Title

2017 Sustainable LA Grand Challenge Environmental Report Card for Los Angeles County Energy and Air Quality

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SUSTAINABLE LA ENVIRONMENTAL REPORT CARD
FOR LOS ANGELES COUNTY

ENERGY & AIR QUALITY | 2017

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EXECUTIVE SUMMARY

The 2017 Sustainable LA Environmental Report Card (ERC) for Los Angeles County (LA County) on Energy and Air Quality offers an in-depth look at the region's sustainability efforts focusing on the energy we use, greenhouse gas emissions, and the air we breathe. The LA County Environmental Report Card is the only comprehensive environmental report card for a megacity in the world. This ERC assesses 21 indicators that fall into five categories: Stationary Energy Use; Transportation; Renewable Energy Resources; Greenhouse Gas (GHG) Emissions; and Air Quality and Human Health Impacts. A majority of these indicators are entirely new areas of inquiry for the ERC, and together will provide a broader picture of current conditions compared to the 2015 ERC. Grades were assigned in each category based on compliance with environmental laws or numeric standards where applicable, on our best professional judgment, and on historical improvements and context. This year's grades range from C-/ Incomplete to B, and although there has been progress towards meeting local and state goals, and there have been a number of new standards and regulations that will have a positive impact in years to come, these grades would not get you on the UCLA Dean's list.

STATIONARY ENERGY USE: C / Incomplete

- Total electricity and natural gas consumption remained fairly consistent with only a 2-3% net decrease between 2006 and 2015, and less than 1% decrease in residential electricity use. During this same period, the County's population increased by more than 4%, while the gross domestic product increased by 8% between 2011 and 2015.
- Many wealthier residential neighborhoods used over 10 times as much energy per capita as the average user in 2010, despite having newer and more energy efficient homes. In lower-income communities, older homes were less efficient and used more energy per square foot.
- LA County households used less electricity and natural gas, but spent 32% more for that energy than the average California household in 2010. They also spent a larger percent of their income on energy (2.9%) due to higher energy costs and lower median household income.
- Between Los Angeles Department of Water and Power's (LADWP) retrofit rebates and the City of LA's Cool Roof Ordinance, LA has over 12 million square feet of cool roofs and over 10 million kWh of energy savings.
- Although there were 178 million LEED (Leadership in Energy and Environmental Design) certified square feet in LA County in 2015, the number of LEED certified buildings comprised less than 0.1% of total buildings in the County in 2014.
- In 2016 the County only had three verified zero net energy (ZNE) buildings, and 17 emerging; while the state's goal is for all new residential construction to be ZNE by 2020, and all new commercial construction to be ZNE by 2030.
- Between 2014 and 2016 the Property-Assessed Clean Energy (PACE) program funded nearly 22,000 residential assessments (energy efficiency and solar PV) across nearly every city in LA County, totaling $520 million.
- The City of LA has converted over 80% of its streetlights, resulting in an estimated average annual savings of 105 GWh and $9.3 million. SCE has not yet conducted LED conversions for the majority of streetlights it owns and maintains in LA County.

California's ambitious energy-use standards and energy-efficiency policies are among the toughest in the nation, but new efficient buildings can still consume large amounts of energy due to size and the number of appliances and energy consuming fixtures. Targeting new buildings isn't enough. With 40% of the County's greenhouse gas (GHG) emissions coming from buildings, energy efficiency improvements to existing buildings are critical to reaching the region's GHG reduction goals. Despite significant growth in the number of LEED-certified buildings, PACE projects, cool roofs, and ZNE buildings in the County, the region is barely scratching the surface on reducing stationary energy use. Limitations on data related to privacy and availability for recent years is reflected in the "Incomplete" grade designation for this category. Addressing these limitations would further strengthen the UCLA Energy Atlas, which provides an unparalleled, spatially explicit tool essential to understanding energy use progress over time, and which will inform regional GHG reduction efforts in coming years.

TRANSPORTATION: C- / Incomplete

- Retail gasoline sales dropped by 8% between 2014 and 2015, but diesel sales rose by 16% in that same time period.
- Total vehicle miles traveled (VMT) in LA County barely changed from 2005 to 2014, while VMT per capita decreased by 3.3%. Per capita VMT needs to decrease by 4.7% to achieve the regional goal of 20.5 miles by 2040.
- From 2005 to 2015, driving alone increased by 3.5%, carpooling dropped by 24%, and public transit use decreased by 6% for commuters in LA County. Commuters taking public transit took 69% longer to get to/from work than commuters driving alone in 2015.
- Annual passenger miles traveled (PMT) on public transit increased by 22% from 2005 to 2014, but slowed since 2009 with only a 4.3% increase through 2014. PMT needs to increase by nearly 890 million annual miles to reach the regional 2040 goal.
- Plug-in Electric Vehicles (PEV) sales were an order of magnitude greater in 2015 compared to 2011 in LA County. In 2015, the County had around 190,000 PEVs, which puts it nearly halfway to the estimated target of 400,000 PEVs by 2025. Despite this increase, PEVs only made up about 3% of the County's registered automobiles, and only had access to just under 1,000 charging stations (most with multiple outlets).
- The County scores low in access and connectivity of its transit system (7 out of 10) compared to other major cities. Transportation also takes up a larger portion of total income (20%) compared to San Francisco (11%) and New York (9%).

Recent legislative efforts carried out by the state of California and region aim to transform California's car culture by electrifying transportation and increasing funding for public transportation and overall infrastructure. Notably, County voters approved Measure M in November, promising to raise $120 billion for public transportation, traffic improvement, and enhanced mobility, while the state legislature passed a new 12-cent gas tax. Despite this enthusiasm and commitment to improvements, recent trends show large increases in diesel fuel sales, declining use of public transit for commuters, and almost no change in total vehicle miles traveled. Although the increase of PEVs is promising, their prevalence is mostly limited to higher income areas (although the City's EV car-sharing program is promising). The "Incomplete" grade in this category is a reflection of the fact that no group or agency is tracking travel patterns in a comprehensive way, which makes it difficult to assess the effectiveness of transportation-related investments and inform future spending and planning. Most notably, there was little or no data available for car-sharing networks and for travel outside of commuting.

RENEWABLE ENERGY RESOURCES: B

- In 2015, Glendale, Burbank, Pasadena, and Southern California Edison (SCE) reported at least 25% renewable purchases, and Glendale and Burbank already achieved 33% renewables (the State's 2020 goal). LADWP purchased just over 20% renewables, while Vernon and Azusa purchased less than 20% and Cerritos purchased zero.
- Utility-scale solar generation increased by over one million MWh between 2012 and 2015 and reached over 575 MW of capacity in 2015. Coal energy was still prevalent, and "unspecified power" made up 41% of SCE's portfolio.
- The County's power plants produced nearly 14% of electricity generation from renewable energy sources in 2015. This is equivalent to less than 5% of the County's electricity consumption. Most of this renewable energy came from solar.
- A total of 475 MW of rooftop solar was installed in the County as of 2015, with most of it installed in SCE territory. In 2016, LA County was one of the top three counties in California for MW of online / pending distributed generation systems.
- The area of available rooftop for solar is far less than what is needed to supply building energy consumption for much of the County.
- Most energy storage in LA County comes from a single pumped-hydro facility of 1,247 MW; less than 21 MW of other storage was in place as of January 2017.

California continues to raise the bar on the adoption of renewable energy – from state legislation that requires utilities to increase their renewable energy portfolios, to the County's recent efforts to bring community choice aggregation (CCA) to LA County cities. Renewable energy continues to increase in the County, with over half of the utilities reaching the state's 2020 goal. The County is one of the top three producers of distributed solar in the state, and Los Angeles is second only to San Diego in MW of solar installed. Although

SCE has completely divested from coal, and the City of LA is committed to getting off coal by 2025, much of the County is still far too reliant on coal. Significant emphasis is needed to increase energy storage, which is vital to integrating solar into the grid and reducing the need for natural gas "peaker" power plants. CCAs will be key to providing renewable power benefits to renters and residents living in buildings that do not have sufficient solar capacity. With national regulations and energy standards on the chopping block, California and LA County must continue to lead in promoting renewable energy resources.

GREENHOUSE GAS EMISSIONS: C+ / Incomplete

- GHG emissions from all building types decreased by 2.5% from 2006 to 2010. Residential GHG emissions per capita were much higher in high-income neighborhoods such as Bel-Air and Brentwood, compared to the lowest emitters in 2010.
- Transportation GHG emissions decreased by 9.5% from 2005 to 2012.
- Emissions from categories regulated under Cap and Trade in 2013 decreased by 5% in 2015. Electricity importers and fuel suppliers categories were added in 2015 and emitted more than half of the regulated carbon dioxide equivalent (CO2e) emissions.
- The 3.5 month long Aliso Canyon gas leak in 2015-2016 emitted 2.7 million metric tons (MT) CO2e – an amount equal to about 13% of 2015 emissions from all refineries and electricity generators in LA County.
- Los Angeles city reduced its GHG emissions by 20% in 2013 from 1990 baseline levels and is on target to meet its 45% reduction goal by 2025.
- About 3.2 million MT of wildland carbon were lost in LA County due to wildfire or land conversion between 2001 and 2010.
- Supplying water from distant sources to LA County in 2015 emitted over 860 thousand MT CO2e in 2015.
- Only seven out of 88 cities in LA County had Climate Action Plans in 2016, and only 21 were in the planning stage or beyond.

The state's GHG emission reduction targets increased to 40% below 1990 levels by 2030, and in Los Angeles the city's Sustainable City pLAn aims to cut GHG emissions by 45% by 2025, 60% by 2035, and 80% by 2050, compared to 1990 levels. While California remains a global leader in GHG emissions reduction, the 2015 Aliso Canyon natural gas leak set the state back in achieving its GHG emission reduction goals. While modest GHG emissions reductions have been realized in recent years, few cities have developed climate action plans or GHG emissions inventories. Lack of planning and tracking, coupled with limitations around underlying energy consumption data, is reflected in the "Incomplete" grade designation. Biennial or triennial GHG emissions and climate action plan updates should be required, and funded, to ensure that cities and counties are accurately tracking and reducing GHG emissions to meet state targets.

AIR QUALITY & HUMAN HEALTH IMPACTS: C

- Overall ozone and PM2.5 (particulate matter less than 2.5 micrometers) concentrations in the South Coast Air Basin decreased significantly since 2000, although trends since 2010 have slowed.
- In 2015, monitoring sites in the San Gabriel Valley, Pomona, Santa Clarita Valley and Antelope Valley exceeded ozone standards more than 10% of the time, and Central LA exceeded the annual average PM2.5 standard.
- Although outside of LA County, a site in Riverside County exceeded the state 24-hour PM10 (PM less than 10 micrometers) standard more than 45% of the time. Three sites, including the East San Gabriel Valley increased PM10 exceedances in 2014 and 2015 compared to 2013.
- Air emissions of 10 hazardous/carcinogenic chemicals decreased between 2010 and 2015, although there is no clear trend of improvement in overall air emissions of the 25 assessed chemicals. Two chemicals increased at an alarming rate (polycyclic aromatic compounds and chloroform).
- Clustering of facilities resulted in areas where 10's to 100's of thousands of pounds of hazardous / carcinogenic chemicals were emitted per year. Top emitters were clustered near the ports, and in southeast LA.
- The total number of asthma-related hospitalizations dropped by 21% between 2010 and 2015, but the total number of asthma-related emergency department (ED) visits rose by 11%, and the age-adjusted rate per 10,000 residents rose by 18%.
- Asthma-related ED visits and hospitalization disproportionately impacted young children, ages 0-4 year, and hospitalizations disproportionately impacted adults aged 65 and older.

Since the early 1990s, Los Angeles has worked hard to overcome its reputation as one of the "smoggiest" cities in the United States by consistently passing and advocating for legislation to raise air quality standards in the region. However, despite these efforts and the impressive progress over the last couple of decades, the recent drought undoubtedly impacted air quality throughout the County and likely contributed to the observed increases in ozone and particulate matter. Toxic industrial air emissions also continue to pose neighborhood-scale concerns, and asthma-related emergency room visits, linked to poor air quality, are on the rise. Climate change will continue to exacerbate all of these effects. However, we anticipate that air quality will continue to improve as a result of stricter regulations, such as SB 1383 (Lara, 2016), which will reduce methane, black carbon, and hydrofluorocarbons emissions. Continued progress towards greening the ports and replacing diesel engines with no or ultra-low emissions engines is essential in order to greatly improve air quality in some of the most polluted areas of the basin. Los Angeles must push for even stricter regulations and enforcement and work to ensure that the most vulnerable communities are protected from air related human-health impacts.

CONCLUSIONS

Over the last few decades, the County has experienced dramatic improvements in energy efficiency, renewable energy, and air quality. With the release of the first Sustainable City pLAn for Los Angeles in 2015, the advancement of UCLA's Sustainable LA Grand Challenge, and other local and state efforts, such as the hiring of LA County's first ever Chief Sustainability Officer and the release of the online interactive LA Energy Atlas, rapid progress towards renewable energy and reduced GHG emissions is expected in the coming years.

Since the release of the 2015 ERC, California committed to increasing the RPS to 50% and doubling the energy efficiency of existing buildings by 2030 with the passage of SB 350 (de León, 2015). Additionally, SB 32 (Pavley, 2016) extended and expanded AB 32 to reduce GHG emission levels to 40% below 1990 levels by 2030, targets were created for short-lived climate pollutants (methane, hydrofluorocarbons and black carbon) (SB 1383, Lara, 2016), and AB 197 (Garcia, 2017) creates a policy of equity, transparency, and accountability in future climate programs. Although related legislation failed, Governor Brown has a stated goal of cutting petroleum use by cars and trucks in half by 2030. Most recently, de León introduced legislation to transition the state to 100% renewables by 2045, and a 12-cent gas tax was passed (SB 1, Beall, 2017) that will provide $52 billion for transportation and related infrastructure over the next decade.

Locally, the County overwhelmingly welcomed the passage of Measure M in November 2016, which is aimed at transforming transportation in LA. In 2016 the city of Los Angeles committed to the development of a plan to transition to 100% renewable energy, adopted an ordinance that will improve energy efficiency in existing buildings, pledged to bring electric vehicle sharing to disadvantaged communities, passed the Clean Up Green Up to protect communities at high risk from pollution, and witnessed the opening of the La Kretz Innovation Campus, home of the LA Cleantech Incubator.

In subsequent ERCs we will continue to assess how well LA County is moving towards achievement of the state and region's ambitious energy, transportation, and air quality goals – heralding our accomplishments, and making recommendations for improvements. Overall, we expect the County to continue to excel, but recommend even more protective policies, stricter enforcement of regulations, better monitoring and reporting, access to data, and more research aimed at evaluation that can be used to inform new investments and programs aimed at improving the health and wellbeing of LA County residents.

Introduction

Los Angeles (County) is the most populous county in the nation, with 10.2 million people, and home to the second largest city in the United States. Its 4,751 square miles is comprised of 88 cities and 11 unincorporated areas that span diverse landscapes – from beaches to desert and mountains – and population densities that range from 1 to 50,000 per square mile. The County is equally distinct when it comes to people and its economy. Over the past five years, the population increased by 3%, and is expected to rise by an additional 1.5 million people by 2050.[1] During this same time, the growth in gross domestic product outpaced population growth and increased by 8%. Climate change is expected to result in an increase in temperature of 4-5°F and in far more extreme heat days in many parts of the County by 2050.[2] Moving the region to sustainability and addressing the effects of climate change is imperative, but no small task. Fortunately, local, regional, and state officials have demonstrated a commitment to leading in this area, but given the scale of this challenge, even stronger commitment is needed.

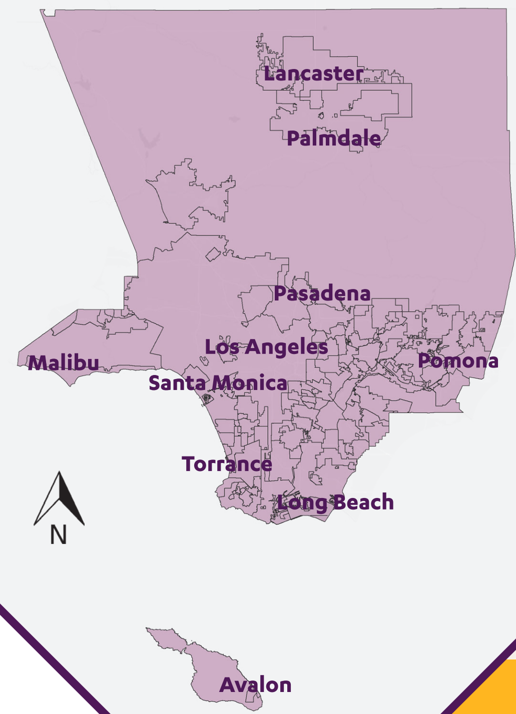
In 2015, UCLA's Institute of the Environment and Sustainability issued the nation's first environmental report card for a major metropolitan area.[3] The 2015 Environmental Report Card for Los Angeles County (2015 ERC) provided a careful look into the state of the environment through the evaluation of 22 total indicators spanning the categories of Water, Air, Ecosystem Health, Waste, Energy and Greenhouse Gases, and Environmental Quality of Life. These environmental indicators were used to grade the environment within each of the six categories, with grades ranging from a C-/incomplete for Ecosystem Health, to a B/incomplete for Waste. The overall grade for the County was a C average – leaving a lot of room for improvement.

The purpose of the 2015 ERC was to establish a baseline from which to measure the County's progress toward environmental sustainability, and to create a thought-provoking tool to catalyze discussions and policy changes that contribute to a healthier environment for Los Angeles (LA) County residents moving forward. In this sense, the 2015 ERC was a success. The 2015 ERC was released around the same time as the City of Los Angeles Sustainable City pLAn – the city's first-ever sustainability plan, which was developed under the leadership of Mayor Eric Garcetti.[4] Both the Sustainable City pLAn and information gathered and analyzed in the 2015 ERC were instrumental in the development of the UCLA Sustainable LA Grand Challenge (Sustainable LA) Five-Year Work Plan (Work Plan), which identifies over 100 research recommendations critical to transforming LA County to the first sustainable megacity in the world.[5]

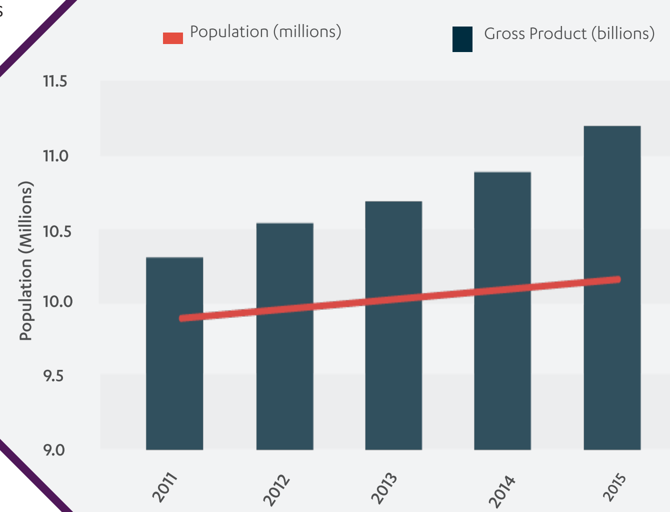
The advancement of the Sustainable LA Grand Challenge provided a natural opportunity to align subsequent editions of the Environmental Report Card (ERC) with Sustainable LA's specific goals to transition LA County to 100% renewable energy, 100% locally sourced water, and enhanced ecosystem and human health by 2050. While Sustainable LA is focused on coordinating the research and building partnerships with local and regional stakeholders to reach these ambitious goals, the ERC serves to measure progress on the path to sustainability and will aid in informing research priorities. As such, the framework of this and subsequent ERCs will more closely reflect the Sustainable LA goals. In addition, there is a tremendous opportunity to continue our partnership with the city of Los Angeles on their pLAn implementation and assessment efforts, and to coordinate with the County of Los Angeles on the development of their first-ever county sustainability plan over the next year and a half.

Sustainable LA Environmental Report Cards will be released bi-annually with a focus on one of three major areas: Energy & Air Quality, Water, and Ecosystem Health. Associated human health indicators will be included within each ERC. A summary ERC that highlights major accomplishments and important current environmental topics will follow Ecosystem Health. This ERC will combine the 2015 categories of Air and Energy & Greenhouse Gases, as well as relevant indicators from Quality of Life. A number of new indicators were developed that align better with local and state energy and transportation targets. The release of this Energy & Air Quality ERC represents the first edition affiliated with the Sustainable LA Grand Challenge, and the aim is to provide a more comprehensive assessment of energy production and use in both buildings and for mobility, and of related air quality and impacts on human health as the County shifts to 100% renewable energy. This ERC reflects overall performance in these areas, and is not limited to the two-year time period since the last ERC.

Los Angeles County



Los Angeles County Population & Gross Domestic Product (2011-2015)



Relationship among the energy & air quality categories within this ERC

*According to the State of California, "renewable energy" includes the following, subject to certain state regulatory requirements and conditions: biodiesel, biogas, biomass, conduit hydroelectric, digester gas, fuel cells using renewable fuels, geothermal, hydroelectric incremental generation through efficiency improvements, landfill gas, municipal solid waste, ocean wave, ocean thermal, tidal current, photovoltaic, small hydroelectric, solar thermal, and wind (CEC, 2012).

Methodology

Indicators and Data Selection

In the 2015 ERC, environmental conditions across LA County were assessed using a comprehensive approach based on 22 quantitative indicators. The indicators were linked to compliance with federal and state regulations where applicable, and selected specifically for their relevance to LA County. This ERC builds upon the 2015 indicators in the areas of Energy & Air Quality and expands them to include many more measures of energy use, transition to renewables, transportation and mobility, as well as to add a critical health indicator related to asthma hospitalizations and emergency room visits.

We used 21 indicators across five categories to grade status and trends of Energy, Air Quality and associated health outcomes for LA County. The ideal criteria for an indicator to be useful in the annual report card are that data for that indicator are collected countywide, easily obtainable, and quantifiable; published by agencies, universities, or non-profit organizations; and updated on at least an annual basis. However, as with the 2015 ERC, we found that such data is difficult to come by and many of the factors critical to assessing environmental conditions are not regularly measured and/or the data is not accessible. Thus, we made a number of exceptions to include important data that did not meet these ideal criteria and include recommendations on monitoring and data needs throughout this report.

We found that some data sets searchable at the county-level had significant limitations. In particular, the EPA's Toxic Release Inventory (TRI) data reflects only a subset of County facilities – those large enough to meet the reporting criteria. In a few cases, indicators had significant regional implications – as was the case with ambient air quality monitoring data – so we chose to broaden the geographic scope of those data. Furthermore, some information was not yet available for 2015 during the data collection phase of this project (such as building energy use), so we used the most current data available. Also, since most of these indicators were not included in the previous report card, and because we sought to evaluate trends, we included historic data where available.

Data are presented in figures, graphs, tables, and maps – with a high-resolution interactive map gallery available online.[6] We were often constrained by the format of the spatial data we had access to, and therefore some map scales (e.g., city, zip code, census tract) may not be ideal for the data type displayed. Data that did not meet our indicator criteria, but that we deemed important are presented as "highlights" throughout the report under the most relevant category. Conversely, we acknowledge that some indicators, although accessible and regularly updated, do not represent the most important measures of progress in their respective areas, but are included due to the lack of data availability on more critical metrics. We have addressed this issue through recommendations for improved monitoring and/or by using an "incomplete" designation as part of our grading, discussed further below.

Grading

We encountered numerous challenges to developing an objective system for the 2015 report card, and faced many of those same challenges here. Although there are examples of approaches to multi-metric index development and grading, particularly in the transportation/mobility field, such indices usually benefit from large data sets that help establish reference conditions and allow selection of the most meaningful component metrics using robust statistical tools. An alternative approach is to base grades on compliance with environmental laws or progress towards accepted policy targets. This may be feasible for indicators such as ambient air quality or renewable portfolios; however, the majority of indicators are not tied to any environmental standard or legal requirement. There are also some indicators that pose an assessment challenge. For example, although LA County's air quality has improved dramatically over the last 45 years, the region is still frequently in non-attainment for ozone and PM10 standards. As such, how does one objectively grade the region?

Grades could also be based on the achievement of regional environmental numeric goals, but in many cases those goals have not been established for LA County. Even where associated targets are identified, a grading rubric must still be developed to characterize conditions when targets are not being met (i.e. if zero exceedances is an "A," what exceedance levels are associated with grades B through F?).

Furthermore, as we assembled indicators across a wide range of environmental dimensions, we recognized there are combinations of stressors, conditions and responses that have varied environmental impacts. As such, the weighting of different indicators in determining the final grades varied. For example, ambient air quality exceedances were considered of greater importance for the air quality grade than toxic air emissions because the ambient air quality monitoring program covers all of LA County and includes a far more robust database than the EPA Toxics Release Inventory. As a result, we believe that it would not be appropriate to give them equal weight in an overall Air Quality category grade.

Consequently, this Energy & Air Quality ERC again used a less complex and more subjective grading approach. Like before, we grade at the "category" level and have therefore issued five grades based on the best professional judgment of the authors, taking the historical context into account. We will continue to improve our choice of indicators and grading system based on feedback from government agencies, NGOs, academics, business leaders, and the community. We will also work to establish more objective numeric targets, and goals and metrics necessary to develop a more consistent and explicit grading rubric.

1

STATIONARY ENERGY USE

Overview

Energy use and energy efficiency play important roles in the fight against climate change, especially since buildings are responsible for approximately 40% of the greenhouse gas emissions in the County. Improvements in energy efficiency should reduce overall energy demand, and thus reduce greenhouse gas emissions associated with the production of energy. Energy efficiency technologies also tend to have a low cost compared to other climate mitigation technologies, and their payoff for the consumer is quickly realized.

California continues to lead the country through its ambitious energy efficiency policies. The state's building energy efficiency standards (Title 24) are the toughest in the nation, and were raised with each triennial edition (the 2016 Edition became effective Jan 1, 2017). The California Energy Commission requires all new residential buildings to be zero net energy by 2020, and by 2030 for all new commercial buildings. Since new buildings make up a very small percentage of buildings throughout the state, the real impact comes from energy efficiency retrofits to existing buildings. California committed to doubling the energy efficiency of existing buildings by 2030 with the passage of SB 350 (de León, 2015), and the state's Energy Commission has an Action Plan for how that might happen over the next 10 years in residential, commercial, and public buildings.[7]

With the release of the Los Angeles Sustainable City pLAn in 2015,[8] Mayor Garcetti pledged to significantly reduce the carbon footprint of LA buildings with targets to reduce energy use by 14% by 2025 and 30% by 2035. The city made progress on this pledge in December 2016 with a unanimous City Council vote on the Existing Building Energy and Water Efficiency ordinance, which will require actions to reduce energy use at least every five years and will make energy use data public for all buildings over 20,000 square feet. The availability of energy use data is critical for determining patterns and trends that can inform sustainability strategies for building owners and policymakers. These assumptions drove the development and launch in 2015 of UCLA's LA Energy Atlas,[9] for which the County of LA was a partner and fiscal sponsor, and which provides for the first time a platform to interact with California's energy data at a fine spatial scale.

This category includes an analysis of trends in the sale of electricity and gas and how this energy is used in LA County buildings. In this report we do not separately consider electricity and natural gas that is used to power transportation – it is currently lumped into stationary energy use. We then look at programs and strategies that were implemented in the region to increase energy efficiency and reduce energy use, including LEED certification, Property Assessed Clean Energy Financing for Energy Efficiency and Solar PV program (PACE), and streetlight conversion to energy-efficient LED lighting technology.

INDICATOR • ELECTRICITY & NATURAL GAS CONSUMPTION



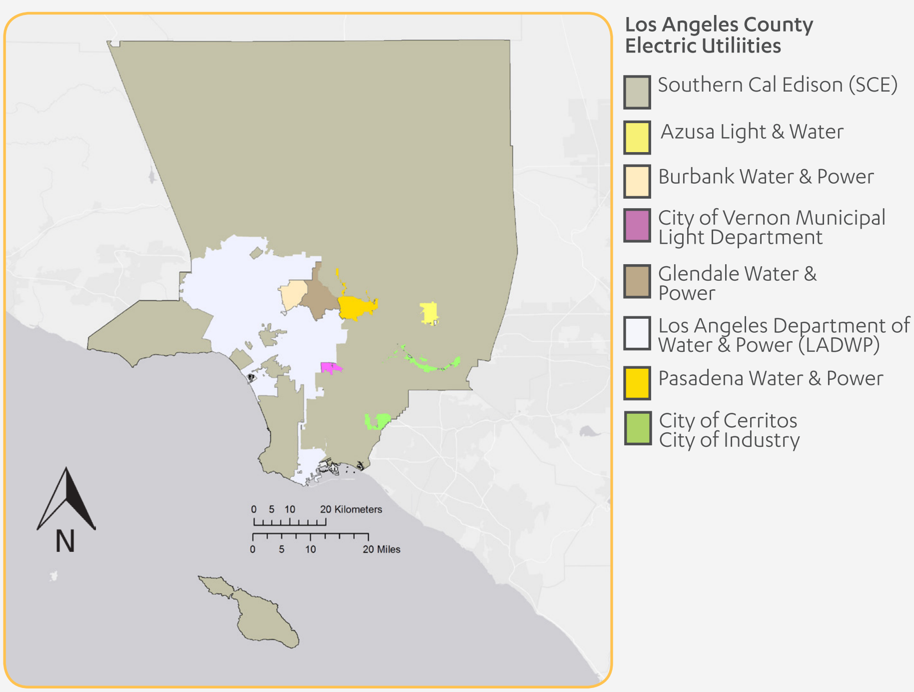
Introduction

Electricity and natural gas provide the energy used in buildings (for heating and cooling, lighting, cooking, and powering our appliances and electronics) by municipalities (for streetlights, water pumping and wastewater treatment), and by manufacturing facilities, as well as for powering alternative fuel vehicles. Overall electricity and natural gas consumption is a critical, but high-level indicator that should be evaluated in conjunction with other measures that are spatially explicit and that represent component categories of usage, such as building energy consumption. Note that electricity and natural gas consumption is not limited to "stationary" energy use, as it is categorized in this report card due to its use in electric and natural gas powered vehicles. We expect electricity and natural gas use in the transportation sector to increase as we shift from our reliance on fossil fuels.

Data

We looked at total electricity and natural gas consumption for both residential and non-residential sectors for a ten-year period between 2006 and 2015. The California Energy Commission provided us with an LA County-specific dataset from their Energy Consumption Database.[10] This dataset included electricity sold in LA County by the two largest electricity providers, Southern California Edison (SCE) and Los Angeles Department of Water & Power (LADWP), and by six smaller municipal providers: Azusa Light & Water, Burbank Water & Power, City of Cerritos, Glendale Water & Power, Pasadena Water & Power, and the City of Vernon. The dataset also included non-retail electricity consumption from on-site self-generation (solar PV generation and gas-fired cogeneration), and water-pumping loads managed by the Department of Water Resources and the Metropolitan Water District of Southern California. All natural gas consumption data is from Southern California Gas Company and includes the categories of residential, non-residential, electricity generation, and co-generation.

