2013 is the second year that other providers (in addition to LADWP) were included and analyzed. Compared to 2012, total LADWP supply increased by 14%, which is a reduced amount compared to the changes from 2011 to 2012 (18%). Other providers combined also showed an 8% increase in water supply in 2013 (**Figure 29**). The increase in demand may be attributed to an increase in Metro's services (boarding and passenger revenue miles), fleet number, construction-related activities, and recently extended lines.

## THE INCREASE IN CONSUMPTION IS INHERENT IN METRO'S GROWING OPERATIONS AND SERVICES.

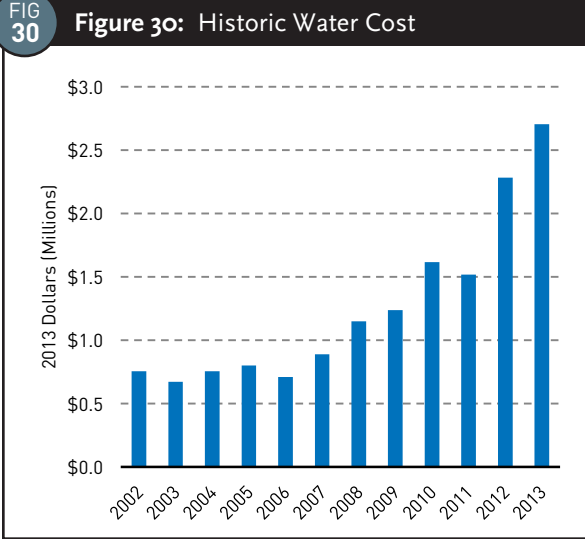


## ACCOMPLISHMENTS

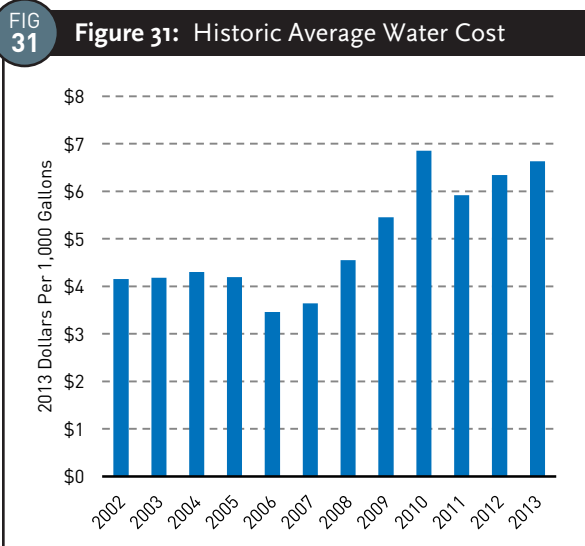
- > Developed and conducted Energy and Water Conservation Awareness and Recycling training at four Metro locations.
- > Pursued formal case closure from the Regional Water Quality Control Board for Metro's Divisions 10 and 18, resulting in closure award and formal abandonment of monitoring wells.
- > Managed implementation of the agency's Stormwater Management Plan at all bus and rail divisions.
- > Completed a Low Impact Development Study, with a case study examining Metro's Division 4, to evaluate opportunities and strategies to reduce runoff and enhance groundwater supply.
- > Analyzed water reduction opportunities using LKC technology to reduce water consumption and cost savings; recommended for Divisions 5 and 18.

1. At the time of publication, LADWP data were not available for the months of September through December for calendar year 2013. The data for these four months were estimated based on the methodology described in the *Reporting Methodology* section of this report.

2. Beginning in 2012, water consumption data included LADWP and the category Other Providers. The other providers included PWP, California Water Services, Park Water Company, Golden State Water Company, and other municipal providers.



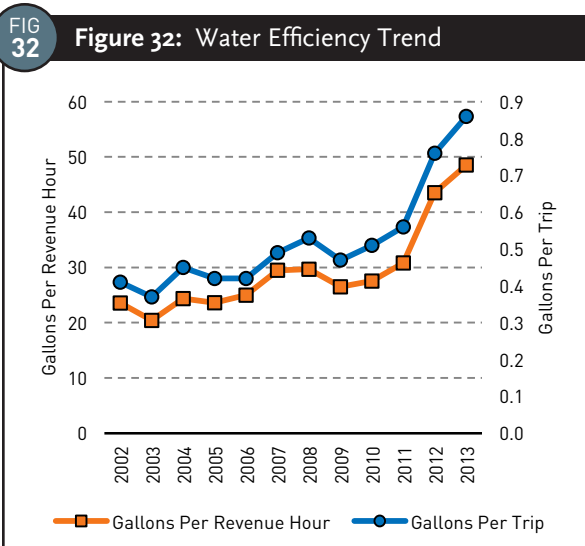
Because of the increase in water use, the associated water costs increased by approximately 19% from \$2.25 million in 2012 to \$2.70 million in 2013, after adjustment for inflation (**Figure 30**). In terms of average water unit cost, there was a 29 cents per 1,000 gallons increase for total water consumed in 2013 compared to the previous year, which represents a rate increase of 4.6%. This is a slight reduction compared to the 7% increase in average cost from 2011 to 2012 (**Figure 31**). It is also worth noting that starting in 2013, sewer costs were separated out from the overall water bills for 2012 and 2013 to increase the accuracy of reporting.



Overall, water consumption experienced an increase that outpaced transit service growth, which led to a decrease in water efficiency in 2013. Water efficiency in 2013 was 48 gallons per revenue hour, compared to 43 gallons per revenue hour in 2012 (**Figure 32**). However, there was a slowdown in the rate from 41% to 11% between 2012 and 2013 when compared with the previous year. This trend can be attributed to the various programs being implemented to promote water savings, sustainable practices, and management improvement.

**MAJOR FACILITIES**

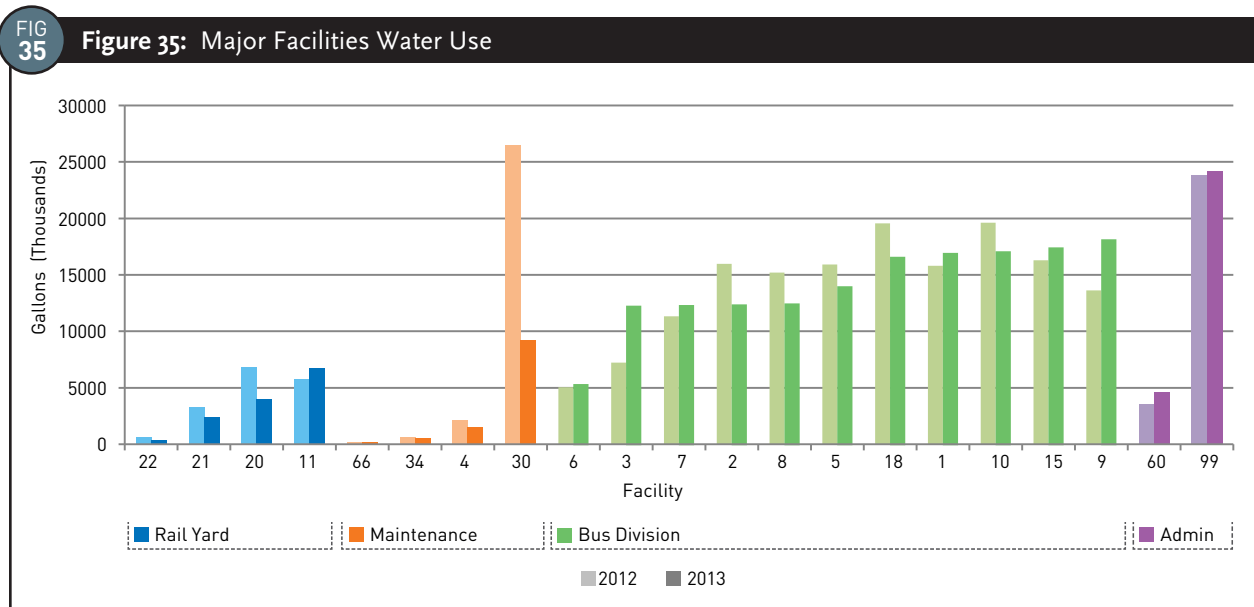
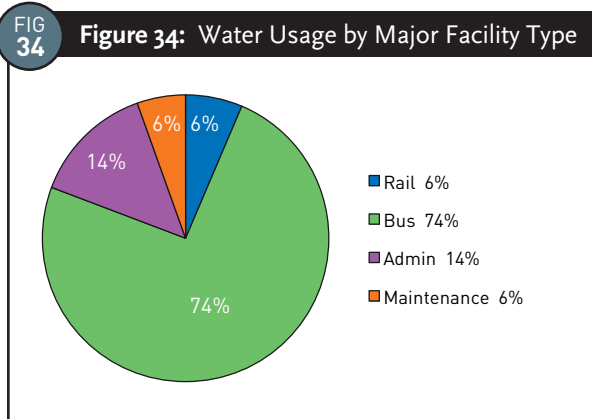
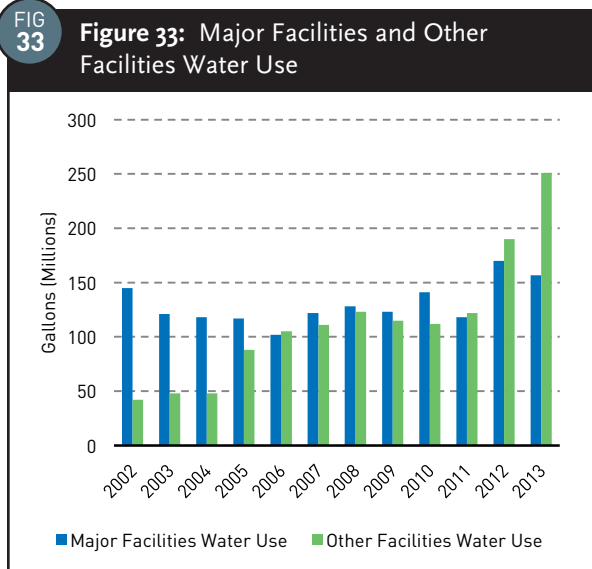
Metro’s major facilities account for approximately 38% of Metro’s overall water footprint in 2013. Annual water consumption for major facilities in 2013 was approximately 157 million gallons of water, of which 114 million gallons were provided by LADWP (73%) and 42 million provided by other providers (27%).

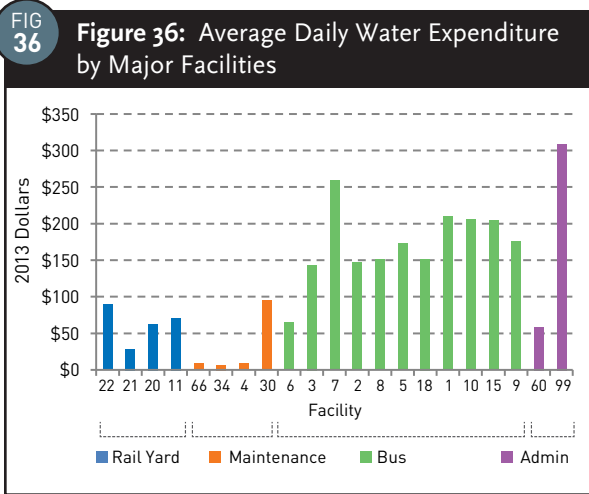


In 2013, the major facilities consumed 14.4 million gallons less than 2012, which represents a 9% improvement in water conservation (**Figure 33**). This accomplishment may be attributed to the proactive conservation programs and strategies implemented at several key major divisions. These include developing and conducting water conservation awareness and recycling training at key Metro locations; analyzing water reduction opportunities using new technology to reduce water consumption and cost savings; and recycling water at the bus washers. Divisions 5 and 18 consumed 5% and 15% less water, respectively, compared to 2012. Both are due to timely monitoring and repair of water leakages on-site.

In general, Metro has four types of major facilities based on functionality and operations: rail yards, bus divisions, other maintenance, and administrative buildings. On average, the bus division facilities (11 locations) consume 74% of the overall water usage, which is more than rail (6%), maintenance (6%), and administrative buildings (14%) (Figure 34). This primarily reflects the bus washing needs for Metro, which has one of the largest bus fleets in the nation.

Comparatively, Metro's Gateway Headquarters continues to be one of the major water consumers, mainly due to the function and nature of the office-based building. Several key facilities have effectively reduced their consumption, with the top three decreases occurring at CMF, Divisions 20, and 21, mainly due to the implementation of key effective measures and programs at bus divisions in 2013 (Figure 35). CMF experienced a significant water reduction; however, further investigation into the water meters for Buildings 1, 3, 4, and 5 is necessary since they were replaced by LADWP in 2013 and there may be incorrect readings. The increases in water consumption at Divisions 3, 9, and 60 may be due to construction-related work on-site. The slight increases in water consumption at Divisions 6 and 7 can be attributed to the increases in fleet size in 2013 at 14% and 8%, respectively.





