



2018 ENERGY & RESOURCE REPORT





ACKNOWLEDGMENTS

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Image at left: Mariachi Plaza Station, Gold Line

ACRONYMS & ABBREVIATIONS

AB	Assembly Bill	HC	Hydrocarbons
APTA	American Public Transportation Association	ISO	International Organization for Standardization
BEVs	Battery Electric Vehicles	kWh	Kilowatt Hour
CAAP	Climate Action and Adaptation Plan	LA	Los Angeles
CARB	California Air Resources Board	LEED	Leadership in Energy and Environmental Design
CDP	Carbon Disclosure Project	METRO	Los Angeles Metropolitan Transportation Authority
CLAX	Crenshaw / LAX Transit Corridor Project	MJ	Megajoules
CNG	Compressed Natural Gas	MRDC	Metro Rail Design Criteria
CO₂	Carbon Dioxide	MSW	Municipal Solid Waste
CO₂e	Carbon Dioxide Equivalent	MT	Metric Tons
ECSD	Environmental Compliance and Sustainability Department	NOx	Nitrogen Oxides
EIR	Environmental Impact Report	O&M	Operations and Maintenance
EMS	Emergency Management System	PM	Particulate Matter
EPA	Environmental Protection Agency	PM₁₀	Particulate Matter less than 10 micrometers in diameter
EV	Electric Vehicle	RAMP	Regional Advance Mitigation Program
FY	Fiscal Year	RNG	Renewable Natural Gas
G	Grams	ROG	Reactive Organic Gases
GCP	Green Construction Policy	SB	Senate Bill
GDP	Gross Domestic Product	TCO	Total Cost of Ownership
GGW	Growing a Greener Workforce	UPT	Unlinked Passenger Trips
GHG	Greenhouse Gas	VMT	Vehicle Miles Traveled
G-PRO	Green Professional Building Skills Training	VRM	Vehicle Revenue Miles

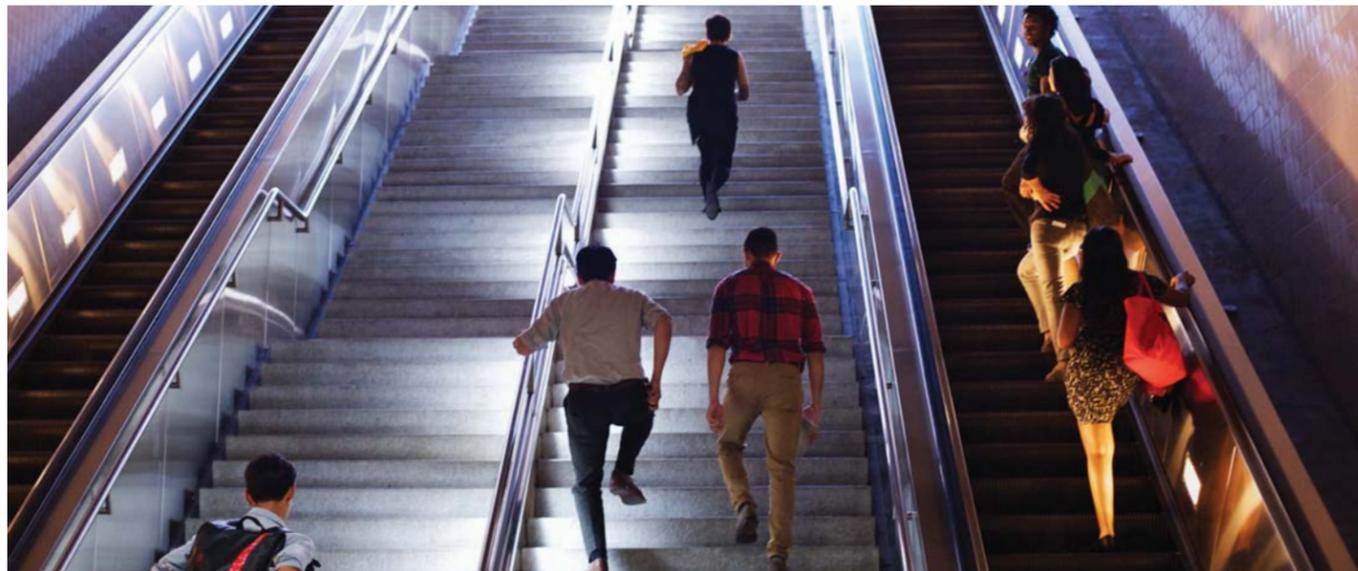
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MESSAGE FROM THE CEO

Metro's transportation revolution is making sustainable practices the norm while meeting the needs of an increased population and economic growth. While acting as responsible stewards of taxpayer's trust, we are actively thinking boldly and challenging ourselves to provide mobility service in the most environmentally-sound and energy-efficient manner possible. Our world-class, innovative solutions not only get Angelenos where we want to go, but also reduce greenhouse gas (GHG) emissions in the process. And this is only the beginning.

Sustainability and environmental responsibility is infused into everything we do — planning, constructing, operating, and maintaining our infrastructure, assets, and human capital. We are expanding our system to provide a convenient, zero emissions fleet combined with various alternative modes to driving alone. As Metro's services expand, we are significantly limiting the impact transportation has on the environment. That's what Metro's mission of excellence in service and support look like in action.

Sincerely,

Philip A. Washington

MESSAGE FROM THE INCOMING BOARD CHAIR

I'm so pleased that Metro is already an award-winning, international leader in environmental stewardship and sustainability. Just in the last 10 years, we have reduced dangerous nitrogen oxides by 82%. Sustainability practices are infused in all aspects of our work.

Moreover, in the coming year, we will do even more to benefit the health and welfare of Angelenos by rapidly implementing technologies that improve air quality. We will continue to add zero emission vehicles to our fleet and increase the use of biomethane as we move towards a zero emissions bus fleet by 2030. We are also streamlining processes designed to protect sensitive habitat, improve water quality, and protect the environment, as well as expanding our resilience planning. Our goal is to increase service and strengthen our infrastructure while reducing our impact on the environment.

Metro is committed to building, operating, and maintaining a safe, efficient, resilient, and sustainable public transportation system for all.

Sincerely,

Sheila Kuehl



EXECUTIVE SUMMARY

Metro has a unique role among the nation's transportation agencies as the planner, coordinator, designer, builder, funder, and operator of transportation services for one of the country's largest and most populous counties. As such, measuring the environmental and sustainable performance of an organization with such a diverse scope and impact can be difficult. Clearly, we must look beyond tailpipe emissions.

The 2018 Energy and Resource Report provides an annual update of Metro's impact on the environment and reports performance across sustainability metrics designed to inform the agency's various stakeholders of how we are doing and where we are heading. This report marks the ninth installment since 2010 when the agency began reporting, which underscores Metro's commitment to transparency. The report is a look under the hood, not just to show how we've progressed from last year, but also to show how our fundamental understanding of sustainability continues to evolve. Ultimately, this report is intended to communicate two things:

1. The performance metrics serve to quantify Metro's sustainability performance across ten key indicator areas, summarized in the table on the right. Since 2012, many of the indicator areas are trending positively, largely due to institutional best practices, such as the now agency-wide Environmental Management

System that was first piloted in 2007. Metro continues to operate one of the cleanest fleets in the nation with emissions nearly cut in half since 2012. Overall water use and greenhouse gas emissions are down one-third since 2012, and Metro continues to displace more emissions than it produces by encouraging transit use. However, evaluating year-over-year performance reveals areas where additional focus is needed as the agency continues to retool, reenergize, and prepare for the next generation of transit expansion.

2. The Highlight sections in this report dive deeper into how sustainability is being adopted as a core value at Metro, so that the next generation of transit expansion is planned, built, and maintained in a way that does not just avoid negative impacts but encourages positive and restorative changes to communities and the environment. For example, features like Green Procurement (page 24) and Sustaining Creativity (page 42) illuminate how principles of sustainability have become embedded into decision making and are reinforced through training and cross-departmental collaboration. Another feature on Environmental Justice (page 18) highlights how Metro's construction pollution reduction policies and transit planning address long-term environmental equity.



Performance Metrics	2012	2013	2014	2015	2016	2017	Trends	
							Since 2016	Since 2012
OPERATIONAL EFFICIENCY								
Unlinked Passenger Trips <i>(per Capita x 100)</i>	4,752	4,757	4,649	4,377	4,111	3,904	-5.0%	-17.8%
Vehicle Miles Traveled <i>(per Capita x 100)</i>	78.7	78.7	78.8	79.4	79.3	78.8	-0.6%	0.1%
Operating Expenses <i>(Dollars per Vehicle Revenue Mile)</i>	\$10.91	\$10.97	\$10.88	\$11.08	\$12.22	\$13.64	11.6%	25.0%
AIR QUALITY								
Criteria Air Pollutant Emissions <i>(Short Tons per 100,000 Vehicle Revenue Miles)</i>	70.2	60.1	56.9	50.8	34.7	40.9	17.9%	-41.7%
CLIMATE								
Greenhouse Gas Emissions <i>(Pounds CO₂e per Vehicle Revenue Mile)</i>	8.61	8.37	6.85	6.72	6.68	6.74	0.8%	-21.7%
Greenhouse Gas Displacement <i>(Net Emissions, MT CO₂e)</i>	-4,069	-3,933	-86,433	-73,827	-57,461	-40,758	-29.1%	901.6%
ENERGY								
Energy Use <i>(MJ per Vehicle Revenue Mile)</i>	55.7	57.6	57.2	56.6	55.3	55.6	0.6%	-0.2%
WATER								
Water Use <i>(Gallons per Vehicle Revenue Mile)</i>	2.96	3.33	2.48	2.15	1.74	2.11	21.3%	-28.7%
WASTE								
Total Solid Waste <i>(Tons per 100,000 Vehicle Revenue Miles)</i>	7.52	7.83	7.44	7.73	7.68	9.57	24.6%	27.3%
Diversion from Landfill <i>(% Diverted)</i>	48%	26%	25%	21%	21%	28%	34.6%	-41.7%

METHODOLOGY

REPORTING FRAMEWORK

Metro is a founding member of the American Public Transportation Association (APTA) Sustainability Commitment, which “recognizes members who commit to becoming more sustainable in their operations and practices. Through a series of core sustainability principles, the commitment provides both agency and business members with a common framework that helps define, initiate, and advance sustainability in the public transportation industry.”

Signatories to the APTA Sustainability Commitment are required to quantify and report annually on a series of key performance metrics and to track performance against each metric over time. The commitment establishes the following sustainability performance metrics:

- > Unlinked passenger trips
- > Vehicle miles traveled
- > Operating expenses
- > Criteria air pollutant emissions
- > Greenhouse gas emissions
- > Greenhouse gas displacement
- > Energy use
- > Water use
- > Total solid waste
- > Diversion from landfill

The reporting framework and methodology used in this report conform to APTA's *Recommended Practice* “Quantifying and Reporting Transit Sustainability Metrics.” The reporting period is calendar year 2017. The raw data was gathered through utility bills, fuel and mileage reports, weight tickets, transit data, program data, and interviews with key staff. All references to US dollars in this report are presented as 2017 US dollars unless otherwise noted. A technical appendix will be made available online which will include the current and historical data used for this report.

Metro became a founding signatory of the APTA Sustainability Commitment in **2009**

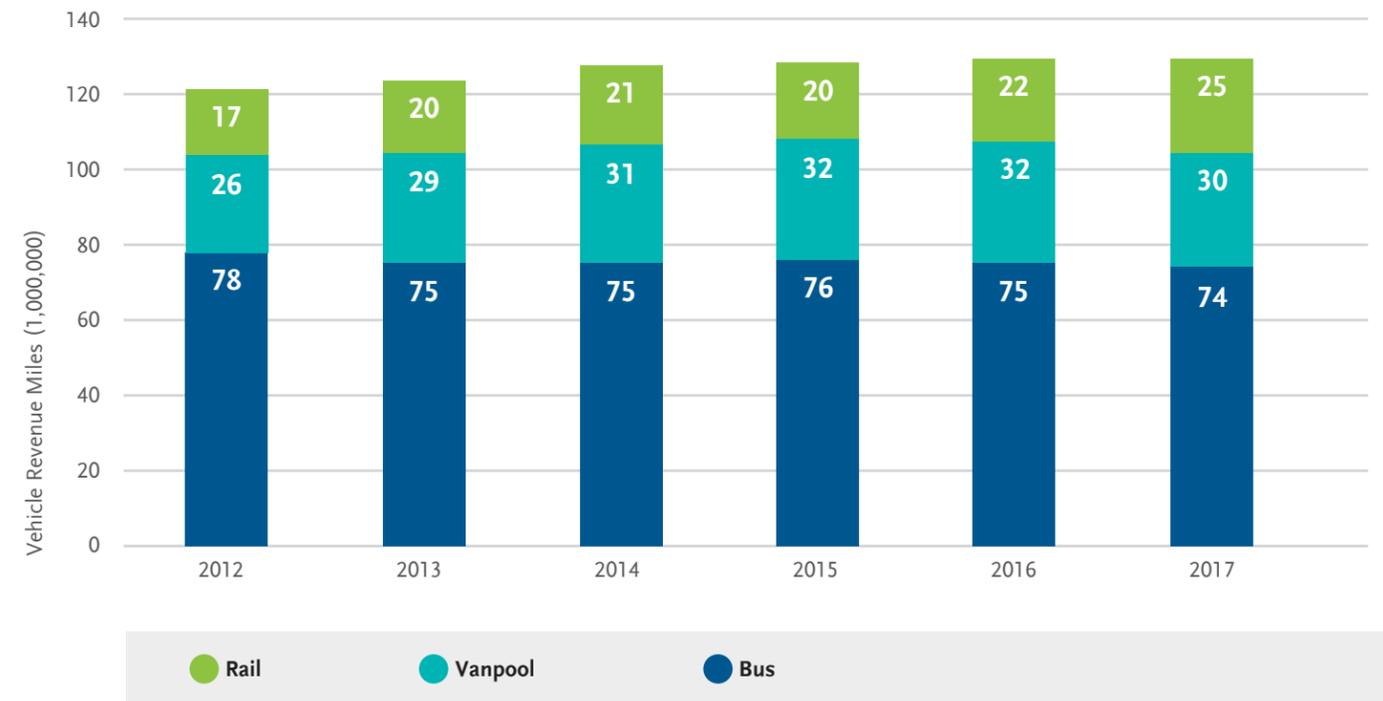


NORMALIZATION FACTORS

The APTA framework recommends that transit agencies use normalization factors when reporting performance metrics in order to provide context for the agency's operations and better track sustainability performance over time as transit services grow or change. The normalization factor selected by Metro and used in this report is Vehicle Revenue Miles, unless otherwise noted.