Electric[11] Utilities Within & Serving LA County



Findings

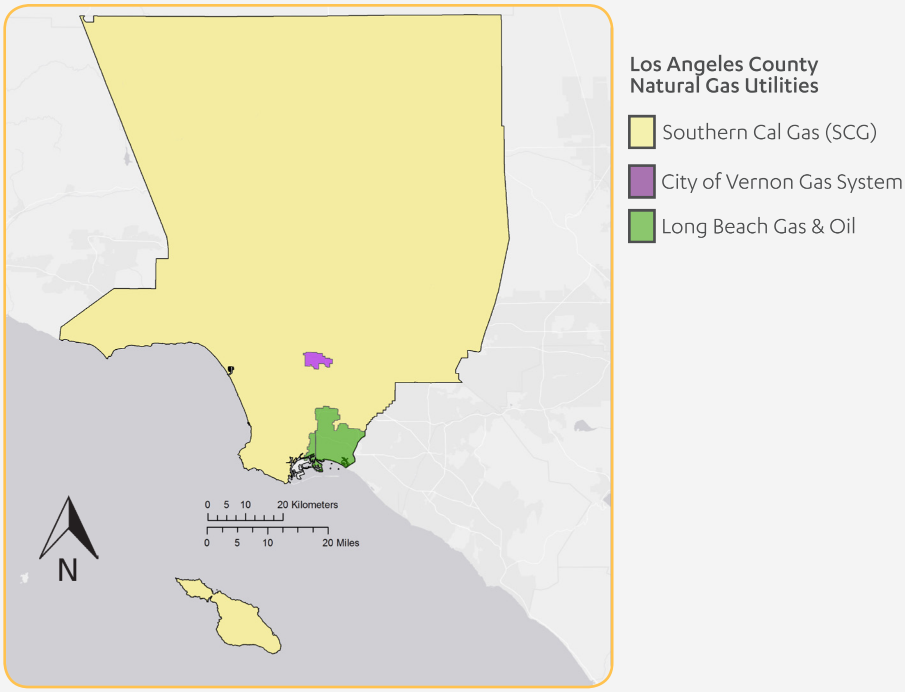
Electricity

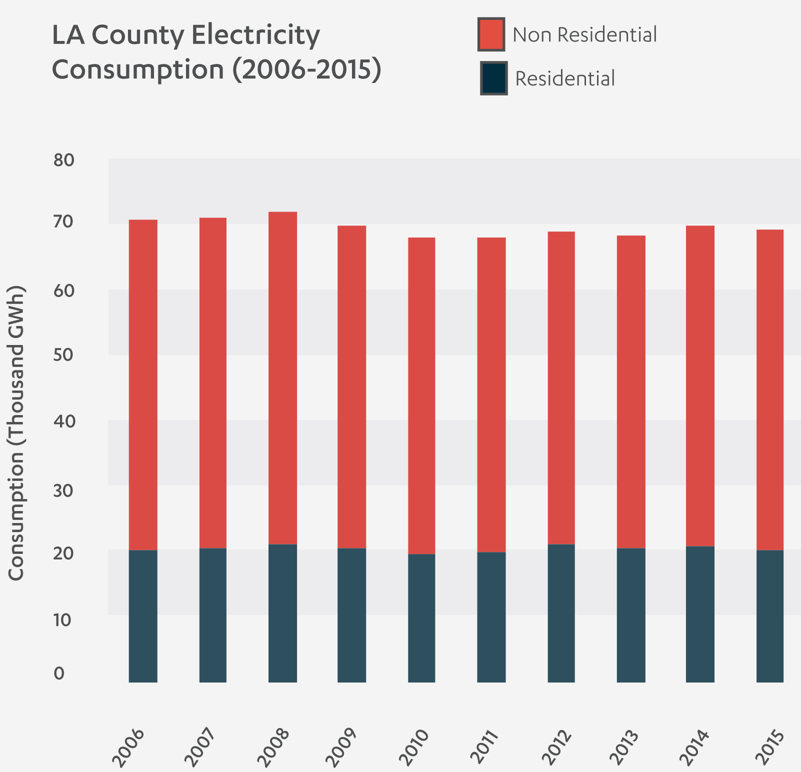
- Total electricity consumption for the county was just under 70,000 GWh in 2015. Approximately 29% of consumption was residential and 71% non-residential.
- Retail consumption comprised the vast majority of total electricity used at just under 63,000 GWh in 2015. Non-retail consumption was 6,600 GWh, or approximately 10% of the total.
- Total electricity consumption remained fairly consistent over the past ten years with only a 2% net decrease between 2006 and 2015 (a decrease of <1% for residential and 3% for non-residential). During this same period there was more than a 4% increase in the county population. County gross domestic product also increased by 8% between 2011 (the earliest year for which we have data) and 2015.
- LADWP electricity consumption decreased by 1% and SCE consumption decreased by just over 4% between 2006 and 2015.
- Of the total electricity consumption in 2015, roughly 1%, or 825 GWh came from distributed solar PV generation within the County (categorized under "self-generation" in the Energy Consumption Database). The 825 GWh value appears to be reasonable in light of the 475 MW identified in the Distributed Renewable Energy Generation indicator in Section 3, below; representing an average of 4.76 hours per day over one year.

Natural Gas

- Total natural gas consumption in 2015 was just over 4.5 billion therms. Approximately 24% of consumption was residential, 38% non-residential, and 38% was used for electricity generation and cogeneration. Note that because a substantial percentage of natural gas use is for electricity generation, caution must be used to avoid "double-counting" when evaluating overall energy use in the County.
- Total natural gas consumption decreased by 3% between 2006 and 2015.
- Residential natural gas usage decreased by 18%, while non-residential use increased by 4% and electricity generation and cogeneration increased by 1% between 2006 and 2015.

ELECTRICITY & NATURAL GAS CONSUMPTION

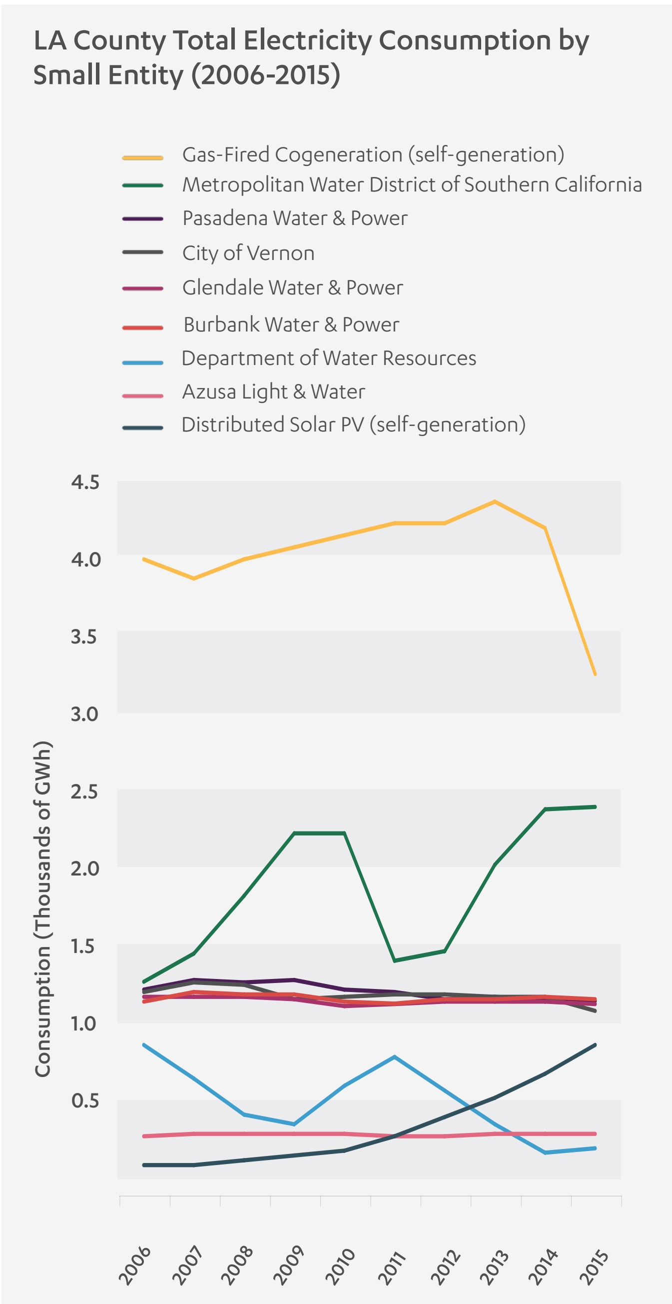


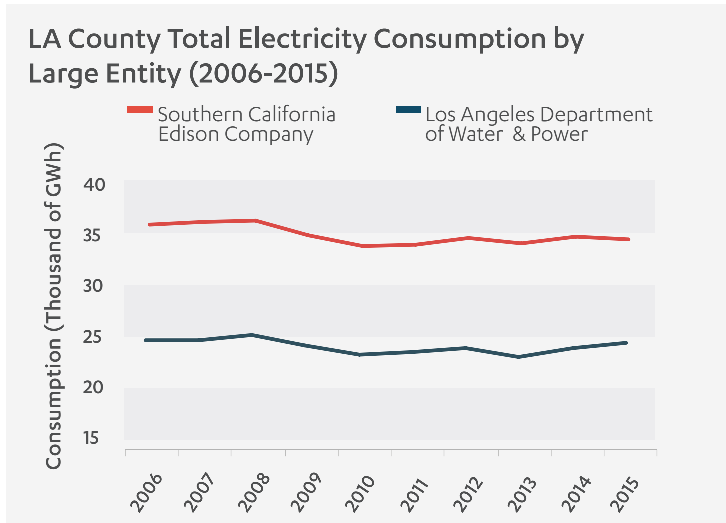


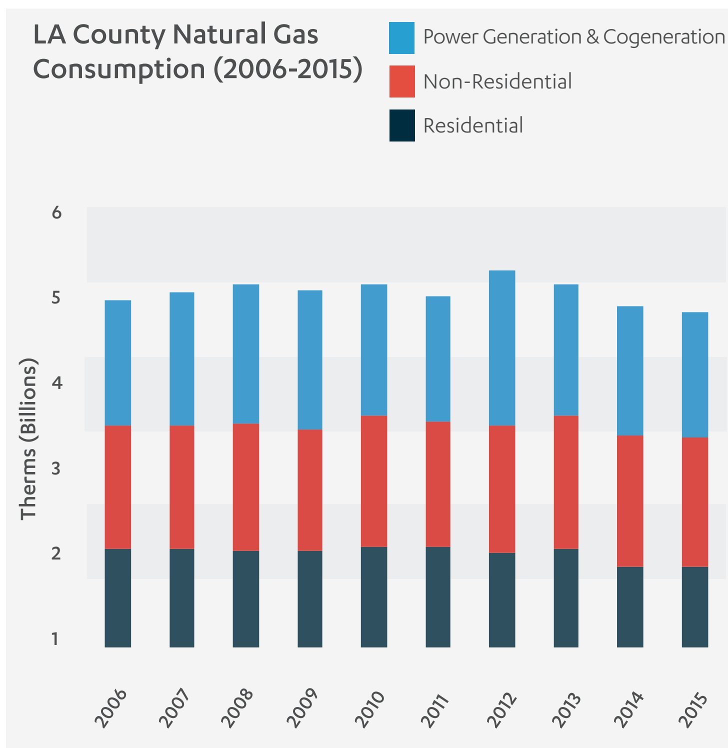
Data Limitations

- Natural gas sales data are from Southern California Gas Company and do not include data for smaller city utilities in the County, such as the City of Long Beach Gas & Oil Department.
- This data set does not include renewable gas sales to transportation fleets.
- Inter-annual variation in weather, such as number of high heat days, affects energy consumption. While there are methods for normalizing energy consumption for weather impacts, such an analysis was beyond our capacity for this Report Card.

ELECTRICITY & NATURAL GAS CONSUMPTION







INDICATOR • BUILDING ENERGY USE

Introduction

Building energy use is a fundamental challenge for any urban region undergoing a transition to sustainability. Buildings are one of the primary sources (along with transportation) of greenhouse gas emissions. For residents, building energy use is a household budget item linked to families' thermal comfort and indoor air quality, and for non-residential properties it is a business expenditure supporting the creation of products and services that boost the local, regional, and national economy. Improving building efficiency is imperative to reducing energy consumption. However, energy efficiency is only part of the equation. Many other factors contribute to energy use in buildings. Building size, the energy intensity and number of appliances and light fixtures, and individual behavior are all key drivers of total building energy use. Climate is a big influencer, especially with regard to heating and cooling, and the type of commercial and manufacturing activities occurring within a building also play in important role.

Data

We used data from the UCLA LA Energy Atlas for the years 2006-2010 to provide detailed metrics of energy consumption.[13] The Energy Atlas uses account level, monthly energy consumption data, aggregated according to state regulations to protect privacy.

While the Atlas does not yet provide more recent data than the County's GHG Emissions Inventory used in the 2015 Report Card, it provides information on the spatial distribution of energy use at the neighborhood scale, and allows for an examination of changes over time and the contrast between energy use on a per capita versus a per square foot basis. The Energy Atlas will be updated with data through at least 2014 by the time our next Energy & Air Quality Report Card is released.

Findings

- The combined energy consumption for all building types in 2010 was 428.6 trillion BTUs. This value only decreased by 0.1% since 2006.
- Residential use comprised the largest percentage of total energy use, at approximately 47%. Industrial and commercial energy use each comprised less than half of residential energy use in 2006.
- Total building electricity use in 2010 was 53.4 thousand GWh, a reduction of over 4% since 2006; however, total building natural gas use increased by 3% since 2006 to 2.47 billion therms in 2010.
- Residential electricity use and natural gas use both decreased from 2006 to 2010, by 1.6% and 5.7%, respectively.
- While commercial electricity use decreased by 5.5% between 2006 and 2010, commercial natural gas use increased by 18.6%.
- Total building electricity consumption in 2010 (53.4 thousand GWh) is about 78% of the total

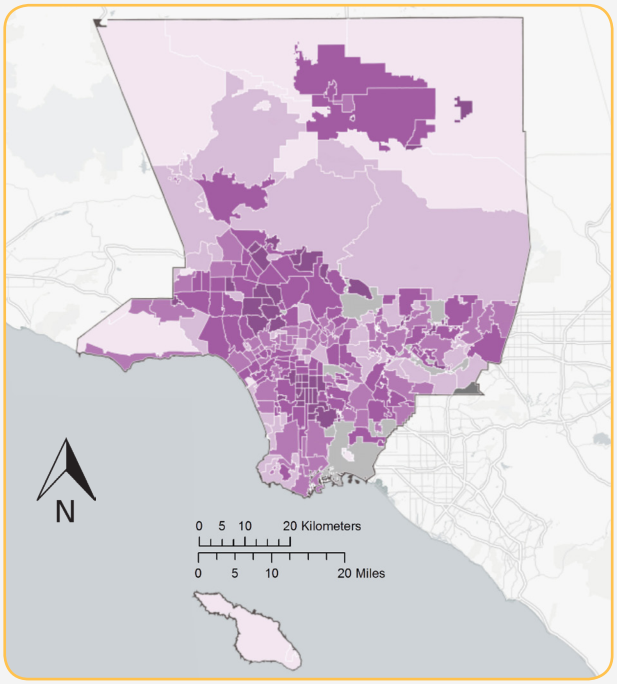
Energy Use in Los Angeles County (2006-2010)

	Electricity Use			Natural Gas Use			Combined Consumption (Electricity + Natural Gas)		
	(Thousand GWh)		Change from 2006-2010	(Billion Therms)		Change from 2006-2010	(Trillion BTU)		Change from 2006-2010
	2006	2010		2006	2010		2006	2010	
All Building Types	**55.6**	**53.4**	**-4.2%**	**2.39**	**2.47**	**3.0%**	**428.9**	**428.6**	**-0.1%**
Residential	20.3	20.0	-1.6%	1.31	1.24	-5.7%	200.4	191.8	-4.3%
Commercial	15.4	14.5	-5.5%	0.25	0.29	18.6%	77.0	78.8	2.2%
Industrial	11.4	10.2	-10.2%	0.59	xx	xx	98.0	xx	xx
Institutional	2.53	2.42	-4.6%	0.086	xx	xx	17.2	xx	xx
Other / Uncategorized / Mixed Use	6.02	6.23	3.5%	0.16	xx	xx	36.2	xx	xx

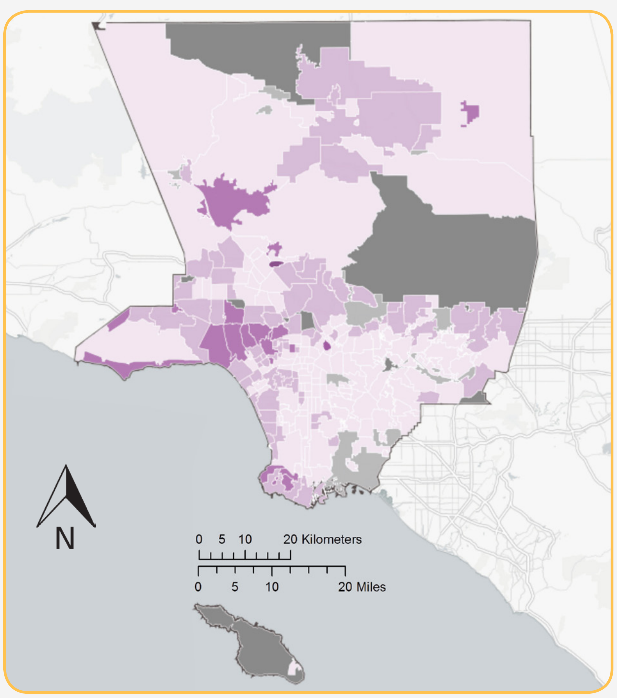
•Values in table may not sum due to rounding
•Masked data (shown as "xx") is due to privacy restrictions. See Energy Atlas for further details.
•Natural gas use in this table represents direct, in-building use of natural gas for such purposes as cooking and home heating. It does not refer to the natural gas that may have been used to generate the electricity consumed.

BUILDING ENERGY USE

Median Residential Building Energy Consumption by Neighborhood (Electricity and Natural Gas; thousand BTUs) per square foot in LA County, 2010.



Total Residential Building Energy Consumption by Neighborhood (Electricity and Natural Gas; million BTUs) per capita in LA County, 2010



electricity retail sales shown in the previous indicator (68.3 thousand GWh). The difference comes from municipal energy uses (e.g., streetlights, water pumping, and wastewater treatment), as well as large industrial uses (facilities regulated under cap and trade that are not included in the Energy Atlas building energy data).

- Energy use varies significantly across communities of LA County, but the variations change based on metrics of analysis. Specifically, total energy use per parcel is highest in many wealthier communities, resulting from newer and larger homes. However, energy intensity, or energy use per square foot of floor space, is high in both higher- and lower-income communities. In low-income communities, older, less efficient homes are energy intensive. Use the following interactive map link to explore this data further.[14]
- Median annual residential energy consumption per square foot was 44,245 BTU in 2010. Neighborhoods with the highest energy consumption per square foot were 20-28% higher than the median value. These neighborhoods are priority candidates for home energy efficiency upgrades.
- While the average residential energy consumption per capita in 2010 was 19.6 million BTUs, neighborhoods with the highest levels of energy consumption used between 11 and 16 times as much energy as the average. These neighborhoods are priority candidates for education and messaging related to energy conservation.

Data Limitations

- Inter-annual variation in weather, such as number of high heat days, will affect energy consumption. While there are methods for normalizing energy consumption for weather impacts, such an analysis was beyond our capacity for this Report Card.
- Currently the Energy Atlas does not include data for the following municipally owned utilities (MOUs): Azusa Light & Water; Cerritos Electric Utility; City of Industry; Pasadena Water & Power; and Vernon Gas & Electric.
- Data privacy restrictions established by State agencies limit the availability of some data, especially for the industrial and institutional sectors.
- Energy use by facilities regulated under state cap and trade regulations is not included in the Energy Atlas data because these high-users exacerbate the issue of data masking due to privacy restrictions.
- A detailed description of the methodology used to create the Energy Atlas, including limitations, is provided on the LA Energy Atlas website.

HIGHLIGHTS

Household Building Energy Use as a Percent of Income

We estimated the cost of building energy use as a percent of household income in LA County and compared it to the State average.[16] In 2010, approximately 2.2% of the median household income in LA County was spent on electricity and 0.7% on natural gas. Overall, LA County households spend 2.9% of income on energy, which is 32% higher than the average Californian household, despite lower electricity and natural gas usage by LA County residents. The higher percentage is due to both higher energy costs, as well as a lower median household income.

Average Annual Energy Costs for LA County and California (2010)

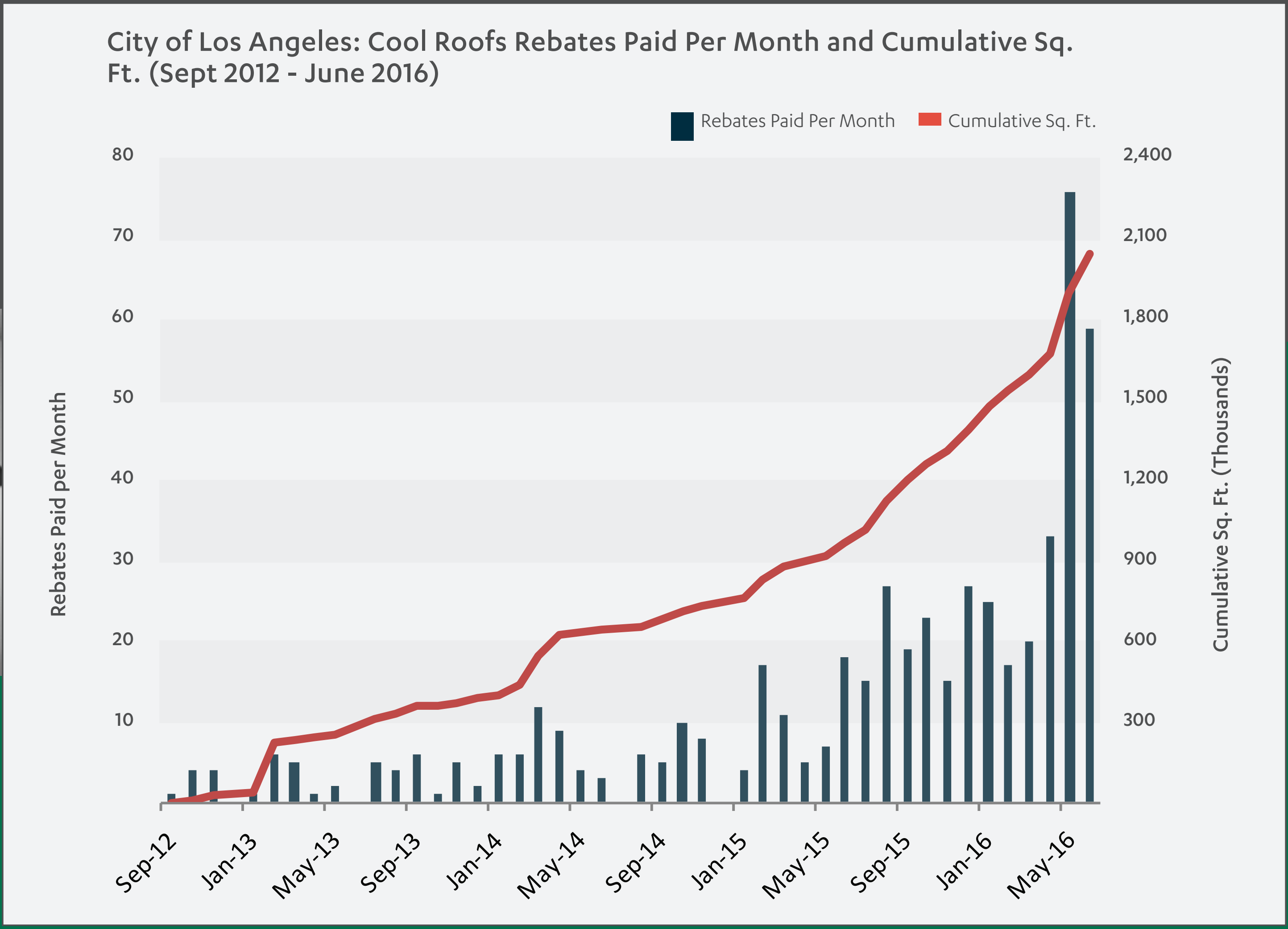
	LA County	California
Average Household Electricity Consumption (kWh)	6,163	6,888
$/kWh	$0.196	$0.130
Electricity Cost per Household	$1,210	$896
Electricity Cost as Percent of Income	2.2%	1.5%
Average Household Natural Gas Consumption (therms)	368	400
$/therm	$1.08	$0.96
Natural Gas Cost	$397	$384
Natural Gas Cost as Percent of Income	0.71%	0.67%
Total Energy Cost (Electricity + Natural Gas)	$1,607	$1,293
Total Energy Cost as a Percent of Income	2.9%	2.2%

Cool Roofs

The LADWP offers a variety of rebates through its Consumer Rebate Program (CRP) to promote energy-efficient housing installations for their customers. One product is the cool roof, which is designed to reflect more sunlight and absorb less heat than a standard roof.[17] This allows for a cooler house or building, so residents or building managers can save energy and spend less on utility bills.

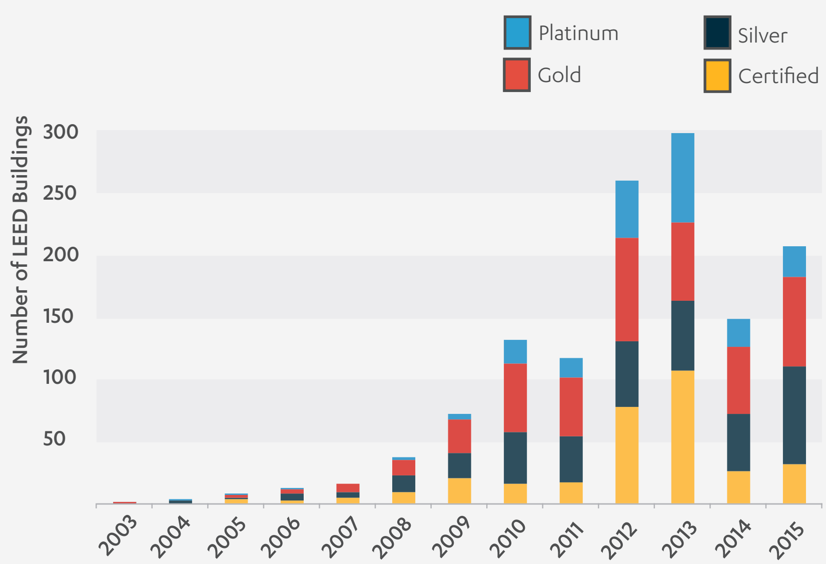
Based on data from September 2012 through June 2016, LADWP has awarded 534 cool roof retrofit rebates for over 2 million square feet of roof, which they estimate saved over 900,000 kWh of energy (LADWP does not track cool roofs installed on new residential buildings since the rebates are for retrofits only). The average number of rebates paid per month increased more than 5-fold between 2014 and 2016.

The City of Los Angeles also passed a Cool Roof Ordinance as part of its Green Building Code, which went into full effect at the beginning of 2015. This ordinance requires that new residential buildings and large residential roof replacements install cool roofs, with a few exceptions. Since 2015, under the City's Cool Roof code requirements, nearly 7,000 residential cool roofs have been installed, covering over 10 million square feet in the city, and saving over 4.5 million kWh/yr from the program.

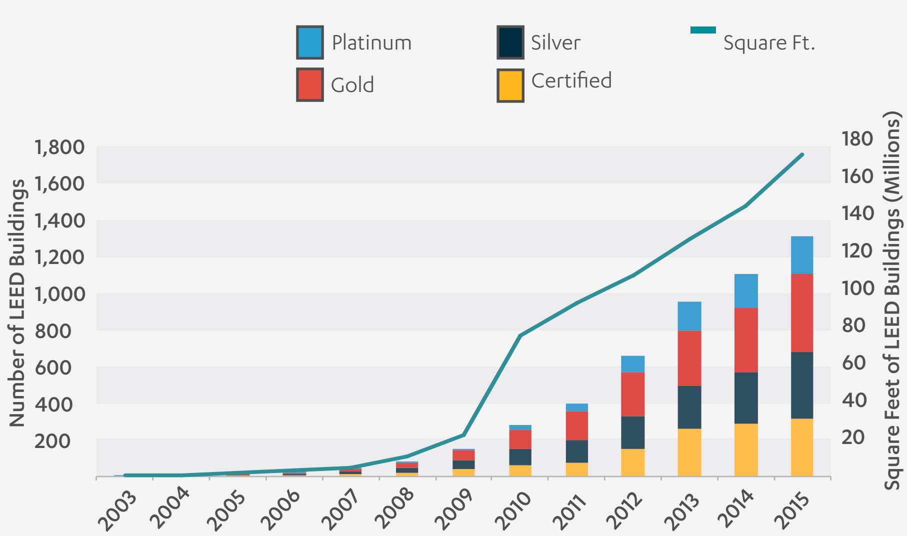


INDICATOR • LEED CERTIFIED BUILDINGS

Number of LEED Buildings Certified per Year by Rating Level in LA County (2003-2015)



Cumulative Number & Cummulative Square Feet of LEED Buildings Certified in LA County (2003-2015)



Introduction

LEED, or Leadership in Energy and Environmental Design, is a third-party verification system developed by the US Green Building Council (USGBC) for rating building sustainability. The program is used worldwide, and is applicable to all types of buildings during any phase of development or renovation. To be LEED certified, a building must earn sufficient points across areas related to sustainability in energy, water, and material use, as well as in innovation and living quality. Depending on the number of points earned, a building may be awarded one of four ratings: Certified, Silver, Gold, or Platinum, in order of increasing level of sustainability. LEED provides a standardized evaluation system that is widely recognized, and helps to evaluate the progress of green buildings in LA County.