In terms of expenditures, the 2013 trend was consistent with 2012. Most of the major facilities are served by LADWP and have the same service charge rates. Average daily water costs of these major facilities reflect their daily water usage (Figure 36).

**CHANGE ANALYSIS**

An operational change that contributed to a significant increase in Metro’s overall water usage was the opening of the Expo Line on April 28, 2012, which continued to impact resource consumption in 2013. In addition, boarding and revenue miles both increased in 2013, reflecting Metro’s continuing expansion of its services to meet the growing transit demand.

**NEXT STEPS**

- > Implement a capital improvement project to reduce water use at CMF by retrofitting the air scrubber in the Paint Shop.
- > Install recycled water lines along a portion of the Orange Line.
- > Build permanent canopies over scrap bins at CMF to eliminate potential for stormwater runoff.

## LINEAR KINETIC CELL WATER CONDITIONING SYSTEM PROJECT



### CHALLENGE

A large portion of Metro's water consumption comes from the bus washes at Metro's various locations that provide service to approximately 2,200 buses. Reducing water consumption at Metro's bus wash facilities while still maintaining the same level of cleanliness of the buses is the challenge at hand. Innovative strategies that conserve water use from these activities lessen Metro's water demand and impact.

### ACTION

Beginning in November 2011, Metro installed the first Linear Kinetic Cell (LKC) water conditioning system at Metro's Division 6 to replace an existing deionized (DI) water system. Unlike DI water systems, the LKC system does not require expensive filters and can provide a one-to-one water ratio, compared to the two-to-one ratio a DI water system provides. In December 2013, Metro began procuring new LKC systems to be installed at Division 18 and Division 5, which provide service to 270 and 170 buses every night, respectively. The LKC system contains a 2-inch copper pipe that is installed directly into the water line and plugs into a standard 120-volt circuit.

### OUTCOME

The LKC system has proven to work at a one-to-one water ratio, meaning it only takes one gallon of tap water to create one gallon of conditioned water. Other water conditioning systems can use up to five gallons of water to produce a single gallon. The LKC system is non-polluting as it requires no chemicals. The system will provide

continuous treatment because it operates automatically, 24/7. Metro will further evaluate when and where to install these LKC systems to reduce water consumption.



INDICATOR AREA

# ENERGY USE



# FUEL USE

## ACCOMPLISHMENTS

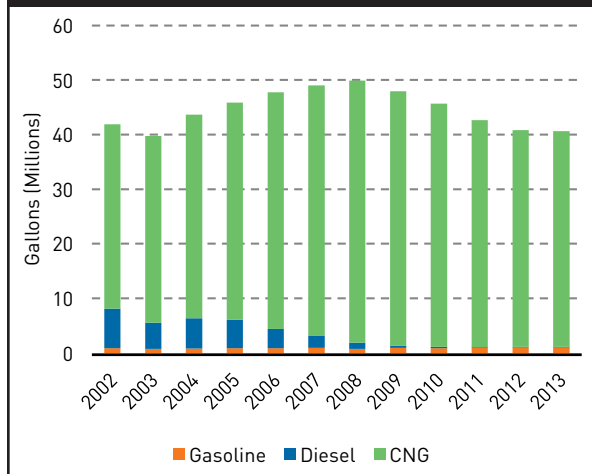
- > Participated in the California Air Resources Board's Low Carbon Fuel Standard program.
- > Identified energy cost saving opportunities associated with Metro's CNG compression operations.

## DATA AND ANALYSIS

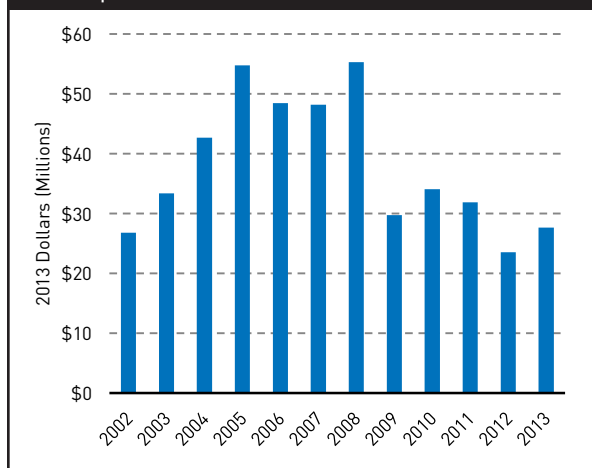
In 2013, Metro's bus fleet used 40.6 million GGEs of fuel, which is a slight decrease of 0.5% from 2012 (**Figure 37**). This decrease may be attributed to the reduced Metro-operated bus services, since the total revenue miles in 2013 from Metro's bus operations were reduced by 4% as compared to 2012, and the total boardings were reduced by 3%. CNG continues to be the primary fuel type used by Metro by accounting for more than 97% of total fuel used. This is due to Metro's transition to a 100% CNG-powered bus fleet for its directly operated bus services. However, the CNG consumption for Metro-operated bus services has been decreasing over the past five years, with a nearly 18% drop from its peak use in 2008. This may be attributed to Metro replacing and repowering CNG buses with the newest technology engines.

In 2013, fuel expenditures for Metro-operated bus services were \$27.6 million, which is a 17% increase from 2012 (**Figure 38**). This increase is due to the increase in CNG prices, which accounts for over 86% of total fuel expenditures. The average price that Metro paid for CNG was 50 cents per therm in 2013, which is a 25% increase from 2012 at 40 cents per therm. The prices in 2013 for diesel and gasoline experienced a 3% decrease from the previous year (**Figure 39**).

**FIG 37** Figure 37: Historic Fuel Consumption for Metro-Operated Bus Services



**FIG 38** Figure 38: Historic Fuel Cost for Metro-Operated Bus Services



**FIG 39** Figure 39: Historic Price of Fuel

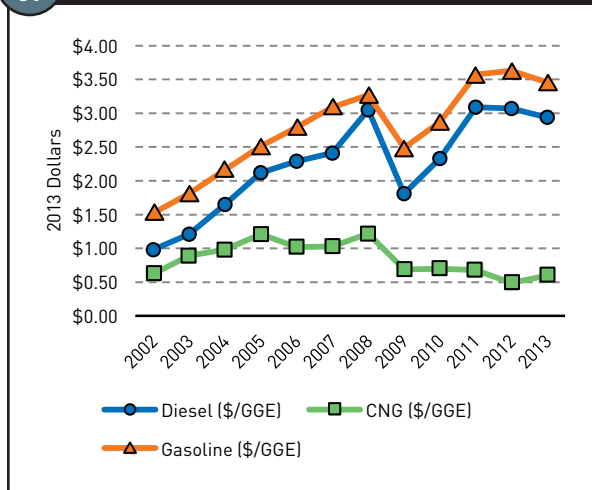
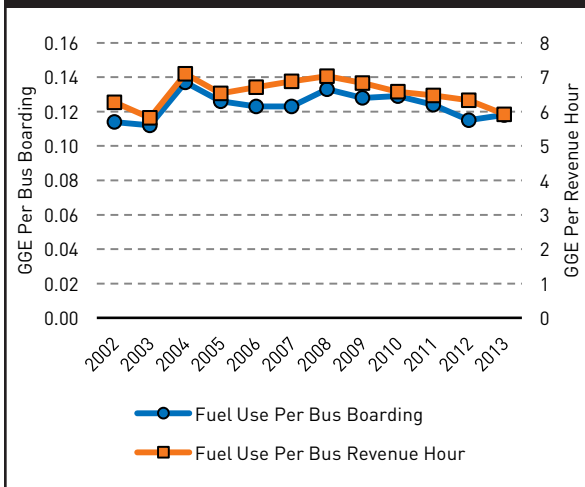






FIG 40

**Figure 40: Metro-Operated Bus Fuel Use Efficiency**

### NEXT STEPS

- > Continue to transition Metro's transit bus fleet to cleaner fuels and more modern technology.

The overall fuel use efficiency has slightly improved from 2012 by 7%, with GGE per revenue hour decreasing from 6.3 to 5.9 (Figure 40). The improvement on GGE per revenue hour has been seen over the past five years. The fuel use for Metro-operated bus boardings in 2013 increased slightly from the previous year at 2%. This may be attributed to Metro's various efforts to improve bus efficiency and higher mileage per gallon performance, such as replacing bus fleet batteries with absorbed glass mat (AGM) batteries to reduce fuel use.

In addition to Metro-operated bus services, buses operated by Metro contractors used an additional 1.5 million GGE of fuel in support of Metro's transit services in 2013. Unlike Metro's direct fleet, which is 100% CNG powered, 55% of the fuel consumption for Metro-contracted bus services is from diesel-powered buses, with the remaining 45% being CNG-powered buses. It is estimated that approximately \$2.7 million was spent by the contractors on fuel costs in 2013, with diesel accounting for 85% of the costs. In terms of efficiency, Metro-contracted bus services use less fuel per boarding, a 10% improvement compared to Metro-operated bus services.

# RAIL PROPULSION POWER

## OVERALL PERFORMANCE

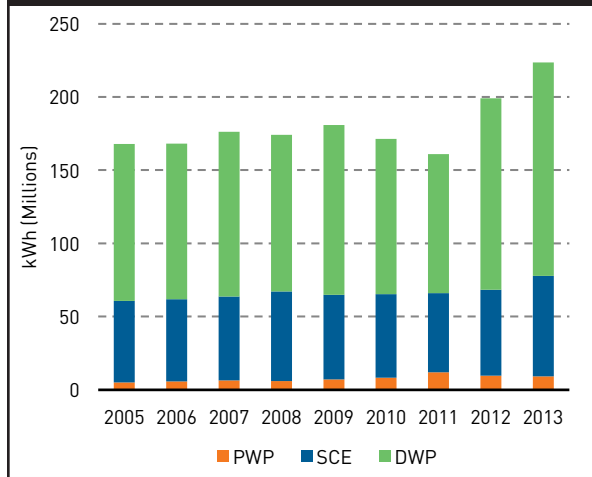
Overall, rail propulsion power consumed 223 million kWh in 2013, which is a 12% increase from 2012 (Figure 41). LADWP continues to be the major provider of rail propulsion power, accounting for 65% of total rail propulsion power. Similar to previous years, the Red Line was the largest consumer of rail propulsion power compared to other transit lines, at 43% of total consumed rail propulsion power.

This increase in rail propulsion power is directly tied to Metro's continuous expansion of rail services. From 2012 to 2013, the combined ridership of light rail and heavy rail increased by 11% to 113 million boardings. The total share of total transit ridership increased 3% from 2012. In terms of revenue hours, the rail service revenue hours jumped 21% from 2012, which aligns with Metro's increase in transit services.

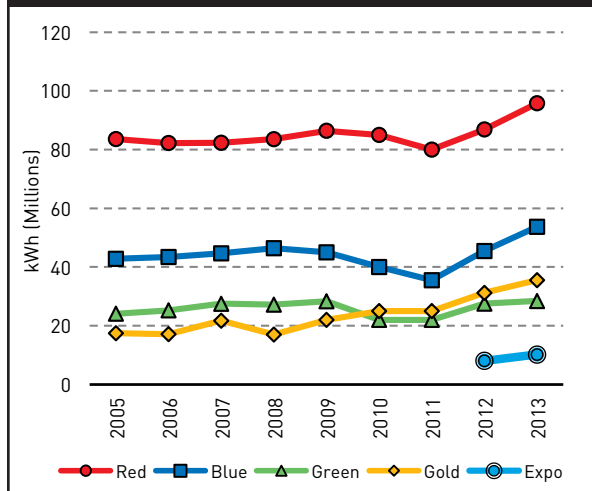
## DATA AND ANALYSIS

From 2011 to 2013, the Blue Line experienced the most rapid increase in electricity consumption, at an average of 15% (Figure 42). The new Expo Line experienced a 26% increase in electricity consumption from 2012 to 2013 due to the ramping up of its services. In 2013, the amount of rail propulsion power supplied from LADWP and Southern California Edison (SCE) increased, with SCE providing the most significant increase of 17% from 2012. However, the amount of rail propulsion power supplied from PWP decreased by 6% from 2012 to 2013.