Vehicle Revenue Miles (VRM) represents the total number of miles Metro's vehicles travel while in revenue service (i.e., the time when a vehicle is available to the general public and there is an expectation of carrying passengers). Reporting sustainability performance in terms of VRM allows Metro to more accurately depict trends over time and normalize for changes in service size and scale. The trend in Metro's total VRM by mode since 2012 is displayed below.

Vehicle Revenue Miles



OPERATIONAL EFFICIENCY

PERFORMANCE METRICS

- **Unlinked Passenger Trips**
- **Vehicle Miles Traveled**
- **Operating Expenses**
- The operational efficiency metrics measure trends in ridership, regional travel behavior, and agency financial sustainability. The metrics are normalized for transit system size and population growth.

REGIONAL CONTEXT

In addition to reporting on the identified sustainability performance metrics, APTA guidelines include annual reporting on three metrics that relate to operational efficiency and help provide regional context for the sustainability performance of an agency. The Unlinked Passenger Trips and Vehicle Miles Traveled metrics are normalized using the population of LA County, reflecting the effectiveness of Metro's efforts to provide transit services to the region.

The passage of Measure M continues the **TRANSPORTATION REVOLUTION** in Los Angeles County



RIDERSHIP

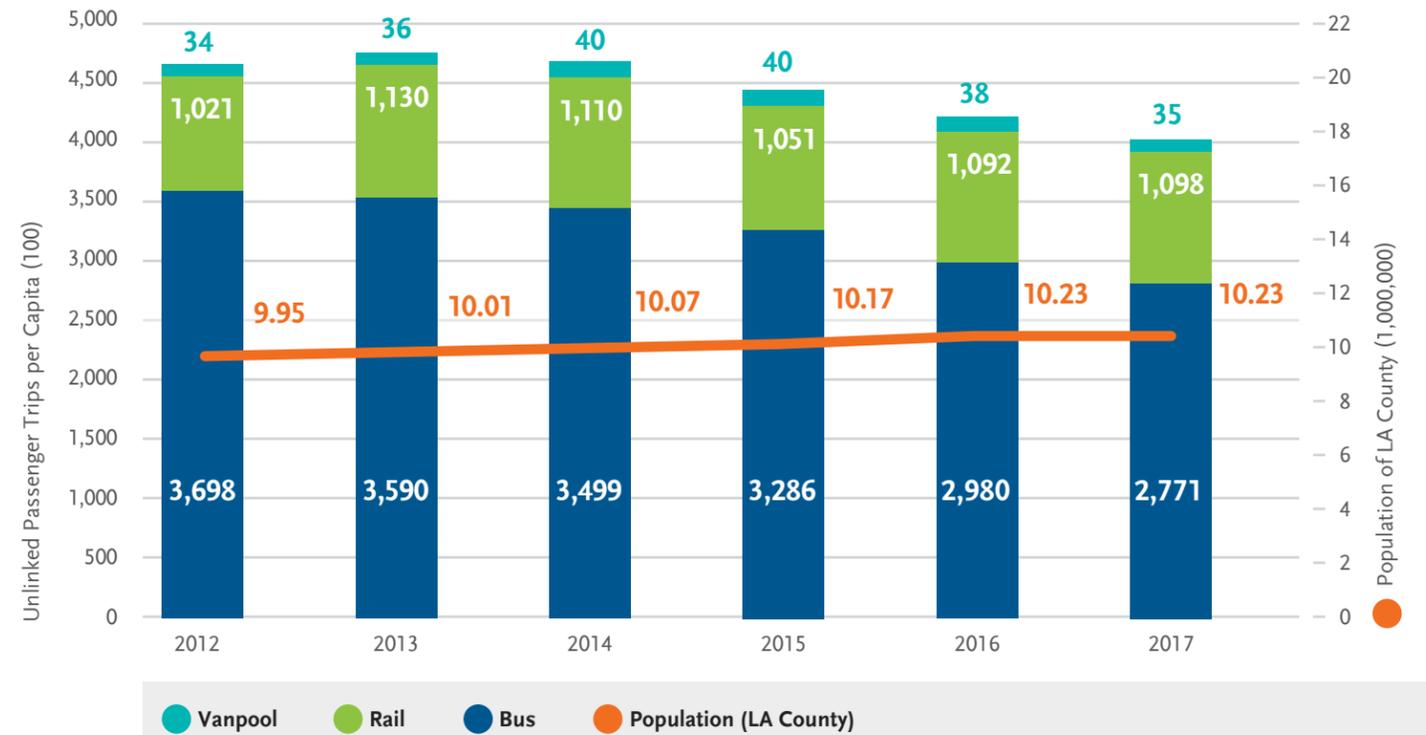
Unlinked Passenger Trips (UPT) is defined as the total number of times passengers board public transportation vehicles, regardless of whether the boarding results in one or multiple trips. In line with the national trend, transit ridership has been declining over the past few years. While there is no single cause, increased access to vehicles amongst lower-income populations, declining unemployment, and historically low gas prices are often cited as important factors. However, investment in improved transit infrastructure is proving effective at attracting riders. From 2012 to 2017, a period during which Metro opened up three new light rail extensions (Gold Line Foothill Extension

Phase I and Expo Phase I & II), rail ridership increased nearly 8% after normalizing for population growth.

Metro is also adapting existing services to be more relevant and attractive to the residents of LA County. The current bus network carries over 70% of Metro's transit customers, yet the system hasn't been overhauled in 25 years. Launched in 2017, the NextGen Bus Study will design a new bus network that addresses LA's growing population and evolving travel patterns, ultimately resulting in a more flexible system that can better serve current customers and attract new customers.

Unlinked Passenger Trips

8%
increase in rail ridership per capita since 2012



MOBILITY TRENDS

Vehicle Miles Traveled (VMT) is one indicator of the impact a public transit agency has on mobility trends within the agency's service territory. After accounting for population growth, Los Angeles countywide VMT has remained largely unchanged since 2012 and declined by 3.2% since 2007.



“Metro is assessing dynamic population, demographic, employment, economic, fiscal and land use changes in order to inform long-term planning.”

From the Report to Board, September 2017 on the Long Range Transportation Plan Update

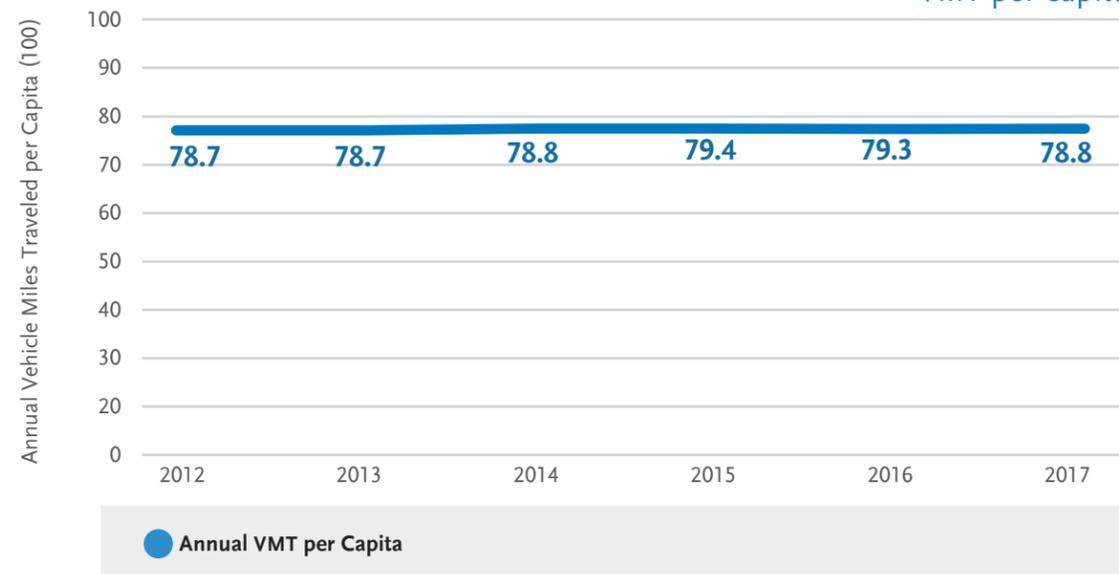
OPERATING EXPENSES

Economic efficiency and stability are key components of Metro's sustainability program and remain core business goals. While operating costs per revenue mile have increased by 5% each year since 2012, many of Metro's efforts to provide additional community resources such as bike share, workforce development, and air quality improvements are

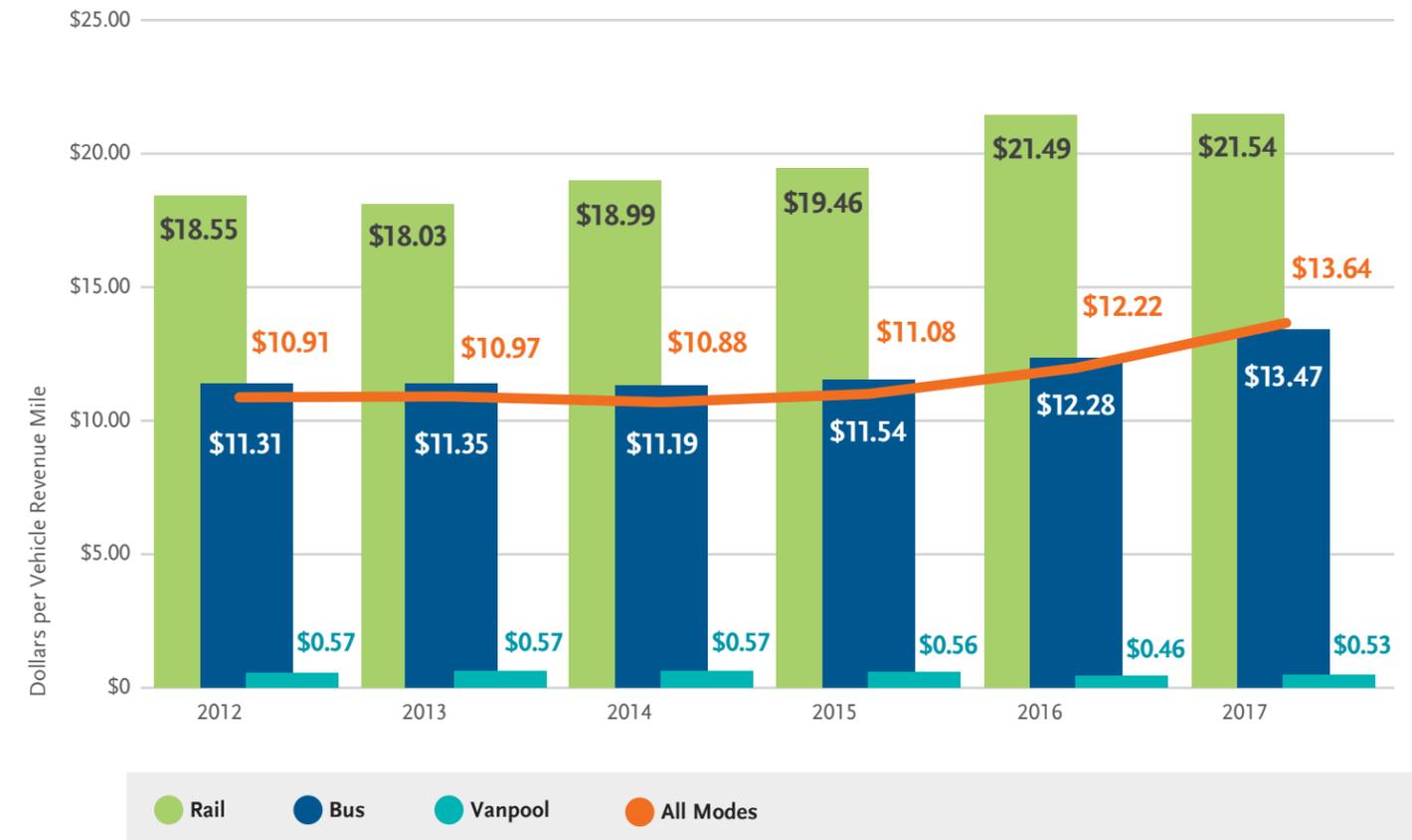
not reflected in the graph below. Rail service is traditionally the most-costly mode to operate when normalized. Vanpool is the most cost effective, but it only offers a limited reach. Improvements to bus service planning represent an important strategy for optimizing efficiency and managing operating expenses.

Vehicle Miles Traveled

3.2%
decline in countywide
VMT per capita since 2007



Operating Expenses



AIR QUALITY

PERFORMANCE METRIC

Criteria Air Pollutant Emissions

The criteria air pollutant emissions metric measures tailpipe emissions from Metro's bus fleet and support vehicles. The major criteria air pollutants are hydrocarbons (HC), nitrogen oxides (NOx), and particulate matter (PM).

Compared to 2008, Metro has reduced NOx emissions by

82%

LET'S CLEAR THE AIR

Metro operates one of the largest compressed natural gas (CNG) bus fleets in the nation, which emits far less pollution than traditional diesel buses. In 2011 alone, the last year that Metro operated diesel buses, nitrogen oxide (NOx) emissions were higher than the last three years of emissions from CNG powered buses combined (2015-2017). Compared to 2012, Metro has reduced NOx pollution by 40%.

After the initial conversion to an all CNG fleet, Metro has been able to achieve additional reductions in criteria air pollutant emissions by retrofitting aging CNG engines with newer, more efficient models. Last year, a slight increase in emissions resulted from the use of older buses on Metro routes. However, cleaner buses are continuously being introduced into the fleet. In 2017 Metro repowered 142 engines with new engines that average a 15% reduction in NOx emissions and purchased an additional 395 "near-zero emission" CNG engines. Low NOx engine technology will continue to play a role in fulfilling Metro's near-term commitments to reducing fleet emissions and improving air quality in the region.

A BOLD INVESTMENT

On July 27, 2017 the Metro Board of Directors took a historic step and unanimously voted to transition the entire Metro bus fleet to zero-emission vehicles by 2030, becoming the largest American transit agency to adopt such a goal.