Data

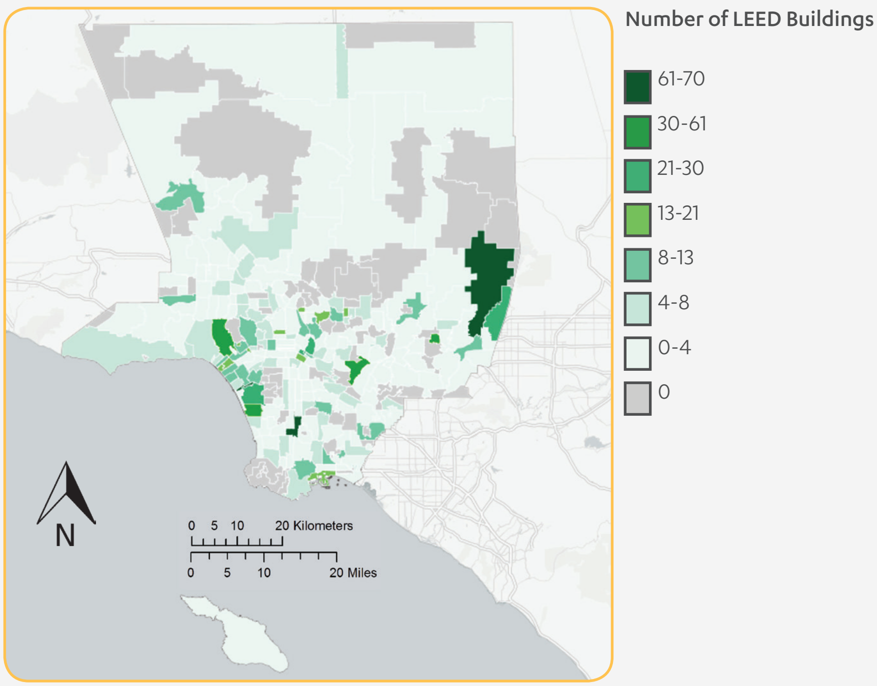
We obtained a list of all LEED building projects in the County from the Los Angeles chapter of the USGBC. The dataset covered certifications from 2003 to 2015. We looked at total number of certified buildings in each of the four LEED categories, the square footage of LEED buildings certified, project types certified, and the number and percentage of buildings that are LEED certified by zip code throughout the County. We used 2014 building data from the LA County GIS Data Portal as the basis for the percentage calculations.

Findings

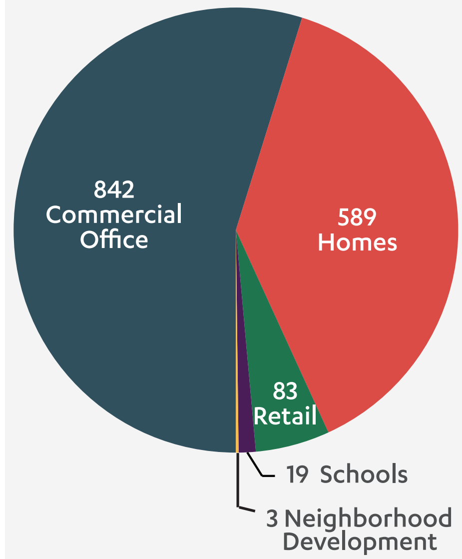
- The number of annual LEED certifications rose almost every year since 2003 until it peaked at 298 in 2013. In 2014, certifications dropped nearly 50%, but rose again in 2015.
- LEED Silver was the most frequent certification level in LA County from 2003 to 2008. Starting in 2009, LEED Gold made up the largest fraction (over 30%) of certifications, and the largest square footage (50%).
- The cumulative square footage of buildings rose exponentially from 2003 to 2010, after which it continued to grow at a slower, but consistent rate. As of 2015, there were 178 million square

LEED CERTIFIED BUILDINGS

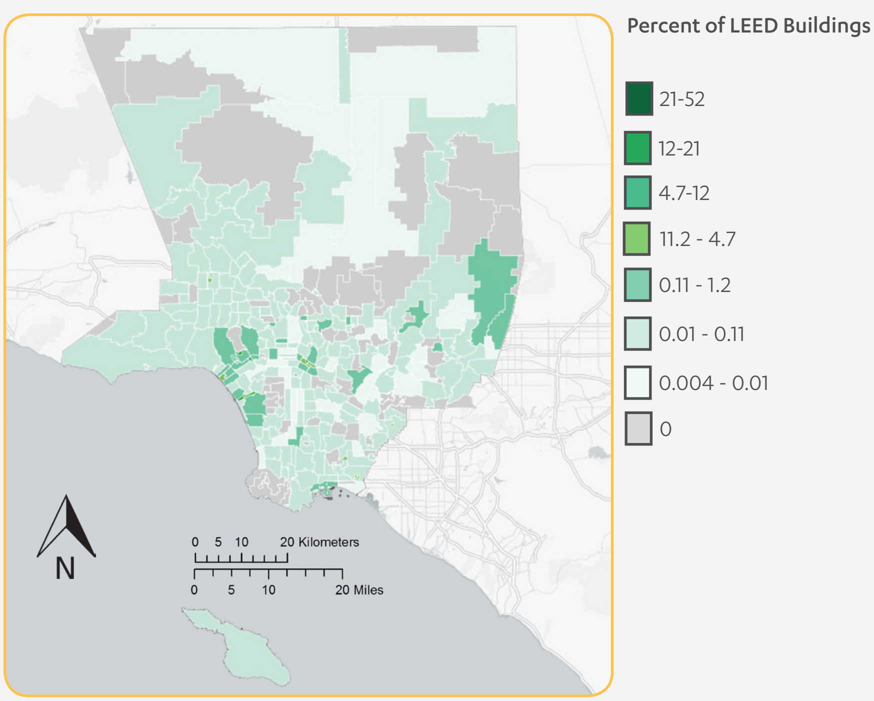
Number of LEED Certified Buildings by Zip Code in LA County as of 2015



Certified LEED Projects by Type in LA County (2003-2015)



Percentage of all Buildings in a Zip Code that are LEED Certified Buildings in LA County as of 2015



feet of LEED certified buildings in the county.

- About 55% of all LEED projects between 2003 and 2015 are commercial office buildings, while 38% are homes.
- Although project classifications in the database made it challenging to determine an exact breakdown between new construction and retrofits, at least 68% of LEED projects were new construction between 2003 and 2015.
- In 2014, there were nearly 2 million buildings in LA County. In the same year, LEED certified buildings (approximately 1500 buildings) made up less than a tenth of a percent of total buildings (less than one LEED certified building per thousand buildings).
- There were higher numbers and greater percentages of LEED buildings on the Westside, downtown LA, at the ports, and in Claremont and La Verne to the east; while there were low numbers in places like South LA, East LA, and the San Fernando Valley. Use the following interactive map link to explore this data further.[18]

Data Limitations

- Although there is prestige associated with LEED certification, the cost of the certification process may dissuade certain buildings that meet LEED standards from becoming certified. This may be especially true in California because Title 24 building standards for new buildings is somewhat analogous to LEED for energy efficiency, and has become more rigorous over the years. Therefore, more buildings may meet LEED standards than are certified in LA County.

HIGHLIGHT

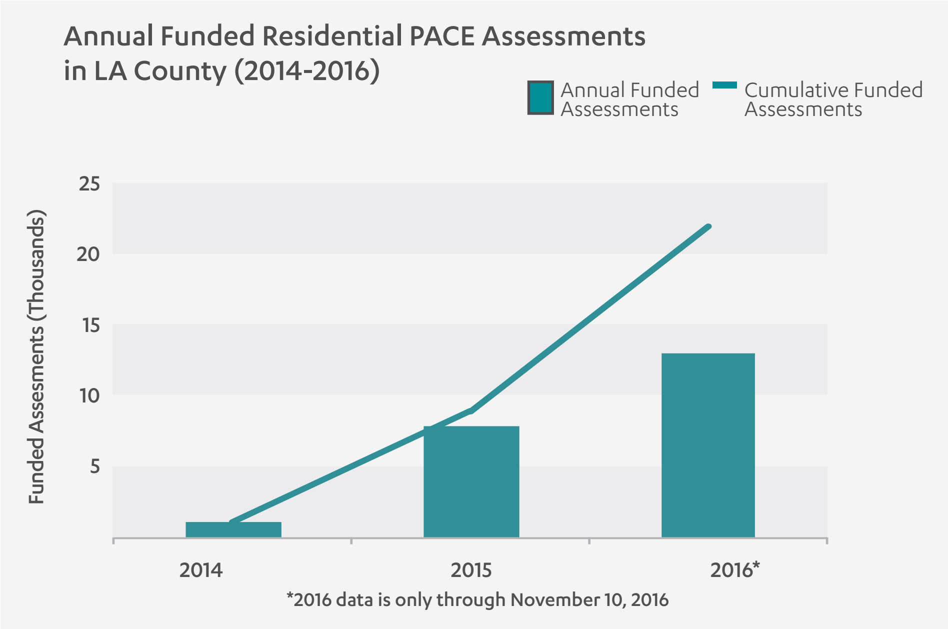
Zero Net Energy Buildings

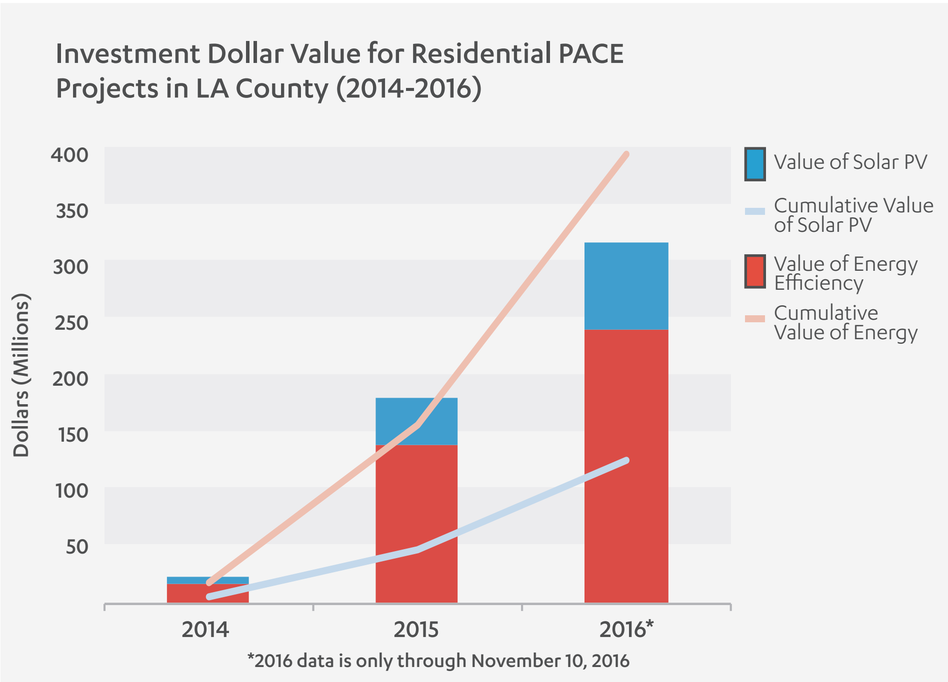
California's goal is to have all new residential construction in the state be zero net energy (ZNE) by 2020, and all new commercial construction to be ZNE by 2030. A ZNE building is commonly defined as one that "produces enough renewable energy to meet its own annual energy consumption requirements."[19] Note that most ZNE buildings are not off the grid, and without additional storage capabilities, a ZNE building will still rely on peaker power plants during times of high demand. As of August 2016, California had 17 verified commercial ZNE buildings, and 91 working towards achieving ZNE (referred to as "emerging"). Verification is conducted by the New Buildings Institute (NBI) and will only be conferred after the building achieves ZNE status for at least a full year. LA County contains three verified ZNE buildings and 17 emerging ZNE buildings.[20]

Zero Net Energy Buildings in LA County (Aug 2016)

Year Built	Building Name	City	Size (sq ft)	Gross Energy Use (kBtu/sf/yr)	Onsite Renewable Energy Production (kBtu/sf/yr)	Net Grid Energy Use (kBtu/sf/yr)
VERIFIED						
2003	Audubon Center at Debs Park (off grid)	Los Angeles	5,020	17.1	17.1	0
2004	Challengers Tennis Club	Los Angeles	3,500	9.0	9.0	0
2011	National Park Service - Diamond X Ranch Student Intern Center	Calabasas	3,500	31.5	34.1	-3.6
EMERGING						
2008	Aquarium of the Pacific Watershed Addition	Long Beach	2,500	-	-	-
2011	Pierce College Maintenance & Operations Facility and Net-Zero Central Plant	Los Angeles	42,000	16.0	8.0	8.0
2012	Conrad N. Hilton Foundation	Agoura Hills	22,240	22.0	24.0	-2.0
2012	Morphosis Architecture Studio	Culver City	11,600	24.0	20.0	4.0
2012	William S. Hart High School District	Santa Clarita	-	-	-	-
2013	Forest Service's Technology and Development Center	San Dimas	-	-	-	-
2014	Glumac Office Aon Center Floor 203	Los Angeles	17,500	-	-	-
2014	Kaiser Permanente Antelope Valley Medical Office Building	Lancaster	136,800	31.0	6.0	25.0
2014	Student Success and Retention Center at East Los Angeles College	Los Angeles	136,000	-	-	-
2014	The Village at Beechwood	Lancaster	22,960	-	-	-
2015	CA Lottery District Office	Santa Fe Springs	520,000	22.1	22.2	-0.1
2015	Los Angeles Harbor College Sciences Complex	Los Angeles	71,800	5.2	5.8	-0.6
2015	Muse School	Calabasas	-	-	-	-
2015	Net Zero Plus Electrical Training Institute	Los Angeles	142,000	-	-	-
2016	Fair Oaks Zero Net Energy Office	Pasadena	12,000	-	-	-
2016	Mt. San Antonio College	Walnut	20,610	-	-	-
2016	Vista Grande Elementary School	Rancho Palos Verdes	-	-	-	-

INDICATOR • PACE FINANCING FOR ENERGY EFFICIENCY & SOLAR PV





Introduction

The property-assessed clean energy (PACE) finance model is one method for funding energy efficiency, renewable energy, and water conservation/efficiency improvements for both commercial and residential property owners. The program was first initiated in California in 2007 after the passage of AB 811, and funding for it was improved with SB 77 in 2010.[21] High efficiency air conditioners and heating systems, windows, cool roofs, and rooftop solar panels are examples of improvements. Local and state governments across the U.S. finance the initial cost of the upgrades, which increase property value, create jobs, and reduce GHG emissions. The cost of these upgrades is paid back by the owner over time through a property assessment added to the property's tax bill.[22] A property assessment is defined as the combined project and finance cost that is recorded as a lien against the property as a result of the project.

Los Angeles County established its own residential PACE program in 2015 with two approved program administrators: Renovate America (HERO) and Renew Financial (CaliforniaFIRST or CalFIRST). These administrators were chosen as a means of generating competitive options for the delivery of clean energy projects; however, County residents may also use program administrators approved by other cities or counties, such as those programs delivered by FigTree and Ygrene.[23] To participate in the LA County Residential PACE program, a city must pass a resolution to opt into the program; 87 of 88 cities in the County currently participate. The city of Los Angeles has a goal of retrofitting 12,500 homes through PACE by 2017. The County also established its own commercial PACE program in 2013.

It is important to note that PACE is only one of many financing strategies to improve energy efficiency and increase the adoption of renewables. It is a public program that is available to all homeowners. Data was not available for private financing options.

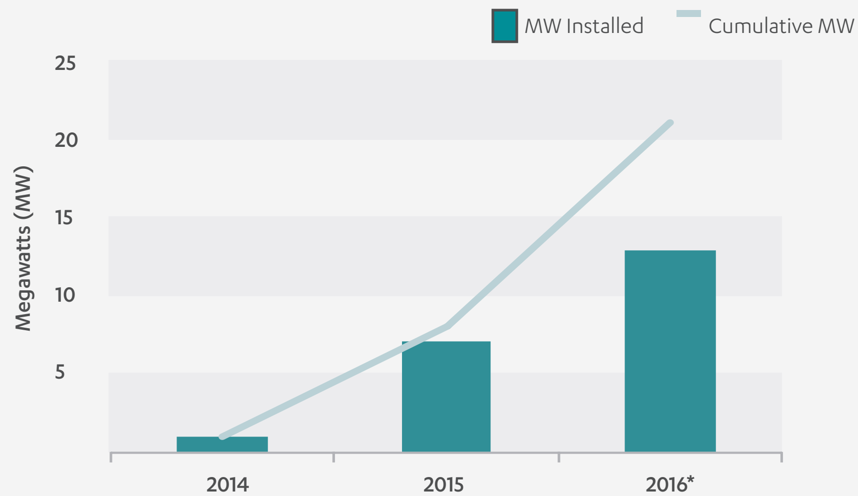
PACE FINANCING FOR ENERGY EFFICIENCY & SOLAR PV

Data

Data were obtained through the County for residential PACE financing administered by HERO and CalFIRST. These programs are designed for residential properties with three units or less. Data for HERO are from 2014-2016 (this includes some financing prior to the start of the County-sponsored program), and data for CalFIRST are from 2015-2016. The data for these two programs were combined to evaluate the total number of properties that used PACE financing (referred to as "assessments"), the investment value for energy efficiency and solar PV through these programs, and the total megawatts of solar PV installed through these programs. We used the number of eligible residential properties to normalize data for mapping across the County.

We also obtained information on the total amount of commercial PACE funding invested since 2013 under the County program.

Megawatts of Residential PACE Solar PV Projects Installed in LA County (2014-2016)

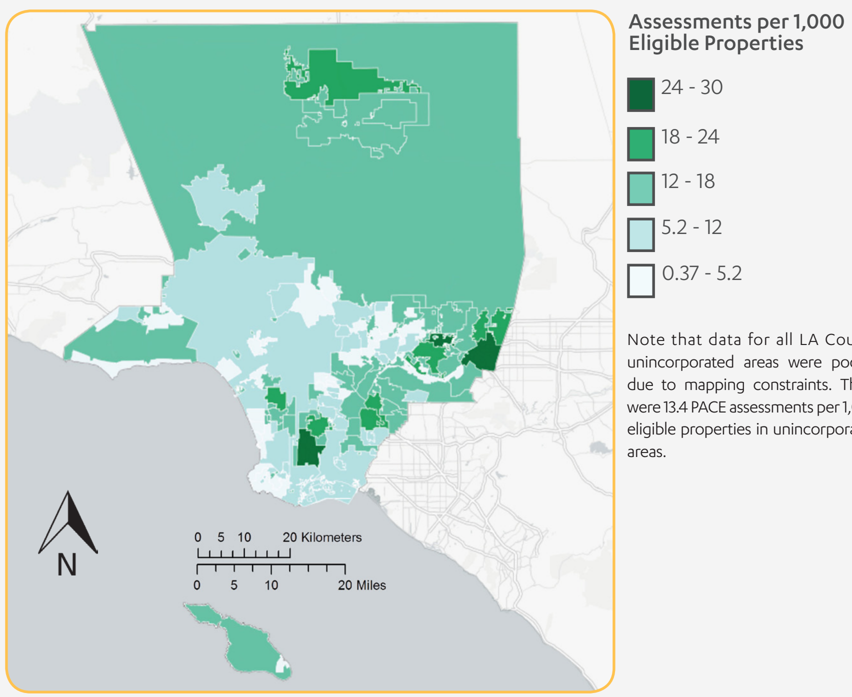


*2016 data is only through November 10, 2016

Findings

- There are PACE-funded residential projects within every LA County city except Vernon.
- The PACE program funded nearly 22,000 residential assessments throughout LA County since 2014.
- There was a 66% increase in the number of residential assessments between 2015 and 2016.
- Approximately $520 million of PACE residential financing was invested in solar PV and energy efficiency projects since 2014.
- The total value of PACE loans invested in residential energy efficiency projects was higher than for solar PV projects each year. In 2016, 67% more money was invested in energy efficiency projects compared to solar.
- More than 21 MW of solar PV were installed since 2014 through residential PACE financing.
- The 7 MW of PACE-financed solar PV projects installed in 2015 accounted for around 6% of the total (119 MW) distributed renewable energy brought online that year.
- Cities with the highest number of residential assessments per property had more than six times as many as the cities with the lowest assessments per property. However, some cities may administer their own independent PACE programs, and such financing is not included in our data. Use the following interactive map link to explore this data further.[24]
- Approximately $17 million were invested in the County's commercial PACE financing since the commercial program began in 2013.

Total Residential PACE Assessments per 1,000 Eligible Properties in LA County by City as of November 2016 under HERO & CalFIRST programs



Note that data for all LA County unincorporated areas were pooled due to mapping constraints. There were 13.4 PACE assessments per 1,000 eligible properties in unincorporated areas.

Data Limitations

- The total value of PACE assessments reported here only includes project values, and does not include associated fees and interest.
- Due to the nature of the data, all County unincorporated areas were grouped together for mapping; this included data from the following neighborhoods: Acton, Altadena, Arleta, Canoga Park, Canyon Country, Castaic, Chatsworth, Encino, Granada Hills, Hacienda Heights, Harbor City, La Crescenta, La Habra, Lake Hughes, Littlerock, Mission Hills, Montrose, Newhall, North Hills, North Hollywood, Northridge, Pacoima, Panorama City, Pearblossom, Porter Ranch, Reseda, Rowland Heights, San Pedro, Sherman Oaks, Stevenson Ranch, Studio, Studio City, Sun Valley, Sunland, Sylmar, Topanga, Tujunga, Valencia, Valley Village, Van Nuys, West Hills, Winnetka, and Woodland Hills.

INDICATOR • STREETLIGHT CONVERSIONS TO LED

Introduction

In recent years, municipalities are demonstrating their commitment to lowering energy use by converting streetlight bulbs to light-emitting diode (LED) bulbs as part of their energy efficiency efforts. LEDs are more energy efficient, produce less carbon dioxide emissions because they use less energy, and last longer than other streetlights before needing replacement.[25]

The City of Los Angeles has over 210,000 streetlights that until recently were fit with incandescent, mercury vapor, metal halide, or high-pressure sodium lamps.[26] Over the past several years, the city's Bureau of Street Lighting has been converting streetlights to LEDs.

The County of Los Angeles Department of Public Works administers 99,700 streetlights within unincorporated County areas and 19 cities.[27] Southern California Edison (SCE) owns and maintains the majority of these streetlights, but has not yet conducted LED conversions.[28] However, SCE does track LED conversions conducted by cities within their service area.

We looked at the number of conversions and/or energy savings generated for streetlights overseen by the City of Los Angeles and SCE in order to track progress on LED installations. Note that the total energy savings is a function of both the number of streetlights converted and the wattage of the bulb being replaced.

Data

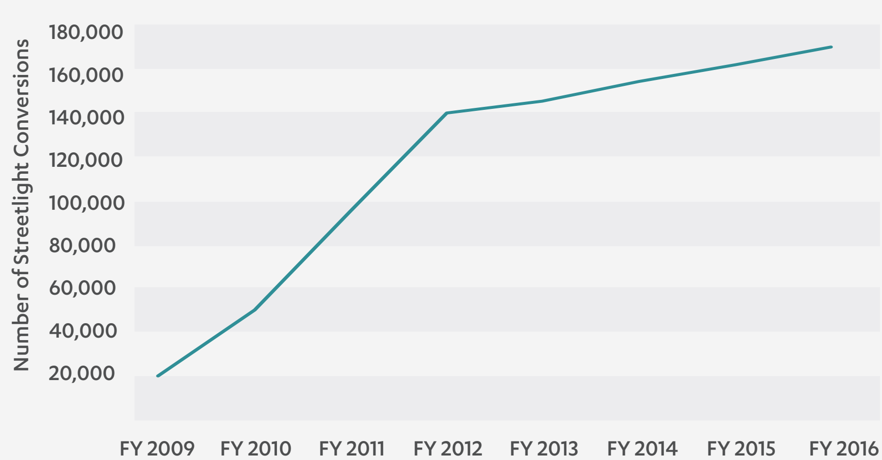
We obtained streetlight conversion data from the City of Los Angeles' LED conversion project from the Bureau of Street Lighting website. The data included cumulative units converted to date, energy savings, and carbon dioxide reductions. To view the number of units converted per year, we looked at numbers provided to the Los Angeles Open Data website by the Bureau of Street Lighting.[29] Information on the amount of energy savings generated per year was not available.

For countywide projects, we got data from Southern California Edison on replacement projects carried out by local governments whose service was metered by SCE.[30] These LED conversion projects took place in 24 cities across the County, including parts of the City of Los Angeles that are in SCE's territory. The data included the kWh savings that resulted from the projects each year; information on the number of lights converted was not available.

Findings

- Starting in 2009, the City of Los Angeles converted an increasing number of streetlights per year until fiscal year 2012 when they reached an annual peak of 45,000 conversions. The conversion rate in subsequent years was lower, with 8,000 conversions occurring in the most recent fiscal year.
- In the City of Los Angeles, over 170,000 streetlights (approximately 81% of the total) were converted to LED since 2009.[31] The Bureau of Street Lighting estimates that these conversions resulted in an average annual energy savings of 64%, or 105 GWh, which translates into an annual CO2 reduction of 62,000 metric tons, and an annual savings of about $9.3 million.
- Over the past six years, 21 additional cities across the County within the SCE service area

Cumulative Streetlight Conversions to LED in LADWP Service Area (2009-2016)



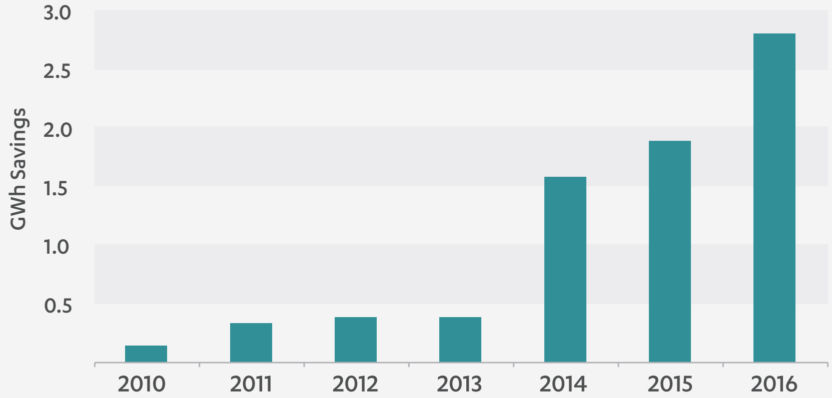
STREETLIGHT CONVERSIONS TO LED

conducted LED street light conversions. The cities with the greatest savings are South Gate, El Monte, South Pasadena and Norwalk. Annual energy savings from conversions increased nearly four-fold in 2014 over the previous year, with nearly 1.6 GWh savings from conversions. Annual savings as of 2016 are over 2.8 GWh.

Data Limitations

- We were unable to obtain historical energy savings data from the City of LA's Bureau of Street Lighting.
- It was not possible during the timeframe of this project to gather data from each city within the County. Thus, we relied on data from SCE for streetlights within their service territory; however, SCE could not provide data on the number of streetlights converted.

Annual Energy Savings from Street Light Conversions to LEDs within SCE Service Area of LA County (2010-2016)



grade C / incomplete

for stationary energy use

Overall, energy consumption only slightly decreased over the past decade in LA County (2-3%). What this means is that energy efficiency efforts have done little more than keep pace with the County's growing population and economy; the population grew by 4% during the same time, while the GDP grew by 8% over the last five years. Although per capita energy use decreased, much greater reductions are needed to support greenhouse gas emissions reduction goals. Despite significant growth in the number of LEED buildings certified, PACE projects, cool roofs, and ZNE buildings in the County, the region is barely scratching the surface on reducing building energy use. Although these programs have recently grown, it is important to note that the percentage of buildings that are LEED certified is less than one in a thousand, and the County PACE program has reached only about 1% of eligible properties. Both programs have great potential to expand, and there are a number of other energy efficiency efforts that were not covered in this report. It would be great to see more of these programs offered at low interest rates to lower-income residents with little equity in their homes. On the municipal side, the City of LA has impressively converted over 80% of their streetlights to LED, saving energy and money, but this trend has not spread throughout areas of the County where SCE owns and maintains most of the streetlights.

There is reason for hope that energy use will decline moving forward. The energy efficiency requirements in SB 350 (de León, 2015) and the city of LA's new building energy use requirements for buildings greater than 20,000 square feet should result in significant energy use savings in the next decade. Energy efficiency requirements for new and redevelopment continue to get tougher over time because of improvements in Title 24. The CEC has set zero net energy requirements for new residences by 2020 and commercial properties by 2030. Unfortunately, new buildings only make up a small percentage of buildings in the County, and therefore a much more aggressive approach is required to implement energy efficiency measures in existing building stock, and to ensure that disadvantaged communities are given affordable access to such improvements. One element of such an approach that should be considered is a retrofit upon sale requirement for residences and for significant new leaseholders. Perhaps new types of "offsets" for ZNE new construction could help pay for retrofits. Adoption of advanced energy codes / ordinances by cities is another tool for advancing building efficiency. Reducing energy consumption is essential to the feasibility of achieving the 100% renewable goals of Sustainable LA.

The region had a big win in 2016 with regard to energy use in manufacturing with the award from the Department of Energy for the establishment of the Clean Energy Smart Manufacturing Innovation Institute, which will be headquartered in Los Angeles.[32] This award will bring $140 million of public-private funds to the region to tackle energy efficiency in manufacturing through the development of smart sensors and digital process controls.

The reason for the "incomplete" part of this grade is due to a number of limitations on data availability. One of these involves the strict privacy limitations on consumption data that required masking of results for major sectors of building use types (industrial, institutional, and mixed uses) even when aggregated across the entire county. Also, recent building energy use data is not readily available. The City's new building energy use ordinance aims to open up this data for larger buildings, but this will only be useful if compliance levels are high. Another limitation is the lack of readily obtainable data on County-wide utility energy efficiency programs and resulting efficiency gains. A study is currently underway at UCLA examining the effectiveness of SCE energy efficiency programs using actual consumption data from the Energy Atlas; this may serve as the basis for an additional indicator in the next Energy Report Card.

2

TRANSPORTATION

Overview

Los Angeles County is home to a major international airport, three other smaller commercial airports, the largest seaport complex in the United States, freight and passenger rail, numerous bus lines, and over 20,000 miles of freeways and roads.[33] Recent years have seen the expansion of our rail lines, the advent of the very popular CicLAvia open streets program,[34] and integration of Transportation Network Companies, like Uber and Lyft, into our mobility portfolio. But Los Angeles is still known for its cars and congestion, SigAlerts, and rush "hours" that extend 4-5 hours at a time.

Transportation, and the fuels that power it, contributes greatly to greenhouse gas emissions and the poor air quality characteristic of the Los Angeles basin. Electrification of the transportation system, combined with an overall reduction in the miles traveled per person will reduce some of the negative impact of our car culture. California already has the strictest emissions standards of any state, and although related legislation failed, Governor Brown has a goal of cutting petroleum use by cars and trucks in half by 2030.