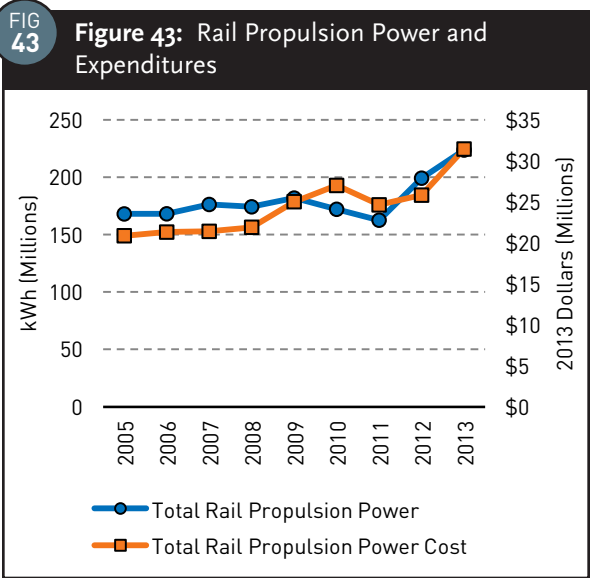
**FIG 41** Figure 41: Historic Rail Propulsion Power Use by Provider



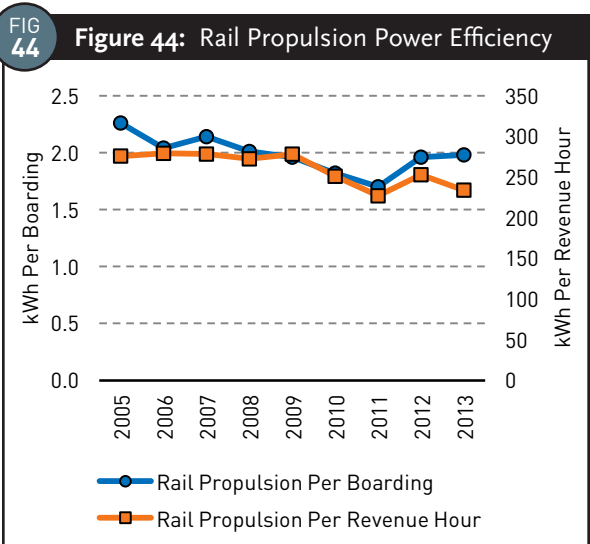
**FIG 42** Figure 42: Rail Propulsion Power Use by Rail Line



THIS INCREASE IN RAIL PROPULSION POWER IS DIRECTLY TIED TO METRO'S CONTINUOUS EXPANSION OF RAIL SERVICES.



In terms of expenditures, rail propulsion power increased approximately 22%, from \$25.8 million in 2012 to \$31 million in 2013 (**Figure 43**). This 22% increase in expenditure outpaced the increase in rail propulsion power, which indicates Metro’s rail propulsion power has gotten more expensive in 2013 compared to 2012.



Overall, the increase in consumption of rail propulsion power is mainly attributed to the expansion of Metro’s rail services. Since revenue hours per boarding increased 21% from 2012, the rail propulsion power usage per revenue hour reduced from 253 kWh per revenue hour to 233 kWh per revenue hour, which constitutes the most efficient performance in the last 10 years (**Figure 44**). In terms of ridership, the increase in rail propulsion power consumption correlates with the increase in rail ridership. With an 11% increase in passenger boardings in 2013, the rail propulsion power consumption per boarding remains consistent with 2012, increasing slightly from 1.96 kWh per boarding to 1.98 kWh per boarding.

## CASE STUDY

## DATA MANAGEMENT



## CHALLENGE

With a total of 20 active operating divisions and critical facilities, six active and expanding rail lines, two BRT lines, and approximately 2,200 buses spread throughout Los Angeles County, Metro is tasked with developing an approach to efficiently collect and analyze incoming sustainability-related data points. Metro's sustainability data come from a diverse set of agencies, and are reported in a variety of formats and time periods. As Metro continues to expand and improve its transportation network throughout Los Angeles County, it is becoming increasingly important to streamline the methods in which data are collected and analyzed.

## ACTION

To effectively analyze and display all of Metro's incoming data points, Metro has been exploring various innovative data management software packages. Taking advantage of cloud-based software tools, collected data will be able to be displayed in an efficient and accessible format. One component of Metro's overall data management platform is to utilize static and interactive geographic information system (GIS) tools to create visual stories of Metro's sustainability-related progress. This provides Metro with an analytical approach to further improve energy and resource use, as well as enhance environmental compliance in all of the agency's activities, while simultaneously packaging this information to enhance customer experience through the use of innovative technology.

## OUTCOME

Beginning in 2013, Metro began developing a cloud-based GIS portal through the use of ArcGIS online. This visual database encompasses the metrics discussed in Metro's annual Energy and Resource Report, utility information, climate change data, and other Los Angeles-related environmental data. In addition to Metro's GIS

platform, Metro is in the process of exploring the details of several document management software packages. Additional tools are being identified and will be implemented in conjunction with Metro's EMS program.

## FACILITY ELECTRICITY USE

### ACCOMPLISHMENTS

- > Developed and conducted Energy and Water Conservation Awareness and Recycling training at four Metro locations.
- > Completed energy opportunity assessments at Divisions 7 and 22; currently conducting energy opportunity assessments at Divisions 9 and 11.
- > Completed lighting retrofits at Division 22.
- > Completed sub-meter design plans for Divisions 8, 15, 20, and 22.
- > Implemented a LED lighting and automated dimming controls pilot program at Gateway Building and Division 7.
- > Installed the wayside energy storage substation (WESS) along Metro's Gold Line.
- > Implemented a renewable energy procurement plan.

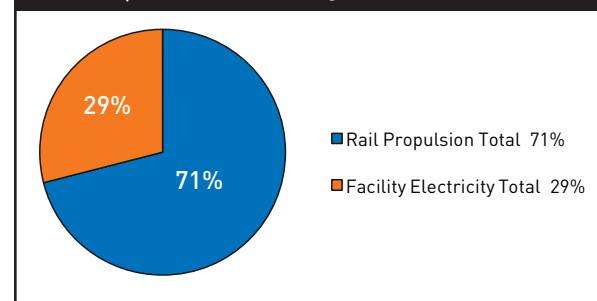
## COMPARED TO 2012, LESS ELECTRICITY WAS USED FOR METRO'S FACILITIES.

### OVERALL PERFORMANCE

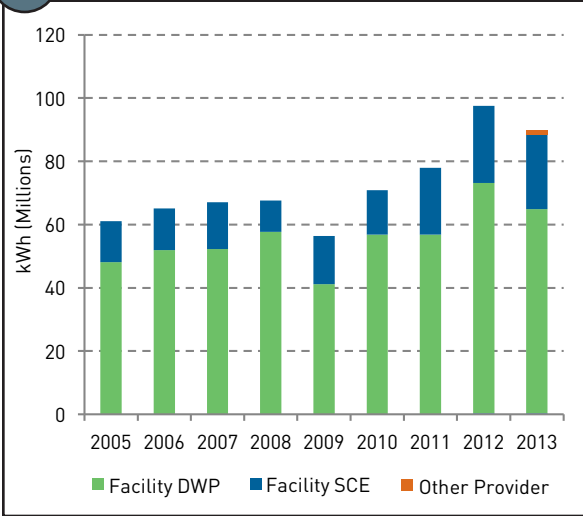
Electricity plays a major role in Metro's everyday operations. In 2013, Metro used 313 million kWh of electricity, which is a 5.7% increase from 2012. In 2013, 29% of electricity consumption was attributed to meeting facility energy demand and 71% was used for rail propulsion (**Figure 45**). Compared to 2012, less electricity was used for facilities, with 35% of electricity in 2012 being used for facilities and 65% for rail propulsion. This shift in the share of electricity used for facilities and the electricity used for rail propulsion from 2012 to 2013 may be the coupled result of increased rail usage as well as a variety of electricity conservation programs and measures that were implemented across Metro and at specific facilities. For example, over 6,700 solar panels were installed at CMF, and approximately 4,000 lighting fixtures were replaced with energy-efficient lighting.

FIG 45

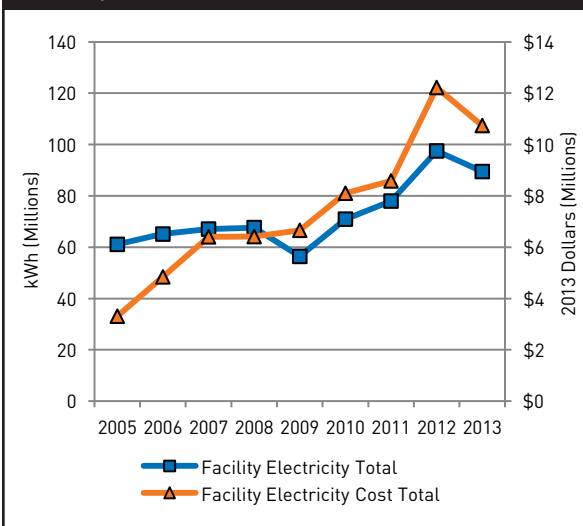
**Figure 45: Facility Electricity Use vs. Rail Propulsion Use in 2013**



**FIG 46** Figure 46: Facility Electricity Use by Provider



**FIG 47** Figure 47: Facility Electricity Use and Expenditures



**OVERALL ELECTRICITY EFFICIENCY HAS IMPROVED SINCE 2012.**

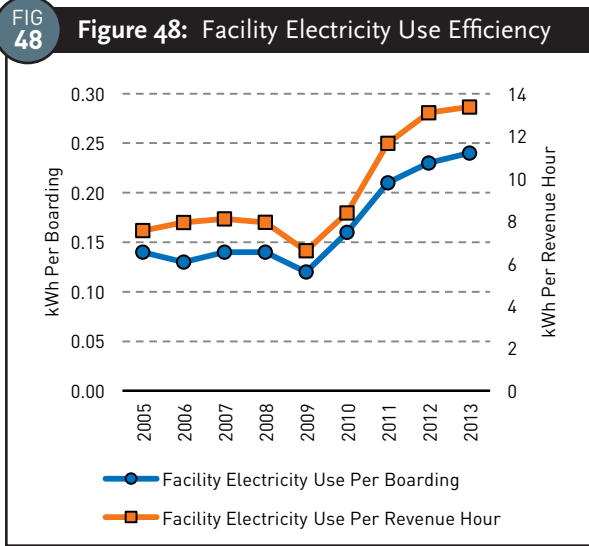
**DATA AND ANALYSIS**

Despite the increase of total electricity consumption, electricity use by Metro facilities decreased by 8%, from 97 million kWh in 2012 to 89 million kWh in 2013. This improvement may be attributed to the implementation of comprehensive energy efficiency upgrades including lighting and HVAC upgrades, and renewable energy installations at multiple bus and rail divisions. Metro is also conducting energy opportunity assessments at a number of divisions to better understand the sources of facility energy consumption so that appropriate energy conservation measures can be implemented. For example, a lighting retrofit occurred at Division 22 where old, inefficient light fixtures in the vehicle shop were replaced with energy-efficient fixtures, reducing energy use by 1.4 million kWh, saving approximately \$165,000 per year.

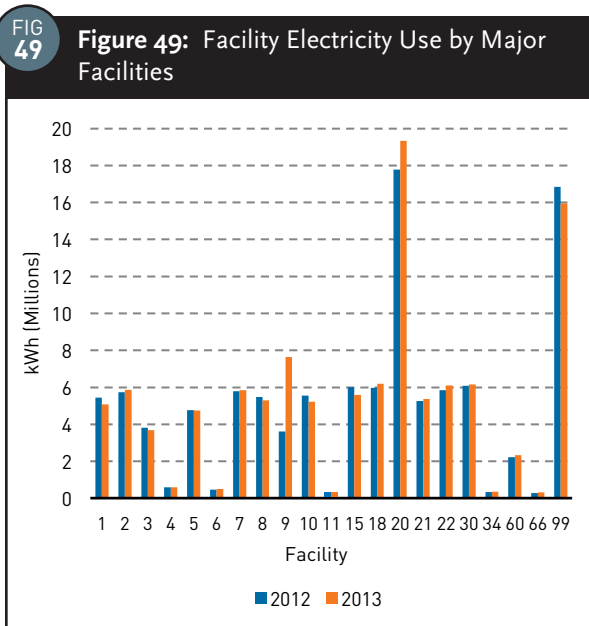
Electricity consumption increased between 2006 and 2008, dropped in 2009, and had an artificial rise in 2010 due to changes in how facility versus rail propulsion electricity was calculated. In 2011, Metro experienced a rise in electricity consumption due to the switch from diesel-powered compressors to electricity-driven CNG compressors at bus facilities.