In the words of Metro CEO Phillip A. Washington:

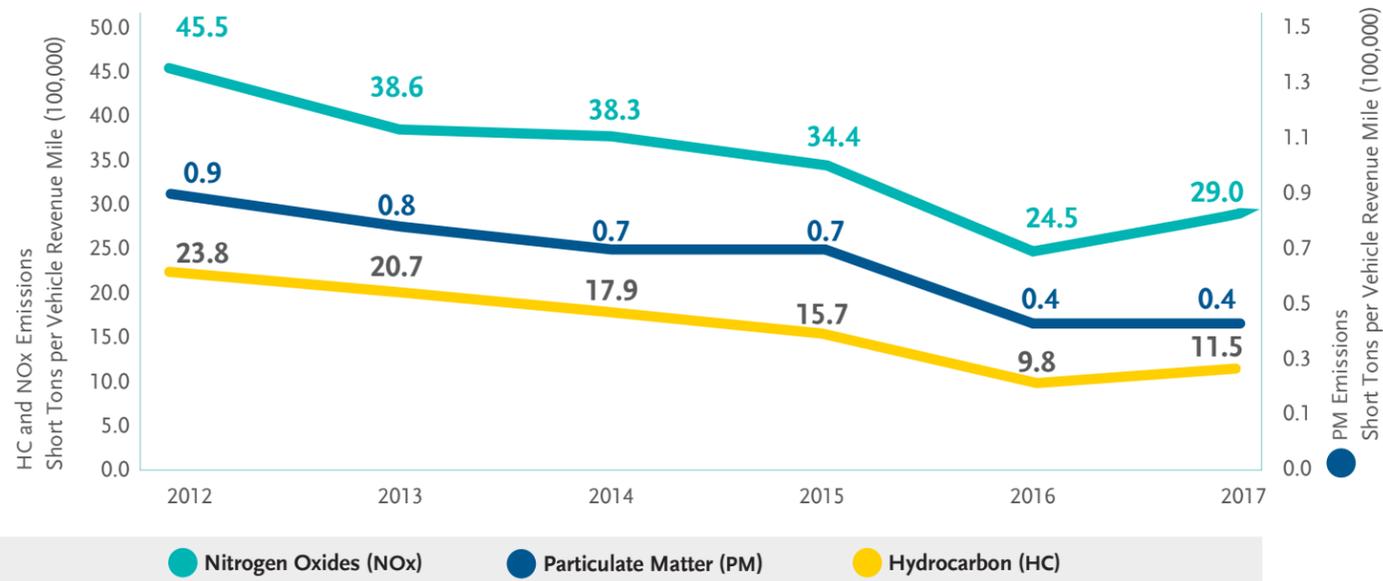
"As we continue our transportation revolution, we must continue to make sustainable practices the norm. We hope our move toward a zero-emission fleet will inspire other transit agencies across the nation to consider this as a possibility and investigate how they can transition toward greener fleets for the benefit of patrons, as well as the cities and towns they serve."

Towards this end, the Board approved the purchase of sixty 40-foot all-electric buses manufactured by BYD and thirty-five 60-foot articulated zero-emission buses by New Flyer.



BYD's Metro electric bus early prototype; photo courtesy of cleantechnica.com

Criteria Air Pollutant Emissions



Crash Course in Air Quality

Particulate Matter
PM₁₀

PM₁₀ are airborne particles that are 10 micrometers or less in diameter. Finer particulate matter can deposit deep in the lungs and is associated with a variety of adverse health effects, including lung cancer.

Reactive Organic Gases
ROG

ROGs (such as hydrocarbon) are volatile organic compounds that react with NOx to form ground-level ozone or smog. Increased levels of ozone are associated with greater health impacts, including respiratory illnesses and increased asthma episodes.

Nitrogen Oxides
NOx

NOx is a family of highly reactive gases that are precursor pollutants to ground-level ozone or smog. NOx commonly affects the respiratory system and is a greater health threat to children and the elderly.



In 2017, Metro reduced NOx emissions from its fleet of support vehicles by **26%**

A FLEET OF THEIR OWN

Metro is also working hard to reduce emissions and increase sustainability behind the scenes. Alongside its bus fleet, Metro maintains a fleet of vehicles used for field operations and driver relief assignments. Efforts to reduce the fuel usage of these vehicles and replace older gasoline vehicles with hybrids and battery electric vehicles (BEVs) have been successful in reducing criteria air pollutant emissions. In 2017, these field operation vehicles logged over 11.5 million miles (only 5% less than in 2016), but emitted 4% less PM10, 39% less ROG, and 26% less NOx than the year prior. In 2017, Metro also acquired its first fully battery-electric fleet vehicle, the Chevy Bolt, and has plans to purchase additional Bolt vehicles to further reduce its emissions. For more information on the Chevy Bolt vehicle procurement, see the Highlight on page 24.



“We’re making bold investments in new technology because Metro is serious about making our air cleaner and communities healthier.”

Mayor Eric Garcetti
Chair of the Metro Board (FY18)

GREENING CONSTRUCTION

Not only is air pollution harmful to human health, it disproportionately affects disadvantaged neighborhoods. While increasing public transit will help displace more air pollution in the future, near term construction activities will result in increased localized pollution in areas receiving a larger environmental pollution burden. The Environmental Protection Agency (EPA) and California Air Resources Board (CARB) established phased-in standards to reduce the air pollution resulting from construction equipment and activities. However, California’s off-road construction fleets are not required to meet the highest emission standards until 2029.

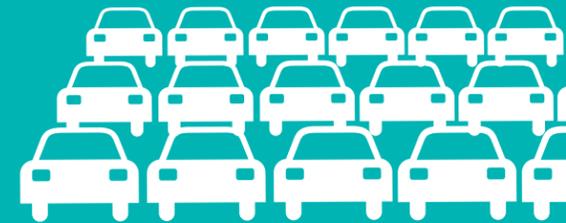
In order to mitigate these impacts, Metro’s Green Construction Policy (GCP) accelerates this timeline and requires Metro’s contractors to start using cleaner vehicles and equipment now. The policy, which was established in 2011, requires Metro’s contractors to use less polluting equipment and reroute construction traffic away from schools, daycares, playgrounds, and hospitals. As in previous years, the results are significant.

In 2017, not only were pollution emissions significantly reduced from the estimated business as usual levels as a result of this policy, they were reduced in locations close to vulnerable populations and in neighborhoods that historically receive a greater burden of pollution exposure.



The reduction in emissions from construction equipment in 2017 was equivalent to removing over

27,000
cars from the road



JUST AND IMPACTFUL

When it comes to air quality, not all emission reductions are equal. Due to the location of Metro’s air quality improvement efforts, Metro’s emission reduction strategies have an amplified effect. Emissions produced upwind or in locations with higher population densities have a greater impact on human exposure and health. Based on research, Metro’s GCP emission reductions, which are currently near or upwind from dense populations, have a 114% greater impact on reducing pollution exposure compared with reducing an equal amount of pollution elsewhere in the region. In addition, Metro plans to incorporate cleaner electric buses into the Silver Line, which runs from El Monte to Downtown LA to San Pedro. This route runs through a number of high-density communities, so this investment will help reduce the pollution levels experienced in these areas. For more information on pollution impacts, see the Highlight on page 20.

HIGHLIGHT: ENVIRONMENTAL JUSTICE



Environmental justice is the meaningful involvement of all people in decisions that can significantly affect their community. It also means that certain communities, regardless of race, ethnicity, income, national origin, or education, should not bear a disproportionate burden of pollution from increased development or changing policies. Despite measurable gains in addressing environmental justice, it still remains a prevalent issue in Southern California. Metro's ongoing and planned transit projects are anticipated to address long-term environmental equity issues by increasing public transportation, which is associated with improved air quality.

Metro's 2009 Long-Range Transportation Plan emphasizes three main measures: improving mobility, improving air quality, and promoting environmental justice. Through comprehensive planning and community engagement, Metro strives to promote environmental justice through avoiding, minimizing, or mitigating disproportionately adverse human health and environmental effects. Metro helps ensure the full and fair participation by all potentially affected communities in the planning process.

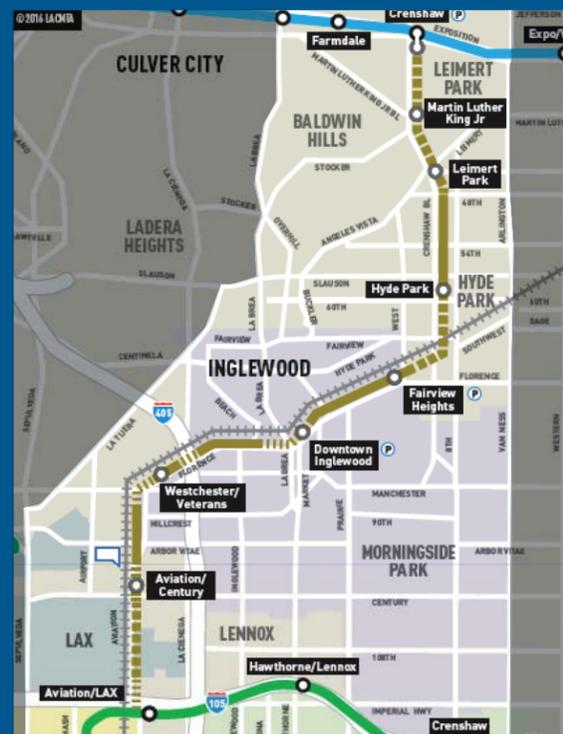
Metro recognizes that low-income and minority residents constitute a majority of the transit dependent population and are anticipated to benefit most from Metro's ongoing transit programs. CalEnviroScreen is a mapping tool that helps identify vulnerable communities that are most affected by sources of pollution. Scores are based on multiple indicators, including the overall pollution burden, socioeconomic data, and the prevalence of health conditions (www.oehha.ca.gov/calenviroscreen). With Metro's existing network situated in areas identified in CalEnviroScreen as receiving a greater burden of environmental hazards, Metro's future transportation network is expected to reduce air pollution and improve the quality of life for neighborhoods that need it.

Metro improves
quality of life
for neighborhoods that need it

ADDRESSING ENVIRONMENTAL JUSTICE THROUGH POLLUTION REDUCTION

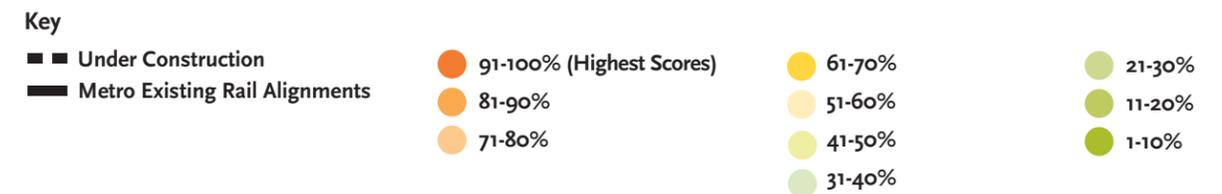
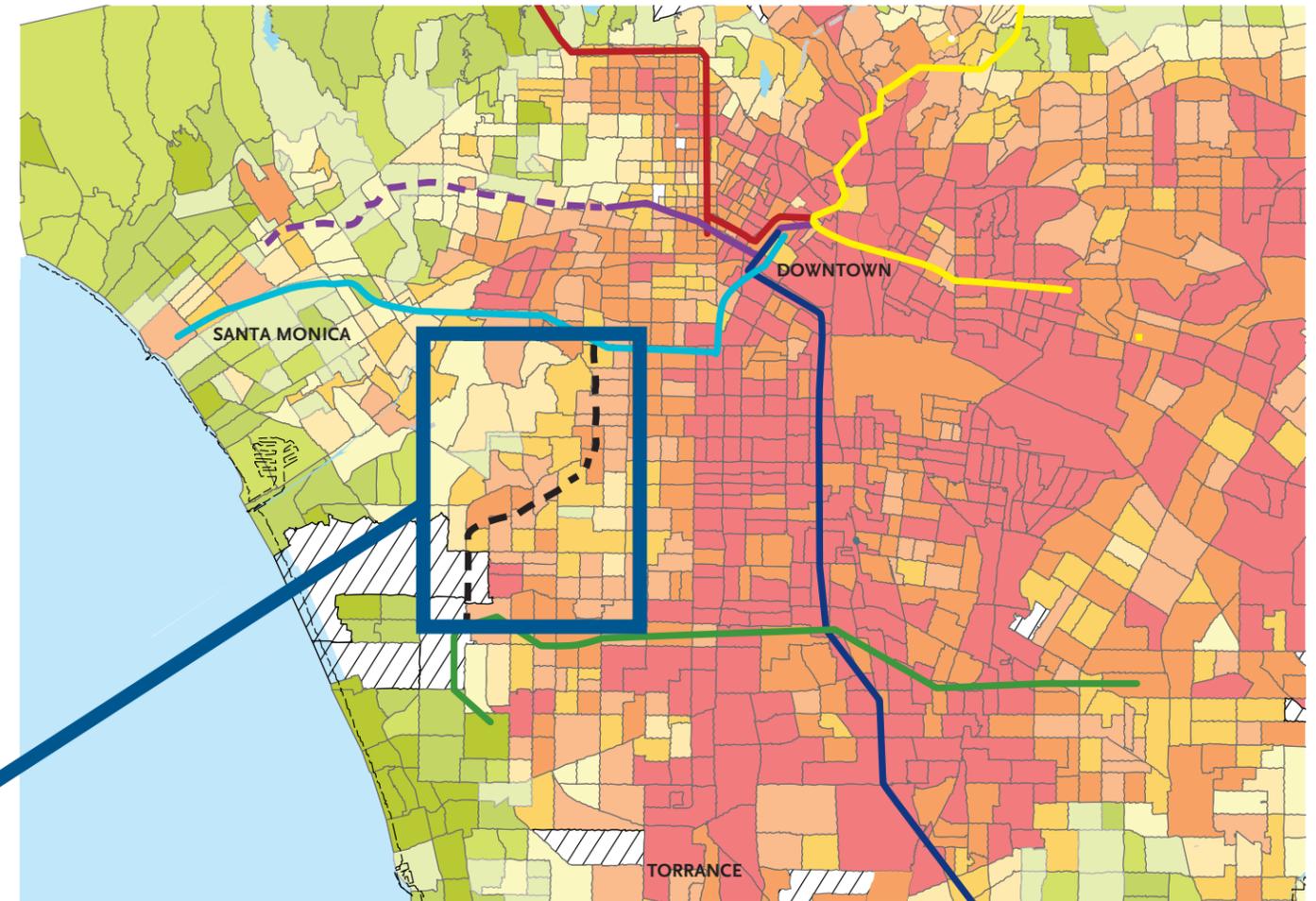
For the Crenshaw/LAX (CLAX) Transit Corridor Project, the impact of Metro's Green Construction Policy toward human health and environmental justice is substantial. Over 370,000 people live in the CLAX transit corridor area; 94% belong to a minority group and 23.1% live below the poverty threshold. In comparison, Los Angeles County is 69% minority, with 18% living below poverty. Consequently, CalEnviroScreen scores in the Crenshaw/LAX Transit Corridor project area are significantly higher when compared to other regions (average: 83 percentile). Through this policy, reductions in pollution not only improve the overall health of the residents in the area, but impact communities where it matters.