As part of the state's efforts to reduce fossil fuel emissions from transportation, the Governor's Office created a Zero Emissions Vehicle (ZEV) Action Plan for 2013 and 2015. Governor Brown's Executive Order aims to have 1.5 million ZEVs on Californian roads by 2025, and sufficient infrastructure for 1 million ZEVs in California by 2020.[35] While there is not yet an official county-level target, an estimate (using the state-to-county population ratio) of about 400,000 plug-in electric vehicles (PEVs) would serve as a minimum target for assessing regional progress, although this number is expected to be higher based on adoption rates in metro areas compared to rural areas. In addition, the Southern California Association of Governments' (SCAG) 2016 Regional Transportation Plan/Sustainable Communities Strategy (RTP/SCS) proposes a regional charging network to increase use of electric power for plug-in hybrid vehicles (PHEVs) instead of gasoline.[36] In 2015, LAX allowed Transportation Network Companies to pick up passengers, which gives locals and tourists more travel options as the highly-anticipated metro rail line to the airport is completed. On last November's ballot, LA County passed Measure M with over 70% approval – committing an estimated $120 billion toward public transportation, traffic improvement and enhanced mobility.[37] Just recently, the California legislature approved SB 1 (Beall, 2017) to provide $52 billion for the state's transportation needs over the next decade. The majority of these funds will come from a 12 cent per gallon increase in the gasoline tax, with a significant portion of the funds coming to the region.

The City of LA's Sustainable City pLAn has stated goals of increasing electric or zero emission vehicles to 25% of all light duty passenger vehicles, as well as increasing the use of alternative transit to 50% of all journeys, and shared transportation to 5% of all trips by 2035.[38] The City also aims to reduce the per capita vehicle miles traveled by 10% during that same time. In 2016, the City of Los Angeles, in partnership with Metro, launched the Metro Bike Share pilot program in downtown, and exceeded its goal of installing 1,000 EV charging stations by 2017. In December 2016, the city of Los Angeles ensured that clean transportation isn't just for the rich by establishing the nation's first electric vehicle sharing pilot program in disadvantaged communities. This program is set to deploy 100 electric vehicles and 200 charging stations in 2017.

This category explores the County's progress as it relates to the consumption of transportation fuels, its use of vehicles and other forms of transportation, and adoption of electric vehicles and related infrastructure.

LA County bus, metro rail, and highway routes, 2017

INDICATOR • GASOLINE & DIESEL FUEL SOLD

Introduction

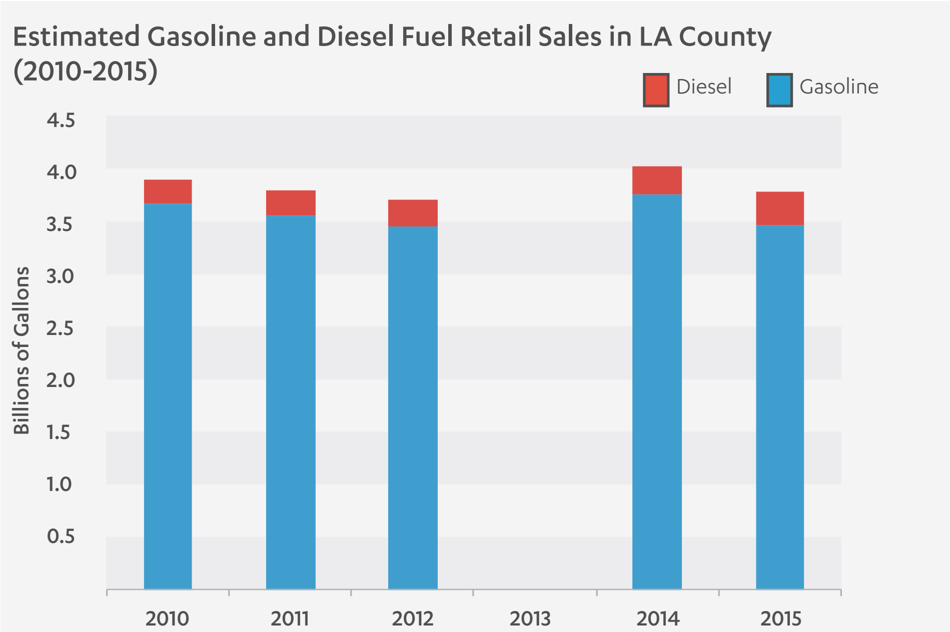
LA County has the most registered vehicles of any county in the state, with over 7.8 million registered vehicles in 2015.[39] On-road transportation makes up the second-largest sector of the county's greenhouse gas emissions at 33.5% in 2010,[40] which is why transportation is a key target in reducing the County's overall emissions. Under the Petroleum Industry Information Reporting Act (PIIRA),[41] all fueling stations that sell at the retail level, such as airports, marinas, truck stops, and convenience stores, are required to report all gasoline and diesel sales to the California Energy Commission (CEC) with no minimum volume reporting limit. By analyzing transportation fuel trends and demands, the CEC can help inform and steer energy policy development toward alternative fuels.

Data

We used information from the California Retail Fuel Outlet Annual Reports from the CEC's Energy Almanac to assess the amount of gasoline and diesel sold in LA County and for statewide comparisons.[42,43] Two data sets are provided: (1) sales reported through surveys administered by the CEC, and (2) estimated sales based on a calculation that accounts for stations that do not report (mostly small retailers). No data were available for 2013 at the time of this report. While diesel fuel has 12% more energy per gallon than gasoline, this report only assesses the volumes sold and does not address energy consumed.

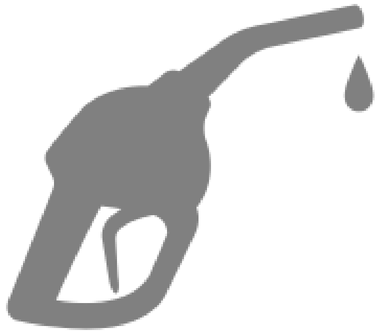
Findings

- LA County's estimated annual retail gasoline sales in 2015 were approximately 3.5 billion gallons. This represents over 93% of total fuel sales in the County, around 23% of the total gasoline sales in the State, and is equivalent to ~31 million metric tons of CO2e.[44]
- LA County's mean estimated annual retail diesel sales were approximately 313 million gallons, which represents about 16% of total diesel sales in the state.
- Estimated gasoline sales in LA County in 2015 were 5% lower than in 2010 and close to 8% lower than in 2014. In contrast, estimated gasoline sales in California increased by 1.7% since 2010.
- Estimated diesel sales were more than 33% higher than in 2010 and 16% higher than in 2014. In comparison, estimated diesel sales in California increased by 37.3% since 2010.



Data Limitations

- The sales data in the reports did not include commercial fleets, government entities, or rental facilities/equipment yards. Non-retail diesel sales, which comprise an estimated 47% of all diesel sales, were not included in the report. These limitations potentially mask significant reductions in diesel fuel use that occurred over the last few years through conversions of diesel operated bus fleets, other vehicles, and heavy equipment at the ports and LA World Airports to natural gas or electric vehicles.
- Not all retail fuel stations report their sales, despite the requirement. Survey responses from gasoline retail stations were at the mid-80% level from 2010-2012, but dropped to 69% in 2014. Diesel retail station survey responses decreased from 90% in 2010 to 72% in 2014. The estimation process applied by the CEC for the Energy Almanac dataset accounts for these unreported sales.
- Because data clean-up is still underway, 2013 estimates were not available in time for analysis in this report.
- The CEC cautions that 2012, 2014, and 2015 data technically cannot be directly compared to other years because of changes in the calculation/estimation methodology; however, results were within 5% of the previous methodology.
- We do not have biodiesel sale information for LA County.



INDICATOR • VEHICLE MILES TRAVELED

Introduction

Vehicle Miles Traveled (VMT) per capita is a measure of a population's travel behavior, which impacts traffic congestion, fuel sales, air pollution and greenhouse gas emissions.[46] Reductions in VMT, along with vehicle electrification, are needed to achieve the State's 2040 emissions target for transportation GHGs, per SB 391 (Liu, 2009). The Southern California Association of Governments (SCAG) 2016 Regional Transportation Plan/ Sustainable Communities Strategy (RTP/SCS) aims to achieve an average daily rate of 20.5 VMT per capita by 2040,[47] a 7.4% decrease from the 2012 baseline. Fluctuations in VMT per capita may be ascribed to changes in transit use, gasoline prices, and disposable income.

Data

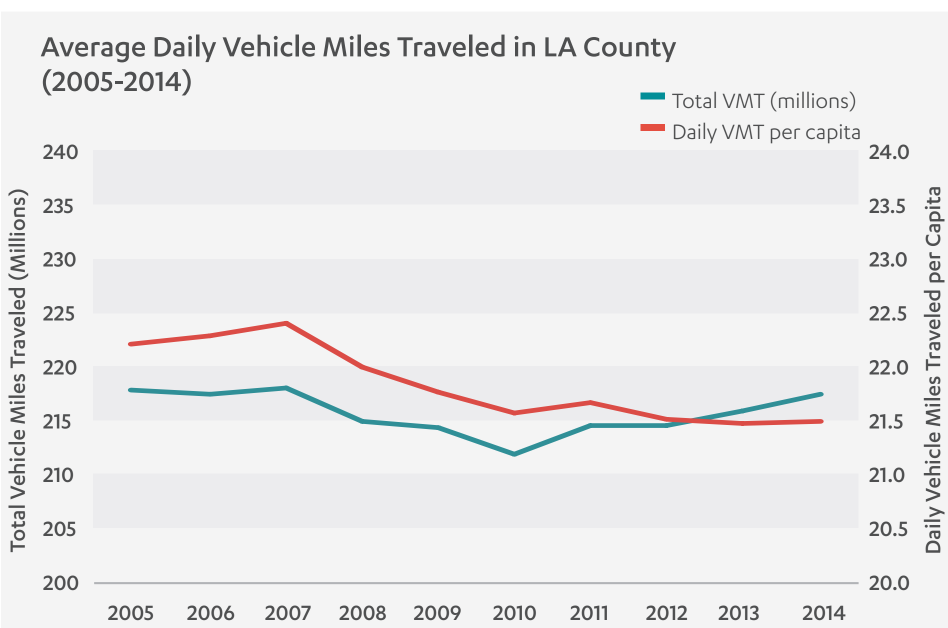
To determine the number of average daily VMT in LA County, we used data from the California Department of Transportation.[48] We looked at the annually reported California Public Road Data from the years 2005 – 2014. The California Public Road Data utilizes information provided by the Highway Performance Monitoring System (HPMS). Data were used from Table 6: "Maintained Miles & Daily Vehicle Miles by Travel Estimates by Jurisdiction", which contains average daily VMT for every county and city in California. LA County data also includes unincorporated areas of LA, National Park Service, State highways, State Park Service, U.S. Forest Service and U.S. Navy lands. We calculated VMT per capita using LA County population data obtained from the United States Census Bureau.[49]

Findings

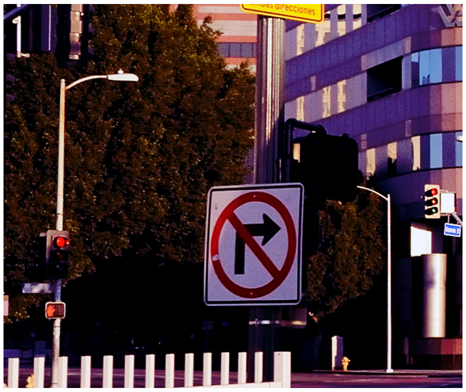
- While total VMT in LA County barely changed from 2005 to 2014, VMT per capita decreased by 3.3% during that time.
- The ten-year high VMT per capita was 22.4 miles in 2007, while the most recent figure was 21.5 miles in 2014 – the lowest since 2005. Note, there was not any appreciable change since 2012.
- VMT per capita will need to decrease by an additional 4.7% to achieve the SCAG goal of 20.5 miles by 2040. This seems feasible given the declining trend and the amount of time between now and 2040. Additional research is needed to determine whether the SCAG goal of 20.5 miles is optimal for achieving the State's 2040 emissions target for transportation GHGs and for the County to reduce energy demand enough to feasibly meet the Sustainable LA 100% renewable energy goals.

Data Limitations

Data used to calculate VMT may be estimated using a "growth factor" based on previous years if Annual Average Daily Traffic data was not recorded for a particular location.



INDICATOR • COMMUTE TIMES & MODE OF TRANSPORTATION



Introduction

Los Angeles has a reputation for heavy traffic and long commutes. Commute times and mode of transportation to work are linked to many aspects of urban life, including accessibility of public transportation and proximity of housing to jobs. This indicator explores how people get to work and how long it takes. The County's Metropolitan Transit Authority provides bus and rail transit to much of the region. There are also individual city transit authorities such as the Santa Monica Big Blue Bus, LADOT's DASH and Commuter Express services, the Culver City Bus, Foothill Transit, Long Beach Transit, Torrance Transit, and Antelope Valley Transit. The Metro Light Rail System is expanding. In March 2016, the Gold Line added six stations in the San Gabriel Valley, and in May 2016 the Expo Line expanded the Metro Rail System by seven new stations, connecting Santa Monica to various points throughout the region.[50]

Data

We used the 1-year estimates from the U.S. Census Bureau's American Community Survey (ACS).[51] Responses from LA County were found through the U.S. Census Bureau American FactFinder.[52] Each year's survey includes responses from over four million workers who are 16 years and over and do not work at home. We looked at commute times and modes of transportation for 2015, as well as trends in mode of transportation since 2005.

Findings

- Among survey respondents in 2015, 78% drove alone, 10% carpooled, 6% took public transportation, and 6% walked, or took a bike, motorcycle, or taxi to work.
- The mean commute time in 2015 was 30.9 minutes, which was a 2.9% increase from the 2013 mean commute of 30.0 minutes.
- In 2015, 3.5% more people reported driving alone and 24% fewer people reported carpooling compared to 2005.
- Public transit use increased from 2005 to 2011, but decreased from 2011 to 2015. Overall, nearly 6% fewer people reported using public transit in 2015 compared to 2005.
- Slightly more people were taking taxis or similar modes in the past couple of years, perhaps due to the expansion of car sharing services. Note that this dataset applies only to commuting to work, not recreational trips. The survey's focus on only commutes and the lack of available data on ride sharing and multi-modal transportation on non-commute transportation means that the impacts of more transportation opportunities in these areas is currently unknown.
- The mean commute time for those who take public transportation was 69% greater than those who drive alone, and nearly 40% of public transportation trips took more than one hour in 2015.

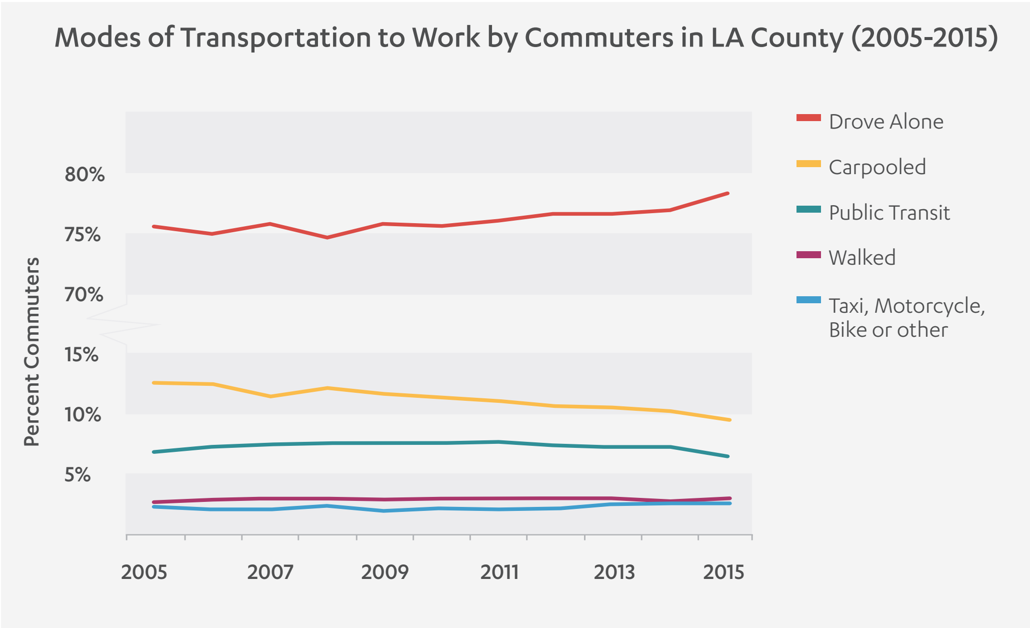
Data Limitations

- Commuting to and from work made up approximately 16% of all person-trips and 19% of all person-miles of travel in the County,[53] and therefore trends in travel habits for a large majority of trips were not captured in these data.
- The information for workers who biked or walked was presented in a modified version of the original survey, and we were unable to estimate the mean commute time for these modes because of the limited data.

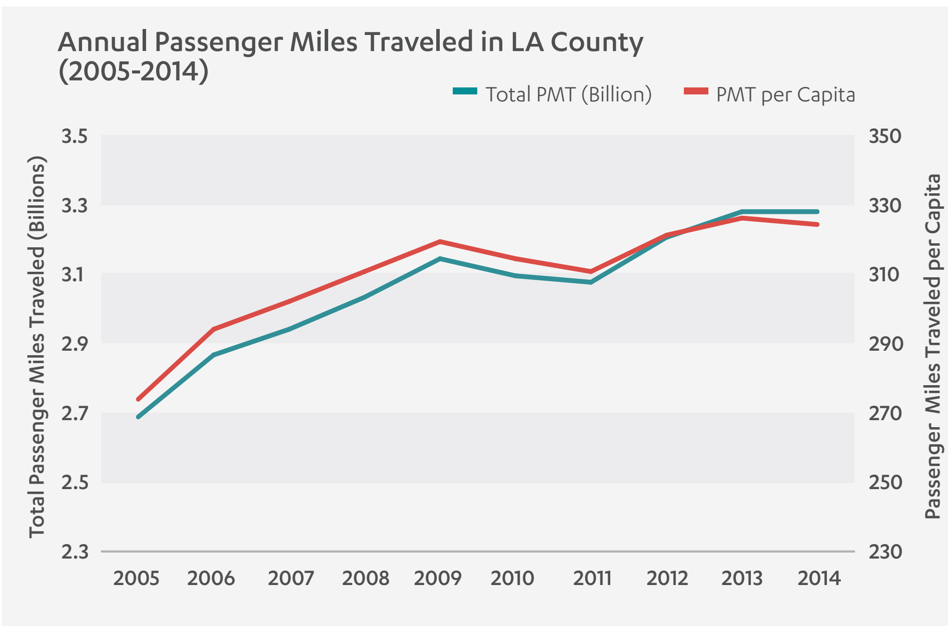
Los Angeles County Travel Times and Modes of Transportation to Work (2015)
Source: ACS

	Total	Drove Alone	Carpooled	Public Transportation (excl. taxicab)	Walked	Taxicab, motorcycle, bicycle, or other means:
Workers 16 years and over	4,454,851	3,489,716	426,493	287,562	133,636	117,444
0-19 minutes	31%	31%	28%	9%	77%	44%
20-59 minutes	55%	57%	57%	52%	22%	43%
60 or more minutes	13%	12%	15%	39%	1%	13%
Mean travel time to work (min)	30.9	29.8	32.6	50.3	--	--

COMMUTE TIMES & MODE OF TRANSPORTATION



INDICATOR • USE OF TRANSIT: PASSENGER MILES TRAVELED & PASSENGER TRIPS



Introduction

Public transit is an alternative transport option that reduces greenhouse gas emissions compared to car travel, and decreases traffic congestion and air pollution. There are two primary metrics used to assess the use of public transport:

- ***Passenger miles traveled (PMT)*** is defined by the Federal Transit Administration (FTA) as the "sum of the distances traveled by each passenger" on transit. Similar to the target reductions for average daily VMT identified in the 2016 RTP/SCS, SCAG aims to increase daily transit miles by 30% by 2040 from the 2012 baseline through better transportation oriented developments and services.[54]
- ***Unlinked passenger trips*** is defined as the total number of times a passenger enters a public transit vehicle; passengers are counted each time they board vehicles, regardless of how many vehicles they use to travel from their origin to their destination.[55]

Annual changes in PMT and unlinked passenger trips may be influenced by changes in transit infrastructure and services, as well as economic conditions and fuel prices.

Data

To assess public transit use in LA County, we looked at annual PMT and unlinked passenger trips annually for the years 2005-2014 (the most recent data available). These numbers are reported by transit agencies across the U.S., and are made available through the Federal Transit Authority's National Transit Database (NTD), under the heading of "service consumed."[56] We selected only those transit agencies operating in LA County, using a list compiled by the UCLA Institute of Transportation Studies. To calculate per capita values, we used LA County population data from the U.S. Census Bureau.[57]

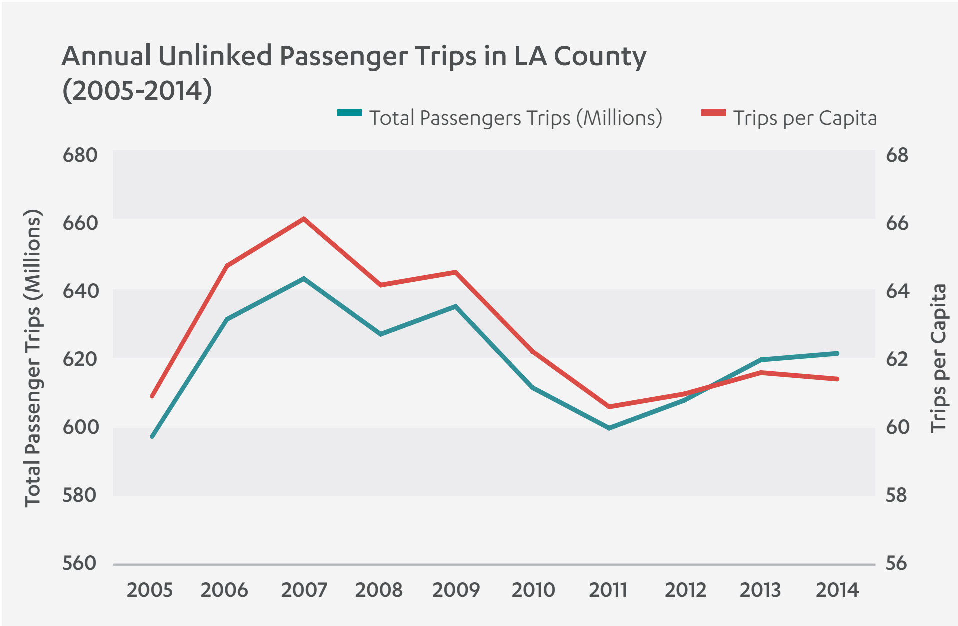
Findings

- Public transit use increased overall since 2005; but recall that public transit use decreased slightly for commutes (see "Commute Times and Mode of Transportation" indicator). The annual PMT in 2014 was ~3.3 billion, a 22% increase since 2005. This increase in PMT may mean that more people were using public transit, or it may mean that the same people were traveling longer distances, perhaps because of more public transit opportunities over a larger portion of the county, or any combination of the two.
- Increases in PMT slowed since 2009, with only a 4.3% increase over the most recent 5-year period. The dip between 2009 and 2011 likely resulted from a combination of Metro service cuts, the recession (job loss) and low gas prices that put people back into cars.
- Since 2012 (SCAG's baseline year for their 30% increase by 2040 goal) annual PMT only increased by 2.3% through 2014. PMT will need to increase by nearly 890 million total annual miles over the next 25 years to reach this goal. As with VMT, additional research is needed to determine whether or not the SCAG goal of increasing daily transit miles by 30% is the right target for achieving the State's 2040 emissions target for transportation GHGs and for the County to reduce energy demand enough to feasibly meet the Sustainable LA 100% renewable energy goals.
- Unlinked passenger trips decreased by 3.4% since a high of 642.8 million in 2007, but increased since 2011. Passenger trips may have decreased as a result of a more extensive transit system. For example, the 2009 opening of the Silver Line and the extensions of the Gold Line in 2009 and 2016, followed by the 2012 opening of the first half of the Expo line and the extension of the Orange line, may have allowed passengers to take a single train trip to reach their destination rather than a combination of a train and bus, for example. However, this may also have been a reflection of fewer transit passengers overall, or some combination of the two factors.
- Since 2011, PMT per capita and passenger trips per capita increased at a slower rate than the absolute value of those metrics.

Data Limitations

- Transit agencies self-report to the National Transit Database. There is no independent third party review of data accuracy.

USE OF TRANSIT: PASSENGER MILES TRAVELED & PASSENGER TRIPS



INDICATOR • NUMBER OF REGISTERED ELECTRIC VEHICLES

Introduction

Plug-in electric vehicles (PEVs) use no fossil fuel or far less fossil fuel than traditional vehicles, and thus reduce greenhouse gas emissions and decrease air pollution.[58] When combined with renewable energy sources, their impact and cost savings are even greater for the consumer, especially if the consumer combines a PEV with rooftop solar. Pure battery electric vehicles (BEV) and plug-in hybrid electric vehicles (PHEV) are two common types of PEVs sold in LA County. PHEVs utilize a battery plus a traditional combustion engine to power the vehicle. PEVs fall under the category of zero-emission vehicles (ZEV), along with hydrogen fuel cell electric vehicles (FCEV).

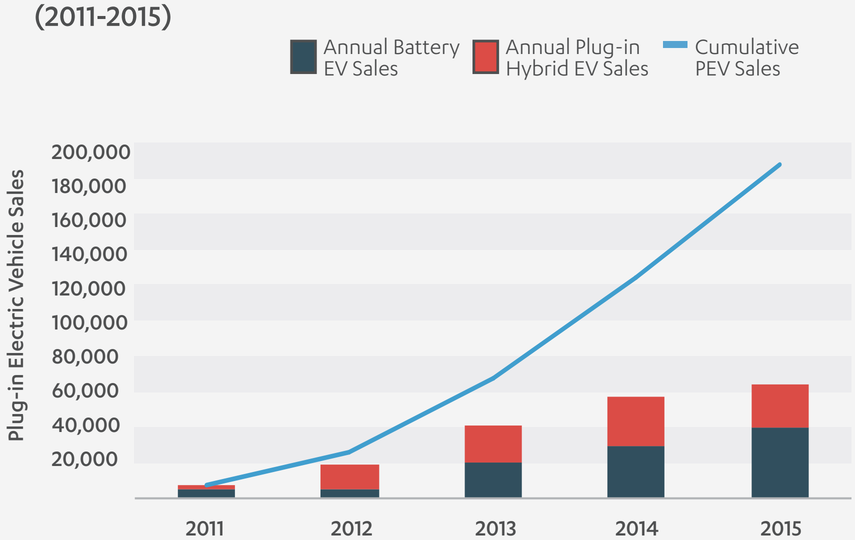
Data

We used data from the UCLA Luskin Center for Innovation that was obtained from IHS Automotive on all new vehicle registrations (sales and leases) in LA County between the years 2011 and 2015. The types of PEVs included are PHEVs and BEVs only. Vehicles registered as “fleet” or “dealership/ manufacturer” (such as vehicles registered by car-rental companies, businesses or public entities) are not included; these two categories combined make up less than 3% of all registrations in the IHS Automotive data set, although rental cars are typically driven more than personal vehicles.

Findings

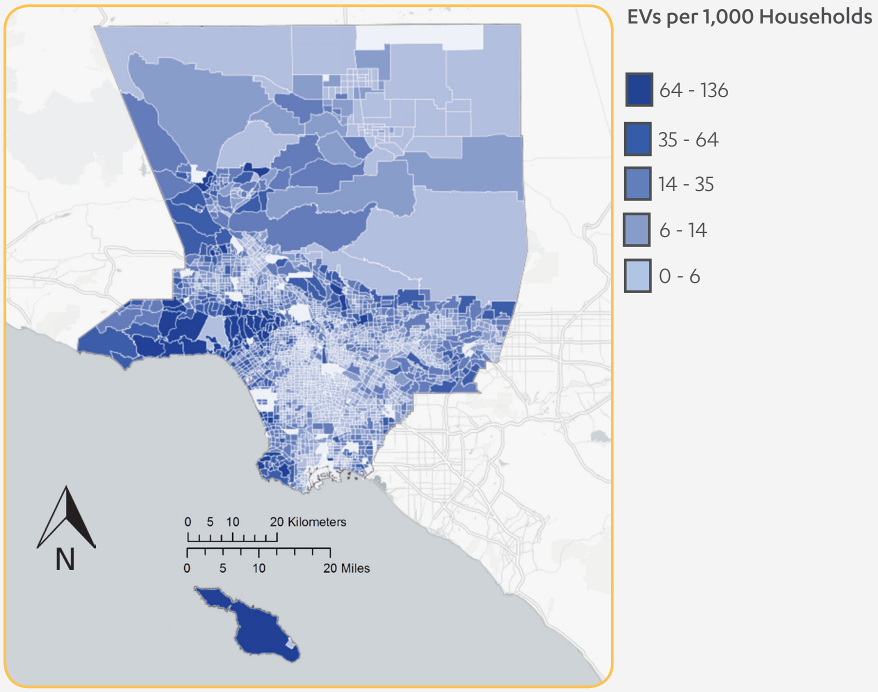
- Overall PEV sales increased rapidly since 2011. Sales in 2015 (just under 64,000) were an order of magnitude greater than in 2011. With nearly 190,000 PEVs in 2015, LA County was nearly halfway to the estimated minimum target of about 400,000 PEVs by 2025.
- Plug-in hybrid EV sales made up a majority of PEV sales between 2011 and 2012, but this trend switched to battery EV sales starting in 2013.
- In 2015, almost twice as many battery EVs were sold than plug-in hybrids.
- There were 10 to 20 times as many PEVs per household in high ownership census tracts then in low ownership tracts.
- In 2015, PEVs made up around 3% of the 6.3 million registered automobiles in LA County.
- PEV ownership is heavily concentrated on the west side and other higher-income areas, with large areas of very low ownership in the central and south central parts of the County as well as in the San Fernando Valley.