There are three main electricity provider groups for Metro: LADWP, SCE, and other local electricity providers. LADWP continues to be the largest electricity provider for Metro’s facilities by delivering approximately 64.5 million kWh of electricity (72%)<sup>1</sup>, with SCE providing approximately 24.6 million kWh (27%) (Figure 46). In 2013, Metro spent \$10.7 million on electricity for all facilities, which is 10% less than in 2012 (Figure 47). Comparatively, electricity expenditures for facilities decreased more sharply than the decrease of electricity use, indicating that the overall average electricity cost per kWh use also decreased in 2013. It is worth noting that the two providers, LADWP and SCE, have different rates for rail propulsion versus facility electricity usage.

1. At the time of publication, LADWP data were not available for the months of September through December for 2013. The data for these four months were estimated based on the methodology described in the Reporting Methodology section of this report.



Overall, electricity efficiency has improved since 2012, due to a decrease in facility electricity use coupled with Metro experiencing a 0.8% increase in revenue hours and a 1.6% increase (3.6 million) in UPT in 2013. This is reflected in the reduction of electricity consumption per revenue hour from 11.8 kWh 10.6 kWh, as well as a reduction in consumption per boarding from 0.21 kWh to 0.19 kWh in 2013 (**Figure 48**).



Among the major facilities, Division 20, a major rail maintenance division, continues to be the highest consumer of electricity at over 19 million kWh in 2013, a 9% increase from 2012 (**Figure 49**). This is largely due to construction activity for new projects. The Gateway Building (Location 99) has the second highest annual electricity consumption at 15 million kWh, which is a 5% decrease from 2012; this may be attributed to the installation of LED lighting and automated dimming controls. The Gateway Building serves as Metro’s headquarters and consists mainly of office space for approximately 1,800 personnel.

Despite an overall decrease in facility electricity use, major facilities combined saw a slight increase of 4% in electricity consumption compared with 2012. The largest increase occurred at Division 9, which may be attributed to the electrifying of the CNG compressors as well as metering issues associated with the El Monte terminal station coming online in 2012. Divisions 1, 3, 8, 15, and the Gateway Building experienced a decrease in electricity use compared to 2012.

**NEXT STEPS**

- > Initiate LEED-EBOM Certification activities at Divisions 7 and CMF.
- > Initiate LEED-EBOM and LEED-ND for Union Station and the Union Station Master Plan.
- > Develop resiliency indicators to prepare Metro to withstand and continue to provide reliable service in light of potential climate change impacts.
- > Conduct a social vulnerability assessment for impacts of climate change on Metro ridership.
- > Initiate LEED-EBOM Certification at Divisions 9, 20, 21, and Union Station.
- > Conduct a lighting retrofit at Division 11.
- > Conduct sub-meter design and installations at Divisions 1, 4, 5, 6, 8, 9, 11, 15, 18, 21, and 22, as part of the LEED-EBOM Certification effort.
- > Conduct the Renewable Energy Inventory and identify which facilities will be appropriate for the installation of solar power.



## DIVISION 7 MAINTENANCE BAY LED LIGHTING PILOT



### CHALLENGE

With operations at the division-level occurring 24/7, it is an ongoing challenge to reduce energy consumption and maintenance associated with lighting, while also improving lighting uniformity at Metro bus maintenance facilities and ensuring a high-quality work environment for Metro employees. High bay high-intensity discharge lamps (HID lamps) used at Metro's bus maintenance facilities consume a great deal of energy and require lamp replacements about every two years.

### ACTION

Metro is in the process of testing a number of different lighting and control strategies at its Division 7 Bus Maintenance Bay in West Hollywood. Energy-efficient lighting technologies were piloted to replace the existing 1,000-watt metal halide fixtures. Metro is currently testing a 280-watt dimming LED fixture equipped with a daylight sensor to reduce energy consumption and provide for longer fixture life.

### OUTCOME

Metro is planning to move forward with employing the 280-watt energy-efficient LED fixture. Projected annual savings are over 300,000 kWh and \$25,000 in electricity costs. The fixtures have a rated life of over 50,000 hours, which will reduce long-term maintenance costs as well. The daylight sensor feature has

proven successful, as one-third of the installed fixtures remain off during the day, increasing energy savings and the life expectancy of the fixtures.





INDICATOR AREA

# WASTE AND RECYCLING



## SOLID WASTE AND RECYCLING

### ACCOMPLISHMENTS

- > Developed and conducted Energy and Water Conservation Awareness and Recycling training at four Metro locations.
- > Increased solid waste recycling and accounting with a new waste hauling contractor.

### DATA AND ANALYSIS

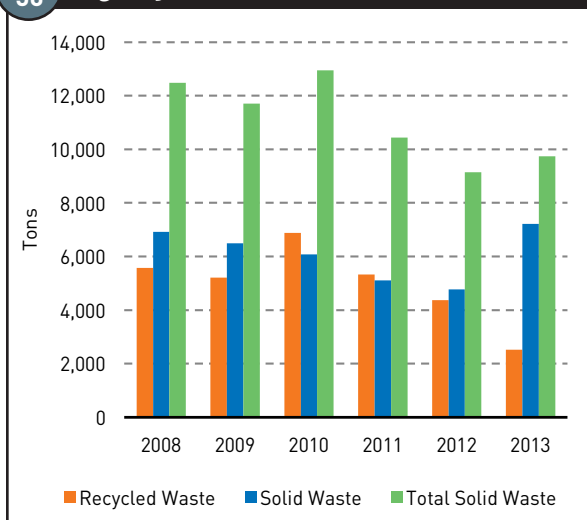
Overall, solid waste output has decreased since 2008,<sup>1</sup> from approximately 12,500 tons in 2008 to 9,700 tons in 2013 (**Figure 50**). However, there was a 6.5% increase overall in total solid waste from 2012 to 2013, with a 51% increase in solid waste output and a 42% decrease in recycled waste collected from Metro facilities. Since waste activities have remained steady for Metro, this drastic change in reported solid waste and recycled waste may be attributed to different waste collection methods employed by Republic Services, Inc. For example, the colors of the waste and recycling bins changed from previous years, which may have led to the misclassification of waste and hindered recycling efforts. In addition, possible reporting errors, such as inconsistent reporting of waste collected from divisions, may also contribute to the changes in reported solid waste and recycled waste.

Metro continues to actively work on reducing waste and expanding recycling efforts. Improvements to existing recycling programs and implementation of waste reduction targets will continue to reduce overall waste production and increase diversion rates. Metro has implemented several internal programs to divert waste from landfills. These recycling programs focus on products such as bus batteries, printer cartridges, scrap metal, e-waste, and other office products.

1. Due to changes in data collection techniques, recycling data are only available as recent as 2008.

## METRO CONTINUES TO ACTIVELY WORK ON REDUCING WASTE AND EXPANDING RECYCLING EFFORTS.

**FIG 50** Figure 50: Historic Waste Production



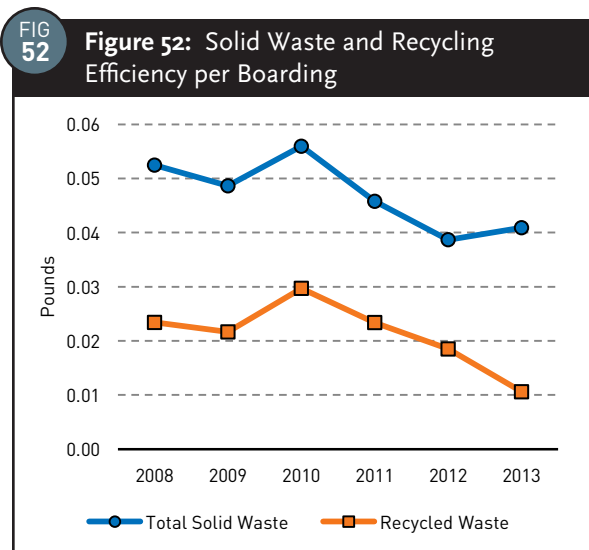
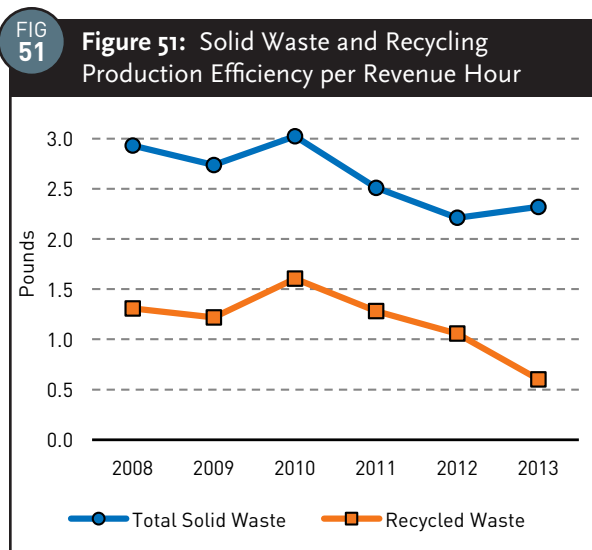
In addition, specific recycling programs are being implemented in certain divisions based on our activities. Nearly all facilities recycle cardboard as well as non-ferrous and ferrous metal. Recycling efforts at CMF, the Regional Rebuild Center where Metro buses get rebuilt, include re-using parts from failed buses that would otherwise be scrapped, and replacing shop equipment in fabrication shops that produce less waste material.

Total solid waste efficiency has increased since 2008, with the decrease in the number of pounds of solid waste produced per revenue hour (Figure 51) and boarding (Figure 52). Solid waste production per revenue hour decreased from 2.93 pounds of waste in 2008 to 2.32 pounds of waste in 2013. Solid waste production per boarding decreased from 0.052 pounds of waste in 2008 to 0.041 pounds of waste in 2013. However, there was a decrease in efficiency from 2012 to 2013 due to the increase in reported solid waste for 2013.

In contrast, recycling efficiency has decreased every year since 2008, with 1.31 pounds of recycled waste per revenue hour in 2008 to 0.6 pounds of waste recycled per revenue hour in 2013 (Figure 51). Recycled waste efficiency per boarding decreased from 0.023 pounds of recycled waste per boarding in 2008 to 0.011 pounds of waste recycled per boarding in 2012 (Figure 52).

NEXT STEPS

- > Conduct waste and recycling audits at all of Metro’s bus and rail divisions, in addition to the Gateway Building, to explore opportunities to improve Metro’s diversion rate.
- > Incorporate plastic recycling and increase cardboard recycling at CMF and other applicable divisions.
- > Increase recycling efforts to exceed Metro’s goal of \$1 million in revenue from recycling in FY 2014.
- > Consolidate Metro’s waste and recycling procedures and develop an agency-wide policy.
- > Conduct waste and recycling training, as well as deliver outreach materials, to increase awareness of waste and recycling practices across the agency.
- > In addition to waste and recycling audits, Metro is leveraging its LEED-EBOM Certification efforts to conduct detailed waste stream audits, which monitor the facility’s waste stream and improve overall diversion rate at that location.



## EXPLORATORY TEST SHAFT: METRO PURPLE LINE EXTENSION



### CHALLENGE

The Purple Line Extension, with an estimated completion date of 2022, will add over six miles of underground subway service to the existing Metro Purple Line, effectively connecting downtown Santa Monica with downtown Los Angeles. The subway route runs near the La Brea Tar Pits along Wilshire Boulevard; construction of the subway along this route requires boring through special ground conditions. As a result of the extensive construction process involved with tunneling along one of the county's most traveled transportation corridors, Metro will generate a large volume of soil and may produce additional substances like gas, tar, asphalt, or other debris.

### ACTION

Metro needed to gather as much information as possible on the unique underground conditions that the project will encounter in order to build safely and identify opportunities to reuse or recycle boring byproducts. The Wilshire Test Shaft is a 75-foot-deep vertical exploratory excavation along Wilshire Boulevard near the Los Angeles County Museum of Art. This effort enabled Metro to assess soil conditions, evaluate material, and explore potential opportunities for reuse and proper disposal.

### OUTCOME

The project provided a wealth of information to Metro, not only in terms of construction design, engineering, and execution, but also in identifying opportunities to reduce construction waste. In addition to archeological and paleontological items, excavators uncovered methane deposits, naturally occurring asphalt,

tar deposits, and other petroleum-based soils. Metro will seek to identify productive uses for all materials uncovered, either in the project or in other industries.