The use of cleaner burning construction equipment (i.e. Tier 4 engines) reduced PM₁₀, ROG, and NO_x pollution by 0.50, 1.30, and 11.1 tons respectively along the CLAX alignment alone. Based on the EPA's average annual car emissions, the reduction in emissions for 2017 was equivalent to removing over 15,000 cars from the road.



CLAX Transit Corridor

CalEnviroScreen Map of LA With Existing and Proposed Transit Alignments



Higher scores are attributed to areas with higher environmental hazard exposures and vulnerable populations.

The reduction in emissions related to construction activity for CLAX was equivalent to removing over

15,000
cars from the road 

CLIMATE

PERFORMANCE METRICS

- Greenhouse Gas Emissions
- Greenhouse Gas Displacement

The climate performance metrics measure trends in greenhouse gas emissions *produced* by transit and greenhouse gas emissions *displaced* by transit through reductions in regional VMT. These metrics are indicators of Metro's net impact on greenhouse gas emissions.

POSITION ON EMISSIONS

The transportation sector is the single largest source of greenhouse gas emissions in California. While public transit is regarded as a climate-friendly alternative to single occupancy vehicles, Metro is dedicated to reducing the greenhouse gas emissions produced from its own activities to optimize the positive impact of transit. Metro's greenhouse gas emissions, measured in carbon dioxide equivalent (CO₂e), have been steadily declining since 2007 (31%) when Metro performed its first emissions inventory. Much of the decrease can be attributed to declining energy emissions factors as the share of renewable energy on the grid increases.

A CLOSER LOOK

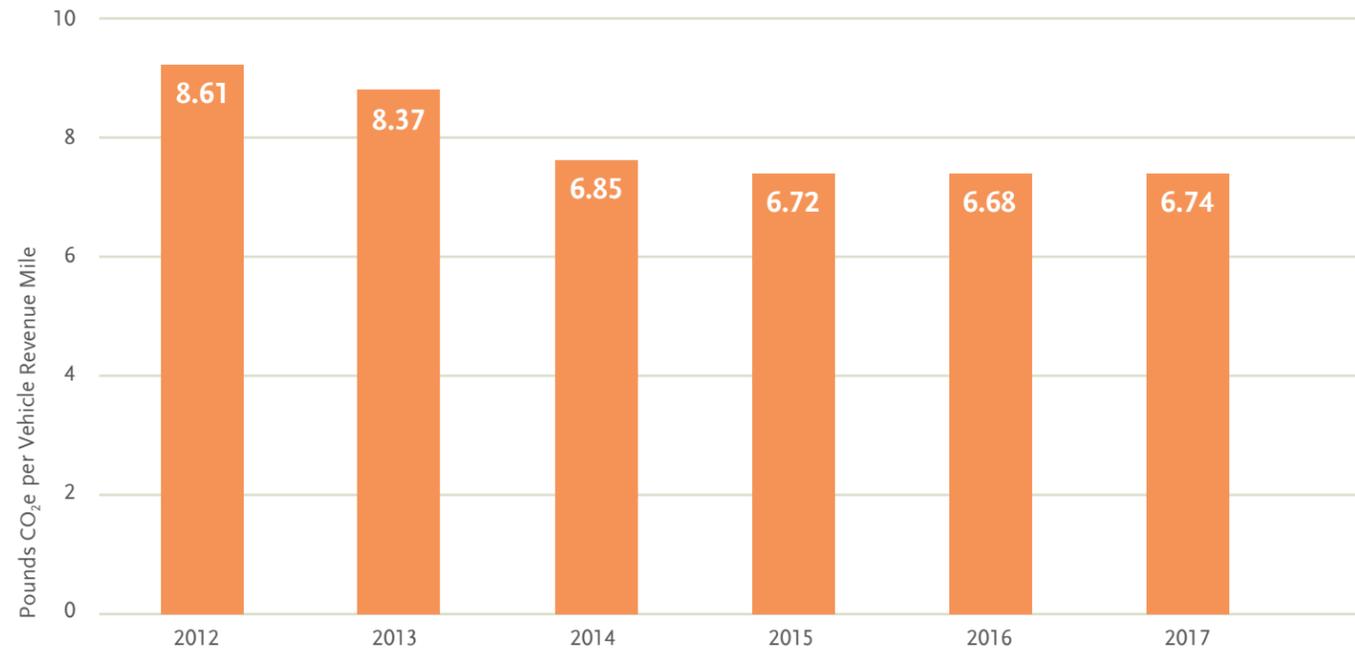
Improved emissions accounting methods have enabled Metro to take a closer look at its emissions trends and identify its major sources. The largest source of emissions for the agency is vehicle fuel (75%). Accordingly, Metro's bus service is the largest source of emissions by mode (65%). New fleet technologies powered by renewable energy can dramatically reduce Metro's emissions over the long term, but the agency is making gains in other areas. Since 2012, emissions resulting from building energy use have decreased by 23% while emissions from water consumption have been cut in half.



Downtown Long Beach Station, Blue Line

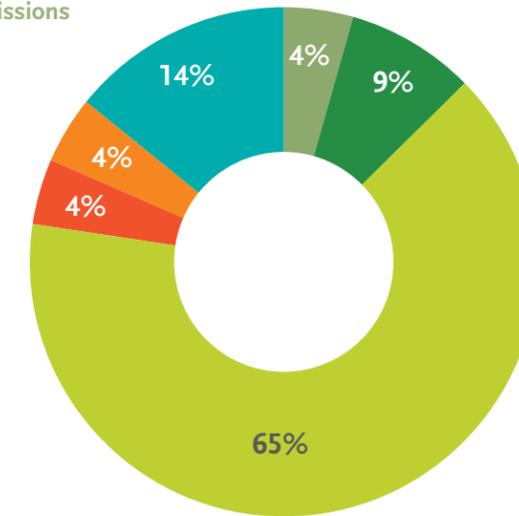
Since 2012, Metro has reduced its emissions by **22%**

Greenhouse Gas Emissions



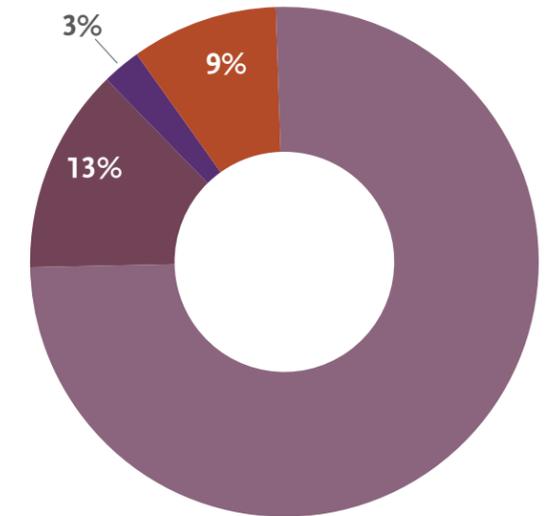
Data Update: Metro's emissions have been updated to reflect additional information obtained as a result of improved data tracking processes established in 2017.

Total Emissions



By Mode

- Heavy Rail – 4%
- Light Rail – 9%
- Metro Operated Bus Fleet – 65%
- Contracted Bus Fleet – 4%
- Vanpool – 4%
- Non-Modal Emissions – 14%



By Source

- Vehicle Fuel – 75%
- Rail Electricity – 13%
- Building Energy and Stationary Sources – 9%
- Other – 3%

Non-modal emissions include building energy use, water, refrigerants, and fuels for support vehicles

NETTING EMISSIONS

Perhaps the best sustainability indicator of an effective public transit system is greenhouse gas displacement. This occurs primarily through mode-shift or taking cars off the road. This factor, often measured in VMT reduction, is a major consideration when Metro plans new transit projects. The results are evident: Metro consistently displaces more emissions than it produces. Sustained commitments to greenhouse gas reductions coupled with expanding service will ensure this trend continues.

Metro consistently
**DISPLACES
MORE
EMISSIONS**
than it produces

Greenhouse Gas Displacement

GHG EMISSIONS BALANCE (MT CO ₂ e)	2012	2013	2014	2015	2016	2017
Total Emissions	474,538	471,932	396,380	391,275	390,840	390,251
Total Displacement	-478,607	-475,865	-482,813	-465,101	-448,301	-431,009
Net Emissions	-4,069	-3,933	-86,433	-73,827	-57,461	-40,758



THE SUPPLY CHAIN

In 2017, Metro continued to partner with CDP to work with its supply chain program to benchmark, manage, and provide meaningful reporting on supply chain impacts as they relate to climate change, resiliency, and GHG emission reductions. Thirty-one suppliers responded to Metro's invitation to report to CDP for 2017 which corresponds to a 37% response rate from selected suppliers. These suppliers reported reductions of 1.9 million tons of CO₂ through sustainable supply chain management activities. Metro will continue to encourage our suppliers to participate in CDP's supply chain program since they represent upstream GHG emissions which indirectly contribute to Metro's overall impact.

A MORE RESILIENT FUTURE

Metro is already experiencing the impacts of global climate change on its operations: more frequent wildfires, more extreme-heat days and higher temperatures, changes in precipitation, and more powerful wind. In order to ensure infrastructure is prepared for a more uncertain future, Metro is pursuing resiliency initiatives intended to bolster core business functions so they can continue regardless of the threat from changing conditions. To advance this effort, Metro's own Executive Officer of Environmental Compliance and Sustainability, Dr. Cris Liban, was appointed to the California's Climate-Safe Infrastructure Working Group, supporting AB 2800. The working group unites experts from across state infrastructure and scientific disciplines to strengthen the inclusion of climate change considerations in state design processes.

In line with the goals of the working group, Metro has been critically considering how to address the impacts of climate change into all facets of its business, including planning, designing, partnering, building, and maintaining its transportation infrastructure. In 2017, Metro began updating its Climate Action and Adaptation Plan (CAAP) to provide a framework for climate change adaptation. Through the CAAP, Metro will not only document these excellent adaptation examples, but also provide additional strategies to help the agency thrive in the face of the region's changing environment. As Metro prepares the CAAP update, the agency has already begun to gather examples of ways the agency currently adapts to the region's changing climate. For example, to account for increases in high heat, Metro researched innovative, technological solutions to address increased wire sagging from its Overhead Catenary System used to supply electricity to its light rail vehicles, and is currently piloting a new system that uses a pulley and balance weight to tighten wires as they sag.



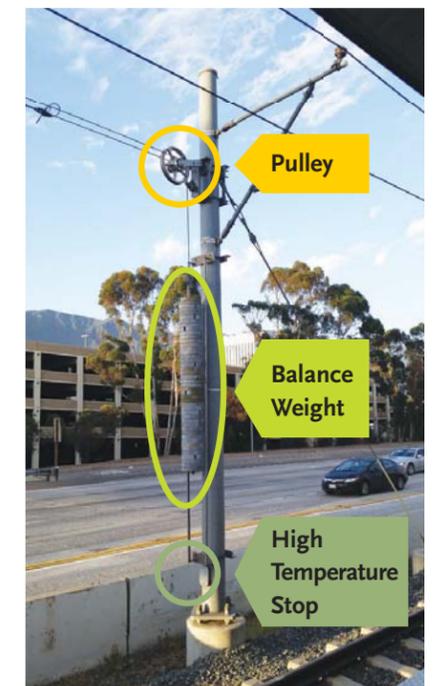
Through Measures R and M, we have been entrusted to be stewards of public funding for the planning, construction, operations, and

maintenance of transportation systems here in Los Angeles County. Our intimate involvement in the California AB 2800 Climate Safe Infrastructure Working Group process allows us to chart a proactive course for the long-term protection of these investments against unpredictable environmental stressors; and as a testament to our commitment to sustainable infrastructure while preserving social equity and ensuring long-term economic vitality.

Dr. Cris Liban, P.E., ENV SP
LA Metro Executive Officer
Environmental Compliance and Sustainability



Catenary system overview



Catenary system resiliency feature

HIGHLIGHT:
**GREEN
PROCUREMENT**



Metro strives to integrate environmental considerations into procurement decisions and evaluate the environmental consequences of a product throughout its lifecycle. To this end, Metro consistently evaluates new products and technologies that advance resource efficiency, pollution reduction, and air quality improvement efforts.

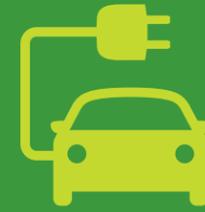
In addition to the bus, rail, and vanpool fleet vehicles that provide revenue services, Metro owns a fleet of non-revenue sedans, trucks, and SUVs. Metro's non-revenue fleet is comprised of vehicles that do not carry fare-paying passengers and do not have any revenue associated with their operation but still play a critical role in ensuring excellence in service and support. In 2017 through the Environmental Management System, Metro's Non-Revenue Department evaluated the viability of purchasing battery electric vehicles (BEVs) for the non-revenue fleet.

Metro calculated the total cost of ownership (TCO) for eight commercially available BEVs and concluded that the all-electric Chevy Bolt could meet Metro's needs while offering a lower TCO at year ten than a Toyota Camry hybrid.

Based on the findings and recommendations of the BEV assessment report, Metro's Non-Revenue Department initiated a pilot project to purchase and deploy ten all-electric Chevy Bolts in 2017. The Bolt has a range of 238 miles on a single charge and fully recharges in about 9 hours. The current fleet is expected to drive about 37,000 miles per year and avoid consuming about 1,000 gallons of gasoline during the same period when compared to Toyota Camry hybrids.

To support implementation, Metro installed 18 charging stations in 2017 with the support of Facilities Maintenance and General Services to provide local fueling capacity to the BEV fleet. Additionally, Non-Revenue partnered with the Environmental Compliance and Sustainability Department (ECSD) and the Talent Development department to produce a BEV driver training program to familiarize Metro employees with the specifics of BEV operation and the Chevy Bolt.