Plug-in Electric Vehicle Sales in LA County (2011-2015)



NUMBER OF REGISTERED ELECTRIC VEHICLES

Number of Electric Vehicles (EVs) per 1,000 Households by Census Tract in LA County as of 2015



INDICATOR • NUMBER OF EV CHARGING STATIONS

Introduction

With the rise of PEVs, it is important to consider the availability and accessibility of charging stations. A charging station is a site where an EV can recharge its battery or electric storage.[59] The availability and location of charging stations, among other aspects, may be factors a consumer considers when deciding to purchase a PEV. Lack of charging infrastructure within their community may discourage residents from buying PEVs. If California is to have more than 1.5 million ZEVs on its roads by 2025, then it is necessary to assess the state of current and future charging infrastructure.[60]

Data

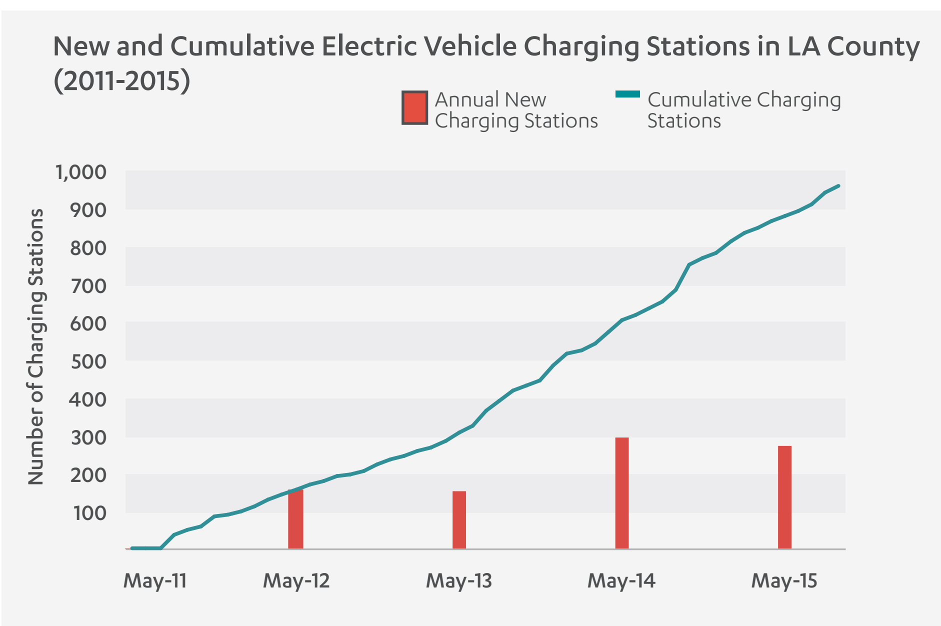
We used data from the UCLA Luskin Center for Innovation that was obtained from the Plugshare database. The data include monthly information on the number of new publicly-accessible charging stations from May 2011 to September 2015. Note that a single charging station may have multiple charge points.

Findings

- Cumulatively, the number of EV charging stations has substantially increased since May 2011, with 964 identified stations as of September 2015.
- The number of new charging stations installed between May 2013 and May 2014 (296) was nearly double that of the previous year. The subsequent year's installations were down by 7%.
- As of 2015, there was only one charging station for every 195 PEVs in LA County.
- Some neighborhoods in south-central LA County appear to be under-served by charging stations, although a more detailed analysis was beyond the scope of this project.

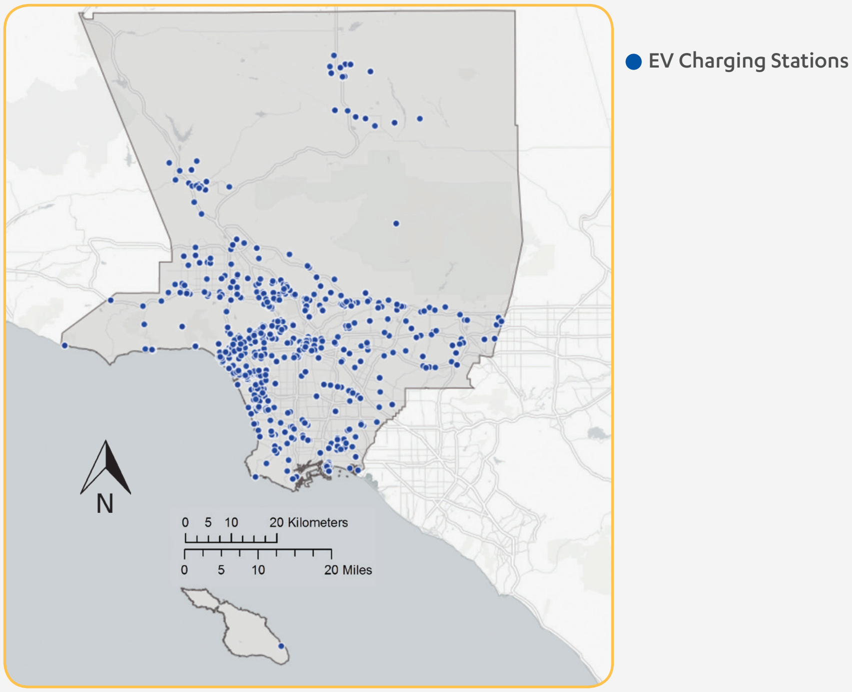
Data Limitations

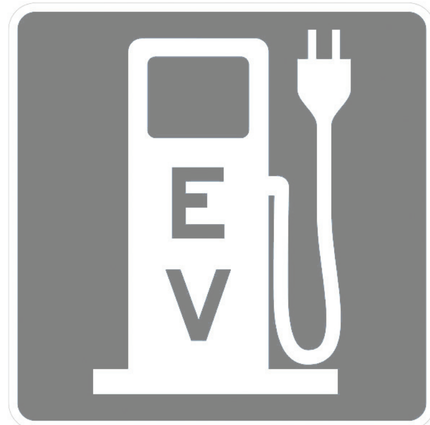
- The data represents the month that the charging station was added to PlugShare's database, which in some cases may be later than the month the station was installed.



INDICATOR • NUMBER OF EV CHARGING STATIONS

Electric Vehicle (EV) Charging Stations in LA County as of 2015





HIGHLIGHT

Transportation Affordability and AllTransit™ Performance Score

Transportation is the second largest expense for most households after housing.[61] Access to affordable transit allows residents to decrease the time, energy, and finances spent on transportation. The Center for Neighborhood Technology (CNT) developed a Housing and Transportation Affordability Index (H+T Index) that assesses neighborhood affordability with respect to both housing and transportation costs (traditional affordability indices only look at housing).[62] This research found that for a typical household in the Los Angeles–Long Beach–Anaheim area, with an annual income of $60,252 and 1.28 commuters per household, transportation costs accounted for 20% of total income or $12,292 annually, putting it among the highest for large cities nationwide in 2016.

Transportation costs as a percentage of total income for selected regions		
	21%	San Diego County
Los Angeles Metropolitan Region	**20%**	
	15%	Chicago
San Francisco	11%	
	9%	New York City

CNT also developed the AllTransit™ Performance Score tool, which integrates numerous measures of transit access and connectivity, using a scale of 1-10, with higher values indicating better access.[63] The tool uses data from 805 transit agencies. Los Angeles County had an AllTransit™ Score of 7.0 in 2016.

AllTransit™ Performance Score for selected regions		
	9.6	New York City
San Francisco	9.6	
	9.4	Boston
Chicago	9.1	
	8.0	City of Los Angeles
Los Angeles County	7.0	
	6.4	City of Sacramento
City of San Diego	6.1	
	5.1	San Diego County

grade C-/incomplete

for transportation

Public transit use for commuting is on the decline in LA County, consistent with national trends. There are small increases in the number of people driving alone, increases in overall commute time, and a decrease in carpooling, which paints a bad picture for LA since an increase in driving alone should result in shorter commute times, not longer. For those taking public transit, passenger miles traveled is increasing. We hope that means those miles are replacing car miles, but we cannot be certain. It is possible that this increase in passenger miles traveled is due to the displacement of workers from gentrified neighborhoods, causing them to commute farther to their jobs. The number of passenger trips on public transit decreased overall since 2007, but increased slightly over the past couple of years, which is the trend we want to see. Gas sales are about the same with only a slight decrease, and diesel sales have increased, but only make up a small percentage of total fuel sales. These figures do not include diesel sales that are non-retail, or sales to government or the port, so the numbers do not reflect a presumed decrease in diesel sales due to fleet, bus line, and truck transitions from diesel to natural gas, and the electrification of some of the region's buses. Overall, transportation is expensive in LA County, and access and connectivity don't score well compared to other metropolitan areas.

In contrast, vehicle miles traveled (VMT) per capita is slightly decreasing in the County, while increasing nationally. Since we only had data until 2014, our VMT per capita doesn't reflect the expected positive impact from recent public transit improvements. If the downward trend continues, the County should be on track to meet its goal of reducing VMT to 20.5 miles per day per capita by 2040. However, it is important to note that more research needs to be done to better understand if the VMT goals will translate into the reduced emission goals set forth by SB 375 (Steinberg, 2008) and SCAG.

The good news is that there are a number of planned rail line extensions, and voters recently overwhelmingly passed Measure M, which will increase investment in transportation by up to $120 billion. Also, the state recently approved $52 billion for California's transportation needs over the next decade (SB 1, Beall, 2017). Public sentiment towards public transportation, active transportation, and smart and equitable transit-oriented development is more positive than ever. California is also leading the nation in its transition to electric vehicles, which is an important step in reducing GHG emissions from transportation if these vehicles are replacing conventional fuel vehicles. Electric vehicle sales are increasing, and the County is doing its part to help California reach its zero-emission electric vehicle goal of 1 million by 2025. There are now more battery electric vehicles sold in LA County than plug-in hybrids, but the distribution of these vehicles and the necessary infrastructure is noticeably concentrated in higher-income areas. As of late 2015, there was only an average of one charging station to every 195 EVs in LA County, and only 3% of the registered vehicles are PEVs – a far cry from the 100% electrification goal of Sustainable LA.

While the number of fuel cell vehicles is still quite small (~330 registered cars in California and only three models available for purchase), efforts are underway to expand the hydrogen fueling infrastructure throughout the state. Six retail stations opened in LA County between 2015 and 2016, and an additional 10 stations are projected to open by the end of 2017.[64]

The rationale for the "Incomplete" grade is because no group or agency is tracking historic travel patterns in a comprehensive way. As such, it is difficult to assess to what extent investments into public transportation, or other transportation-related efforts to reduce GHG emissions and improve air quality are working. Improved surveys and efforts to collect data, combined with a clear definition of the objectives the County wants to accomplish with a transportation plan would contribute to a clearer pathway forward. Some of the challenges in assessing transportation in LA County include the following. CA only does a "household travel survey" every six years, with the last one done in 2012. Additionally, ACS only captures commute travel information, which only make up 30-40% of all trips. Although AQMD requires employer surveys on how employees get to work, the survey hasn't been updated since 1990 and so does not include questions related to transportation network companies or light rail. Furthermore, companies like Uber and Lyft are collecting enormous amounts of travel information from their users, but this data is not yet available for analysis of user travel patterns (although a study out of Berkeley on the impacts of ride sharing on mobility in major cities, including LA, is forthcoming).[65] For biking, there is a Bike Count Data Clearinghouse project at UCLA sponsored by LA County Metro and SCAG,[66] but no county-wide tracking. We would like to see LA County Metro doing their own survey of travel patterns that captures more than just commute patterns, includes all travel modes, and occurs every 1-2 years. Ideally, this data would be housed in a central location and used to measure progress and inform transportation planning decisions.

3

RENEWABLE ENERGY RESOURCES

Overview

Replacing our greenhouse gas emitting energy sources with cleaner renewable energy sources such as solar and wind will provide GHG reduction benefits and air quality improvements. The enormous natural gas leak at Aliso Canyon in 2015-2016 was a startling reminder that carbon-based fuels can cause human health impacts as well as contribute greatly to GHG emissions. The gas leak was the largest methane leak in U.S. History,[67] and emitted other harmful substances that had both immediate and potentially long-term impacts on local health.[68]

California has long been a national leader in its efforts to transition to renewable power generation. SB 1078 (Sher, 2002), SB 107 (Simitian and Perata, 2006), and S-14-08 (Schwarzenegger, 2008) ramped up the mandate on renewable power generation for electricity retail sales to 33% by 2020. In 2011, Governor Brown signed SB X1-2, which required publicly owned utilities, investor owned utilities, and electric service providers to achieve a 20% renewable energy portfolio by 2013, 25% by 2016, and 33% by 2020. Recently, California committed to increasing the renewables portfolio standard further to 50% by 2030 with the passage of SB 350 (de León, 2015),[69] and in February 2017, senate leader de León proposed legislation (SB 584) that would ramp up the transition to renewables to 50% by 2025 and 100% by 2045. If approved, this would make the state's goals even more ambitious than our Sustainable LA Grand Challenge goals of 100% renewables by 2050 in LA County.

San Diego has already committed to 100% renewables by 2035, and Los Angeles is identifying a pathway. Community Choice Aggregations (CCAs) are gaining traction, and in 2016, the LA County Board voted to bring CCAs to LA County cities. CCAs provide communities the ability to purchase their own power from wholesale power generators and to establish their own renewable portfolio targets. Furthermore, the largest utility-scale solar plant, Solar Star, was completed in 2015 for Southern California Edison in an area that spans LA and Kern Counties, and has a capacity of 579 MW of energy.[70]

The Sustainable City pLAn established goals to increase local solar power to at least 1500 MW by 2035, install at least 1 MW of solar on the LA Convention Center rooftop, increase energy storage to at least 1654 MW by 2025, and divest from coal-fired power plants completely by 2025.[71] The City of LA had the most MWs of installed solar of any city in the U.S. until this year (now second to San Diego),[72] and has the largest feed-in tariff program in addition to net metering options for solar producers.

This section looks at LA County's utility renewables portfolios and generation, distributed renewable energy generation, and energy storage capacity to evaluate progress towards local and state goals. We look at how much renewable energy is imported versus generated within the County, as there are benefits to both scenarios. Locally produced renewable energy creates jobs, reduces transmission losses, and provides the County with a more reliable source of energy that is less likely to be disturbed by natural disasters outside of the region during transmission. However, sourcing renewables from further away (through a "regional grid") can create energy supply stability (eliminating the "duck curve" where peak energy demand exceeds renewable power generation during the evening) by taking advantage of a larger and more diverse renewable energy portfolio.

INDICATOR • UTILITY RENEWABLES PORTFOLIO



Introduction

In an effort to increase public awareness and support, SB 1305 (Sher, 1997) and AB 162 (Ruskin, 2009) required electricity providers to disclose information about the energy resources used to generate their electricity. This is communicated through a Power Content Label (PCL), a standardized format developed by the California Energy Commission (CEC).[73] The PCL does not determine compliance with the Renewable Portfolio Standard, but rather is designed to be a simple description of an electric retail supplier's power sources and renewable energy profile.

Data

To assess renewable energy progress, we looked at the PCL for each electric utility within LA County over the past six years. The 2010-2014 data were obtained from CEC's website, while the 2015 data were provided by the CEC upon request. We compiled data on the percent and kilowatt-hours of renewable energy achieved by each local utility, compared these to state targets, analyzed trends, and assessed the mix of renewable energy types. We also looked at the complete portfolio of each company to understand the predominant sources of non-renewable energy. Finally, we did a deeper examination of LADWP's renewable energy portfolio.

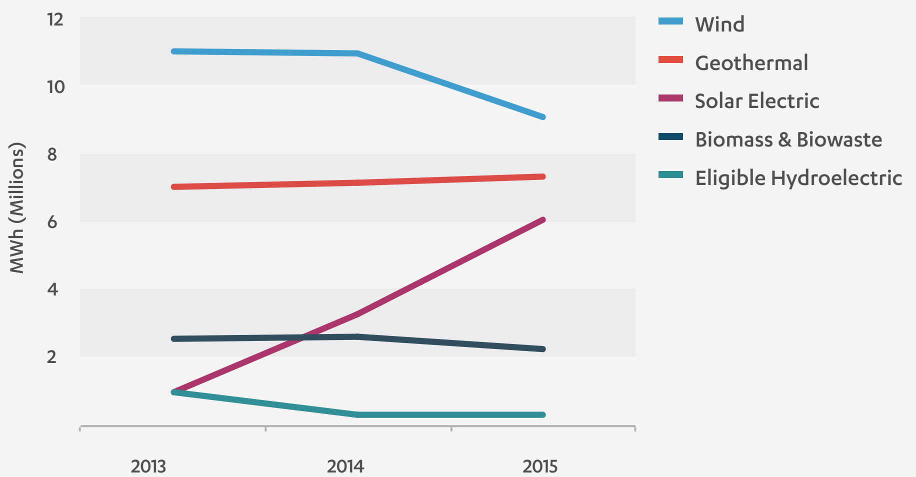
Summary of Utility Renewables Portfolio (2015)

Utility Name	Total Retail Sales (MWh)	Total Renewable Purchases (MWh)		Renewable Breakdown					Non-renewable Breakdown				
				Bio-mass & Bio-waste	Geo-thermal	Eligible Hydro-electric	Solar Elec-tric	Wind	Coal	Large Hydro-electric	Nat-ural Gas	Nuc-lear	Unspec-ified Power
Southern California Edison (SCE)*	75,322,195	18,586,394	25%	1%	9%	0%	7%	8%	0%	2%	26%	6%	41%
LA Dept of Water & Power (LADWP)	23,425,969	4,955,141	21%	4%	2%	1%	3%	11%	37%	3%	25%	10%	4%
Vernon Light & Power	1,128,350	197,370	17%	14%	0%	0%	0%	3%	0%	2%	50%	7%	23%
Burbank Water & Power (BWP)	1,106,933	361,052	33%	12%	3%	2%	9%	7%	36%	2%	24%	5%	0%
Pasadena Water & Power (PWP)	1,086,739	314,630	29%	15%	4%	3%	0%	7%	34%	4%	6%	7%	21%
Glendale Water & Power (GWP)	1,060,141	356,841	34%	10%	1%	3%	0%	20%	4%	5%	37%	7%	13%
Azusa Light & Water	256,626	49,293	19%	0%	4%	2%	1%	12%	58%	1%	15%	6%	0%
City of Cerritos	80,466	0	0%	0%	0%	0%	0%	0%	0%	0%	88%	0%	12%

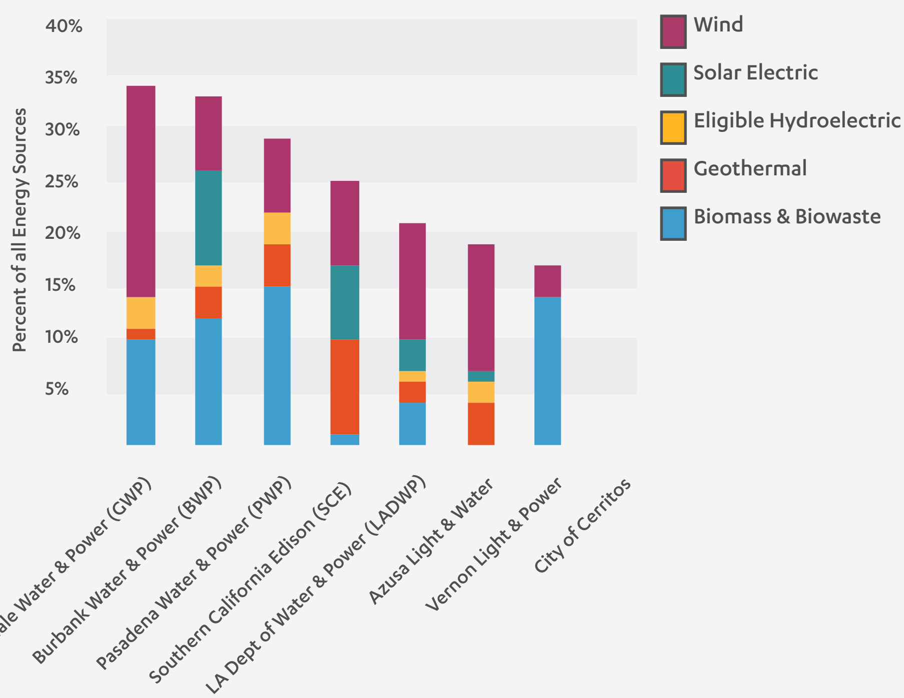
* The power content label for Southern California Edison (SCE) applies to their entire service area, not just LA County, so we were unable to provide totals for the County alone.

UTILITY RENEWABLES PORTFOLIO

Total MWh of Renewable Energy Purchased by Utilities Serving LA County by Type (2013 - 2015)



Breakdown of Renewables for Utilities Serving LA County (2015)

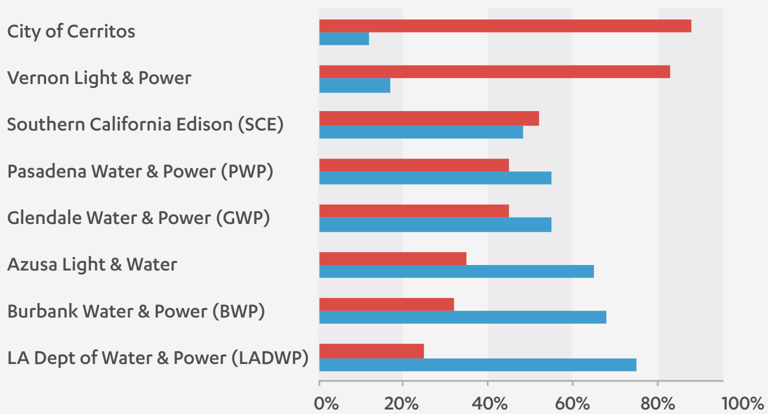


Findings

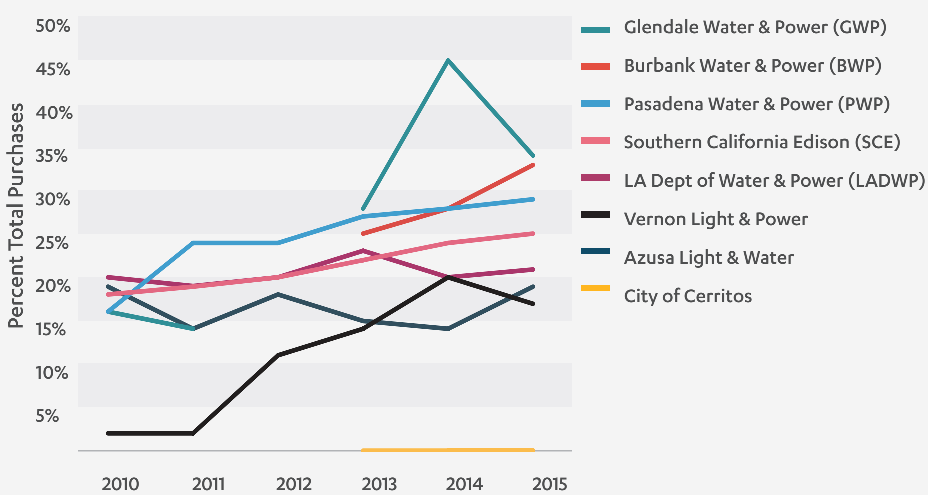
- The City of Cerritos, Vernon Light & Power, and Azusa Light & Water were the only utilities reporting renewable purchases of less than 20% in 2015. Although the PCL data used for this assessment cannot be used for compliance purposes, the PCLs for these three utilities are below the 2013 20% RPS requirement, especially Cerritos, which reported 0% renewables and 88% of energy from natural gas.
- Glendale, Burbank, Pasadena, and Southern California Edison reported at least 25% renewable purchases, and Glendale and Burbank already achieved 33% renewables, the State's 2020 goal (although see data limitations below).
- Since 2010, Burbank, Glendale, Pasadena and Vernon had the greatest increases (13% or more) in renewable energy purchases. Use of renewables by Azusa, Cerritos and LADWP did not change appreciably from 2010 to 2015.
- Solar electric purchases had the largest growth over the past two years, from 980,000 MWh over all eight utilities in 2013 to 6 million MWh in 2015. Meanwhile, wind energy purchases decreased by nearly 2 million MWh in the same time period.
- Coal energy was still prevalent in the region in 2015, with Azusa receiving more than half of their energy from coal sources. Pasadena, Burbank, and LADWP received about a third of their energy from coal sources.
- The category of "unspecified power" constituted a significant percentage of some utility's portfolios, as much as 41% for Southern California Edison (up from 35% in 2013). According to the CEC, "unspecified power" refers to electricity that is not traceable to a specific generating facility, such as electricity traded through open market transactions. Unspecified sources of power are typically a mix of resource types, and may include renewables.[74]
- All utilities sourced at least 25% of their energy from within CA. In-state generation was highest for Cerritos and Vernon, although these were also the two utilities with the smallest renewable portfolios.

UTILITY RENEWABLES PORTFOLIO

Total Energy Sourcing Within and Outside California for Utilities Serving LA County (2015)



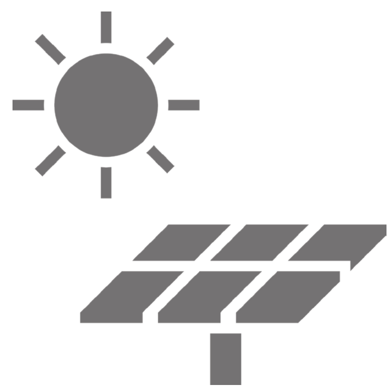
Renewables as a Percent of Total Energy Purchases for Utilities Serving LA County (2010-2015)



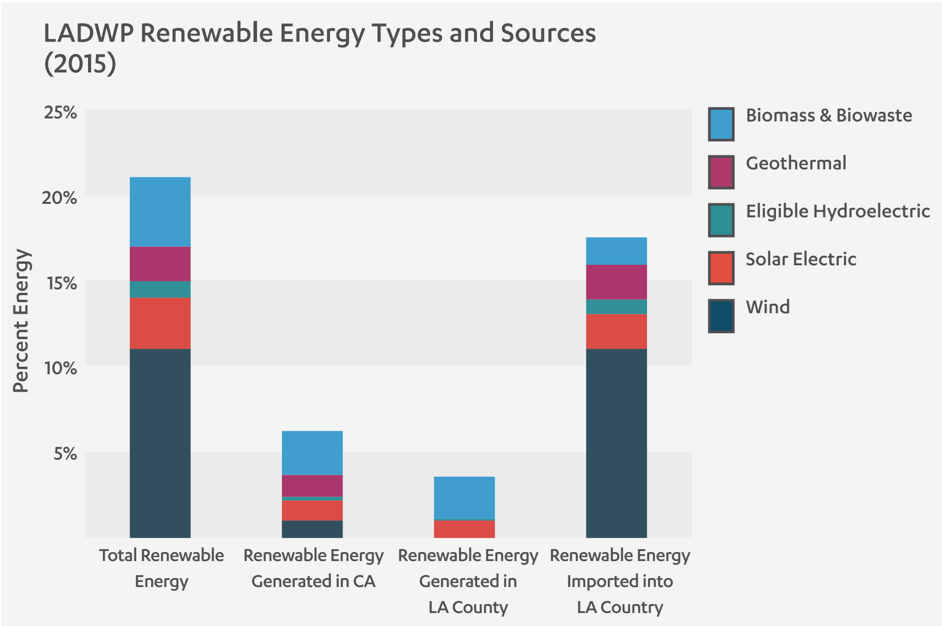
- LADWP purchased about one-third of its renewable energy from within California in 2015, including energy from all categories of renewables.
- LADWP purchased roughly one-fifth of its renewables from generators in LA County in 2015, predominantly from biomass plants and solar electric generation; LADWP did not source any wind or geothermal energy from within the county.

Data Limitations

- The PCL cannot be used to determine compliance with the RPS. Compliance with the RPS uses a different methodology and is calculated over three year periods by tracking the retirement of renewable energy credits, whereas the PCL is based on annual electricity procurements.
- The PCL does not provide information about the origin of electricity used by any particular household or business. Rather, it reflects the overall resource mix that is purchased through that specific utility.
- Data were missing for several years for Cerritos (2010-2012) and Burbank Water & Power (2011-2012). The City of Industry is listed by the CEC as having its own power utility, but the City website indicated that its power comes from SCE, so we did not show it separately here.



UTILITY RENEWABLES PORTFOLIO



HIGHLIGHT

Renewable Portfolio Standard Verification

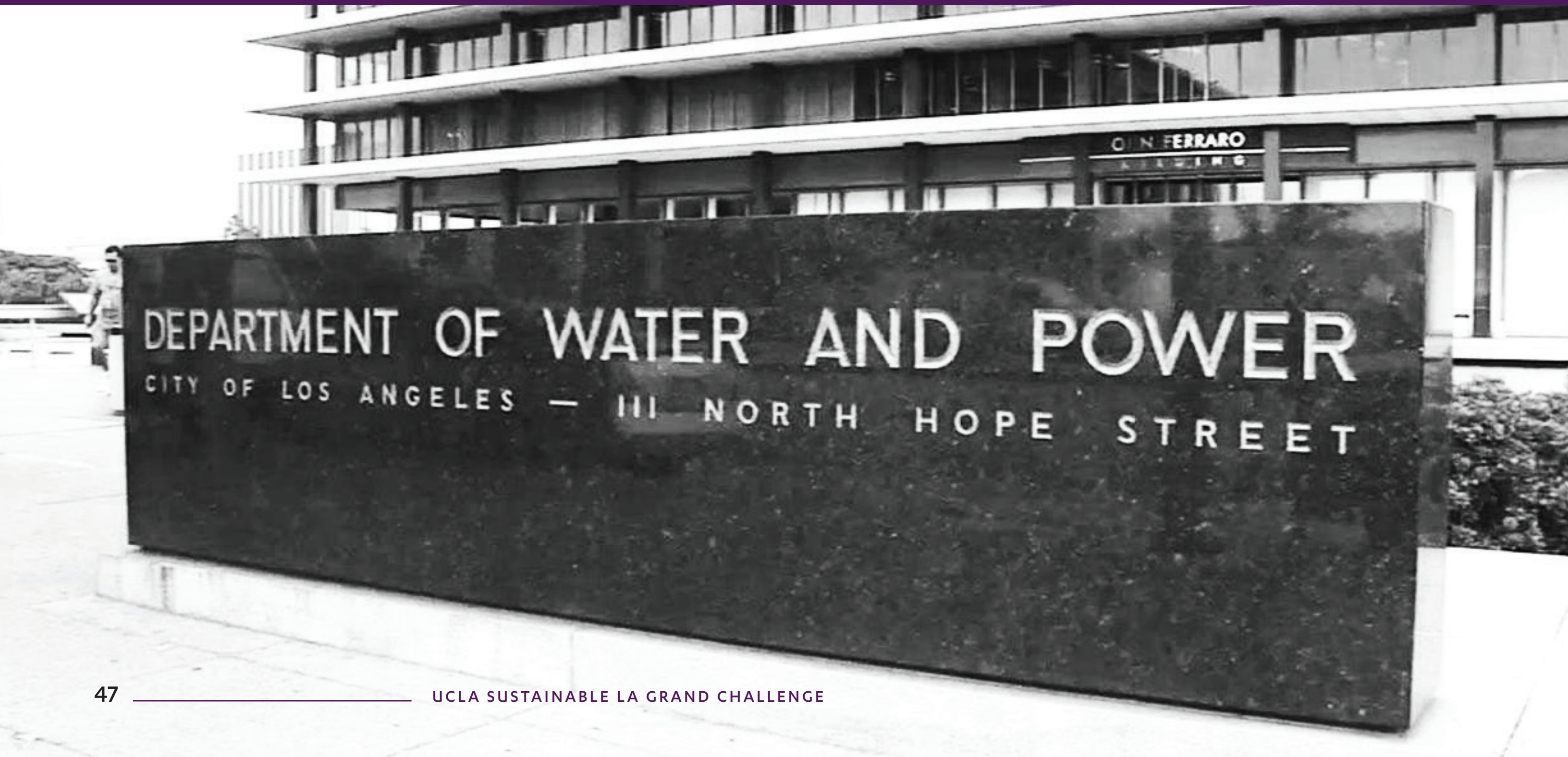
The Renewable Portfolio Standard (RPS) program is managed jointly by the California Public Utilities Commission (CPUC) and the California Energy Commission (CEC) – each with distinct responsibilities. The CEC certifies RPS-eligible renewable energy resources for POUs and also does a basic eligibility check for renewable energy resources for retail sellers; this information is compiled to produce RPS Verification Results reports. Verification results are then reviewed by either the CEC (for POUs) or CPUC (for retail sellers), in order to make a compliance determination.