# USED OIL WASTE

## ACCOMPLISHMENTS

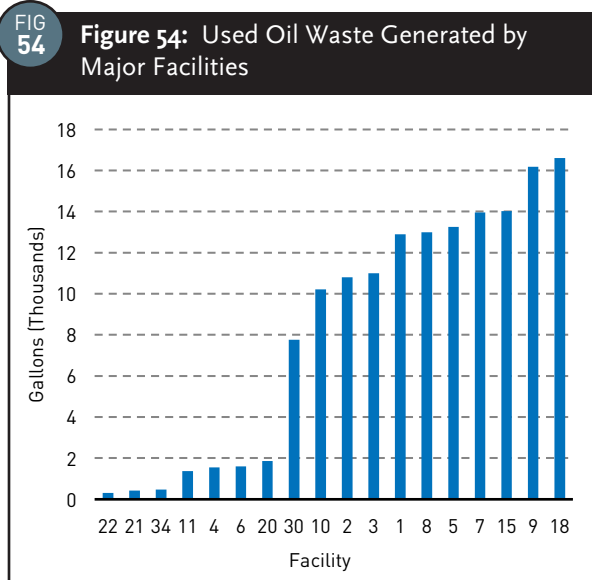
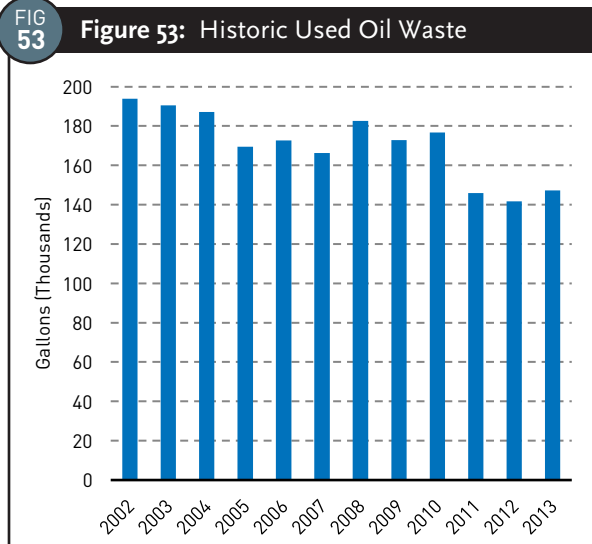
- > Ensured that used oil filters were drained and removed from all locations and placed in correct hazardous materials containers.
- > Scheduled and tracked used oil waste disposal from all divisions.

## DATA AND ANALYSIS

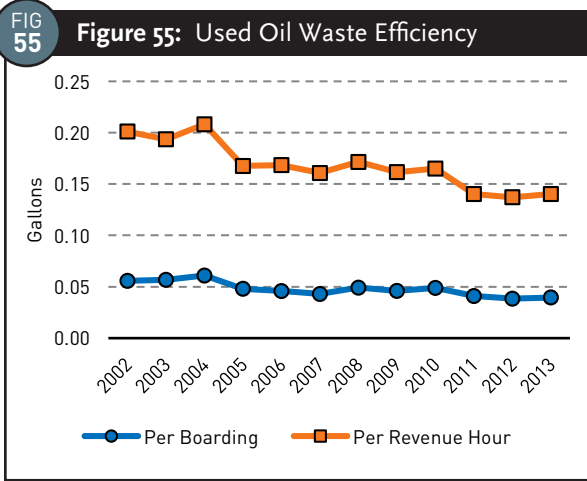
Overall, Metro has seen a 24% decrease in gallons of used oil from 2002 to 2013, which can generally be attributed to the increased use of synthetic oil (Figure 53). During 2013, Metro produced approximately 147,000 gallons of used oil, which represents an increase of 3.9% from 2012. This slight increase may be attributed to a slightly larger bus fleet in 2013 at 2,262 buses, instead of 2,254 in 2012.

The bus divisions (Divisions 1, 2, 3, 5, 6, 7, 8, 9, 10, 15, and 18) continue to be Metro's main producers of used oil waste at approximately 91% of the total (Figure 54). Division 18 remains the top producer of used oil waste at 16,600 gallons in 2013, mainly due to having one of the largest bus fleets at 250 buses. Division 9 has the largest bus fleet with 257 buses and is the second top producer of used oil waste at 16,200 gallons in 2013. The range in used oil waste produced across the other bus divisions is attributed to varying fleet sizes and activities.

Additionally, effective September 2011, used oil disposal became a revenue-generating service, with Metro receiving 81 cents for each gallon of used oil it recycles. In 2013, Metro recycled 145,435 gallons of used oil with a total revenue of \$117,082.



**METRO RECEIVED 81 CENTS FOR EACH GALLON OF USED OIL IT RECYCLED, FOR A TOTAL REVENUE OF \$117,082 IN 2013.**



Overall, used oil waste efficiency has increased since 2002 with the decrease in the amount of used oil produced per revenue hour and boarding (**Figure 55**). In 2013, 0.14 pints of used oil were produced per revenue hour, which represents a significant decrease from 2002 with 0.201 pints of used oil produced per revenue hour. Used oil waste production per boarding decreased from 0.056 ounces of used oil waste in 2002 to 0.04 ounces of used oil waste in 2013. However, there was a slight decrease in efficiency from 2012 to 2013 due to the increase in used oil waste for 2013.

**NEXT STEPS**

- > Ensure that all oil filter drainage locations, including shop pits, are free from oil spills, trash, or debris.
- > Continue to use synthetic oils and other alternative oil products.



# HAZARDOUS LIQUID WASTE

## ACCOMPLISHMENTS

- > Managed Metro’s on-call emergency response to hazardous waste and liquid spills.
- > Quality Assurance continued to schedule and track underground storage tank certifications across divisions.

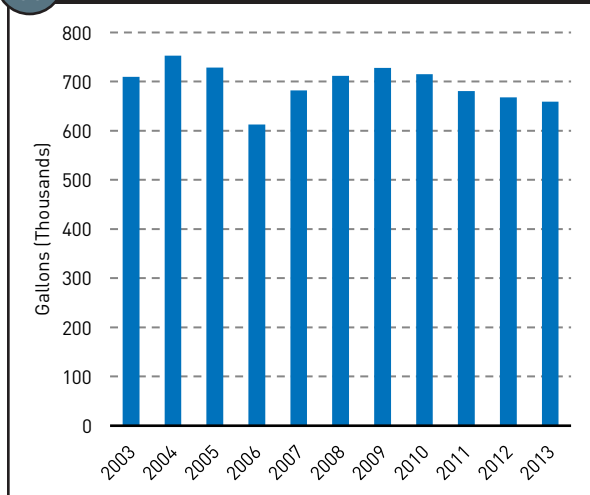
## DATA AND ANALYSIS

Hazardous liquid waste is mainly generated by Metro’s bus maintenance divisions and repair centers from chassis jets, steam bays, and fuel station trenches and clarifiers. Metro produced approximately 659,000 gallons of hazardous liquid waste in 2013, which represents a 1.3% decrease from 2012 and a 7.1% decrease from 2003 (Figure 56).

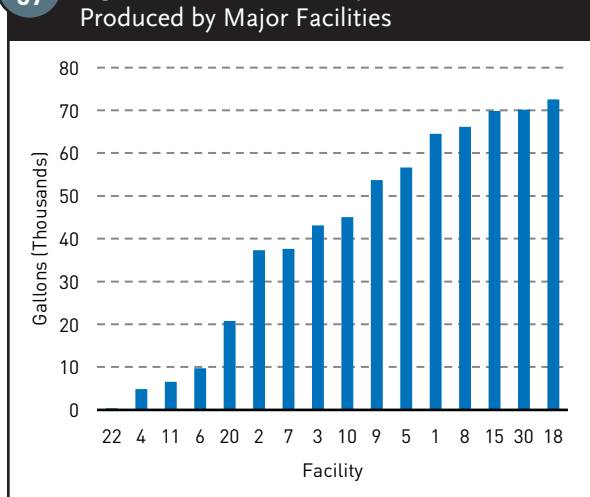
Similar to previous years, over 52% of the hazardous liquid waste was produced by Bus Divisions 1, 8, 15, and 18, and CMF, with Divisions 18 and the CMF being the highest producers of hazardous liquid waste (Figure 57). This is mainly attributed to the servicing of bus fleets and repair work at these divisions.

Overall, waste disposal costs for hazardous liquids have remained steady from 2003 to 2013 (Figure 58). In 2013, Metro paid approximately \$515,000 in hazardous liquid waste disposal fees, which is a slight decrease of 1.9% from 2012.

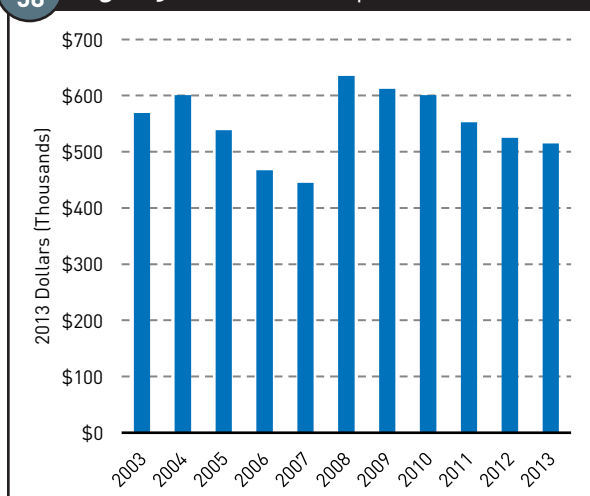
**FIG 56** Figure 56: Historic Hazardous Liquid Waste



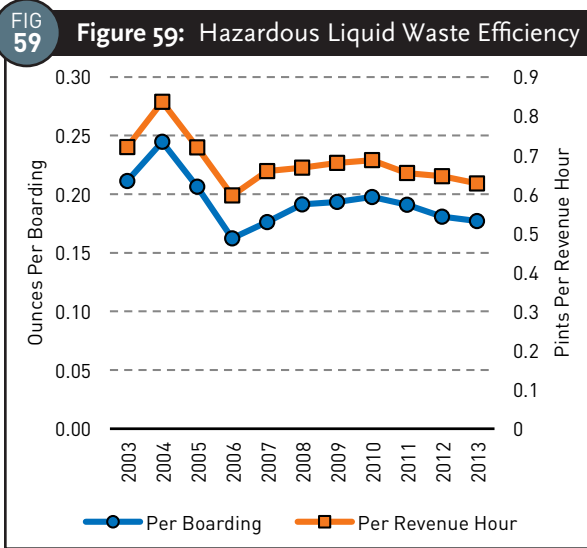
**FIG 57** Figure 57: Hazardous Liquid Waste Produced by Major Facilities



**FIG 58** Figure 58: Hazardous Liquid Waste Costs







Hazardous liquid waste efficiency has increased since 2009, with a slight decrease in the amount of hazardous liquid waste produced per revenue hour and boarding (**Figure 59**). In 2013, 0.177 ounces of hazardous liquid waste were produced per boarding, which is a decrease from the 0.181 ounces produced in 2012. Hazardous liquid waste production per revenue hour decreased from 0.646 pints in 2012 to 0.628 pints in 2013.

**NEXT STEPS**

- > Continue to schedule and track hazardous and universal waste removal from divisions.
- > Discuss waste minimization strategies for hazardous and universal wastes with divisions.

# NONHAZARDOUS LIQUID WASTE

## ACCOMPLISHMENTS

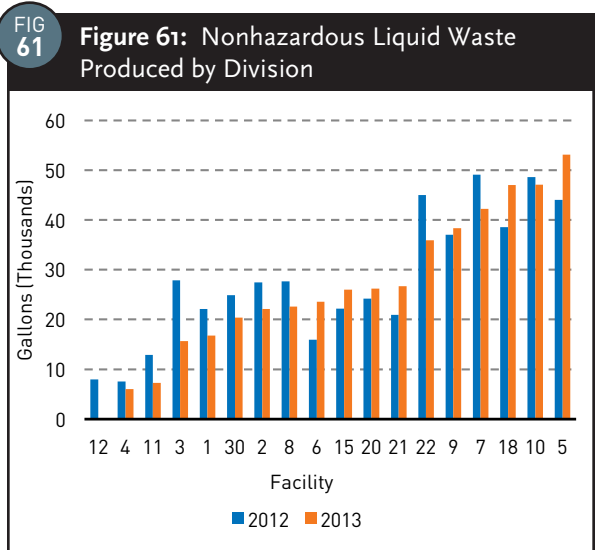
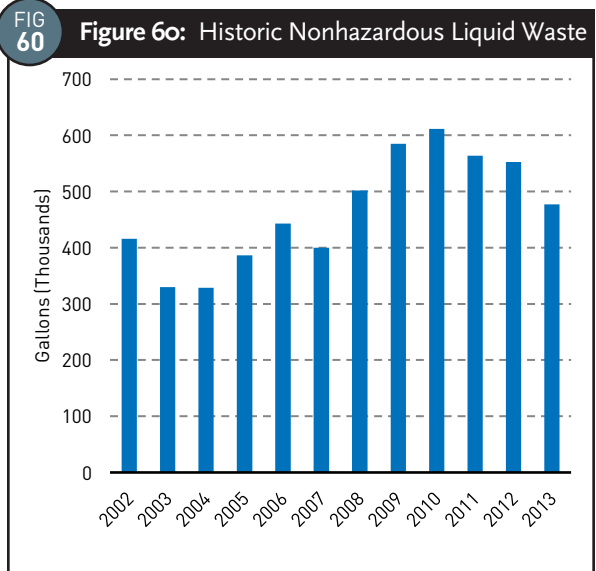
- > Managed the implementation of Metro’s Stormwater Management Plan at all bus and rail divisions.
- > Managed the implementation of Metro’s Industrial Wastewater Management Plan at all bus and rail divisions.