Based on the initial success of the pilot project, Metro is planning to expand the BEV fleet with an additional 20 Chevy Bolts in 2018- 2019. New vehicles will be deployed to bus and rail divisions to support driver relief operations and to replace retiring Toyota Camry hybrids.



"One of the key benefits of the Chevy Bolts is that they have no tailpipe emissions, which reduces the emission of pollutants into the air in the Los Angeles metropolitan area, thereby improving overall air quality."

Andrew Quinn
Sr. Environmental Specialist, Metro ECSD



Dan Ramirez and Andrew Quinn

"The BEV pilot project provides an opportunity to see how new vehicle technology works in Metro's operating environment while working towards agency and state emission reduction goals."

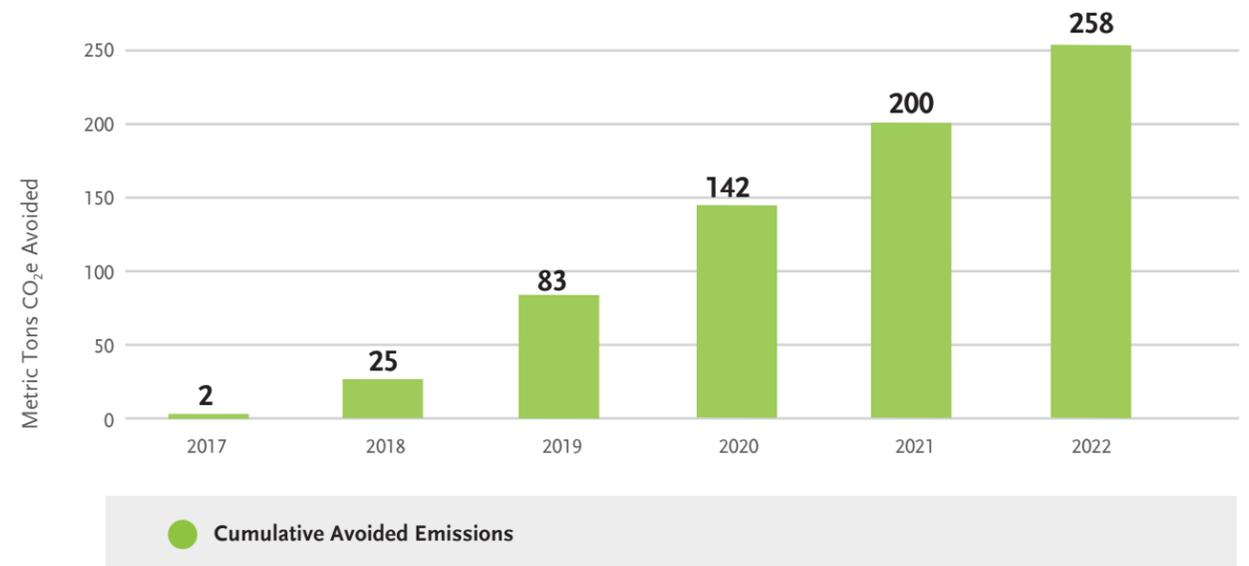
Dan Ramirez
Sr. Director, Metro Non-Revenue Fleet Maintenance



By 2019, over
15%

of Metro's non-revenue sedan fleet will be BEVs

Projected Cumulative Avoided GHG Emissions of Expanded BEV Fleet



COMMUNITY

MORE THAN JUST TRANSIT

Metro's commitment to serving Los Angeles County extends beyond transportation infrastructure. Metro is dedicated to engaging with the community in transformative ways and providing resources that advance connectivity and community health. While the APTA framework does not include metrics related to social sustainability, Metro views community engagement as a critical component of the sustainability program, fulfilling the three dimensions of sustainability: social, environmental, and economic.

In order to drive sustainable change in the region, Metro is working to build internal and community capacity through environmental education and green workforce development programs. These programs create economic opportunity and increase the

sustainability knowledge base of the local professionals that Metro partners with to provide excellence in service and support.

Metro strives to provide resources and services beyond the core transit system that encourage community health and participation in sustainability efforts. For example, the on-going "Go Metro to Farmers' Markets" initiative connects communities with fresh produce and supports Los Angeles's regional health and wellness goals. The addition of new community mobility programs such as Bike Share and public electric vehicle (EV) charging stations enhance regional connectivity while promoting community use of sustainable transportation options.



Farmers market, Santa Monica

GROWING A GREENER WORKFORCE

Growing a Greener Workforce (GGW) is a cross-departmental and community partnership designed to raise awareness within Metro and across Los Angeles County about environmental and sustainability principles. The program began in January 2017 with classes in the Envision Rating System and Green Professional (G-PRO) training. By learning together, GGW fosters the development of authentic relationships and inspires the community to collaborate and innovate through exposure to sustainability ideas.

Transforming Los Angeles through transportation will take a myriad of talents and GGW is building a common vocabulary across professional fields of expertise from which such innovation can flourish. GGW is the first time that Metro has created a learning environment to bring employees and the greater community together side-by-side. This highly diverse team of internal and external stakeholders each contribute unique tools, networks, and strategies to fulfill agency and regional sustainability goals.

2017 Program Participation

ATTENDEES	METRO STAFF	COMMUNITY
G-PRO	169	40
Envision	180	91



GGW Envision class in session

GROWING A GREENER WORKFORCE COURSE OFFERINGS



G-PRO
Comprehensive green building and certificate program developed with and for those who build and operate building infrastructure. The course introduces participants to the principles of green concepts and terminology.



Envision
International rating system used to measure the sustainability of an infrastructure project from design through construction and maintenance across a variety of categories.



"Often, those of us in 'traditional' jobs assume that sustainability has nothing to do with us. That's not true. *Envision* neatly relates sustainability to all aspects of Metro's business, from day-one planning, to finance, engineering, construction, daily operations and maintenance. It encourages good governance and accountability, and considers everything that infrastructure impacts, including stakeholders. This manages the present while being mindful of the future. Through *Envision* I've learned new, healthier strategies for Metro's business. I can promote and support more holistic partnerships across departments."

Anika-Aduesa Smart, ENV SP
Manager, Metro Emergency & Homeland Security Preparedness
Integrated Communications Liaison and Geospatial
Technology Unit
Emergency Management

METRO BIKE SHARE

Metro Bike Share is expanding Metro’s transit offerings with a zero-emissions transit mode that improves health and well-being. Entering its second year of operation, the Bike Share program grew in 2017 by opening new stations in Pasadena, Port of Los Angeles, and Venice. This expansion doubled the number of bikes available and increased the number of miles traveled by 7%, from 355,000 miles in 2016 to 379,118 miles in 2017. Metro is the only transit authority with a bike share program that allows integrated payment services. Payments are designed to match riders’ needs with monthly passes, flex passes, individual ride fares and rider relief coupons. With a total of 1,500 bicycles, 125 stations, and more than 163 MT CO₂e diverted, the Bike Share program is a remarkable success.



Bike Share Stats

Total Trips	107,921
Miles Traveled	379,118
Estimated Calories Burned	8,458,414
Estimated Carbon Offset (MT CO ₂ e)	163



Metro Bike Hub, El Monte Station

BIKE HUBS

The first Metro Bike Hub opened at El Monte Station in 2015. In 2017, Metro expanded this service by opening two new Bike Hub locations at Union Station and the Hollywood/Vine Station. Managed by a Small Business Enterprise-certified contractor, the Hubs offer same-day repairs, accessory sales, bike classes, and onsite staff assistance, as well as secure parking for over 250 bikes combined. These services play an important role in improving connectivity by expanding infrastructure and services for transit passengers’ first/last mile.

Additional bike hubs are planned at Culver City Station, Willowbrook/Rosa Parks Station, North Hollywood Station, and the Airport Metro Connector station.

COMMUNITY EV CHARGERS

In 2017, Metro installed 14 public EV chargers at four stations in order to provide additional charging capacity for the LA region. With the addition of these new chargers, Metro now offers a network of 68 chargers at 16 public parking lots across Los Angeles. These public charging stations are available to all Metro parking patrons and provided 125,202 kWh of electricity in 2017, which is

the equivalent of providing 383,117 miles of driving range. When compared to internal combustion engines, the charging service provided by Metro displaced vehicular emissions by 86.2 MT CO₂e. Metro is continuing to expand its charger network to new locations and is further defining a long-term vision for EV infrastructure with the development of an Electric Vehicle Implementation Plan.

Metro Community EV Charge Stations



HIGHLIGHT: SUSTAINABILITY COUNCIL



PURPOSE

Introduced in 2016 and formed in response to a Metro Board directive, the Sustainability Council supports Metro's sustainability program by advising and providing recommendations on matters such as policies, operations, construction, and maintenance processes that further Metro's goal of delivering a sustainable transit system to LA County. The Council is composed of 26

voting members representing a range of sectors and stakeholder groups with expertise in sustainability and transportation. In 2017, the Council formed four subcommittees to address both immediate and future focus areas related to Metro's sustainability efforts. The four subcommittees include: Resource Management, Electrification, Partnerships, and Metro 27.

MISSION

The mission of the Sustainability Council is to advise Metro regarding its sustainability-related activities and projects; continually improve sustainability efforts by developing targets, metrics, and strategies; and serve as a successful proof of concept for cities it serves in achieving stated sustainability program goals.

GOALS

- > Increase awareness of multi-benefit sustainability-related leading industry practices and best practices for inclusion in all public discussions and decision-making processes
- > Advise in the development of Metro's sustainability goals, establish targets and performance measures, align with regional greenhouse gas reduction targets (SB375) and other relevant air pollution targets, and assist in the tracking and reporting on a quarterly basis
- > Increase involvement of local small business and inform the larger public on sustainability efforts and related training
- > Improve understanding by our constituents and stakeholders of the sustainability-related efforts and opportunities at Metro



From left to right: Peter Meng, Dr. Tona Nikl-Rodriguez, Doug Dietrich, Fernando Cazares, Roy Thun, Mike Kempton, Anthony Bower, Aki Luukkainen, Pavitra Rammohan, Dominique Hargreaves, John Williams, Joel Levin, Dr. Hilda Blanco, Paul Backstrom, Joe Ablay, Berwyn Salazar, Carolina Coppola, Dr. Cris Liban, Dilara El-Assaad, and Mayor Thomas Small

SUSTAINABILITY COUNCIL SUB-COMMITTEES

> Resource Management

Evaluates the needs and feasibility for a Regional Advance Mitigation Program (RAMP) and identifies additional natural resources issues

> Electrification

Focuses on expanding the electrification of Metro's non-fleet vehicles and increasing access to charging stations

> Partnerships

Focuses on developing a work plan to identify and recommend the best partnership opportunities to enhance Metro's plans for the sustainability of our system

> Metro 27

Focuses on the next 10 years of Metro's growth and on preparations for the 2028 Olympics



The Metro Sustainability Council has brought together over 30 organizations representing the diverse interests of non-profits, businesses, and community. The common thread has been to assist Metro in being the absolute best and most sustainable. While Los Angeles is undergoing sustainability planning at the County and City level, transportation and its effect on quality of life is the tie that binds our region together. I'm proud of the Council, its leadership, and the Metro staff who've dedicated themselves to this important effort.

Dominique Hargreaves
Vice-Chair, Metro Sustainability Council 2017-2018
Executive Director, US Green Building Council Los Angeles



This council has created an avenue to communicate Metro's projects and accomplishments to an international audience. With a GDP of over \$700 billion in 2017, LA County is the nation's top county economy. Given the enormous impact L.A. has on the nation and the world, companies around the globe look to LA for guidance and leadership on transportation, environmental, and economic programs. Our council is a unique platform where Metro and the participants have the opportunity to recruit top international companies and technologies to help solve some of the most pressing issues facing this region.

Stephen Cheung
Member, Metro Sustainability Council 2017-2018
President, World Trade Center Los Angeles

MEMBER REPRESENTED SECTORS

- > Academic research/innovation
- > Associated general services
- > County of LA Sustainability Officer
- > Countywide planning
- > Design professionals
- > Foreign interest/advocacy
- > Green building industry
- > LA City Mayor's Sustainability Officer
- > Landscape infrastructure/design
- > Non-governmental organizations: climate, habitat, energy, material resources, social environmental justice, water quality, water resources
- > Procurement
- > Public health
- > Real estate
- > Small cities

ENERGY



PERFORMANCE METRIC

Energy Use

The energy use metric measures the efficiency by which Metro uses energy to provide its transit service. Sources of energy include electricity, natural gas, diesel, and gasoline, which are used in a variety of ways to operate and maintain Metro's system.

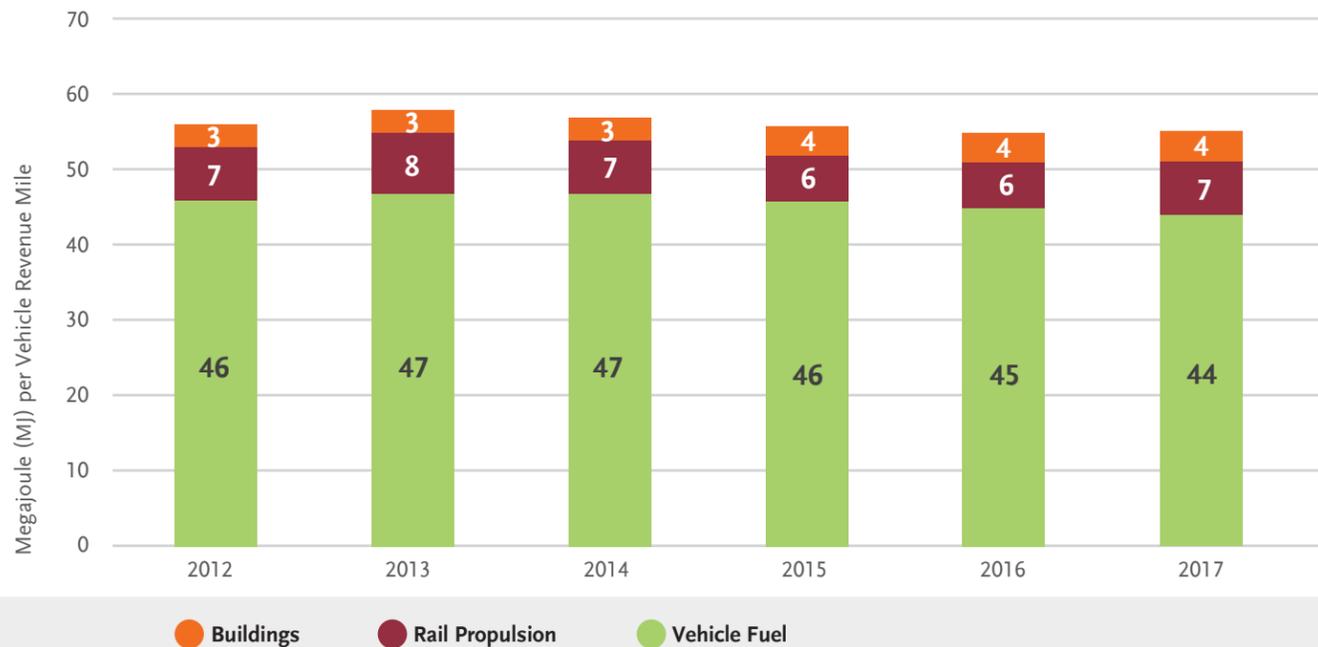
POWER DOWN

Providing public transit is an inherently energy-intensive endeavor, but proactive measures such as adopting renewable energy sources, energy efficient building design, deployment of renewable energy utilization, and energy conservation practices can reduce energy use and costs for the agency. Metro's commitment to energy stewardship is demonstrated by its 11 LEED certified buildings, representing nearly 2,000,000 square feet, and a renewable energy policy that commits the agency to at least 33% renewable energy use by 2020.