The data below include RPS Verification Results for Compliance Period 1 (which spans 2011-2013) for POUs[75] and IOUs[76]. The RPS targets for POUs and IOUs during this period were 20% each year.

Since compliance was required starting in 2011, this is the first publication of verification results. Compliance determinations have not yet been made. Also, no information is available for LADWP, as their results have yet to be finalized by the CEC.

Renewable Portfolio Standard Verification Results for Compliance Period 1 (2011-2013)

Utility Name	Met Procurement Target?	% Renewable Energy	Procurement Target (MWh)
Investor-Owned Utilities			
Southern California Edison (SCE)	Yes	20.6%	44,770,849
Publicly-Owned Utilities			
LA Dept. of Water & Power (LADWP)	CEC results not yet finalized		
Vernon Light & Power	No	6%	678,612
Burbank Water & Power	Yes	20%	678,230
Pasadena Water & Power	Yes	23%	668,319
Glendale Water & Power	Yes	20%	634,760
Azusa Light & Water	Yes	20%	141,275
City of Cerritos	No	0%	26,459



INDICATOR • UTILITY-SCALE RENEWABLE ENERGY GENERATION (IN COUNTY)

Introduction

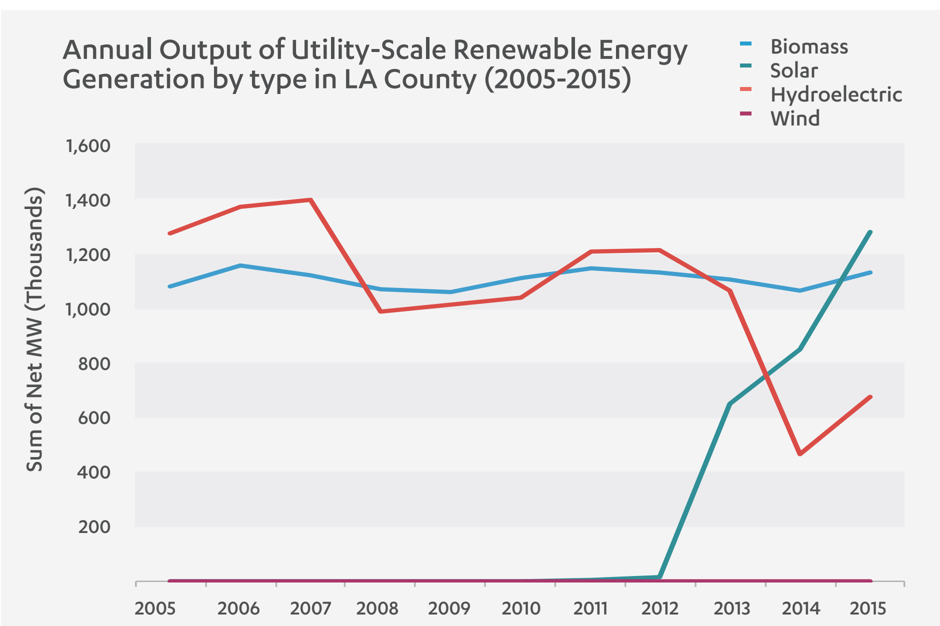
Utility-scale renewable energy generation in LA County includes power plants using biomass, hydroelectric, wind, and solar. The Sustainable LA Grand Challenge aims to produce as much renewable energy for LA County within the region as possible. Benefits of producing energy locally include job creation, a decrease in energy loss during transmission, and greater reliability. It also makes sense to use the abundant natural resources we have in the County, with sun being the most obvious. A preliminary technological assessment by Wirz et al. at UCLA suggests that LA County can meet its 2050 energy needs through local renewables while only using a small fraction of the total compatible land in the region.[77]

Data

Power plants with a nameplate capacity of 1 MW or more provide generation data to the California Energy Commission, which publishes this information in their Quarterly Fuel and Energy Report (QFER).[78] The report lists power plants sorted by fuel type category and gives the sum of net MWh produced. We looked at all the power plants in the QFER located in LA County from 2005-2015 and calculated the MWh produced by each renewable category group. We also made a direct data request to the CEC's Energy Assessments Division,[79] for 2015 data on the number of renewable energy plants, MW capacity, and MWh generation. Because of differences in these datasets (see further discussion in Limitations, below), the Annual Output graph uses QFER values for 2005-2014 generation, and the CEC data request values for 2015 generation. Note that generation of renewable energy within the County does not necessarily mean that the energy was consumed in the County.

Findings

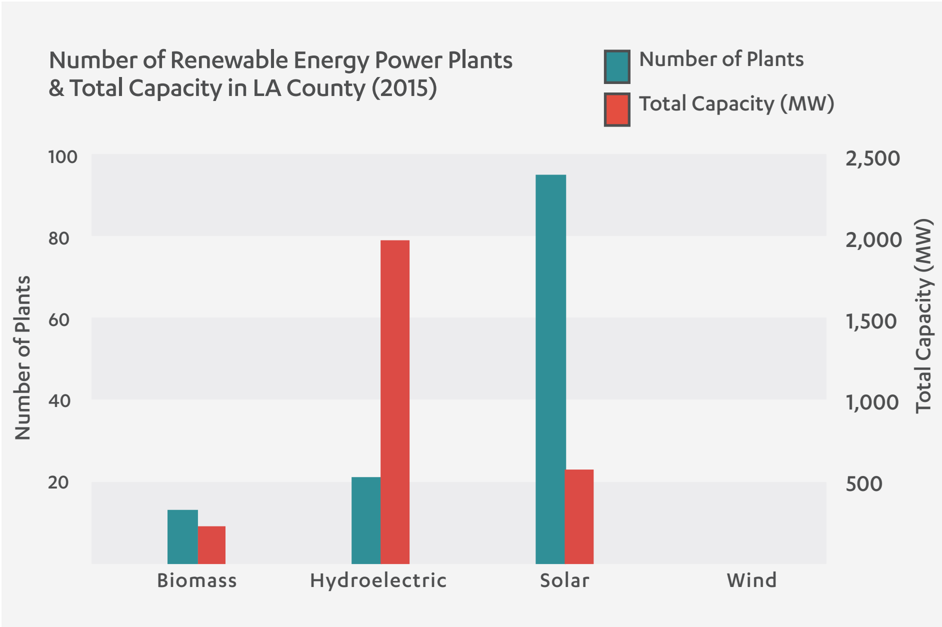
- Out of 173 power plants within the County in 2015, 129 (75%) reported using renewable energy sources. These renewable plants produced 3.09 million MWh in 2015, which is nearly 14% of total energy production in LA County, and represents approximately 4.4% of the County's 70,000 GWh of electricity consumption in 2015.
- The 95 solar plants produced the most energy in 2015 as a group among the renewable plants (1.28 million MWh); this was the first year that solar exceeded the output of biomass (however, data limitations may have contributed to these results – see limitations section below).
- The 13 biomass plants generated 1.13 million MWh, and the 21 hydroelectric plants produced 677 thousand MWh in 2015. There were no wind power plants in LA County.
- Solar grew the most in recent years, increasing production by over one million MWh since 2012. In contrast, hydroelectric as an energy source declined the most, from a high of 1.4 million MWh in 2007 to half that amount in 2015 due to the drought (although 2015 generation was up from 2014).
- The total capacity across all 129 plants was 2,774 MW. Hydroelectric had the largest capacity, at close to 2,000 MW or over 70% of the total, but generation was far less than for solar and biomass in 2014 and 2015, due to the drought.
- A single solar plant (Antelope Valley Solar Ranch 1 in Lancaster) had a capacity of 250 MW and produced 621,330 MWh in 2015, which accounted for over 40% of the total solar capacity (577 MW) and about 49% of the MWh generated that year.



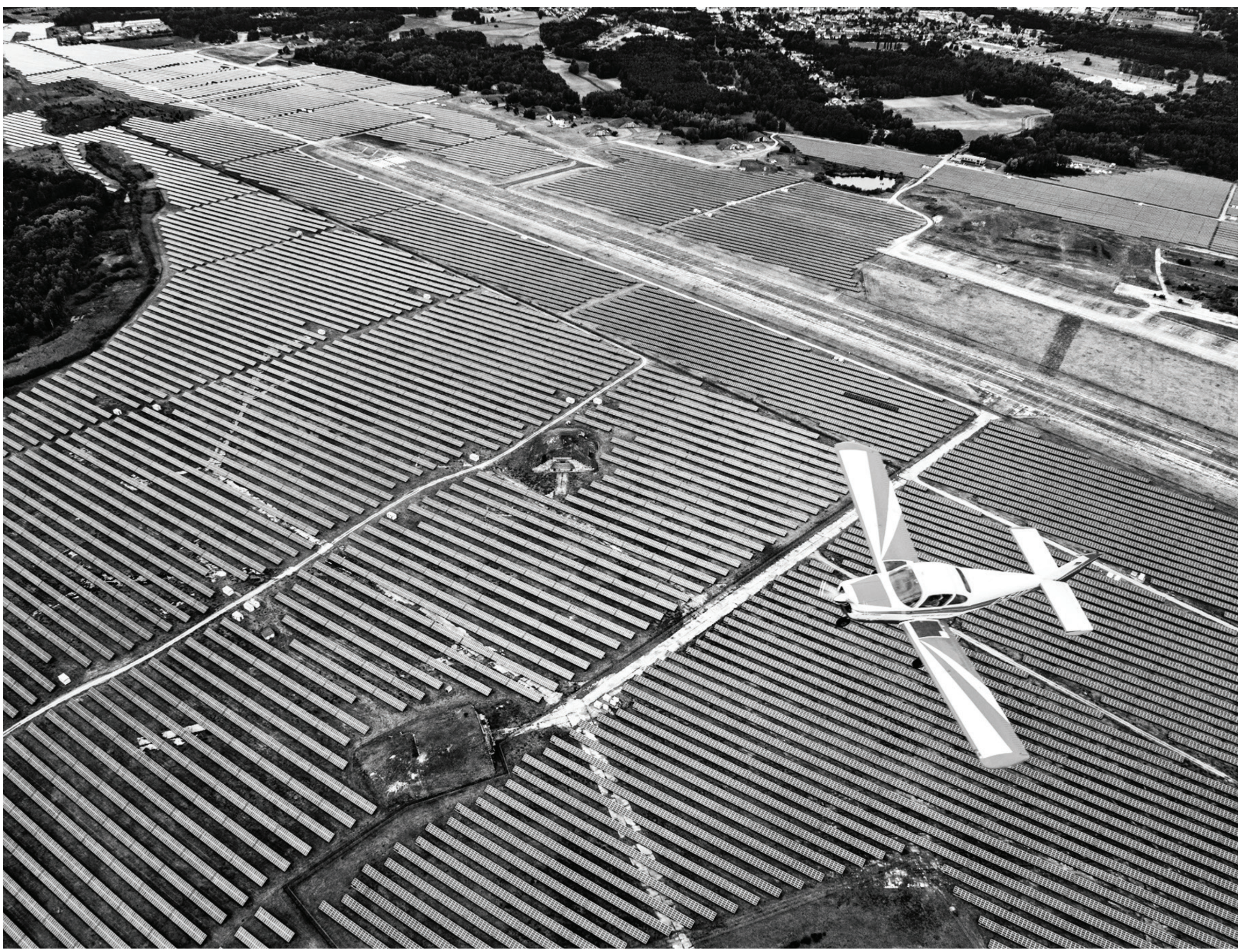
Data Limitations

- The 2015 data on number of plants and total capacity was obtained by a direct request to the CEC, and includes 63 more solar plants and roughly 200,000 more MWh produced by those solar plants than was shown in the 2015 QFER website. Thus, the 2005-2014 data for solar may also be missing a number of solar plants and MWh generated.
- Note that the CEC's Quarterly Fuel and Energy Report (QFER) provides the total electric generation by each facility and cannot be exactly compared to the utilities' Power Content Labels (PCLs) discussed in the Utilities Renewables Portfolio indicator, above, which cover only retail sales.

UTILITY-SCALE RENEWABLE ENERGY GENERATION (IN COUNTY)



- Portions of the electricity generated by renewable facilities in LA County may be used outside of the County or even outside of the state.
- There is some possibility for overlap between projects reported under “utility scale renewables” and “distributed energy resources,” due to limitations on the extent of data available for these projects; however, our best level of review found no specific examples of “double counting” and we believe any such overlap would not have a significant impact on overall findings and conclusions.



INDICATOR • DISTRIBUTED RENEWABLE ENERGY GENERATION

Introduction

Distributed generation is defined as projects that are 20 MW or smaller – including both self-generation and projects that generate energy for the market.[80] For both LA County and the state as a whole, solar comprises the vast majority of distributed generation. The California Solar Initiative is the solar rebate program for California consumers that are customers of the investor-owned electrical utilities,[81] which in LA County includes only Southern California Edison (SCE). This program offers energy rebates for installations of distributed-generation photovoltaic solar power, including residential rooftop solar. Net Energy Metering (NEM) allows customers of Investor-Owned Utilities to receive billing credit for self-generation from their interconnected solar energy system.[82] The California Energy Commission oversees reporting for similar incentive programs for the smaller Publicly-Owned Utilities under SB 1 (Murray, 2006).[83]

Data

We obtained SCE data from the California Distributed Generation Statistics website (for LA County only),[84] and data for the eight publicly-owned utilities in LA County from the California Energy Commission's Publicly Owned Utilities' SB 1 Solar Program Status Reports.[85] We compiled data on the number of megawatts (MW) of energy generated based on installations by each of these nine utility companies.

Findings

- A cumulative total of 475 MW of solar photovoltaic distributed generation was installed in LA County as of 2015 by the eight listed utility companies.
- Most utilities consistently increased the amount of distributed renewable energy generation in their service areas over the period reviewed.
- As expected, SCE and the Los Angeles Department of Water and Power (LADWP) have several orders of magnitude more MW installed than the smaller utilities, consistent with their larger service territories. The rate of growth of distributed PV capacity is higher in the SCE service area than the LADWP service area.
- The City of Cerritos and the City of Vernon did not begin distributed energy installations until 2013.
- As of 2016, LA County was one of the top three counties in California for the number of MW of online and pending distributed generation systems.[86]
- The median installed price of both residential and nonresidential solar photovoltaic systems in California is declining. For residential systems, it dropped from over $8 per watt in 2009 to less than $5 per watt in 2014.[87]

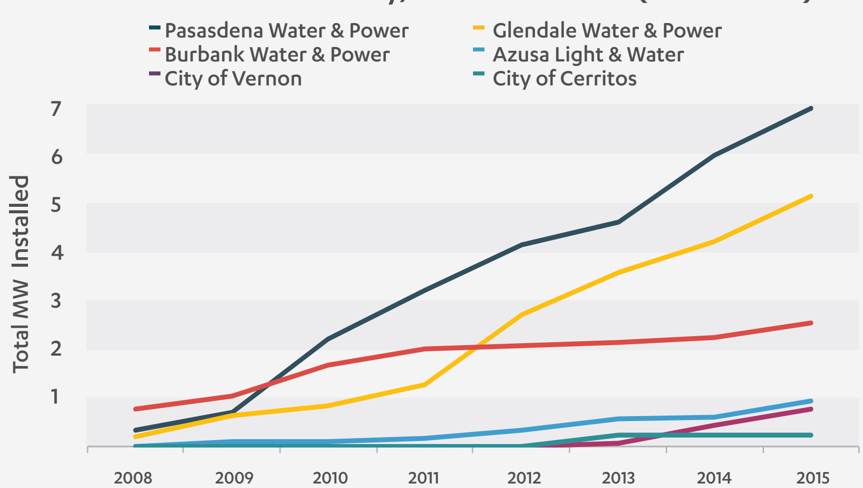
Data Limitations

- There is some possibility for overlap between projects reported under "utility scale renewables" and "distributed energy resources," due to limitations on the extent of data available for these projects; however, our best level of review found no specific examples of "double counting" and we believe any such overlap would not have a significant impact on overall findings and conclusions.

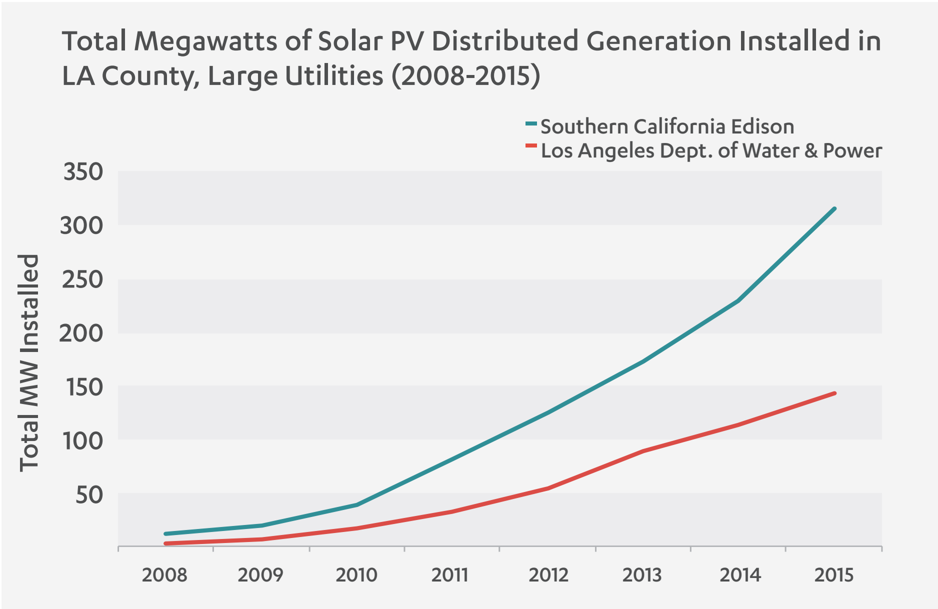
Distributed Energy Generation for each Utility in LA County (2015)

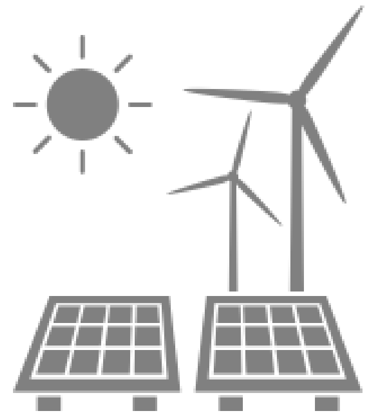
Utility	Total MW of Distributed Energy Generation
Southern California Edison	315
Los Angeles Dept. of Water & Power	143
Pasadena Water & Power Department	6.9
Glendale Water & Power	5.1
Burbank Water & Power	2.5
Azusa Light & Water	0.93
City of Vernon	0.77
City of Cerritos	0.22
TOTAL	475

Total Megawatts of Solar PV Distributed Generation Installed in LA County, Small Utilities (2008-2015)



DISTRIBUTED RENEWABLE ENERGY GENERATION





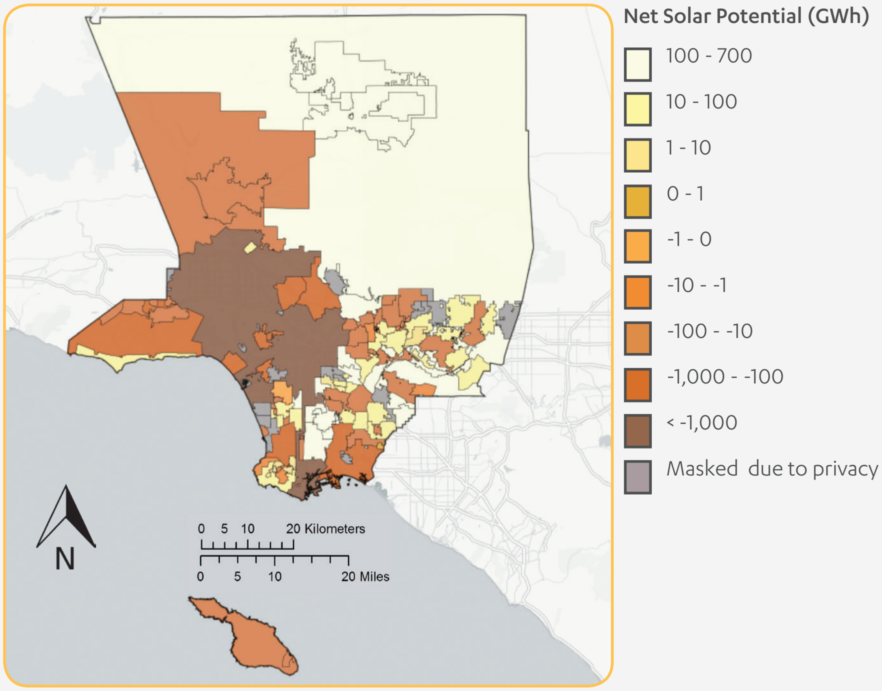
HIGHLIGHT

Net Solar Potential

An analysis of net solar potential by city was conducted as part of the UCLA Energy Atlas, based on 2010 data.[88] Net solar potential is defined as the difference between rooftop solar potential and annual electricity consumption. Net positive solar potential signifies cities that could generate more energy than they consume using available rooftop area.

Cities vary widely in terms of their net solar potential; the City of Los Angeles had the largest negative net solar potential in 2010, meaning that available rooftop solar area is far less than what would be needed to supply the city's building energy consumption. Cities with the highest net positive solar potential include Lancaster, Pasadena, Palmdale, City of Industry, and Compton. The implementation of energy efficiency and conservation measures can serve to reduce consumption, and spaces other than rooftops (such as parking lots) may offer additional opportunities for solar that aren't accounted for in this analysis. Also note that not all rooftop areas included in this analysis may be structurally suitable for the installation of solar photovoltaic systems.

Net Solar Potential (GWh) by City in LA County (2010)



INDICATOR • ENERGY STORAGE (IN-COUNTY)

Introduction

Energy storage systems increase the electricity system's reliability, and are critical to successful incorporation of renewables into the energy grid as the state moves toward meeting the Renewable Portfolio Standard goals. Energy storage can help flatten load curves by providing additional power during peak hours, thereby reducing dependence on fossil fuel "peaker" plants. Other benefits to the grid include reducing transmission congestion and aiding with assimilation of intermittent renewables. Benefits to owners include management of time-of-use electricity rates, and backup supply during power outages.

AB 2514 (Skinner, 2010), amended by AB 2227 (Bradford, 2012) required the California Public Utilities Commission to adopt and achieve energy storage procurement targets for both investor owned and publicly owned utilities.[89] An upcoming statewide procurement goal of 1,325 MW cumulative total energy storage (either electrical or thermal) across the three investor-owned utilities was set for December 31, 2020.[90]

Data

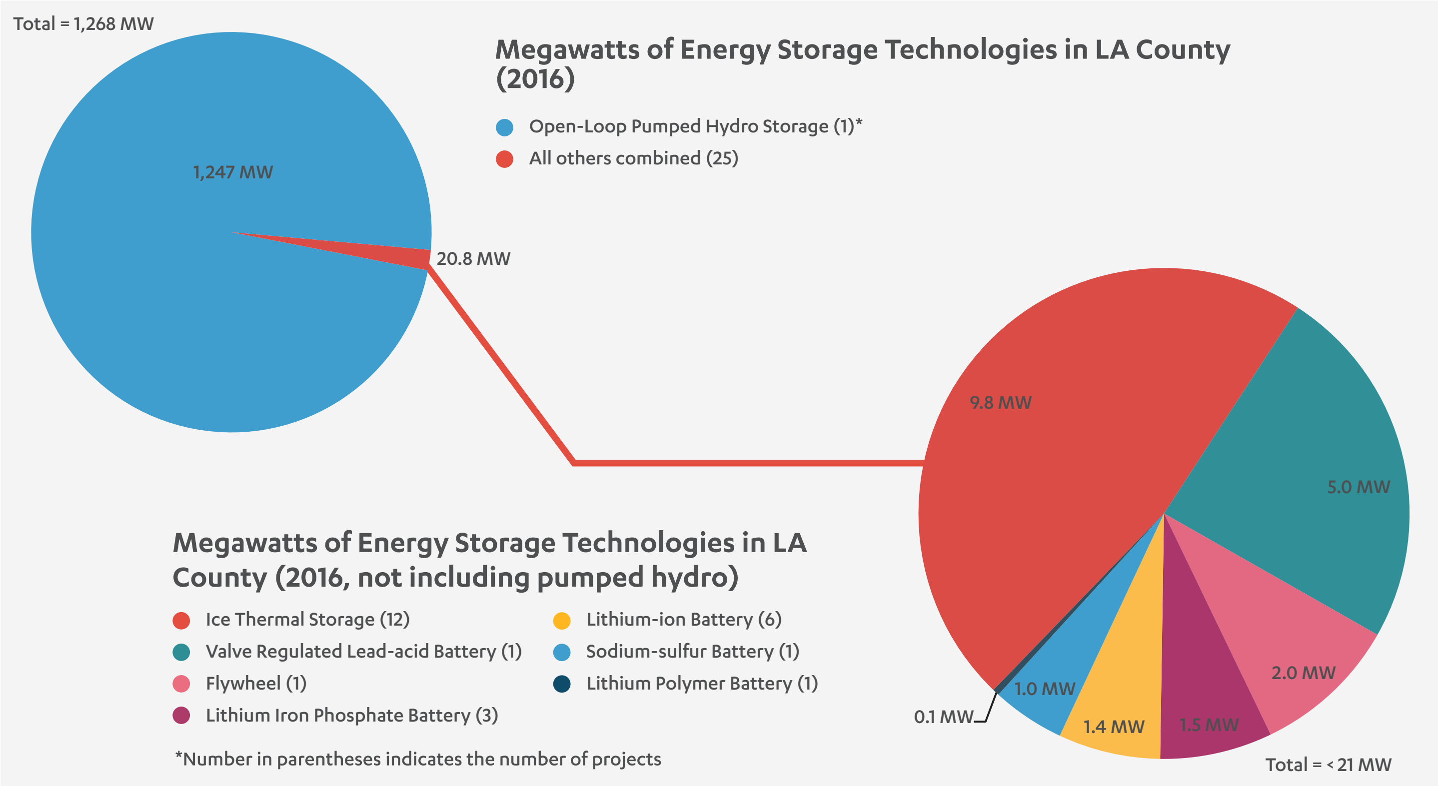
We used the Department of Energy's Global Energy Storage Database to find energy storage projects in California,[91] and filtered for cities in LA County. We selected only facilities that were currently operational, and not those that were contracted, announced, or under construction or repair.

Findings

- A total of 26 storage projects were reported as operational within LA County in 2016, with a combined total capacity of approximately 1,268 MW.
- The vast majority of this capacity (1,247 MW) comes from the single open-loop pumped hydro facility at Castaic Lake. The remaining amount (just under 21 MW) comes from a variety of smaller projects including batteries, flywheel and ice thermal storage, which range from 0.1 MW to 5 MW, with durations from 0.5 to 6 hours, and lifespans from 10-25 years. However, as mitigation for the Aliso Canyon natural gas leak, a Tesla-SCE 20 MW storage facility opened January 2017 in Ontario, just east of LA County.

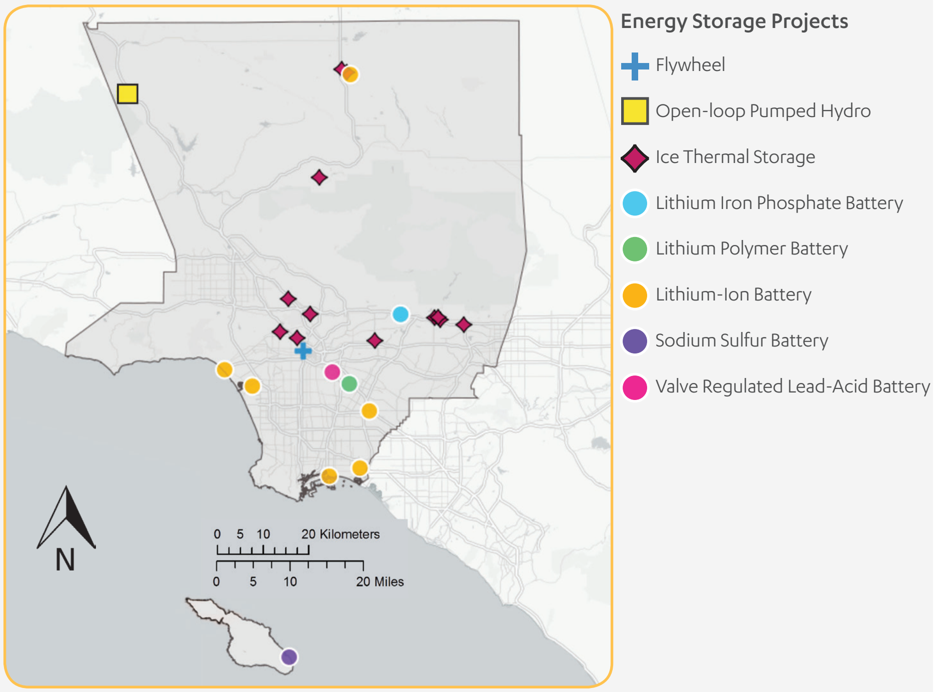
Data Limitations

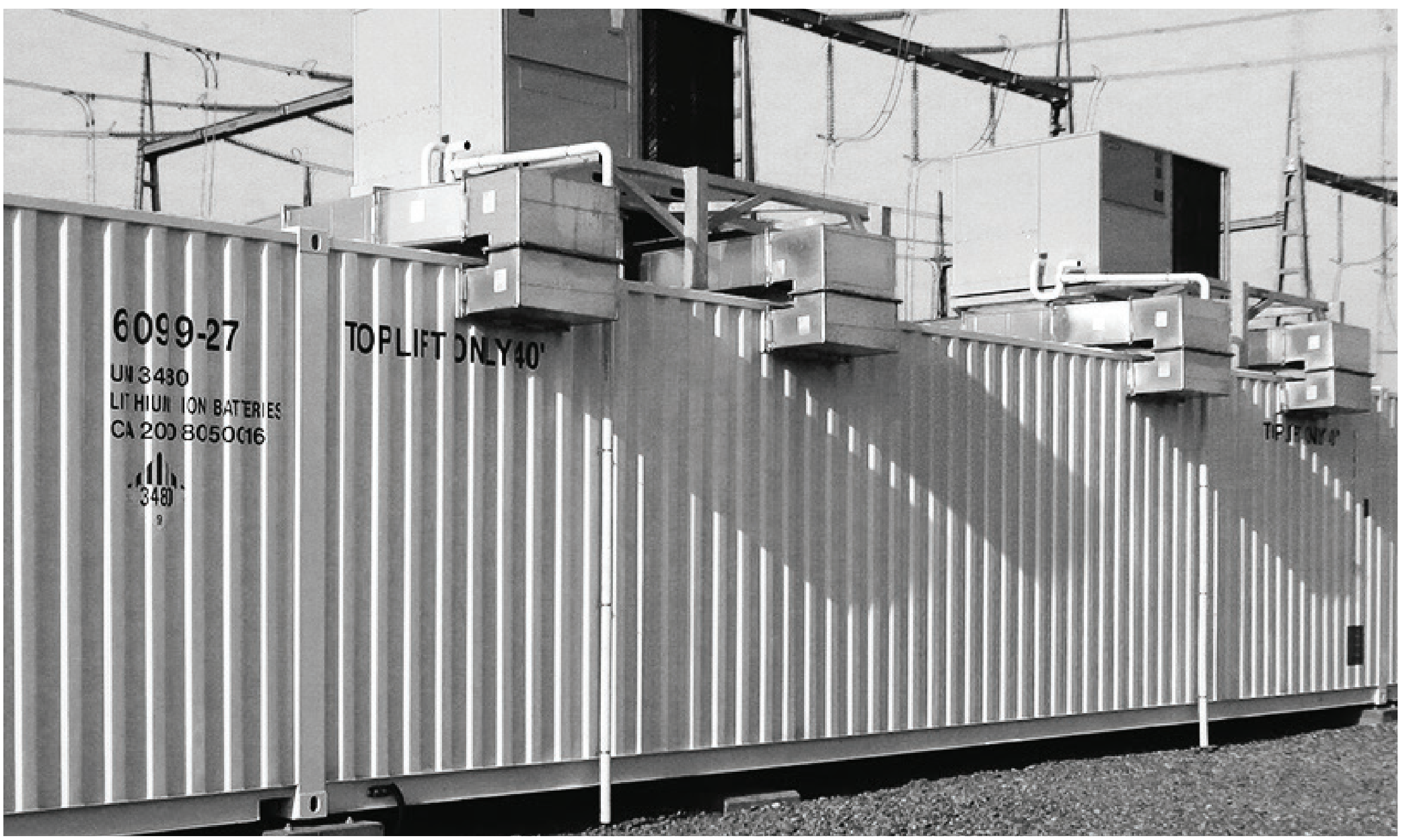
Additional storage projects may be operational, but have not yet been verified by Strategen Consulting, who reviews the database information. These data do not capture residential and building-scale distributed energy storage.