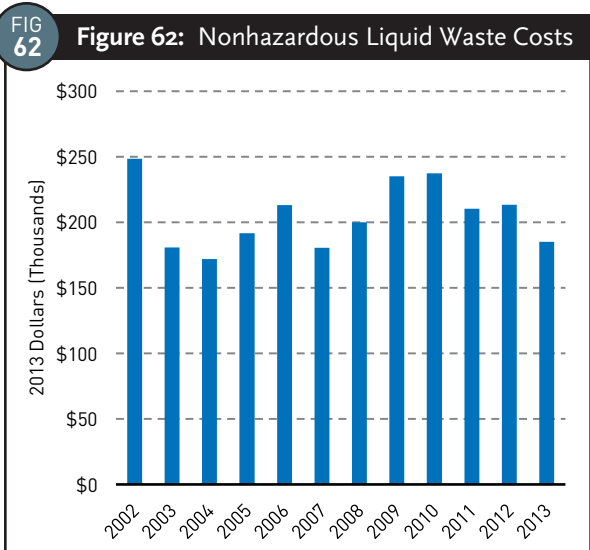
## DATA AND ANALYSIS

Nonhazardous liquid waste includes storm sewer, catch basin, and sanitary sewer clean-out residue; grease trap clean-out residue; industrial wastewater; uncontaminated precipitation removed from secondary containment structures; wash waters; and some off-specification commercial chemical products. Metro produced approximately 477,000 gallons of nonhazardous liquid waste in 2013, which represents a 13.7% decrease from 2012 but an overall 14.6% increase from 2002 (Figure 60). This gradual increase in nonhazardous liquid waste can be attributed to the increase in the number of bus washers between 2007 and 2010. After the peak in 2010, nonhazardous liquid waste continued on a downward trend, due in part to efforts by Metro to reduce wastewater runoff. For example, Division 10 recently completed the construction of a designated bus cleaning station where water runoff is diverted to the clarifiers for filtering and reuse.

Nonhazardous liquid waste varied across divisions from 2012 to 2013. The largest producers of nonhazardous liquid waste were Bus Maintenance Divisions 5, 10, and 18, with Division 5 producing 53,000 gallons in 2013, a 17.2% increase from 2012 (Figure 61). Division 18 also experienced an increase (22%) in nonhazardous liquid waste production from 2012. These divisions consist of maintenance buildings that include bus washes, service bays, and tire shops. Notable decreases in nonhazardous liquid waste production can be seen at Division 3 (44%) and Division 22 (20%).

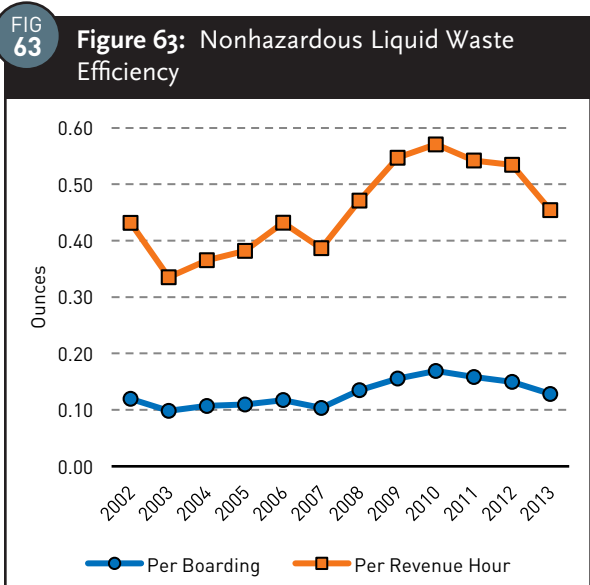
# NONHAZARDOUS LIQUID WASTE CONTINUED ON A DOWNWARD TREND, DUE IN PART TO EFFORTS BY METRO TO REDUCE WASTEWATER RUNOFF.





In 2013, Metro paid approximately \$185,000 in nonhazardous liquid waste disposal fees, which is a decrease of 13.3% from 2012 and in line with the decrease in nonhazardous liquid waste (Figure 62).

Nonhazardous liquid waste efficiency has increased since 2010, with a decrease in the amount of nonhazardous liquid waste produced per revenue hour and boarding (Figure 63). In 2013, 0.454 pints of nonhazardous liquid waste were produced per revenue hour, which is a decrease from the 0.535 pints produced in 2012. Nonhazardous liquid waste production per boarding also experienced a slight decrease, with 0.149 ounces of nonhazardous liquid waste per boarding in 2012 to 0.128 ounces in 2013.



**NEXT STEPS**

- > Continue to schedule and track nonhazardous liquid waste disposal from divisions.
- > For CMF, retrofit or replace the air scrubber system in the body shop to reduce wastewater. With the completion of the study, implement a low impact development pilot project at Division 4 to reduce runoff and enhance groundwater supply.
- > Explore water saving strategies at Metro’s facilities. For instance, a new water conditioning system using LKC technology is being rolled out at Divisions 5 and 18 in 2014.

# ANTI-FREEZE WASTE

## ACCOMPLISHMENTS

- > Procurement of coolant recovery systems, currently at Division 10, which allow for reuse of anti-freeze from buses.
- > Verified the practice of draining coolant trays into waste coolant containers.

## DATA AND ANALYSIS

Anti-freeze is mainly used in Metro’s bus maintenance facilities. Metro produced approximately 81,000 gallons of anti-freeze waste in 2013, a slight increase of 2.5% from 2012 (Figure 64). Since 2008, anti-freeze waste production has been trending downward, which may be partly attributed to enhanced recycling efforts and programs. The slight increase in 2013 may be due to a slight increase in bus fleet size, from 2,254 buses in 2012 to 2,262 buses in 2013.

Effective July 1, 2011, a new contract was enacted to recycle all anti-freeze waste; therefore, disposal fees were only paid through June 30, 2011, and no further disposal fees were incurred.

Anti-freeze waste produced by division in 2013 was comparable to 2012, with Divisions 10 and 18 continuing to be the highest producers of anti-freeze waste (Figure 65). However, Division 10 experienced a 15.9% decrease from 2012 in anti-freeze waste production, even though its bus fleet increased from 203 to 211 buses. Division 7 also experienced a large decrease of 20.5% from 2012, even though its bus fleet increased from 230 to 249 buses. These decreases in anti-freeze waste production may be partly attributed to enhanced recycling efforts.

FIG 64 Figure 64: Historic Anti-Freeze Waste

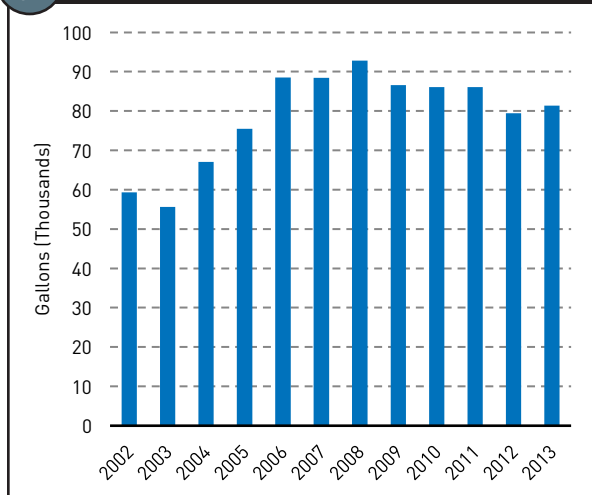
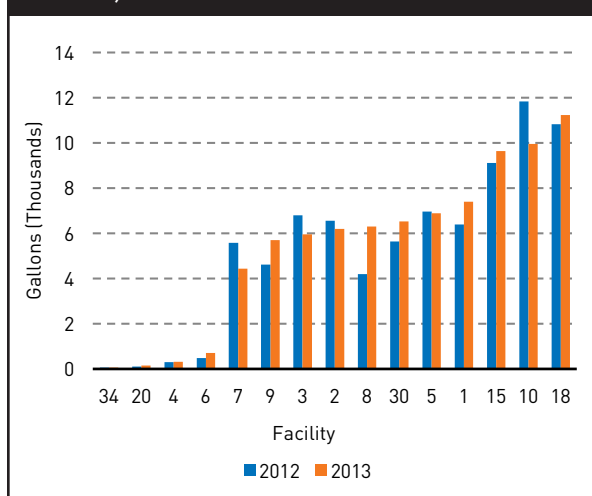
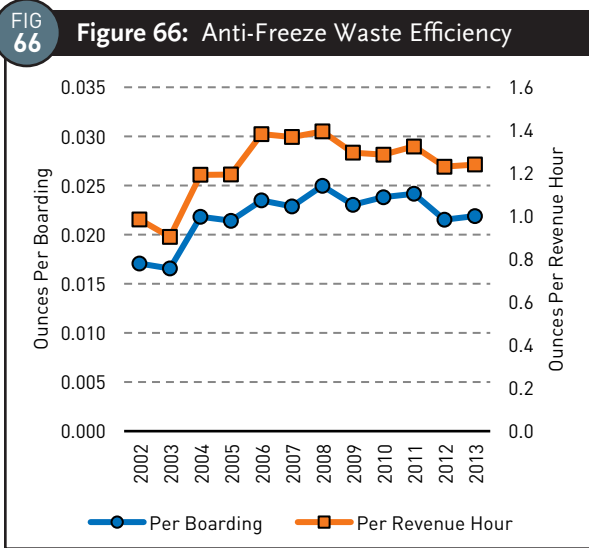


FIG 65 Figure 65: Anti-Freeze Waste Produced by Major Facilities



THE SLIGHT INCREASE IN 2013 MAY BE DUE TO A SLIGHT INCREASE IN BUS FLEET SIZE.



Overall, anti-freeze waste has decreased across the divisions from 2012, with the only notable increases occurring at the following vehicle maintenance divisions: Division 8 (50.4%), Division 9 (23.4%), and Division 1 (15.9%). Anti-freeze waste generated at Divisions 20 and 34 was lower than the other divisions since they are non-revenue vehicle maintenance facilities.

Anti-freeze waste efficiency has increased overall since 2011, with a decrease in the amount of anti-freeze waste produced per revenue hour and boarding (Figure 66). However, in 2013, there was a slight decrease in efficiency due to the increase in anti-freeze waste production, with 1.24 ounces of anti-freeze waste produced per revenue hour, which is a 0.9% increase from the 1.23 ounces produced in 2012. Anti-freeze waste production per boarding experienced a 1.7% decrease in ounces of anti-freeze waste per boarding from 2012 to 2013.

### NEXT STEPS

- > Continue to schedule and track anti-freeze waste disposal from divisions.
- > Coolant recovery systems will be distributed to all bus divisions, which will allow for reuse of anti-freeze from buses.

## SEALED COOLANT RECOVERY SYSTEM



### CHALLENGE

Metro operates approximately 2,200 transit buses, which are serviced and maintained at 11 bus maintenance divisions and one CMF. The daily service and maintenance activities at these 12 facilities require the draining of coolant, which is normally discarded due to concerns about contamination. As a result, new coolant is used to fill buses undergoing repairs instead of using the coolant recently drained from the vehicle. Metro's coolant cost is approximately \$450,000 per year, of which approximately \$150,000 is estimated to be the required coolant change that occurs every two years. Therefore, the inability to reuse the drained coolant is costing Metro over \$300,000 every year.

### ACTION

Metro developed and tested a prototype sealed coolant recovery system for the safe storage of coolant drained from vehicles undergoing repairs. A pilot of the sealed coolant recovery system demonstrated that it can: 1) keep the drained coolant free of contaminants; 2) permit a visual quality check of the drained coolant; 3) allow for vehicles to be filled with the drained coolant; and 4) significantly reduce the amount of new coolant purchased each year by Metro.