When normalized to account for an increase in service levels, Metro's energy use has remained steady since 2012. Because as much as 80% of Metro's energy consumption is used to power road vehicles, minor gains in vehicle efficiency are poised to have a larger, positive impact on Metro's overall energy use trend. These efficiency gains are expected to continue as fuel switching becomes more prevalent.

80%
of Metro's energy use
is vehicle fuel

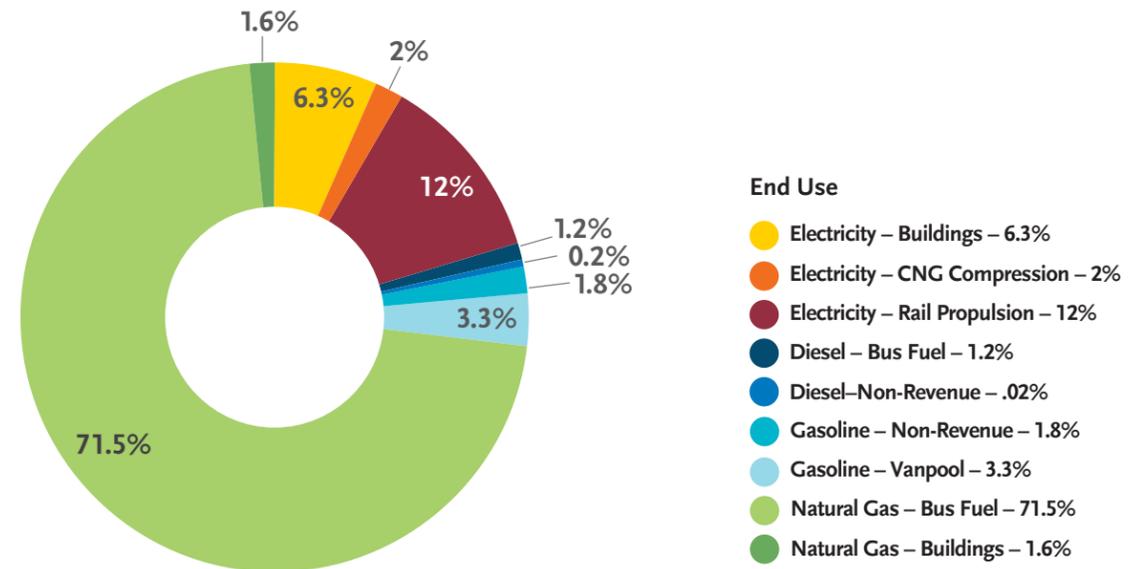
Energy Use



WHERE DOES IT GO?

Metro's largest energy end use is vehicle fuel for its transportation system. Around 92% of Metro's energy is used to move vehicles and rail cars, with the remaining 8% used to operate buildings. As Metro continues to transition its fleet to electric buses, the energy needed for bus propulsion will shift from natural gas to electricity.

2017 Energy By End Use



LOW HANGING FRUIT

In 2017, Metro began an initiative to upgrade the lighting systems at its many parking lots and structures. After energy and lighting audits were conducted at an initial four sites, Metro began retrofitting nearly 1,000 light fixtures with LEDs and installing daylight harvesting and occupancy sensors. In addition to improving lighting conditions and patron safety,

these upgrades will reduce annual energy use at these sites by 70% and approximately 200 hours in annual maintenance replacing lamps. This first phase of projects is expected to be completed in 2019, and additional audits are underway to identify more opportunities to reduce energy use and improve safety.



RENEWABLE ENERGY

In 2011, Metro made a commitment to utilize 33% renewable energy by 2020. Metro is on target to meet this goal: In 2017, 30% of Metro's electricity came from renewable sources, including 2,856,934 kWh generated from Metro's own solar photovoltaic systems. Metro is continuing to expand use of renewable energy through on-site generation by incorporating solar, where feasible, on all new construction projects.

30%
of Metro's
electricity came from
renewable sources

CARBON INTENSITY

The carbon intensities of natural gas and electricity, Metro's most used fuel types, are highly dependent on where these fuels come from. For instance, natural gas derived from landfills, which Metro is presently using in its RNG pilot, have carbon intensities that are about 43% lower than traditional "fossil" CNG. However, new sources of RNG with much lower carbon intensities, such as methane captured from dairy farms, will soon be commercially available and can be used to further reduce the carbon footprint of Metro's bus operations.

Similarly, the carbon intensity of electricity is highly dependent on the energy mix supplying the grid. In fact, RNG derived from dairy farms has been shown to yield carbon intensities comparable or even advantageous to current grid electricity. But California's Renewable Portfolio Standard is further reducing the carbon intensity of grid-supplied electricity by shifting towards more renewable energy sources and away from carbon intensive sources such as coal. By 2030, 50% of utility-provided electricity must be derived from renewable sources such as solar, wind, and geothermal. As the carbon intensity of grid-supplied electricity reduces, the potential for greenhouse gas reduction from future battery-electric buses will improve. The use of RNG and battery-electric buses are not mutually exclusive, and as the availability

and carbon intensity of the available fuels continue to evolve, both technologies will be strategically pursued to minimize the carbon footprint of Metro's bus fleet.

Crash Course on Carbon Intensity

Carbon Intensity is a measure of a fuel's greenhouse gas emissions over the lifecycle of that fuel, represented in grams of CO₂e per megajoule. Utilizing fuels with a lower carbon intensity is one of the most important strategies for reducing GHG emissions in the transportation sector and is a cornerstone of California's aggressive climate policies.

Carbon Intensity of Vehicle Fuels



Carbon Intensity Values (g CO₂e/MJ)

RENEWABLE NATURAL GAS PILOT

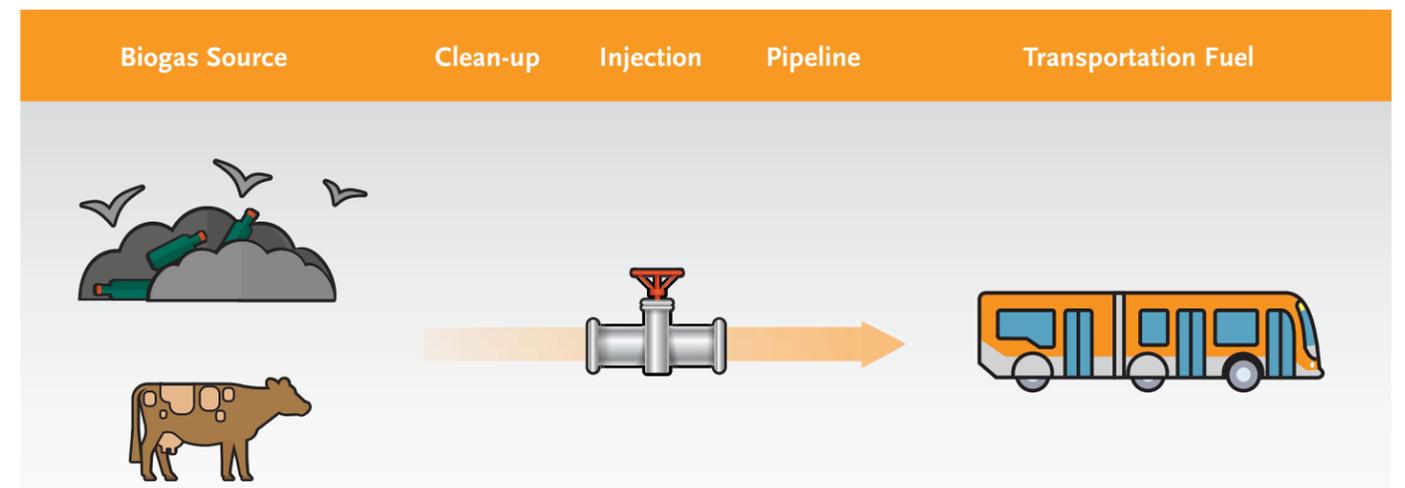
Given Metro's current operations, even the most aspirational renewable energy goals cannot be attained without also focusing on vehicle fuels. Metro's fleet of over 2,200 buses provides mobility services for approximately 1.3 million people per day, so it should come as no surprise that an overwhelming majority of Metro's energy is natural gas for vehicle fuel. But new trends in vehicle technology and fuel sources provide an opportunity for Metro to make a positive impact in the overall air quality of the LA basin and reduce the carbon footprint of its operations.

In 2017, Metro began using renewable natural gas (RNG) as a low-carbon alternative to traditional CNG for its bus fleet. Because renewable natural gas is derived from organic waste sources, the carbon intensity of a Metro bus running on RNG is 43% lower than a typical CNG bus. While these GHG emissions

reductions are significant, transitioning to renewable natural gas was identified as a particularly effective option for Metro because there are little to no operational costs associated with converting to this fuel. All compression and fueling equipment at Metro's facilities are unaffected by the change and can readily accept RNG without any modifications to existing operating procedures. RNG also delivers the same fuel efficiency as CNG, ensuring that Metro is operating at peak efficiency. The pilot program has also been cost effective, reducing Metro's natural gas fuel costs by about 14%. At present, 10% of Metro's natural gas is now RNG. Metro plans to increase its use of RNG to at least 50% by the end of 2018 and 100% by 2019.

Renewable natural gas
reduces the carbon intensity
of a Metro bus by **43%**

Renewable Natural Gas Lifecycle



HIGHLIGHT: LIFE OF A SUSTAINABLE PROJECT



Plan

Metro is committed to integrating sustainability practices through thoughtful environmental planning and the completion of Environmental Impact Reports (EIRs) during the initial planning phase. As such, Metro continually reviews new technologies, construction equipment, and processes to identify cutting-edge measures to minimize the negative impacts of construction. During this phase, Metro creates and approves mitigation measures that advance its vision for a world-class transportation system that serves the needs of the community.

Partner

Metro seeks partners that are committed to the agency's sustainability practices, goals, and expectations to better serve the communities in which it operates. These stakeholders provide valuable input throughout project development and share an understanding of the importance of transforming Los Angeles through sustainable development. Metro offers the Growing a Greener Workforce (GGW) training on environmental topics to assist their partners, including local non-profits, in building their Green IQ as well. Small and disadvantaged business participation is prioritized in Metro's project requirements to further Metro's social equity goals.

Design

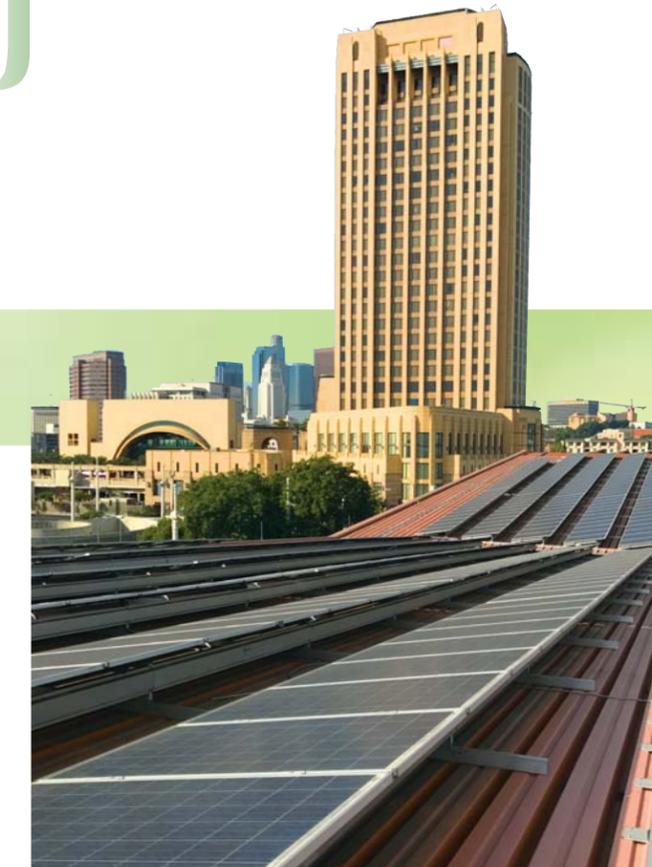
The Metro Rail Design Criteria (MRDC) integrates sustainable features in project design and encourages third-party certifications, such as LEED and Envision, to validate the quality of these decisions. Renewable energy systems, water efficiency, and energy management are key strategies for ensuring that Metro's infrastructure is designed for the future. The MRDC was updated in 2017 through a collaborative effort across Metro departments with the ultimate aim to improve the overall quality of life for Angelenos.

Build

The building phase poses unique challenges, including advanced utilities relocation, remediation, demolition, grading, and construction. The Metro team continually focuses on mitigating the negative impacts of construction and implementing innovative sustainability strategies throughout these phases. An example is the Westside Purple Line Extension – Section 1, which has successfully diverted 365,267 tons of construction waste from landfill through reuse or re-purposing.

Maximize

Metro facilities and transportation systems are on their way to performing at peak efficiency. Metro has developed an asset inventory containing almost 250,000 Metro assets, which prioritizes re-investment and estimates future state of good repair needs. As part of this work, Metro conducts project site risk assessments and upholds sustainability practices, such as emissions and water use reductions. Lessons learned from operations and maintenance inform the planning, designing and building of future projects.