ENERGY STORAGE (IN-COUNTY)

Energy Storage Projects in LA County as of January 2017





grade B

for renewable energy resources

The 2015 Environmental Report Card (ERC) assessed Energy & Greenhouse Gases together and assigned a grade of B-. In 2015, we only evaluated the utility renewables portfolio and utility-scale renewable energy generation. This ERC also looks at distributed renewable energy generation and energy storage, which are imperative to reaching the Sustainable LA goal of 100% renewables by 2050.

The County is still on track to meet the State's renewable portfolio standards (RPS). Only two small utilities in the County failed to meet the RPS of 20% renewable by 2013. Cerritos, in particular is not increasing their use of renewables. But, perhaps that will change if RPS noncompliance penalties are more clearly quantified and enforced as required in SB 350 (de León, 2015). Four utilities, including SCE were already using at least 25% renewables in 2015, and Glendale and Burbank were already using 33% renewables – the state's 2020 goal. Renewables are increasing throughout the County, with solar growing the most both at the utility and distributed scales. The rate of increase for distributed solar PV in the SCE service area is substantially higher than in the LADWP service area, but the City of LA has specific local solar goals that will hopefully contribute to growth in that area – that combined with the drop-in price per watt for distributed solar installations. However, it is important to remember that distributed rooftop solar does not count in the RPS compliance determination. Wind energy is actually decreasing – perhaps because utilities are able to replace it with local solar generation. Hydroelectric also decreased, which is due to the recent drought, but we expect it to increase with this current record wet year.

Although three utilities in the County have eliminated coal, including SCE, and all but one reduced reliance on coal between 2013 and 2015, the reliance on coal is still far too great. LADWP and three small utilities get over 1/3 of their energy from coal, although LADWP is committed to divesting in coal by 2025. Energy generation is largely imported from outside of the County, and a large proportion of the energy comes from outside of California. There isn't any wind energy generated in the County, but we are taking advantage of our most abundant resource and increasing local solar production. There is room for improvement, however, as LADWP imports most of their renewable energy from outside of the state. The addition of storage facilities hasn't ramped up quickly, and without them it will be difficult to integrate the growing solar PV installations and reach the higher RPS goals.

Overall, thanks to state regulatory requirements, renewable energy resources continue to steadily increase within LA County. The County is one of the top three producers of distributed solar, and the state leads the nation. Furthermore, Community Choice Aggregation isn't just an idea anymore. With growing support from the County, CCAs are a promising option for increasing levels of clean energy sources locally. In February 2017, the South Bay Clean Power CCA released their first business plan.[92] In March 2017, the County released draft joint powers agreement (JPA) language for a Los Angeles Community Choice Energy program,[93] and unanimously adopted the JPA and enabling ordinance in April 2017 with the goal of launching the program in January 2018. It is important to note, however that distributed rooftop solar alone cannot meet our energy needs in these densely-populated areas. A State standard for renewable biogas would provide additional benefits for methane producing industries such as landfills and dairies, which have their own emission reduction mandates. With national regulations and energy standards on the chopping block, it is more important now than ever for California to continue to lead in this area.

4

GREENHOUSE GAS EMISSIONS

Overview

Global climate change and its associated increases in temperature and sea level pose a real threat to sustainability worldwide. The cause of these changes is man-made greenhouse gas (GHG) emissions that have been on the rise since the advent of the industrial revolution.[94] World leaders came together in 2015 for the United Nations Climate Change Conference (COP 21) in Paris, France to negotiate the Paris Agreement to reduce the effects of climate change with a goal of limiting temperature increases to less than 2°C compared to pre-industrial levels. The agreement went into effect in November 2016 when 55 countries, accounting for at least 55% of the global GHG emissions, ratified the agreement. Unfortunately, the level of participation from the U.S. is in question with the new federal administration, which has vowed to repeal the Clean Power Plan and has threatened to roll back automobile Corporate Average Fuel Economy (CAFE) standards. These were two of the U.S.'s principle methods of complying with the Paris Agreement.

California, on the other hand, declared it would continue to lead in the face of federal challenges to climate change and clean energy.[95] California is a global leader in GHG reduction, while its GDP continues to rise.[96] It has committed to continue these reductions, with legislation requiring the state to reduce its greenhouse gas emissions back to 1990 levels by 2020 (through legislation known as AB 32, Nuñez, 2006), and then further to 40% below 1990 levels by 2030 (via SB 32, Pavley, 2016). The California Air Resources Board (CARB) developed and is implementing a comprehensive suite of GHG reduction programs that affects sectors across the state's economy and that relies on both direct emission reductions and market-based mechanisms. One such market mechanism is California's Cap-and-Trade program, which went into effect in 2013 and aims to drive a small but important segment of emission reductions in California. The cap-and-trade program was designed by the California Air Resources Board (CARB) to reduce GHG emissions from certain stationary sources. The program has been under attack by industry, but in April 2017 the California court of appeal rejected the challenge that the program is unlawful. One of Governor Brown's and the state legislature's top priorities is to improve and provide a more sustainable cap and trade program in 2017. Since the release of the 2015 ERC, California extended and expanded AB 32 to reduce GHG emission levels to 40% below 1990 levels by 2030 with SB 32 (Pavley, 2016). And locally, the City of Los Angeles Sustainable City pLAn aims to cut GHG emissions by 45% by 2025, 60% by 2035, and 80% by 2050, compared to 1990 levels.[97]

With regard to transportation, SB 375 (Steinberg, 2008) requires regions within California, such as Southern California, to plan to reduce passenger vehicle and light duty truck emissions, with 2020 and 2035 targets.[98] The Southern California Association of Governments' (SCAG) Regional Transportation Plan/Sustainable Communities Strategy (RTP/SCS) aims to decrease GHG emissions from transportation by 8% by 2020, 18% by 2035 and 22% by 2040, compared to 2005 levels.[99]

We chose to create a separate category for GHG emissions in this Report Card because they result from the complex interplay and combined effect of stationary energy use, transportation energy, and the energy resource portfolio (e.g. coal, solar, gasoline). The 2015 ERC used data from the Los Angeles County Regional 2010 Greenhouse Gas Emissions Inventory, developed by the Los Angeles Regional Collaborative for Climate Action and Sustainability (LARC).[100] This Inventory provided the first comprehensive picture of emissions sources and trends for all of LA County. It included emissions generated within the jurisdictional boundaries of the 88 cities and the unincorporated County, as well as emissions that occurred outside those boundaries, but were related to activities inside the County (for example, local building electricity use from power plants outside the County). GHG emissions are expressed in terms of carbon dioxide equivalent (CO2e), a standardized value that accounts for the variation in global warming potential of different greenhouse gases.

Because the County GHG inventory has not been updated since 2010, we chose to look at the three largest GHG source categories in greater detail in this Report Card: building energy (39.2%), on-road transportation (33.5%), and stationary sources (19.7%). Unfortunately, the latest year of data available differs among source categories. Although these sources do not provide as current a characterization as we would have liked, each will be periodically updated to reflect future conditions and we believe they represent the best level of detail and data accuracy currently available.

INDICATOR • BUILDINGS GHG EMISSIONS

Introduction

California's building energy efficiency standards (Title 24) are the most stringent in the U.S. However, as discussed earlier, efficiency of buildings and the appliances and equipment within them is only part of the equation – the size of buildings and the number of appliances or light fixtures per capita, as well as individual behavior, also drive total building energy use. GHG emissions reflect a combination of energy use and the carbon intensity of the energy source, which differs among the municipal-owned utilities (MOUs) and the investor-owned utility (IOU) operating in LA County. GHG emissions will drop as total energy use decreases due to the implementation of energy conservation and efficiency measures, and as utilities transition to more renewable sources in their energy portfolios.

Data

We used GHG emissions data from the UCLA Energy Atlas for the years 2006-2010.[101] More current data was not available for analysis at this time. These emissions data correspond directly to the data shown in the Building Energy Use Indicator (Section 1 of this report), also from the Energy Atlas.

The LA Energy Atlas calculates GHG emissions by year at the customer account level, based on the carbon emissions intensity factor of the utility serving that account (both electricity and natural gas). This may result in geographical differences when comparing building GHG emissions presented in this indicator to building energy use presented earlier. For example, census tracts in different utility territories may have the same total energy use but different GHG emissions due to differences in the utility's energy portfolio (e.g. more or fewer renewables).

We looked at total and residential GHG emissions for the most recent year of data, as well as changes over the period of record. We also looked at the spatial distribution of total GHG emissions from residential buildings across the County.

Findings

- Total building GHG emissions in 2010 were 34.3 million metric tons (MT) of CO_2 equivalent (CO_2e). Residential buildings accounted for about 43% of the total, at 14.6 million MT CO_2e.
- GHG emissions from all building types decreased by 2.5% from 2006-2010, despite the fact that there was only a 0.1% reduction in energy use during that period.
- Residential GHG emissions decreased by 4% from 2006-2010, which corresponds closely to the 4.3% reduction in overall energy use in that sector.
- Commercial GHG emissions decreased by 3.5% from 2006-2010, although overall energy use increased by 2.2%.
- It can be inferred that the combined reduction in GHG emissions from industrial, institutional and other / uncategorized / mixed-use buildings is lower than 2.5%. Individual sectors may have even increased between 2006-2010. However, due to the confidentiality requirements to aggregate data to conform to the disclosure limits imposed by state agencies, we are unable to make any further determinations.
- There was an order of magnitude difference in residential GHG emissions per capita across LA County in 2010. Neighborhoods with high GHG emissions (e.g., Bel-Air, Beverly Crest, Pacific Palisades, Brentwood) emitted 7 to 10 times

Combined GHG Emissions from all Building Types in LA County (2006, 2010)

	Combined Emissions (million MT CO_2e) 2006	Combined Emissions (million MT CO_2e) 2010	Change from 2006-2010
All Building Types	**35.2**	**34.3**	**-2.5%**
Residential	15.2	14.6	-4.0%
Commercial	7.70	7.43	-3.5%
Industrial	7.28	xx*	xx
Institutional	1.48	xx	xx
Other / uncategorized / mixed use	3.54	xx	xx

* Masked data (shown as "xx") is due to privacy restrictions. See Energy Atlas for further details.

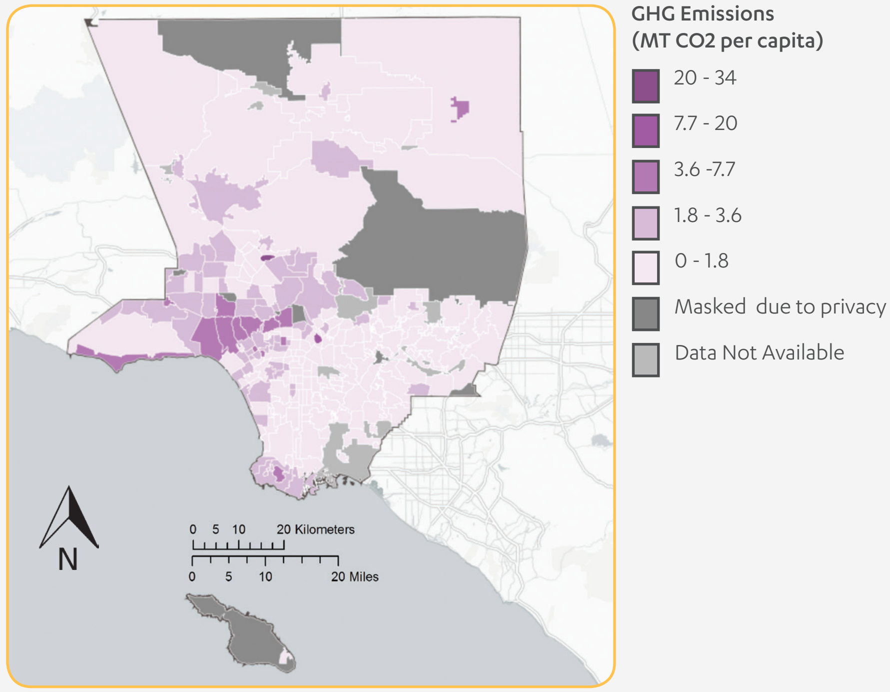
BUILDINGS GHG EMISSIONS

as much as buildings in the lowest emissions category. These results reflect differences in both energy use and in utilities' renewable portfolios.

Data Limitations

- Currently the Energy Atlas does not include (monthly, account level) data for the following municipally owned utilities (MOUs): Azusa Light & Water; Cerritos Electric Utility; City of Industry; Pasadena Water & Power; and Vernon Gas & Electric.
- Data privacy restrictions established by State agencies limit the availability of some data, especially for the industrial and institutional sectors.
- The most current data available for analysis was 2006 to 2010.
- Energy use by facilities regulated under state cap and trade regulations is not included in the Energy Atlas data because these high-users exacerbate the issue of data masking due to privacy restrictions.
- A detailed description of the methodology used to create the Atlas, including limitations, is provided on the LA Energy Atlas website.[102]

GHG Emissions per capita of Residential Buildings by Neighborhood in LA County (2010)



INDICATOR • TRANSPORTATION GHG EMISSIONS

Introduction

The transportation sector is a major source of greenhouse gas (GHG) emissions. Transportation comprised around 37% of total emissions in California in 2014,[103] and approximately 33% in LA County as of 2010.[104] Carbon dioxide makes up most of the GHG emissions from transportation. Other gases emitted include methane, nitrous oxide, and hydrofluorocarbons.[105]

Data

We used data for LA County from SCAG's 2012 and 2016 Program Environmental Impact Reports (PEIR). Emissions calculations were contained in the 2016 PEIR's Air Quality and Greenhouse Gas Emissions and Climate Change Technical Report and in the Greenhouse Gas Emissions Section of the 2012 PEIR.[106,107] Both the 2016 and 2012 PEIR data used SCAG's Regional Travel Demand Model, which is subject to the California Environmental Quality Act (CEQA) and National Environmental Policy Act (NEPA). The California Transportation Commission sets guidelines for the model, and the Air Resources Board sets the specifics for the emissions model and accounting assumptions. Although SB 375 goals cover only passenger vehicles and light duty trucks, SCAG included heavy-duty trucks in the 2016 PEIR, and both heavy-duty trucks and buses in the 2012 PEIR.

Findings

- The 2012 report showed a 7% reduction in emissions in 2011 compared to 2005, whereas the 2016 report showed a 9.5% reduction in 2012 compared to 2005.
- While both reports showed reductions compared to 2005, with improvements between 2011 and 2012, inconsistencies in the types of transportation included in the calculations, as well as changes in reporting units make it challenging to assess the significance of these numbers or compare them.

Data Limitations

- SCAG's Regional Travel Demand Model is updated every four years; currently there are no emission figures from 2013-2016.
- The 2016 and 2012 PEIR data are not reported in the same emissions units and do not include the same types of transportation. In particular, buses are included in the 2012 report, but not in the 2016 report.

Summary of LA County CO2 emissions estimates from SCAG's 2012 and 2016 Program Environmental Impact Reports

PEIR Publish Date	Year of Data Used in Calculations	Calculated GHG Emissions	Units	% Change from 2005	Included in calculations: Passenger vehicles, heavy duty trucks	Buses	Trains, planes, ships
2016	2012	120,929	CO2 emissions (tons/day)	-9.5%	yes	no	no
2016	2005	133,629	CO2 emissions (tons/day)		yes	no	no
2012	2011	40	CO2e (MMT per year)	-7%	yes	yes	no
2012	2005	43	CO2e (MMT per year)		yes	yes	no

INDICATOR • CAP AND TRADE STATIONARY SOURCES GHG EMISSIONS

Introduction

California's Cap-and-Trade program addresses GHG emissions from certain large stationary sources (i.e., large industrial facilities from listed sectors like electricity generation). The cap, currently set at 382.4 million metric tons (MT) of CO2 equivalent (CO2e), is set to decrease by about 3% annually, and currently covers about 450 entities statewide, including those in specified sectors that emit over 25,000 MT of CO2e annually. Distributors of electricity, natural gas, and other fuels recently came under the cap-and-trade requirements in 2015.[108] This cap regulates 85% of the state's GHG emissions.[109]

Data

We used data compiled by CARB from the GHG Mandatory Reporting Regulations (MRR) requirements.[110] Facilities were categorized as Cogeneration, Electricity Generation, Hydrogen Plant, Oil & Gas Production, Other Combustion Sources, or Refinery. Electricity Importers and Fuel Suppliers were added as categories in 2015. The Other Combustion Source category includes facilities such as aeronautics companies, light manufacturing, universities, and hospitals. CARB's Facility GHG Emissions Visualization and Analysis Tool provides a geographic breakdown of the data, allowing for easy sorting for LA County.[111] The visualization tool is only updated to 2014, so data from 2015 was manually sorted.

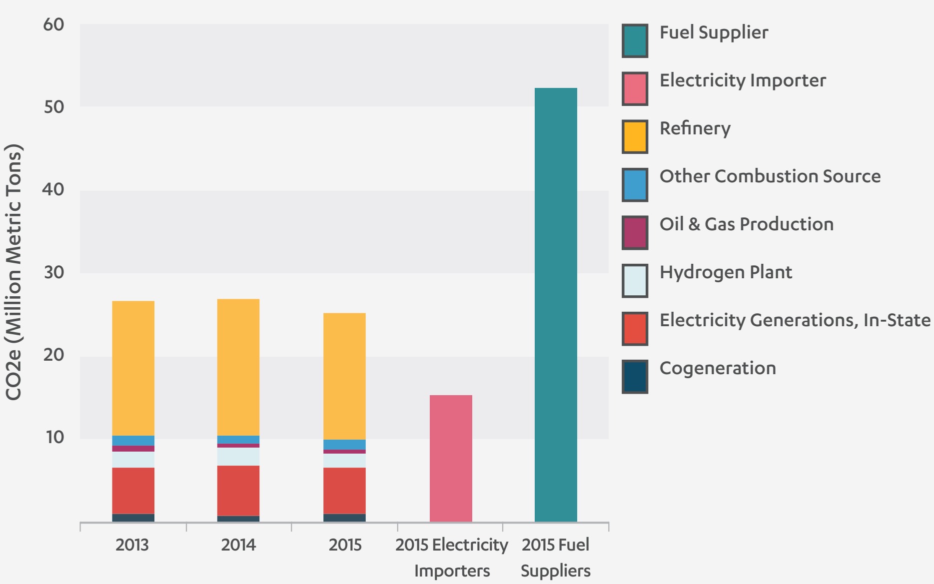
We used the effective date of the cap and trade regulations, 2013, as a baseline year. When showing emissions for 2015, we separated the results for categories regulated since 2013 from those that came under the program in 2015 (electricity importers and fuel suppliers) to better assess trends. We also looked at the number of facilities reporting in each category to provide context for these trends. We included the Aliso Canyon natural gas leak emissions to provide a better understanding of the magnitude of this event; discussion is provided in the "highlight" box below.

Note that the CARB database lists some facilities that were not subject to cap and trade but were subject to reporting requirements; only facilities under the GHG cap are included in this analysis. The indicator for Building Emissions Data, above, includes emissions from all facilities except those under cap and trade regulations. As such, these two indicators do not overlap and are complimentary.

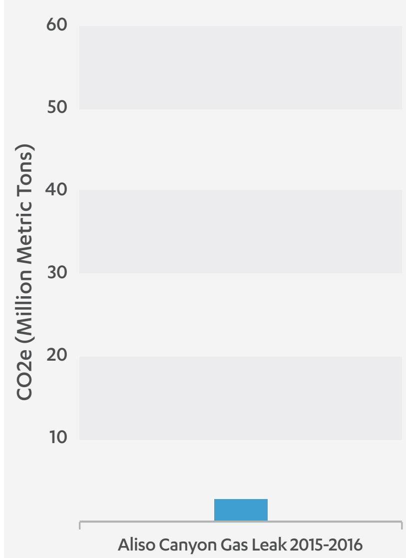
Findings

- The 56 facilities or businesses in LA County reporting under the cap-and-trade program in 2014 emitted just under 27 million MT CO2e, which was slightly higher than 2013 levels. Facilities reporting under these same categories emitted a total of 25.2 million MT CO2e in 2015, which represents a reduction

GHG Emissions from Cap and Trade Facilities by Sector in LA County (2013-2015, new sectors effective in 2015 shown separately)



GHG Emissions from the Aliso Canyon Gas Leak (MT CO2e)*



*Not a cap and trade facility, but presented here for comparison

CAP AND TRADE STATIONARY SOURCES GHG EMISSIONS

Number of Cap and Trade Facilities and Net Change in Emissions by Category in LA County (2013-2015)										
	Co-gen	Electricity	Hydrogen	Oil and Gas Production	Other Combustion	Refinery	Sub total	Electricity Importer	Fuel Supplier	Total
2013	4	15	3	7	19	11	59	-	-	59
2014	4	15	3	6	19	9	56	-	-	56
2015	3	14	3	6	18	8	52	9	6	67
Net change in emissions 2013-2015	1%	-2%	-3%	-34%	-3%	-6%	-5%			

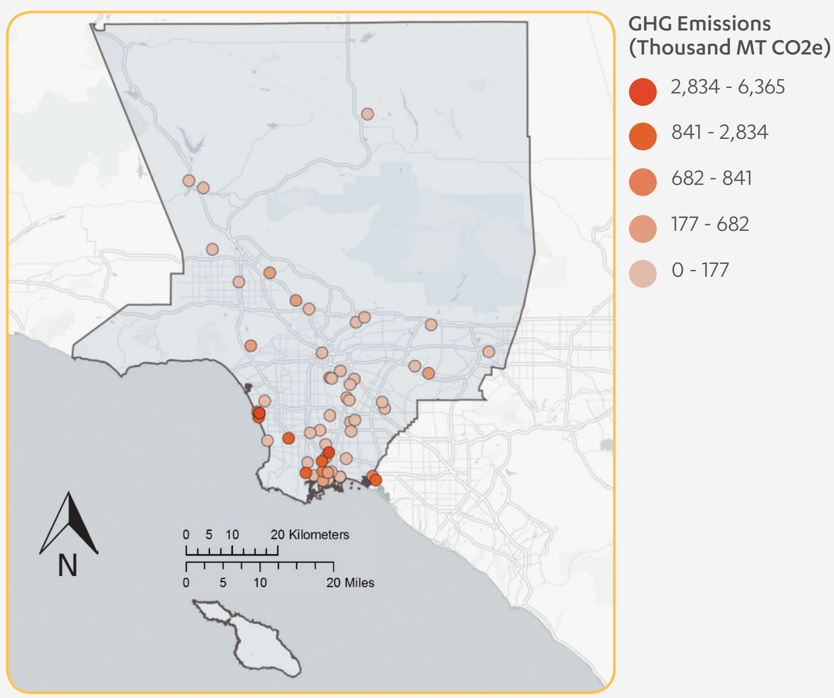
of 5% over 2013 levels. However, there were seven fewer facilities reporting within those categories in 2015 compared to 2013.

- There was a 6% decrease in refinery emissions between 2013 and 2015, but at the same time there was a 27% reduction in the number of facilities reporting in this category.
- While there was a large decrease (34%) in Oil and Gas Production emissions between 2013 and 2015, this was due to one of the seven facilities within that category shutting down. This facility may start operations again in the future, but overall this category of emissions is quite small compared to Refineries and Electricity Generators.
- The addition of "Electricity Importers" and "Fuel Suppliers" in 2015 represented a nearly four-fold increase in the amount of CO2e emissions regulated under the cap and trade program (over 92 million MT).
- In 2015, the newly added fuel suppliers emitted 52 million MT of CO2, which made up the largest portion (56%) of the County's total emissions in 2015, despite comprising less than 10% of the total facilities. This was almost 3.5 times the emissions from refineries.
- The nine electricity importers brought into the program in 2015 emitted 15.3 million MT, about the same amount as the eight refineries.

Data Limitations

- Emissions from the Aliso Canyon natural gas leak were not included under the GHG reporting requirements, but were measured in a separate ARB report.[112]

GHG Emissions from Cap and Trade Facilities in LA County (2014)



HIGHLIGHTS

Aliso Canyon Gas Leak Emissions

Southern California Gas Company's natural gas leak from their Aliso Canyon storage facility lasted approximately 3.5 months - from October 23, 2015 to February 11, 2016. CARB estimated that about 109,000 MT of methane would need to be mitigated to compensate for its impact.[113] This estimate was a collaborative effort between CARB, NASA's JPL, Caltech, Scientific Aviation, and SoCal Gas. Methane has a much higher global warming potential than CO2 (approximately 25 times greater), and the Aliso Canyon leak was equivalent to 2,725,000 MT of CO2e,[114] approximately 13% of 2015 emissions from all refineries and electricity generators in LA County.

The leak also temporarily displaced over 8,000 residents who reported headaches, nosebleeds, and nausea,[115] symptoms known to be associated with natural gas additives. Governor Brown required CARB to prepare a mitigation program that will be funded by SoCal Gas. The devised program recommends that the state focus on reducing methane emissions from agriculture and waste sectors, decrease reliance on fossil fuels, and target previously ignored methane "hot spots"[116] This accident also raises the question of viability of natural gas storage in LA County going forward and may accelerate the move to other forms of energy storage such as large-scale batteries.

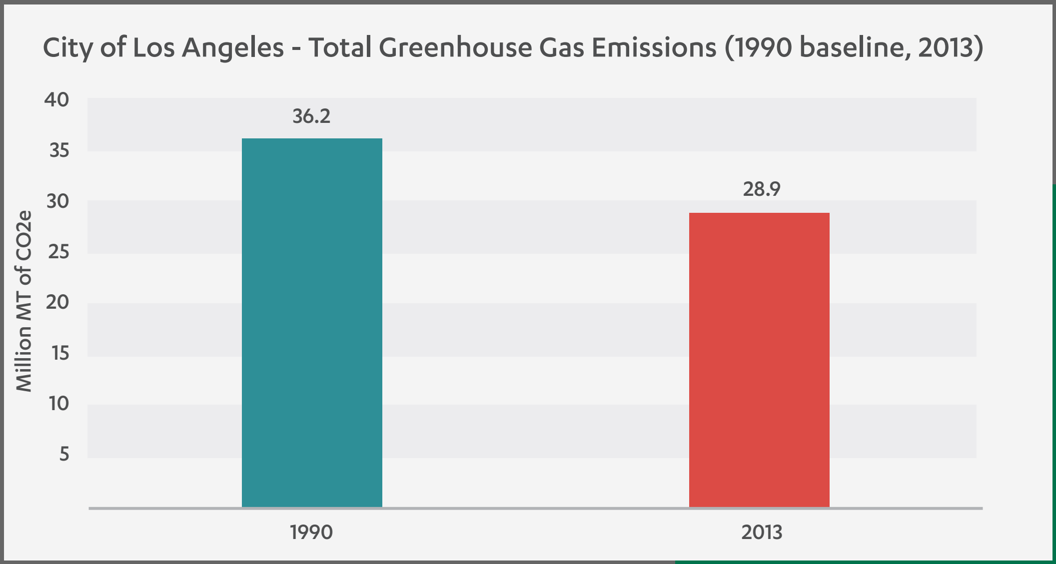
City of Los Angeles GHG Inventory

The 2015 Sustainable City pLAn for the city of Los Angeles sets reduction targets for LA's GHG emissions against a 1990 baseline. These goals aim to decrease emissions by 45% by 2025, 60% by 2035, and 80% by 2050.[117] The Mayor's Office of Sustainability released a city-wide emissions inventory using 2013 data in their Climate Action Report at the end of 2015.[118] The table and graphic provide summary information from this report, including emissions totals for key sectors, and a comparison between 2013 and the "baseline" year, 1990, which shows a 20% reduction.

Note that the city revised its original 1990 and 2013 inventories to the Global Protocol for Community-Scale Greenhouse Gas Emission Inventories (GPC) format, specifically to adhere to the newly adopted and internationally recognized methodology by the Compact of Mayors. Los Angeles was among the first cities in the world to do so.