### OUTCOME

In June 2013, as a result of the successful pilot project, Metro established a capital project to purchase three sealed coolant recovery systems for each bus maintenance facility. Currently, Division 3 and Division 10 have coolant recovery

systems in use at their facilities. A solicitation for sealed coolant recovery systems was released in March 2014, and the delivery of the new systems is expected mid-2014.



INDICATOR AREA

# CRITERIA AIR POLLUTANT EMISSIONS





## ACCOMPLISHMENTS

- > Continued transition of Metro's transit bus fleet to cleaner fuels and more modern technology.

## OVERALL PERFORMANCE

Metro's bus and rail emissions in 2013 reflect Metro's expansion of rail service and continued modernization of the bus fleet. The 12% increase in rail propulsion electricity consumption in 2013 as compared to 2012 was a significant factor in Metro fleet emissions levels; overall, Metro's rail electricity consumption has increased approximately 27% from 2008 levels. Increased rail electricity consumption, and its impact on fleet emissions, was offset by a reduction in transit bus VMT and the continued modernization of the Metro transit bus fleet. Transit bus VMT was approximately 1.3% lower in 2013 as compared to 2012, and 17.1% lower as compared to 2008. Additionally, the ongoing transition of the Metro transit bus fleet to cleaner fuels and more modern technology has resulted in a significant reduction in ozone precursor and toxic air contaminant emissions. As Metro continues to replace and repower our buses with the newest technology engines, emission reductions will continue and eventually taper once all of the older, higher emitting buses are replaced or repowered with state-of-the-art engines.

A notable consequence of bus engine repowering is the increase in carbon monoxide (CO) emissions. The current state-of-the-art urban bus engine is the Cummins ISL G, and while this engine offers reductions in nitrogen oxide (NOx) emissions, it does so at the expense of higher CO emissions. Thus, it is anticipated that total fleet emissions will show an overall increase in future years due to increased CO emissions, even as NOx and particulate matter (PM) emissions continue to decline.

## DATA AND ANALYSIS

The 2013 analysis reflects the continuation of Metro's efforts to repower older CNG buses with new, lower emitting CNG engines. In many cases, buses that were originally equipped with CNG engines, such as the Detroit Diesel Corporation Series 50 natural gas engine, have been repowered with state-of-the-art CNG engines, including the Cummins ISL G 8.9 liter and the Doosan GL11K 11.1 liter CNG engines. The lower NOx emissions rating of the repowered engines resulted in a reduction in NOx, a primary ozone precursor emission. Reductions in ozone precursor emissions are of great importance to the South Coast region, which encompasses Los Angeles County, to meet federally imposed 2023 and 2035 ambient air quality attainment obligations.



TAB 3

Table 3: Comparison of 2013 Fleet Emissions Levels to 2012 Levels

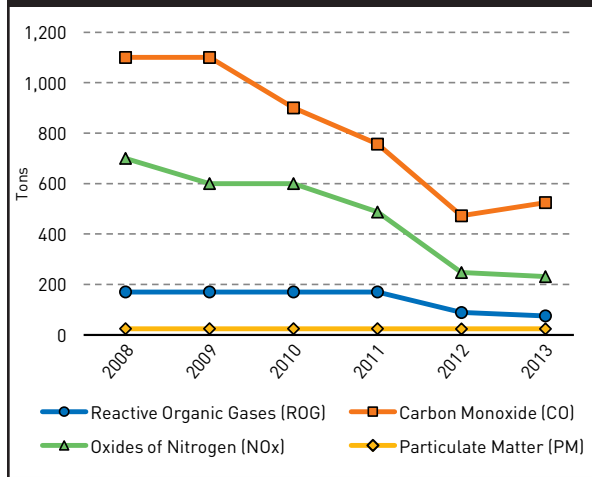
FLEET EMISSIONS (TONS PER YEAR)	2012 BUS	2012 RAIL	TOTAL 2012 EMISSIONS	2013 BUS	2013 RAIL	TOTAL 2013 EMISSIONS	FLEET WIDE (TONS)	PERCENT CHANGE
Reactive Organic Gases (ROG)	86	2.5	88.5	72.3	2.9	75.2	-13.3	-15.0%
Carbon Monoxide (CO)	454.7	17.4	472.1	504.3	20.2	524.5	+52.4	+11.1%
Oxides of Nitrogen (NOx)	164.6	82.6	247.2	135.1	95.8	230.9	-16.3	-6.6%
Particulate Matter (PM)	3.1	2.5	5.6	2.9	2.9	5.8	+0.2	+3.6%
<b>TOTALS (TONS PER YEAR)</b>	<b>708.4</b>	<b>104.9</b>	<b>813.3</b>	<b>714.6</b>	<b>121.7</b>	<b>836.3</b>	<b>+23.0</b>	<b>+2.8%</b>

“+” = Increase in fleet emissions “-“ = Decrease in fleet emissions

As the current level of CO emissions is well under the limit established for the Los Angeles region, it is more critical to reduce NOx emissions in Metro’s operation. A consequence of repowering older CNG buses with the Cummins ISL G 8.9 engine, however, is a higher level of CO emissions. While these levels are well within the engine certification limits established by the US Environmental Protection Agency (EPA), they are at times higher than the certification values of the engines being replaced. In essence, a trade-off is made between NOx and CO emissions; a slightly higher level of CO is emitted to further reduce ozone precursor NOx emissions.

Metro’s overall fleet emission levels in 2013 for reactive organic gases (ROG) and NOx have been reduced by approximately 15.0% and 6.6%, respectively, as compared to 2012 levels (Figure 67). Emissions of CO and PM increased by approximately 11.1% and 3.6%, respectively, relative to 2012. Overall, total criteria pollutant emissions increased approximately 23.0 tons, or 2.8%, from 2012 to 2013 (Table 3).

FIG 67 Figure 67: Historic Criteria Air Pollutant Emissions



AS THE CURRENT LEVEL OF CO EMISSIONS IS WELL UNDER THE LIMIT ESTABLISHED FOR THE LA REGION, IT IS MORE CRITICAL TO REDUCE NO<sub>x</sub> EMISSIONS IN METRO’S OPERATION.



## CHANGE ANALYSIS



The change in Metro fleet emissions between 2012 and 2013 is attributable to three primary factors:

- > **A reduction in transit bus miles traveled in 2013 as compared to 2012.** Total transit bus miles traveled for all divisions in 2012 was recorded as 86,505,433 miles. The total bus miles traveled in 2013 was 85,388,502 miles, a reduction of 1,116,931 miles as compared to 2012. This equates to an approximate 1.3% reduction in bus miles traveled and resulted in a decrease in emissions for all criteria air pollutants.
- > **Continued modernization of Metro's CNG bus fleet.** The repowering of bus engines contributed to the reductions in ROG, NO<sub>x</sub>, and PM criteria air pollutant exhaust emissions; however, higher CO emission levels associated with the Cummins ISL G natural gas engine used to repower buses in Metro's fleet contributed to the net increase in CO emissions in 2013.

## NEXT STEPS



- > Metro is in the process of bringing in 550 new Flyer 40' CNG buses to replace older CNG buses purchased in 1999-2001.

INDICATOR AREA

# GREENHOUSE GAS EMISSIONS



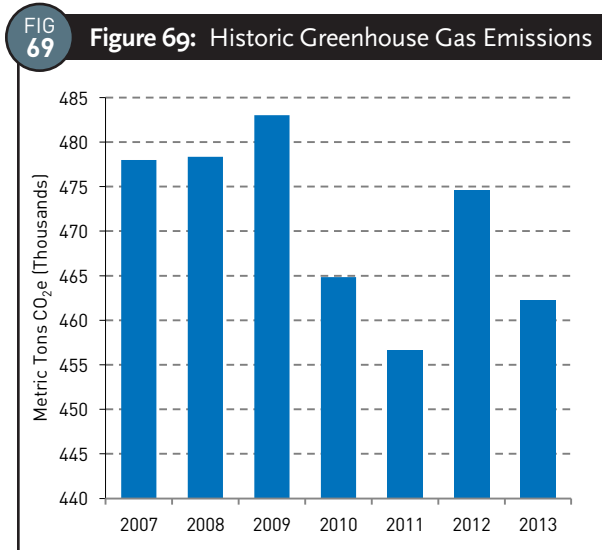
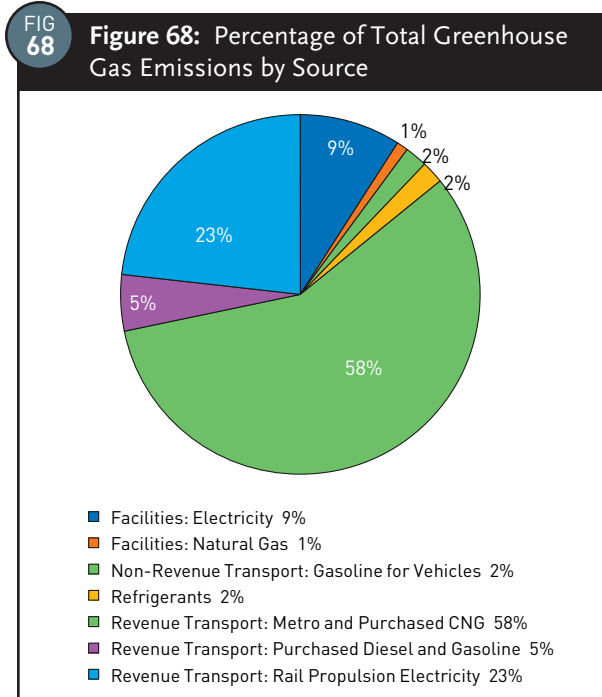
### ACCOMPLISHMENTS

- > Participated in the California Air Resources Board’s Low Carbon Fuel Standard program.
- > Conducted Energy and Water Conservation Awareness programs and Recycling programs at additional locations across Metro.

While Metro’s primary role is to provide safe and effective transportation options for the Los Angeles region, the agency also seeks to do so in a cost-effective and environmentally sustainable manner. The GHG sections of this report address the impact of Metro’s services on global climate change.

### DATA AND ANALYSIS ▼

GHGs occur naturally in the atmosphere, but are also emitted through activities such as the burning of fossil fuels. Increased levels of GHG emissions being released into the atmosphere are causing global climate change, which has impacted the Los Angeles region and will continue to do so in the future. In 2013, Metro emitted approximately 462,272 MT CO<sub>2</sub>e. Approximately 85% of Metro’s total GHG emissions in 2013 were related to fuel consumption from moving passengers (**Figure 68**). In general, Metro’s GHG emissions are directly calculated using activity data. Major emissions-generating activities include revenue-generating fuel consumption, rail propulsion electricity consumption, and facility electricity consumption. Minor activities include non-revenue transportation fuel consumption, facility natural gas fuel consumption, and the use of refrigerants.



### TRENDS IN METRO’S GHG EMISSIONS ▼

Total GHG emissions in 2013 were approximately 3% lower than in 2012 (**Figure 69**). A detailed analysis of major emission-generating activities shows that emissions increased in some Metro sectors, but decreased in others. For example, emissions from rail propulsion electricity consumption increased by 11% between 2012 and 2013. This increase is directly proportional to the increase in electricity used for rail propulsion activities.

## TOTAL GHG EMISSIONS IN 2013 WERE APPROXIMATELY 3% LOWER THAN 2012.

Conversely, GHG emissions from Metro-operated CNG-powered buses decreased by 5%, compared to 2012. This decrease is directly attributed to a reduction in CNG consumed by Metro's revenue-generating buses. Similarly, GHG emissions from Metro's contracted diesel-powered bus services also decreased by 13%, which reflects Metro's efforts to switch contracted bus services from diesel to CNG. The trends in CNG and diesel consumption show that Metro is not only reducing the carbon-intensity of its fuel consumption (CNG is less carbon-intensive than diesel), but also improving the efficiency of its operations with its reduction in CNG consumption. Metro's GHG emissions from its contracted vanpool services increased by 9%, and this increase is proportional to the quantity of gasoline consumed by the agency's vanpool service contractors due to an expansion in Metro's vanpool services. Lastly, Metro's GHG emissions for facility electricity consumption decreased by 20%, attributed to Metro's increasing energy conservation efforts within its facilities.

Trends were also observed in secondary emissions-generating activities. For example, emissions from Metro's non-revenue transportation fuel consumption increased by 3% in 2013 while emissions from facility natural gas consumption decreased by 8%.

Overall, the reduction in Metro's total GHG emissions since 2012 has mainly been driven by efforts to reduce the consumption of CNG in Metro's revenue-generating vehicle fleet, as well as the reduced energy consumed by Metro's facilities.