ENVIRONMENTAL MANAGEMENT SYSTEM (EMS)

Metro's environmental policy is focused on protecting the environment, fulfilling agency compliance obligations, and generating continual improvement for a better Los Angeles County.

Metro integrates sustainability and environmentally-friendly practices into the lifecycle of its projects, including the planning, design, construction, and operations and maintenance (O&M) phases. One tool to achieve this is through Metro's robust EMS, which is certified to the ISO 14001:2015 standard and serves as a system for internal and external stakeholders to help Metro continually improve its environmental and sustainability efforts. As of 2017, the Metro EMS covers 19 operations, bus and rail divisions, and recently introduced construction as part of the scope. EMS seeks to continually improve sustainable building and construction processes through rigorous planning, doing, checking, and acting as part of its overall framework for managing the challenges of a project.



EMS IN ACTION: SOLAR SOLUTIONS

The MRDC includes specifications for on-site solar for all Metro projects, where feasible. These requirements are integrated during Design and Construction, and using the EMS program, Metro ensures that the systems are properly installed and transitioned to O&M during project close-out. There are 7 Metro-owned solar installations around the greater Los Angeles area that generated a total of 2,670 MWh in 2017. Through Metro's EMS, a training program was rolled out for Facilities Maintenance staff to build internal capacity for servicing the photovoltaic solar systems to keep them operating at peak efficiency. Properly maintaining these assets improves the resiliency of Metro's system while providing fiscal responsibility and a state of good repair.

WATER



PERFORMANCE METRIC

- **Water Use**
- The water performance metric measures the agency's use of potable water for domestic plumbing, irrigation, and other processes. The responsible use of water resources is critical in drought-prone Southern California.

WATER CONSERVATION

Metro strives to continually reduce water consumption and improve water efficiency. In recent years, drought conditions have made water a regional priority as well. Since 2015, Metro has been conducting comprehensive surveys of all facilities and rights-of-way to identify water efficiency opportunities and implementing pilot projects to measure the reduction potential of various conservation strategies.

2017 PERFORMANCE

Metro used 2.11 gallons of water per VRM in 2017, which equates to a reduction of nearly 7 million gallons when compared to 2015. In 2016 a number of pilot projects were implemented to assess the viability of several water reduction strategies. After a pilot period and additional analysis, some of these conservation measures were deemed unsustainable. In 2017, Metro identified additional long-term strategies that will continue the downward trend in agency-wide water consumption.

WASHED AWAY

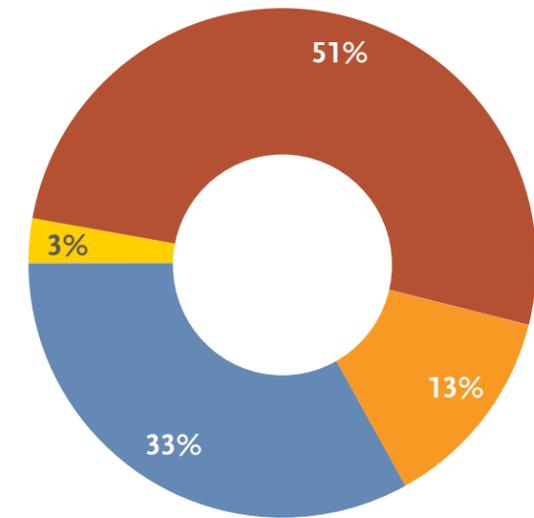
A study conducted in 2017 determined that bus and rail car washes are responsible for as much as 58% of the water consumption at Metro's maintenance facilities, and therefore represent a significant opportunity for water conservation. To address this, Metro initiated a pilot program to modify its bus wash nozzle spray systems, adjust the timing of wash sensors, and reduce the length of wash cycles, all while keeping bus cleanliness and customer experience a top priority.

This pilot study has already been successful at reducing Metro's water use at the car washes. In 2017, only 33% of Metro's water was used at Maintenance facilities, a reduction from 40% in 2016. These results indicate that when the modifications to bus wash facilities are completed in 2018, Metro's maintenance facility water consumption could be reduced by as much as 64,000 gallons per day.



Bus washing station

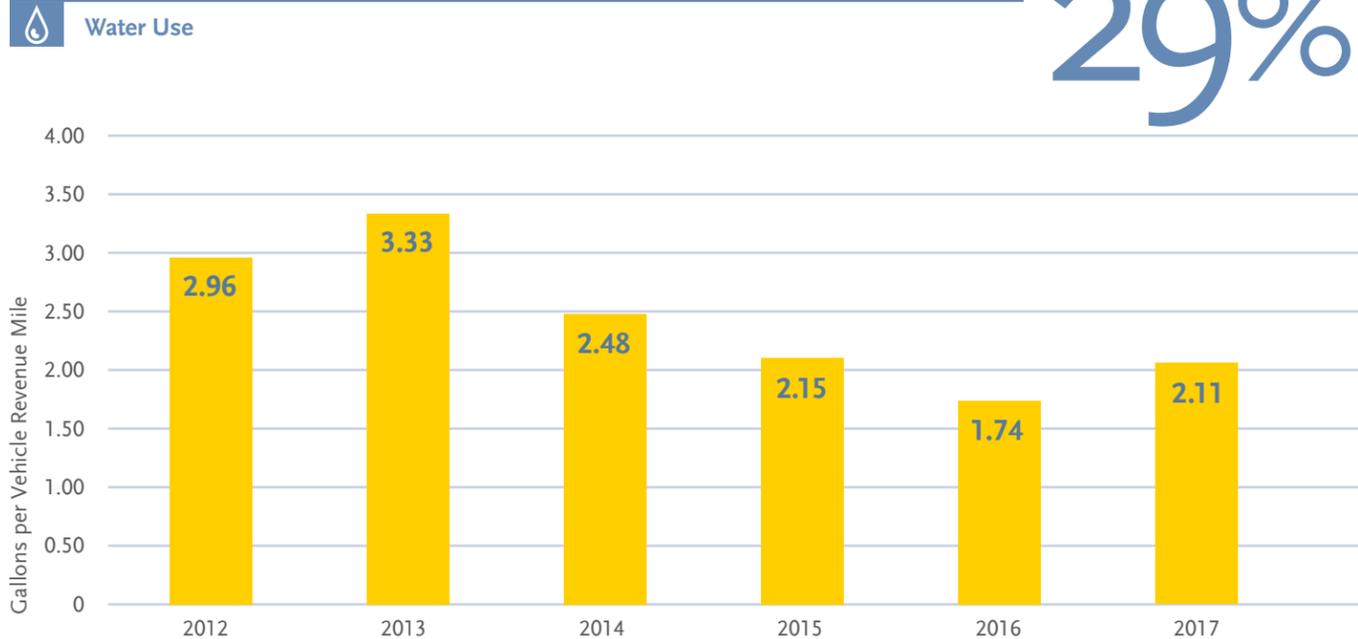
2017 Water Use by Facility Type



- Facility Type**
- Alignments – 51%
 - Administrative Facilities – 13%
 - Maintenance Facilities – 33%
 - Other – 3%



Since 2012, water use has decreased nearly **29%**



Data Update: Metro's 2016 water consumption has been updated to reflect additional information obtained as a result of improved data tracking processes established in 2017.

LANDS OF OPPORTUNITY

Approximately 51% of Metro’s water consumption in 2017 was used along Metro’s rights-of-way (the “alignments”), largely for irrigation. 68% of this water was used along the Orange Line alone. This trend is consistent with previous years and indicates on-going opportunities for water conservation and efficiency along the alignments.

The Orange Line was designed with a 14-mile long protected bike path, which is one of the longest ‘transit-adjacent’ bikeways of its kind in Los Angeles County. While this bike path provides additional connectivity and recreation opportunities to local residents, it also requires a lot of water for upkeep. Metro is in the process of replacing the 40 existing conventional irrigation controllers along the Orange Line with smart controllers and adjusting the irrigation schedules to be more efficient. Overall, these efforts are anticipated to reduce potable water use by approximately 78%.



Protected bike path, Orange Line

MEASUREMENT AND VERIFICATION

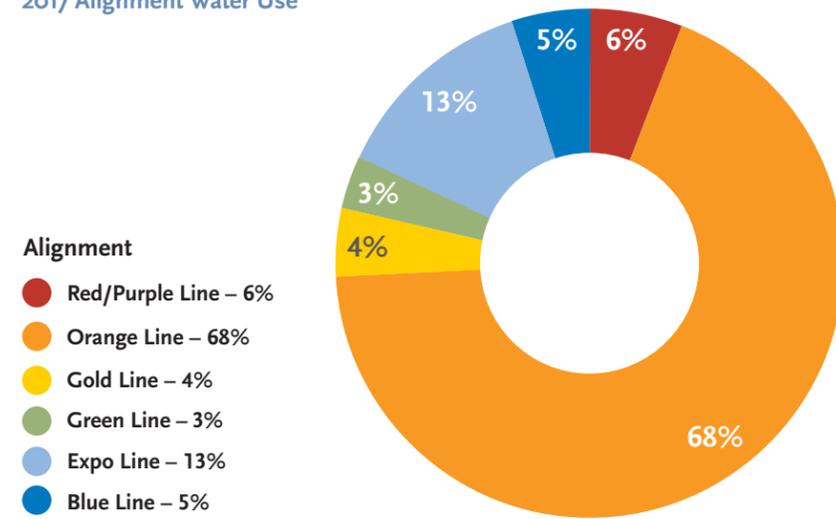
An important component of Metro’s water conservation strategy is developing systems that allow Metro to better track and understand how and where water is being used across the agency. In 2017, Metro installed submeters and data loggers at 5 facilities to track specific areas of water use. The submeters transmit data directly to Metro staff, providing real-time data access and increased supervision of water resources. This system will aid with the identification of leaks or other issues in a timely manner and will assist Metro with preventing water waste.

RECLAIMED WATER

Metro proactively explores opportunities and new technologies that would reduce the agency’s reliance on potable water. Using reclaimed water, reusing bus wash water, and tapping into purple-pipe recycled water for bus/rail wash and landscaping have been identified as key strategies.

In 2017, Metro converted one water meter on the Orange Line to utilize purple-pipe recycled water and plans to convert 2 more meters next year.

2017 Alignment Water Use



Metro is replacing
40
conventional
irrigation controllers along
the Orange Line with
smart controllers



Busway, Orange Line

HIGHLIGHT:
**SUSTAINING
CREATIVITY**



IMPROVING EFFICIENCY THROUGH DESIGN

Metro recognizes that in order to build a more resilient, sustainable city and infrastructure, attention must first focus on building the relationships that inspire innovation. This begins by working across departments, agencies, and within the local community in authentic, transformational ways. The Green Professional (G-PRO) Building Skills Training, offered as part of the Growing a Greener Workforce program, does just that by bringing together diverse departments such as the Metro Environmental Compliance & Sustainability Department, Diversity & Economic Opportunity, Talent Development, Communications, and Marketing in order to raise consciousness about ecological issues and help all Metro employees interpret these issues through the lenses of their own expertise.

The relationships built through this program are part of a decentralized culture change embedding environmental considerations in departments across Metro, transforming all of Metro's employees into agents for change, and spreading sustainable ideas across the agency.

As a result, during the annual review of Metro's Station Signs, Andrew Medvez of the Signage & Environmental Graphic Design team recognized an opportunity to advance sustainability through his work. The existing "donut" style station signs were collecting dirt and bird droppings along the inside rim. This forced the station maintenance teams to power wash and clean the signs frequently to maintain Metro's cleanliness standards, which was using a lot of water and shortening the life of the sign. Andrew realized that by tilting the interior face of the sign ledge inward, the signs would prevent the accumulation of dirt, thereby saving water, reducing maintenance labor, and extending the life of the sign. It's this kind of solution-based thinking that exemplifies the real benefits of learning about sustainability concepts.



Above: Signage concept mockup



Above: North Hollywood Station Signage at the Red Line Gold Line Connection

"It makes sense that our internal practice at Metro parallels our external social value: responsibly using resources, reducing environmental impact, and practicing resilience. I can help my department by learning the principles of sustainability and adapting them for my team's specific functions."

Eileen Hsu
OEI Fellow, ENV SP
Metro Office of Extraordinary Innovation



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WASTE

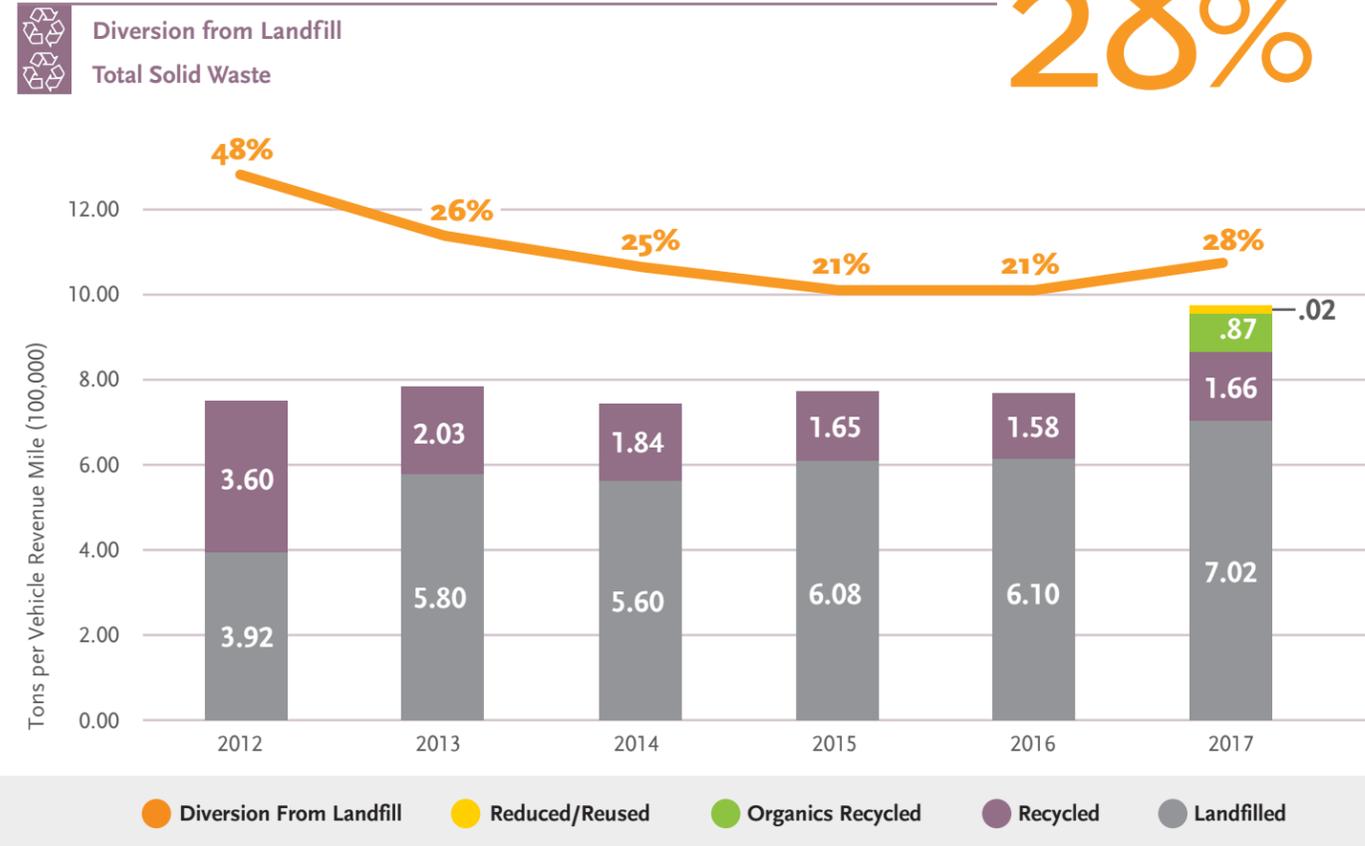
PERFORMANCE METRICS

- **Diversion from Landfill**
- **Total Solid Waste**
- The total solid waste and diversion from landfill metrics measure Metro's municipal solid waste (MSW) generation and diversion resulting from Metro's daily operations.
- Diversion from Landfill compares the total amount of MSW generated with the amount of solid waste that was diverted from landfill through reduction, reuse, recycling, and organic waste recycling efforts.

SOLID WASTE GENERATION AND DIVERSION

California has identified the disposal of commercial solid waste in landfills as a significant source of greenhouse gas emissions and has prioritized the diversion of waste from landfill as a fundamental component of climate protection and sustainability. For several years, Metro has been taking steps to reduce solid waste production and divert waste from landfill. Efforts in 2017 focused on cataloguing all solid waste and recycling activities across the agency in order to establish a more accurate baseline. While these efforts identified additional waste streams, they also identified additional recycling and reuse efforts that increased Metro's diversion from landfill rate from 21% to 28%.

2017 diversion from landfill:
28%



The drop in diversion rate between 2012 and 2013 coincides with Metro's transition to a new solid waste service provider with a more accurate reporting methodology.

ESTABLISHING METRO'S BASELINE

In 2017, Metro concluded a solid waste baseline study to evaluate existing activities and performance while providing a technical base against which to monitor and assess progress over time. The baseline study included an evaluation of operational practices and procedures, waste characterization studies to identify the material composition of the agency's waste streams, and the identification of current reduction and recycling activities. The results allowed Metro to quantify diversion activities not previously reported, such as organics recycling and reuse programs, which positively impacted Metro's diversion rate for 2017.

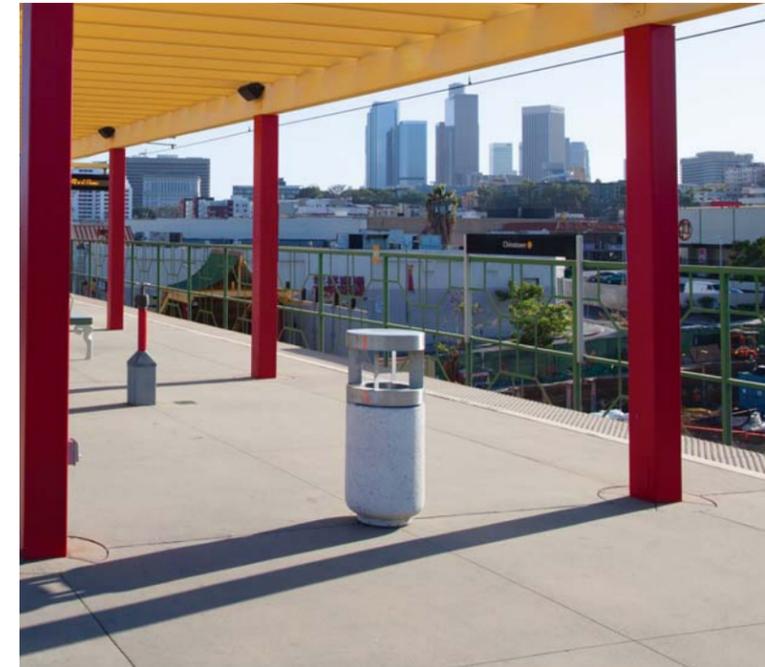
This baseline study provides Metro with valuable information that will inform new programs and support the development of future solid waste reduction and recycling targets. It also gives the agency metrics with which to track compliance with emerging recycling and organic waste regulations resulting from AB 939 and AB 1826.

WASTE REDUCTION AND REUSE

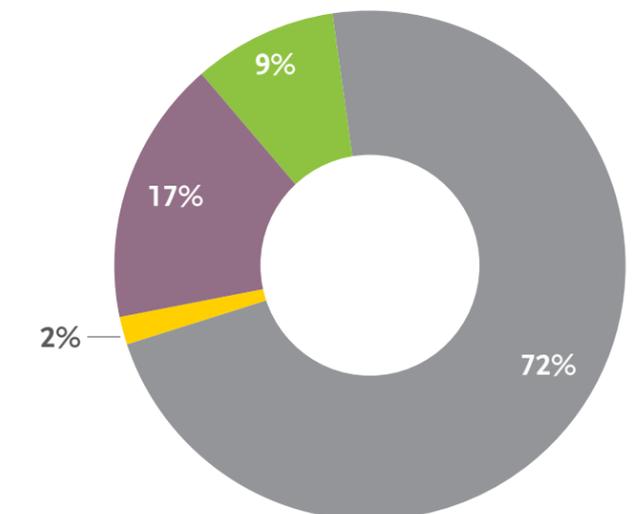
Reuse programs for items like bus parts, surplus furniture, and pallets are particularly important to Metro's waste management program. While recycling remains an important practice, using materials in their current form and preventing waste by prioritizing reusable products is considered the first line of defense for keeping waste out of landfills. Newly identified reuse programs, not previously reported, represented 2% of Metro's total waste composition in 2017 and are considered a best practice for obtaining the highest and best use of a material.



Bus parts are reused as part of the waste management program



2017 Waste Composition



- Waste Composition**
- Reduced/Reused – 2%
 - Recycled – 17%
 - Organics Recycled – 9%
 - Landfilled – 72%

WASTE CHARACTERIZATION STUDY

In addition to establishing Metro's solid waste baseline, Metro undertook a waste characterization study of Metro's headquarters building in 2017. A waste characterization study provides a snapshot in time of the disposed MSW stream of an entity and identifies opportunities to increase material efficiency and eliminate waste materials. Additionally, a waste characterization study supports the establishment of compliance thresholds for regulated waste streams. The study at Metro headquarters identified specific opportunities for Metro to reduce waste production and increase diversion from landfill in line with Metro's solid waste sustainability goals.

Paper comprised the highest percentage of waste, at 50.1% of the headquarters' building waste stream, including both recyclable and non-recyclable paper. Organics comprised 23.9% and plastics comprised 16.1% of the total waste stream.

FURTHER PROGRAM IMPROVEMENTS

- > Identify additional opportunities to go paperless with administrative functions
- > Improve paper recycling
- > Enhance the visibility and knowledge of mixed recycling through improved signage
- > Implement a food waste collection program at the Metro cafeteria

HAZARDOUS WASTE

Metro's EMS provides a structure for tracking and ensuring compliance with environmental regulations, including those related to the agency's waste streams. Through the EMS program, Metro has successfully addressed compliance issues, including the proper disposal of hazardous and non-hazardous liquid waste from its operations facilities, while confirming compliance on a continual basis.

Anti-freeze waste has been consistently trending downward as coolant recovery systems have been implemented at Metro's

bus divisions. Metro has implemented strategies, such as oil filter crushers, to more effectively capture and dispose of oil waste to follow compliance with hazardous waste disposal regulations and prevent the pollution of soil and water resources.

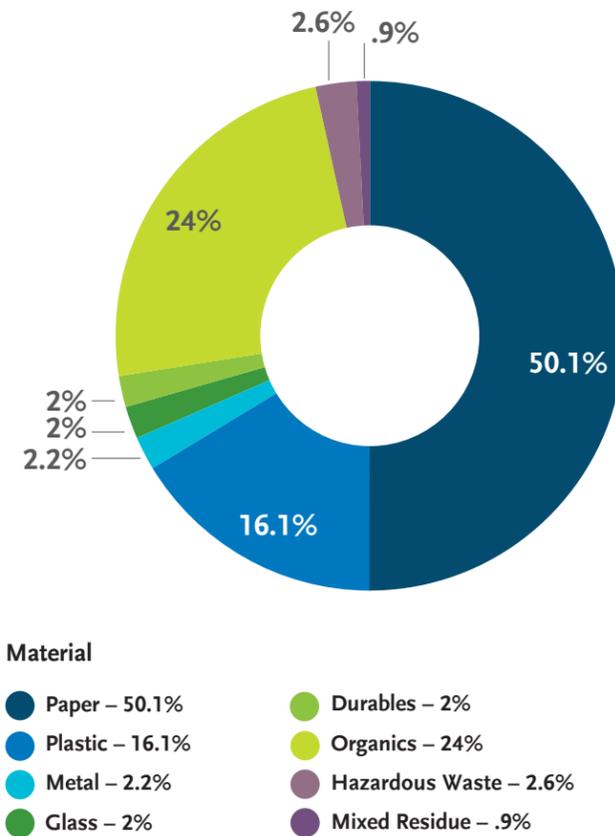
Metro achieved a 10% reduction in hazardous liquid disposal in 2017 compared to 2016. Hazardous liquids come from clarifiers, steam bays, and fuel station trenches associated with Metro's bus operations.

Metro achieved a **10%** reduction in hazardous liquid disposal in 2017 compared to 2016

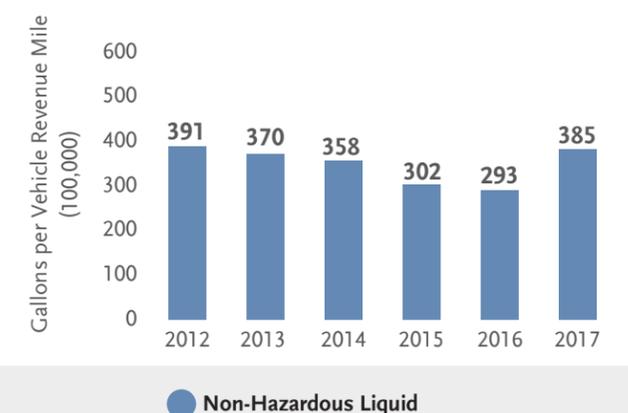
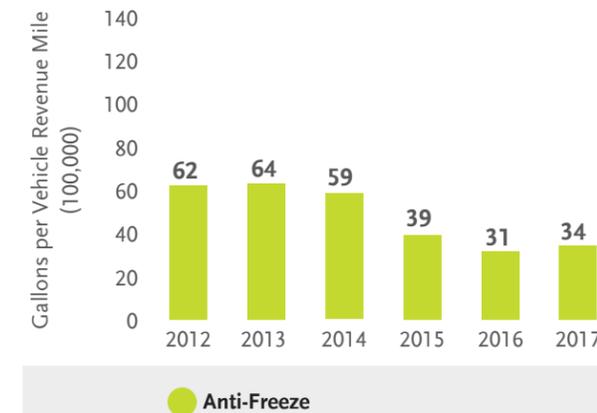
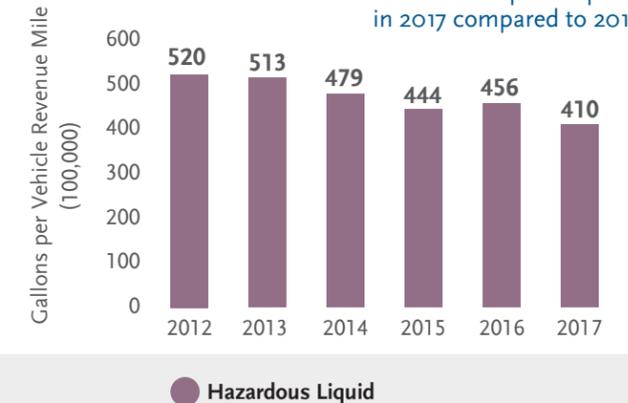


Metro Waste Study

Metro Headquarters Waste Composition



Liquid Waste Trends



NEXT STOP

In 2009, the first of two historical tax measures financing new transportation projects and programs for Los Angeles County went into effect. At the same time, Metro began outlining its commitment to sustainability through actions such as energy use and construction waste policies, adopting new technologies, and implementing nationally recognized management systems. Since that time Metro's performance in key indicator areas for sustainability have improved markedly.

But what was once a best practice may now just be the minimum standard. And while this report highlights where improvement is needed, even the accomplishments of the past may now serve merely as a baseline against which to compare future progress. This is not, however, a revelation: this is simply continual improvement at work. To fully understand how, look no further than Metro's ongoing initiatives: a strategic plan that reimagines how Metro can provide greater mobility in the region; updates to long range planning tools that focus on how these new mobility goals can be accomplished, and a long-overdue redesign of Metro's bus network that is adaptive to new communities, travel patterns, and technologies. At the same time, Metro moves closer to completing major transportation

infrastructure projects including Crenshaw/LAX, Regional Connector, and Purple Line Extensions.

Just as mobility may no longer be defined by bus schedules alone, the environmental impact of a transit agency on the community it serves may no longer be measured only by grams of emissions or gallons of water used. For example, external stakeholders under the auspices of the newly formed Sustainability Council (page 30) are advising Metro in developing new goals, targets, and performance measures that align more closely with state and local sustainability policies. Future Energy & Resource Reports will look to incorporate these new metrics so as to increase transparency and serve as a model for sustainability reporting industry wide.

This report is just a snapshot in time, but the trends, stories, and themes are meant to put the achievements of the past, challenges of the present, and visions for the future in perspective. Since the passage of Measure M, Metro has been in full implementation mode. While the agency looks to provide excellence in service and support, it is well poised to do so in a way that nurtures the environment and improves the quality of life for every Angeleno.

This is
**CONTINUAL
IMPROVEMENT
AT WORK**





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