### PERFORMANCE METRICS

Performance metrics provide information about Metro's direct and indirect emissions relative to its core services and are expressed in terms of emissions per boarding, emissions per vehicle mile, emissions per revenue hour, and emissions per passenger mile.

In terms of emissions per boarding, Metro's buses were the most efficient transit mode in 2013, emitting 1.64 lbs CO<sub>2</sub>e per boarding (**Table 4**). While buses were the most efficient on a per boarding basis, bus-passengers tend to travel fewer miles than rail passengers. GHG emissions per passenger mile traveled is another method of assessing Metro's efficiency. When calculated by passenger mile, light rail and vanpools were the most carbon-efficient

TAB  
4

**Table 4: Greenhouse Gas Intensity by Service Mode in 2013**

MODE	LBS CO <sub>2</sub> E/ BOARDING	LBS CO <sub>2</sub> E/ VEH. MILE	LBS CO <sub>2</sub> E/ REV. MILE	LBS CO <sub>2</sub> E/ PAS. MILE
Heavy Rail	2.38	16.62	390.40	0.50
Light Rail	1.89	8.81	183.74	0.29
Bus Not Operated by Metro (contracted)	1.84	3.71	55.56	0.49
Bus Operated by Metro	1.64	6.78	89.37	0.39
Vanpool	10.27	1.29	58.61	0.23
Non-revenue Metro Vehicles	NA	2.34	NA	NA
<b>TOTAL* LBS CO<sub>2</sub>E/METRIC (TOTAL)</b>	<b>1.82</b>	<b>6.20</b>	<b>103.36</b>	<b>0.38</b>

\* Total numbers only include calculations from revenue vehicle emissions and revenue vehicle miles.

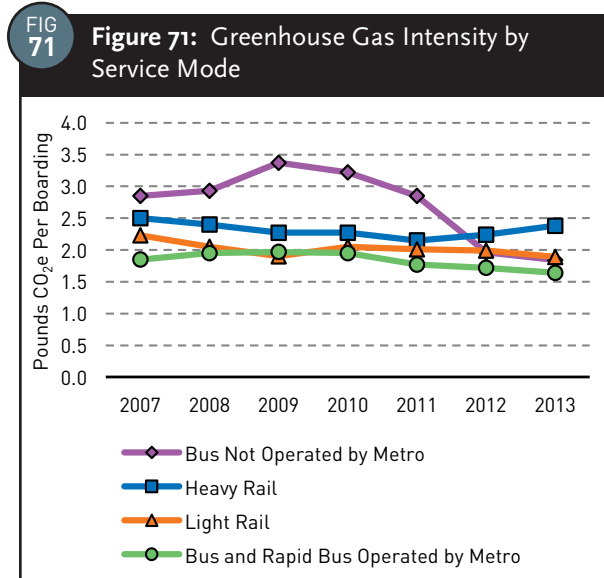
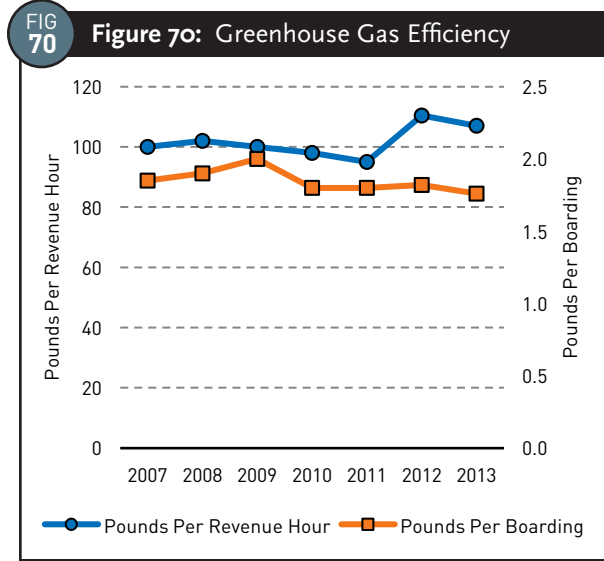
mode of Metro’s operations in 2013. Metro’s efficiency per passenger mile is more efficient for all travel modes than a typical passenger vehicle, which emits approximately 1 lb/mile.<sup>1</sup> Vanpool services also appear to be the most efficient transit mode in terms of GHG emissions per vehicle mile, emitting 0.23 lbs CO<sub>2</sub>e per passenger mile. Lastly, when evaluated on a revenue hour basis, Metro’s contracted bus services and vanpool services show the highest GHG efficiency per revenue hour.

**TRENDS IN PERFORMANCE METRICS** ▼

**Emissions Per Boarding**

Between 2012 and 2013, Metro showed a 3% agency-wide reduction in GHG emissions per boarding (Figure 70). Trends in emissions per boarding varied within each transit mode. GHG emissions per boarding for light rail decreased by 5% even though overall GHG emissions associated with electricity consumption by light rail services increased by 12% (Figure 71). This may be attributed to the increase in light rail ridership by approximately 18%. Conversely, emissions per boarding for heavy rail increased by 6%, because the rate of increase in ridership (4%) was lower than the rate of increase in GHG emissions (10%) associated with electricity consumption by heavy-rail services.

THE TRENDS IN CNG AND DIESEL CONSUMPTION SHOW THAT METRO IS NOT ONLY REDUCING THE CARBON-INTENSITY OF ITS FUEL, BUT ALSO IMPROVING THE EFFICIENCY OF ITS OPERATIONS WITH ITS REDUCTION IN CNG CONSUMPTION.



1. EPA Office of Transportation and Air Quality, Greenhouse Gas Emissions from a Typical Passenger Vehicle, December 2011. ([www.epa.gov/oms/climate/documents/42of11041.pdf](http://www.epa.gov/oms/climate/documents/42of11041.pdf))



Metro-operated and contracted bus services demonstrated a 5% decrease in GHG emissions per boarding even though ridership decreased slightly between 2012 and 2013. This is due to a 5% decrease in fuel consumption by Metro-operated and contracted revenue vehicles. The carbon efficiency of vanpool services on a per boarding basis decreased by 1%, as the rate of increase in emissions from gasoline consumed by Metro's contracted van fleet (9%) was greater than the rate of increase in ridership (8%).

Between 2012 and 2013, Metro experienced a 4% decrease in GHG emissions per vehicle mile, based on mileage from revenue-generating vehicles. Improvements in GHG efficiency per vehicle mile were observed across all transit modes, except for vanpool services, which showed no change in GHG emissions per mile. The most improvement was seen in light rail, at 7%.

A similar trend occurred for emissions per revenue hour, as Metro showed a 3% decrease in GHG emissions per revenue hour, based on revenue hours from revenue-generating vehicles. Improvements in GHG efficiency per revenue hour were observed across all transit modes, except for vanpool services, which showed no change in GHG emissions per revenue hour. The most improvement was seen in light rail, at 11%.

Between 2012 and 2013, Metro showed a 2% decrease in GHG emissions per passenger mile, based on passenger miles from revenue-generating vehicles. The GHG emissions per passenger mile for contracted and Metro-operated bus services decreased by 11% and 3%, respectively. However, the GHG efficiency on a per passenger basis of heavy rail, light rail, and vanpool decreased. The GHG emissions per passenger mile for these transit modes increased by 7%, 1%, and 2%, respectively.

## NEXT STEPS



- > Initiate LEED-EBOM Certification activities at Divisions 7 and CMF.
- > Initiate LEED-EBOM for Union Station and LEED-ND for the Union Station Master Plan.
- > Initiate LEED-EBOM Certification at Divisions 9, 20, 21, and Union Station.
- > Initiate social vulnerability assessment for impacts of climate change on Metro ridership.
- > Develop resiliency indicators to prepare Metro to withstand and continue to provide reliable service in light of potential climate change impacts.
- > Metro is exploring the use of less carbon-intensive fuels and zero-emission vehicles to reduce its carbon footprint while expanding its transit network.

## CLIMATE VULNERABILITY ASSESSMENT



### CHALLENGE

Climate change is recognized by Metro and other transportation agencies as an important issue to address globally and locally. Climate change effects can already be seen in the Los Angeles region, and they are expected to increase in type, length, and severity. While emphasis has been placed on mitigation to reduce GHG emissions, this is only part of the overall climate change response process.

### ACTION

Metro is a leader in recognizing adaptation as an important element in planning for climate change. Metro was one of the first major transportation agencies in the United States to develop a Climate Action and Adaptation Plan (CAAP), which includes a framework for adaptation planning and prioritization. In 2012, Metro received a grant from the FTA to implement a Transit Climate Change Adaptation Pilot Program (Pilot Program). The Pilot Program includes development of a plan to integrate infrastructure adaptation principles into Metro's EMS; track risks to infrastructure; develop metrics for measuring and assessing adaptation progress over time; and develop a plan to communicate these efforts internally and in the community. Metro's Climate Vulnerability Assessment builds on the efforts of the CAAP to develop a risk assessment of assets that are vulnerable to climate change.

### OUTCOME

The goals of the Climate Vulnerability Assessment were to identify key assets vulnerable to extreme weather events/climate change impacts by using refined climate models and a risk framework. Through work with Metro to prioritize risks and development of a Risk Assessment Report, the Climate Vulnerability Assessment informs existing resources, identifies data gaps, and recommends potential future actions to advance Metro's progress toward climate resiliency to maintain a consistent level of service in the future.

The Climate Vulnerability Assessment has been completed and has already helped guide decision-making and prioritization regarding upcoming projects and programs at Metro. Metro is currently pursuing a project that will address high-priority vulnerability: the Overhead Catenary System (OCS) along the Blue and Gold Lines. The OCS is particularly vulnerable to extreme temperatures and heat waves, and initial project development considerations include re-engineering of the OCS, OCS retrofitting, and material substitution.



INDICATOR AREA

# GREENHOUSE GAS DISPLACEMENT



# MORE EMISSIONS ARE DISPLACED BY PEOPLE NOT DRIVING THAN BY ALL OF METRO'S OPERATIONAL EMISSIONS.

## ACCOMPLISHMENTS

- > Installed 20 electric vehicle charge stations at Union Station, Sierra Madre Villa Station, Willow Station, Universal City Station, and El Segundo Station.

Metro continues to implement strategies to reduce GHG emissions, such as retrofitting facilities to be more energy-efficient. However, it is important to understand Metro's larger role in sustainability and reducing GHG emissions in the region. In light of the larger role that Metro plays in regional climate change mitigation efforts, the agency's carbon footprint should not be evaluated merely on the basis of its total GHG emissions. By providing transit options, Metro is reducing GHG emissions that would otherwise have occurred from passenger vehicles, increased congestion, and potentially more sprawl. As Metro expands its rail, bus, or vanpool services, it is contributing to regional GHG emission reductions even though the agency's absolute emissions will likely increase as a result of this expansion. These avoided or displaced emissions are

not as directly quantifiable as Metro's operational emissions, but APTA has provided guidance for estimating three forms of displaced emissions:

- > Mode Shift refers to the GHG emissions displaced by shifting from a passenger vehicle to transit. This is calculated on a per passenger-mile basis, and APTA has estimated that 0.47 vehicle miles are avoided for every passenger mile of transit for a region the size of Los Angeles.
- > Congestion Relief refers to the GHG emissions displaced by improving roadway conditions for those who continue to drive passenger vehicles. Fewer cars on the road lead to increased road speeds, less traffic, and less idling, which increases the efficiency of the remaining on-road vehicles.
- > Land Use refers to emissions displaced when transit enables denser land-use patterns, which encourage shorter trips and increased walking and cycling instead of vehicle use.

In 2013, Metro's 2.31 trillion passenger miles resulted in approximately 475,269 MT CO<sub>2</sub>e avoided through Mode Shift (Table 5). This alone results in more emissions displaced by people not driving than by all of Metro's operational emissions. Congestion Relief and Land Use GHG displacement estimates have not yet been applied as they require more detailed modeling, but would demonstrate even greater emissions avoidance and Metro's central role in creating a more sustainable region.

## NEXT STEPS

- > Install an additional 20 electric vehicle charge stations at five additional park-and-ride lots.

**TAB 5** Table 5: Net Greenhouse Gas Emissions from Metro Operations, 2013

SOURCE	QUANTITY OF EMISSIONS DISPLACED (MT CO <sub>2</sub> E)
Total Emissions Displaced from Mode Shift	(475,269)
Emissions from Metro Operations	462,272
<b>NET EMISSIONS FROM METRO OPERATIONS</b>	<b>(12,997)</b>







2014 Metro  
Energy and Resource Report

Los Angeles County  
Metropolitan Transportation Authority