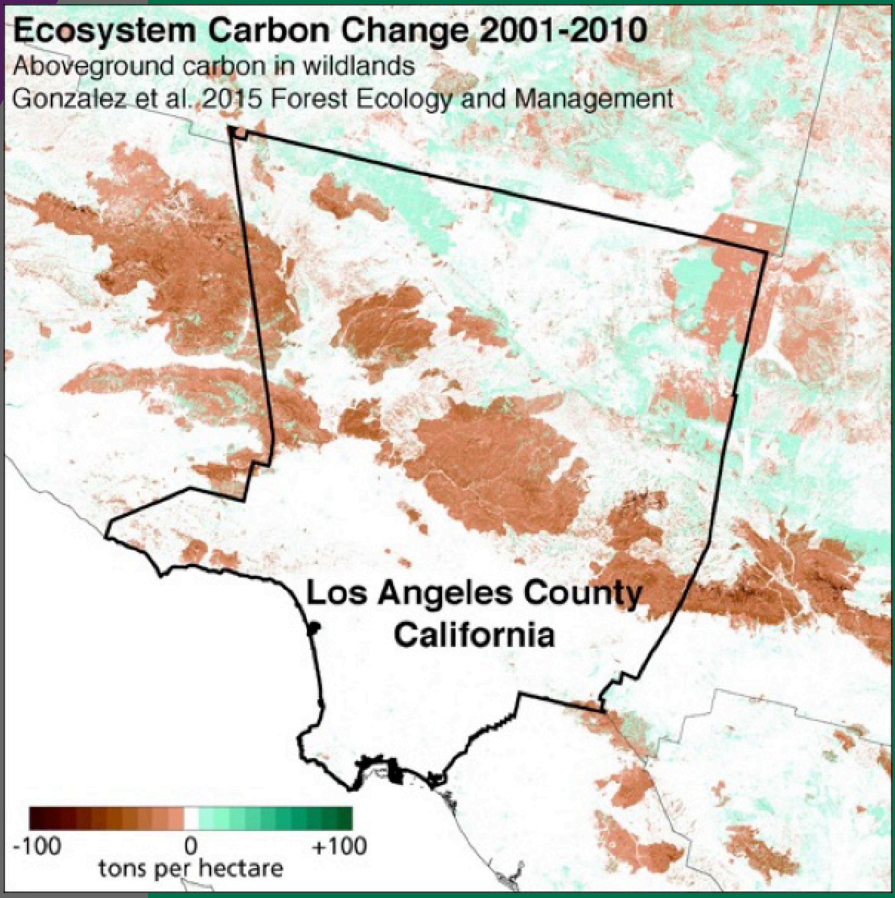
In order to comply with global protocols, emissions inventories are a complex undertaking that consider GHG emissions from sources located within the city boundary (Scope 1), those occurring as a consequence of the use of grid-supplied electricity, heat, steam and/or cooling within the city boundary (Scope 2), and all other GHG emissions that occur outside the city boundary as a result of activities taking place within the city boundary, such as waste disposal and air travel (Scope 3). A combination of certain components of Scope 1, 2, and 3 emissions is referred to as the "BASIC" level of emissions reporting.

City of Los Angeles 2013 GHG Emissions Source (By Sector)	Total GHGs (MT CO2 equivalent)			
	Scope 1	Scope 2	Scope 3	BASIC Total
STATIONARY ENERGY				
Energy use	7,973,387	9,440,124	1,132,815	17,413,512
Energy generation supplied to the grid	1,074,068			
TRANSPORTATION				
Transportation emissions	10,848,145	66,084	7,570,253	10,914,229
WASTE				
Waste generated in the city	30,764		564,291	595,055
Waste generated outside the city	9,984			



Landscape Carbon Cycling

The California Air Resources Board's 2008 Climate Change Scoping Plan, which outlines the State's strategy for meeting the 2020 greenhouse gas emissions limit, set a target of no net loss of carbon from California ecosystems by 2020. To evaluate progress toward this target, the CARB funded Gonzalez et al. to study the change in aboveground live carbon in trees and vegetation in California Wildlands.[119] For the State, the team estimated 69 +/- 15 million MT of carbon were lost from 2001 to 2010. Most of these losses were due to wildfire, with the remaining portion due to land conversion.[120] In LA County, the loss was approximately 3.2 +/- 1.7 million MT (Patrick Gonzalez personal communication 10/13/16). Change in aboveground live carbon does not provide a direct indication of carbon dioxide emissions since all burned wood does not immediately enter the atmosphere as carbon dioxide, and some may be sequestered in soil. However, while likely an overestimate, converting carbon to carbon dioxide equivalents results in a net emission for LA County of 11.7 +/- 6.2 million MT for the period (or an average of 1.2 million MT per year – approximately 3.4% of the city of LA BASIC annual CO2e emissions). These results suggest that emissions from wildlands are substantial and a major challenge for achieving California's emission targets, and that wildland carbon should become a management priority. Restoration of fire regimes to more natural levels, and encouraging resiliency of forest stands to catastrophic, stand destroying fires are recommended objectives by Gonzalez et al. Furthermore, conversion of wildlands should be minimized through land use planning, and urban biological carbon pools should be enlarged through urban tree planting, with consideration for tree water use, longevity, and maintenance.



HIGHLIGHTS

Water Supply Embedded Carbon

Greenhouse gas emissions associated with water supply for LA County are driven primarily by the amount and source of water. The following data sources were used to broadly estimate GHG emissions from the 2015 water supply (Mika, K., 2016, unpublished):

- Sources of water and energy required:
  - LADWP 2015 Urban Water Management Plan[121]
  - MWD 2015 Water Supply Report (MWD personal communication)
- Source of energy: 2015 power content labels for LADWP and SCE (see Utility Renewables Portfolio indicator earlier in this report card)

Due to the complexity of the water supply system for LA County, a number of detailed assumptions were required for this analysis; the most significant included an assumption that the 41% of unspecified power in the SCE portfolio had a GHG footprint of natural gas, and that the energy requirements of the LA County water supply portfolio were the same as those of LADWP's (e.g., that the treatment composition of the County's recycled water, and thus its energy requirement, is similar to that for LADWP).

Total GHG emissions from supplying water to LA County were estimated to be 862,495 MT of CO2e for 2015. These numbers will drop dramatically with the current record wet year in California because LADWP will receive nearly 500,000 AF from the LA Aqueduct – a source of carbon free water supply. Currently, the emissions per acre-foot of supplied water from MWD imports is more than 4 times as high as that of groundwater, and more than 13 times as high as from stormwater (even with the worst-case assumption of pumping stormwater to spreading grounds). While recycled water emissions are twice as high as groundwater, they are still less than half of imported water GHG emissions. It is important to note that from a system-wide perspective, energy is generated from some of the imported water sources that offsets some of these GHG emissions. See 2016 AJPH publication and associated response demonstrating the importance of considering the system as a whole due to the complexity of the interaction between energy and water.[122,123]

Required Energy and GHG Emissions of Water Supply Portfolio (2015)

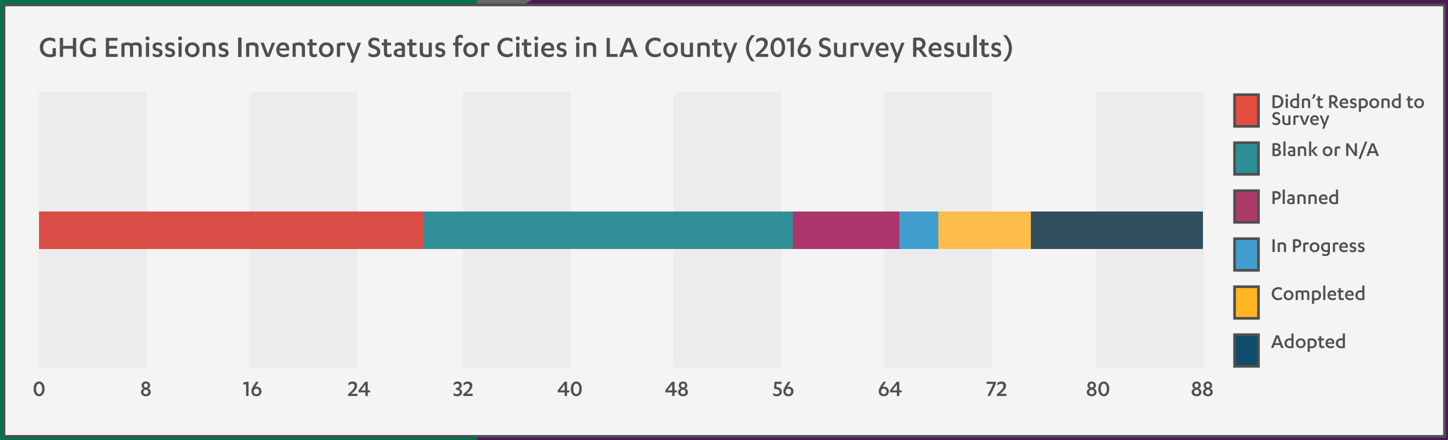
Water Source	LA County Water Supply (AF)	Required Energy (kWh/AF)	MT of CO2e	MT of CO2e per AF
MWD Imported Water	State Water Project: 443,617	2,593	695,758	0.89
	Colorado River Aqueduct: 341,263	2,000		
LADWP - LA Aqueduct	26,828	-	0	0
Groundwater	514,904	580	113,368	0.22
Recycled Water	120,320	1,150	52,526	0.44
Stormwater	12,799	174	842	0.07
TOTAL	1,459,731		862,495	0.59

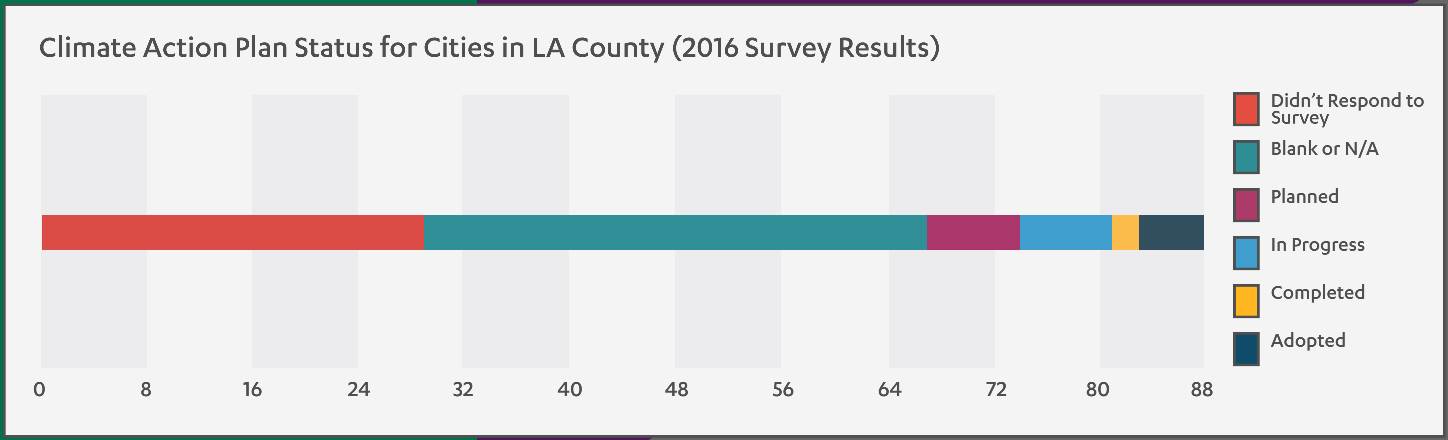
Climate Action Plans

Climate Action Plans (CAPs) lay out specific plans and approaches that an entity, such as a city or agency, will take to reduce greenhouse gas (GHG) emissions.[124] Generally, CAPs assess information from GHG inventories in order to determine the best strategies and targets for mitigation. It is not mandatory for cities in California to perform GHG inventories or to develop CAPs. However, completing these two actions can help cities manage anticipated changes required by laws such as AB 32 (Nuñez, 2006) and SB 375 (Steinberg, 2008). Additionally, the California Environmental Quality Act (CEQA) requires agencies to calculate GHG emissions from proposed projects and identify processes to reduce emissions if they are substantial; CAPs can be utilized to facilitate this environmental review process, provided they meet certain requirements. Furthermore, the CAP process may identify opportunities for monetary savings and job growth, as well as improved air quality and public health.

The California Governor's Office of Planning & Research (OPR) provides data on CAPs in their Annual Planning Survey Results documents (APSR), which are publicly available for most of the years between 1996-2016.[125,126] The survey questions encompass a wide range of topics, including questions on the status of GHG initiatives and CAPs. Although the APS is sent to all cities and counties in California, reporting is not mandatory, which results in variable response rates each year. Furthermore, there were inconsistencies from year to year in both the questions asked and the responses; we were therefore unable to provide a meaningful assessment of trends.

We've shown the most recent responses (from the November 2016 survey results) regarding progress on developing GHG inventories and on creating climate action plans for the 88 cities within LA County. Thirty-eight of 88 cities were in the planning stage or beyond for GHG emissions inventories, and 20 were completed or adopted. Twenty-one cities were in the planning stage or beyond for Climate Action Plans, and seven had a plan either completed or adopted.





grade C+/incomplete

for greenhouse gas emissions

Renewable energy and greenhouse gas (GHG) emissions are undeniably intertwined, and as such were evaluated together in the 2015 ERC and assigned a B- grade. This report card shows that renewable energy has improved, while GHG emissions have remained relatively unchanged within LA County – with the exception of the City of LA, which decreased GHG emissions by an estimated 20% from 1990 levels.

Overall building GHG emissions decreased by only 2.5% from 2006 to 2010, with residential building use doing a little better with a 4.0% reduction. Transportation emissions decreased by 9.5% from 2005 to 2012, but it is important to note that buses, trains, planes, and ships were not included in this calculation. A more modest decrease in GHG emissions was reported between 2005 and 2011 that included buses. In order for the County to reach the state's GHG emissions goals by 2030, the urban areas must be reimagined. More people need to get out of their cars and use public or active transportation. For this to be feasible, urban areas will need to densify around work and commercial centers.[127] UCLA's Now Institute provides a provocative argument for how that might happen around the Wilshire corridor.[128]

For the large GHG emitters under the CARB cap and trade program, 2015 emissions were 5% lower compared to 2013 for those categories of facilities regulated over that time period. Comparisons were not possible for the new "large emitter" categories that started reporting emissions in 2015, and 2015-16 was the time period for the massive Aliso Canyon natural gas leak – a major additional source of GHGs for the County.

An important study funded by CARB indicated that GHG emissions stemming from the destruction of our natural carbon sinks (i.e., forests and wildlands) is substantial and makes reaching the state's emissions goals somewhat dependent on our management of these natural lands. Furthermore, we found that the way we import water to LA County from the Colorado River Aqueduct and the State Water Project was extremely carbon intensive, although some of this is offset through hydrological energy production. Imported water from the LA Aqueduct is essentially carbon free, and stormwater and groundwater are low carbon water supplies. Even the County's current recycled water supply is approximately half as carbon intensive as imports from the Colorado and the Bay-Delta.

Assessment of a grade for GHG emissions was difficult because of the lack of current data available for analysis and data masked due to privacy regulations. The county building data was only available to 2010, the transportation data to 2012, and more than half of the County's cities are not even in the planning stages for GHG emissions inventories or climate action plans. Periodic and standardized GHG emissions reporting and climate action plan updates every two to three years should be a state requirement in order to ensure that cities and counties are actually keeping track of and reducing GHG emissions in support of the State's emission reduction goals. The City of Los Angeles recently completed an inventory with 2013 data that included an analysis of various sectors. Santa Monica is an example of another city that recently completed a detailed comparison of current emissions to 1990 emissions.

5

AIR QUALITY & HUMAN HEALTH IMPACTS

Overview

Fossil fuel energy production and use is associated with an enormous burden of environmental and health impacts. We chose to look at air quality impacts (as well as contributions to air pollution from manufacturing more broadly), and at a human health impact closely linked to fossil-fuel emissions: asthma. While other health impacts of air pollution include lung damage, cancer, birth defects, heart attacks and premature death, it was beyond our capacity to address these in this Report Card; however, a recent study by the LA County Department of Public Health provides a comprehensive assessment.[129] Impacts of fossil fuels on water resources will be addressed in the Report Card focused on water.

Los Angeles is well known for its hazy skies. Although clearer today than in the past 40 years, the basin still has some of the worst air quality in the U.S. A number of factors contribute to the pollution, including energy production from non-renewable sources, our large industrial sector, air, land and water transportation fueled by gasoline, diesel, and other carbon-based fuels, and our topography and climate. Together this results in a number of "non-attainment days" each year where ozone and particulate matter exceed state and federal air quality standards. Climate change induced heat will exacerbate ambient air pollution concentrations, especially for ozone.

Furthermore, the largest manufacturing workforce in the United States is in the Los Angeles – Long Beach – Santa Ana metropolitan area.[130] Manufacturing processes contribute to both climate change and to local air pollution through emissions of toxic air contaminants and hazardous air pollutants. Potential health impacts from inadequately controlled air emissions are an ongoing concern, including such recent issues as lead and arsenic emissions from battery recycling plants[131] and elevated levels of chromium associated with metal plating shops.[132]

Through effective regulation by the EPA, the California Air Resources Board, and the South Coast Air Quality Management District, Los Angeles has seen dramatic improvements in air quality. California continues to lead on the regulation of air pollutants. Since the release of the 2015 ERC, SB 32 (Pavley, 2016) further reduced GHG emission level goals to 40% below 1990 levels by 2030, and SB 1383 (Lara, 2016) created targets for short-lived climate pollutants (methane, hydrofluorocarbons and black carbon); both actions are expected to have significant co-benefits for air quality and human health.[133] Additionally, AB 197 (Garcia, 2016) ensures that disadvantaged communities, which are often most impacted from air toxics, are receiving benefits from future climate programs.

The Sustainable City pLAn for Los Angeles has a goal to reduce "non-attainment days" to zero for air pollution by 2025, and asthma-related ER visits in the most contaminated neighborhoods to 14 per 1000 children by 2025 and 8 per 1000 children by 2035.[134] In 2016, the city passed the Clean Up Green Up ordinance to protect communities at high risk from pollution,[135] and has a number of related goals to reduce GHG emissions, reduce energy use, and increase renewable energy generation. Mayor Garcetti made a statement one year after the Aliso Canyon natural gas leak disaster on the importance of moving toward a fossil fuel-free future, and at the same time the City Council passed an ordinance directing the LADWP to start planning a pathway to 100% renewable energy. The Los Angeles County Board of Supervisors has likewise prioritized prevention of environmental health impacts throughout the County, with initiatives such as the Oil and Gas Strike Team and the Toxic Threat Strike Team. A County Sustainability Plan is forthcoming within the next few years, and Supervisor Kuehl is now a member of the AQMD Board. All of this will contribute significantly to improving our air quality and public health.

This category evaluates the status and trends in the County's ambient air quality and toxic emissions, similar to what was done in the 2015 ERC. Here we also evaluate air quality impacts on human health by focusing on asthma-related ER visits and hospitalizations.

INDICATOR • AMBIENT AIR QUALITY

Introduction

Air pollution can cause or contribute to a wide range of adverse health outcomes, from watery eyes and fatigue to asthma and other respiratory diseases, lung damage, cancer, birth defects and low birth weight, heart attacks, and premature death. State, regional, and federal regulations have resulted in greatly improved air quality in Los Angeles; however, it is still among the top five most polluted regions nationally according to an American Lung Association 2016 report.[136]

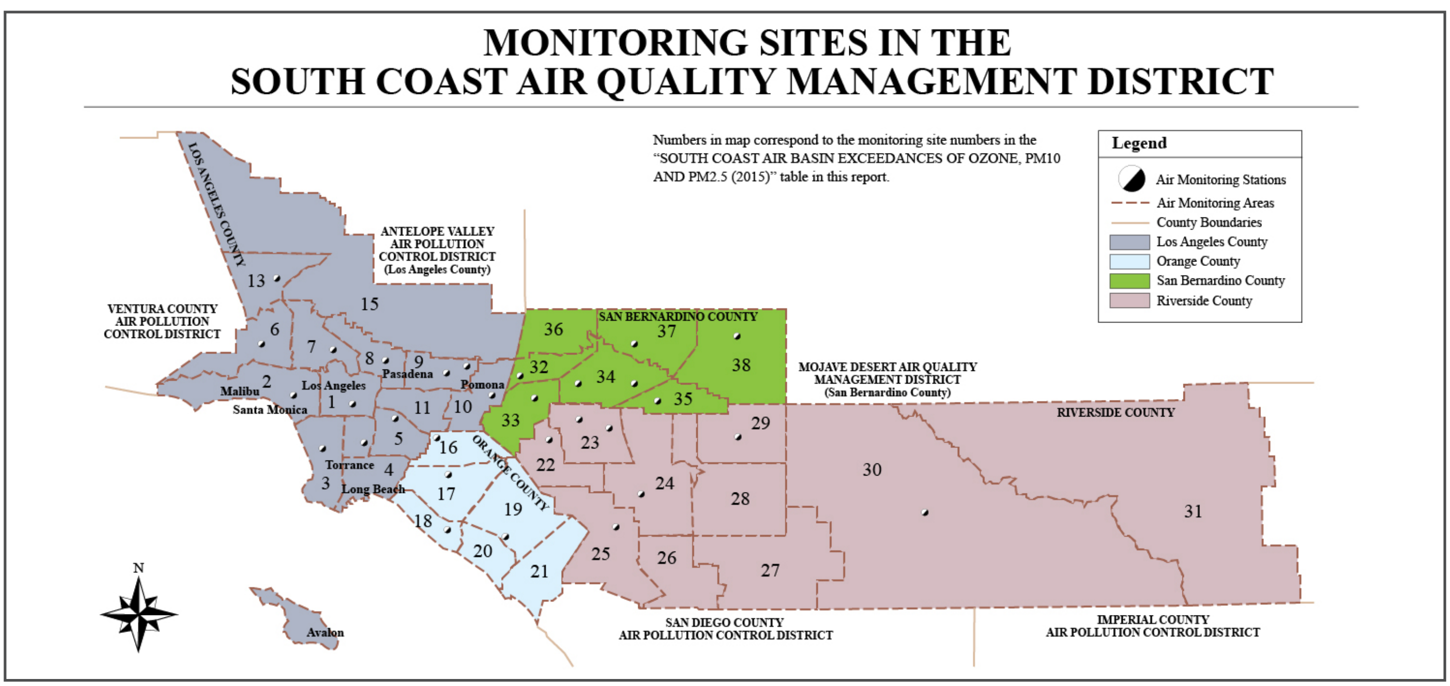
The South Coast Air Quality Management District (SCAQMD) monitors air quality for the South Coast Air Basin (Basin) and oversees the urban portions of LA, Riverside, and San Bernardino counties, and all of Orange County. A small area in northern LA County is under the jurisdiction of the Antelope Valley AQMD (AVAQMD).

A table is included here with the applicable standards, current attainment status, and attainment dates for the Basin as of the 2016 SCAQMD Air Quality Management Plan (AQMP).[137] These consist of both federal standards, known as National Ambient Air Quality Standards (NAAQS), and state standards, known as California Ambient Air Quality Standards (CAAQS). Additional details can be found in the attainment status table in the AQMP.[138]

Areas of the country where air pollution levels persistently exceed standards are known as "non-attainment areas." Portions of the Basin are classified as 'extreme non-attainment' with NAAQS for Ozone (8-hr and 1-hr), 'serious non-attainment' for PM2.5 (particulate matter with diameter equal to or less than 2.5 microns), and 'non-attainment' with CAAQS for PM10 (particulate matter with diameter equal to or less than 10 microns). A portion of LA County is also designated "non-attainment" for lead.

Data

We chose to look at ambient air quality at the basin scale rather than just within LA County due to downwind impacts of pollutants originating in LA County. We compiled available data from the 38 locations throughout the four-county area where SCAQMD monitors air quality, as well as the one location in LA County monitored by AVAQMD.[139,140] We focused on results for the non-attainment pollutants with basin-wide data (ozone, PM10, and PM2.5). The most recent data by monitoring location were from 2015; however, we included preliminary values for 2016 for the overall South Coast Basin ozone trends.[141] For the tables and graphs with ozone data through 2015, federal exceedances were based on the 0.075 ppm standard in effect for most of 2015; however, for the basin-wide ozone trends graph, exceedance frequencies were calculated by AQMD for all years based on the new 0.070 ppm federal standard. Basin-wide trends for annual maximum PM2.5 concentrations were provided through 2015 and are compared to the current Federal standard of 12.0 ug/m3.



AMBIENT AIR QUALITY

South Coast Air Basin Applicable Standards, Current Attainment Status, & Attainment Dates as of the 2016 SCAQMD Air Quality Management Plan

CRITERIA POLLUTANT	STANDARD AGENCY	STANDARD DATE	AVERAGING TIME	VALUE	DESIGNATION	ATTAINMENT DATE
1-Hour Ozone	Federal	1979	1-Hour	0.12 ppm	Nonattainment (Extreme)	2023 - Originally 2010 (not attained)
	California		1-Hour	0.09 ppm	Nonattainment (Extreme)	N/A
8-Hour Ozone	Federal	1997	8-Hour	0.08 ppm	Nonattainment (Extreme)	2024
	Federal	2008	8-Hour	0.075 ppm	Nonattainment (Extreme)	2032
	Federal	2015	8-Hour	0.070 ppm	Designations Pending	~2037
	California		8-Hour	0.070 ppm	Nonattainment	Beyond 2032
CO	Federal		1-Hour / 8-Hour	35 ppm / 9 ppm	Attainment (Maintenance)	2007 (attained)
	California		1-Hour / 8-Hour	20 ppm / 9 ppm	Attainment	2007 (attained)
NO_2	Federal		1-Hour	0.10 ppm	Unclassified/Attainment	N/A (attained)
	Federal		Annual	0.053 ppm	Attainment (Maintenance)	1998 (attained)
	California		1-Hour / Annual	0.18 ppm / 0.030 ppm	Attainment	---
SO_2	Federal		1-Hour	75 ppb	Designations Pending (expect Uncl./ Attainment)	N/A (attained)
	Federal		24-Hour / Annual	0.14 ppm / 0.03 ppm	Unclassifiable/ Attainment	1979 (attained)
PM10	Federal	1987	24-Hour	150 ug/m³	Attainment (Maintenance)	2013 (attained)
	California		24-Hour / Annual	50ug/m³ / 20ug/m³	Nonattainment	N/A
PM2.5	Federal	2006	24-Hour	35 ug/m³	Nonattainment	2019
	Federal	1997	Annual	15.0 ug/m³	Nonattainment	2015
	Federal	2012	Annual	12.0 ug/m³	Nonattainment	2025
	California		Annual	12.0 ug/m³	Nonattainment	N/A
Lead	Federal		3-Months Rolling	0.15 ug/m³	Nonattainment (Partial)	2015
Hydrogen Sulfide (H2S)	California		1-Hour	0.030 ppm / 42 ug/m³	Attainment	---
Sulfates	California		24-Hour	25 ug/m³	Attainment	---
Vinyl Chloride	California		24-Hour	0.01ppm / 26ug/m³	Attainment	---

Attainment
Nonattainment (Partial)
Nonattainment

AMBIENT AIR QUALITY

SOUTH COAST AIR BASIN EXCEEDANCES OF OZONE, PM10 AND PM2.5 (2015)

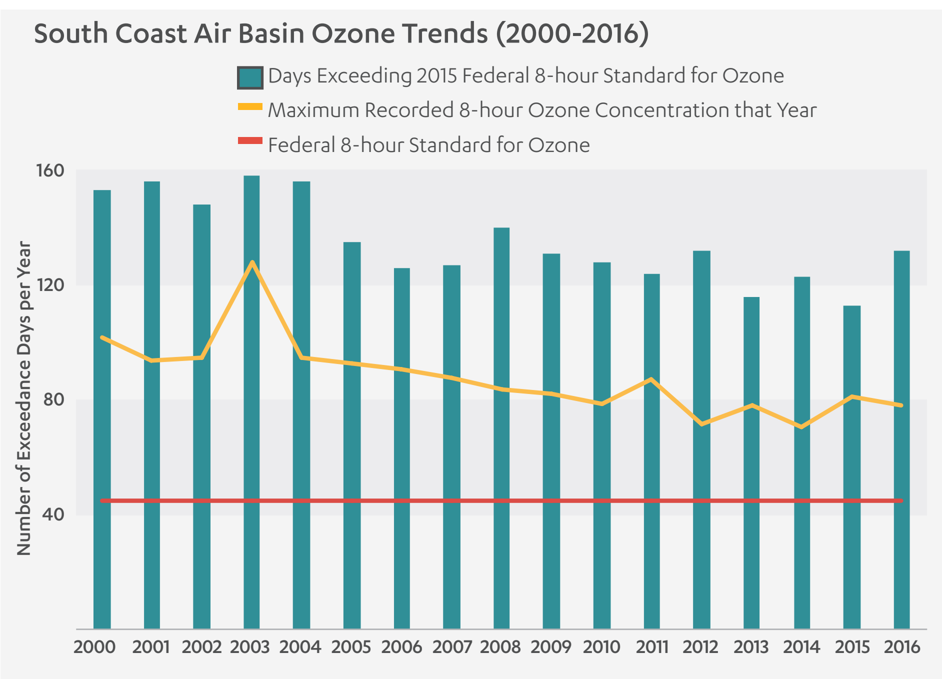
#	Location	% Days Exceeding FEDERAL OZONE 8-hr Standard (> 0.075 ppm)	% Days Exceeding STATE OZONE 8-hr Standard (> 0.070 ppm)	% Samples Exceeding STATE PM10 24-hr Standard (> 50 µg/m3)	% Samples Exceeding FEDERAL PM2.5 24-hr Standard (> 35 µg/m3)
LOS ANGELES COUNTY					
1	Central LA	0	1.6	8	2.0
2	Northwest Coastal LA County	0	0.8	--	--
3	Southwest Coastal LA County	0.3	0.8	0	--
4	South Coastal LA County 1	--	--	--	0.9
4	South Coastal LA County 2	--	--	3	1.2
4	South Coastal LA County 3	0.0	0.0	10	--
6	West San Fernando Valley	4.1	9.3	--	0.9
8	West San Gabriel Valley	1.9	5.0	--	1.7
9	East San Gabriel Valley 1	4.8	8.0	20	1.7
9	East San Gabriel Valley 2	9.4	14.1	8	--
10	Pomona/Walnut Valley	10.4	15.9	--	--
11	South San Gabriel Valley	0.6	3.2	--	2.5
12	South Central LA County	0	0.3	--	2.7
13	Santa Clarita Valley	10.3	15.4	0	--
14	Lancaster (AVAQMD)	14.5	22.5	0	0.0
ORANGE COUNTY					
16	North Orange County	0.6	2.2	--	--
17	Central Orange County	0.3	0.3	3	1.0
18	North Coastal Orange County	0.3	0.6	--	--
19	Saddleback Valley	0.8	2.2	0	0.0

>/=10%	>/=20%	>/=40%

AMBIENT AIR QUALITY

SOUTH COAST AIR BASIN EXCEEDANCES OF OZONE, PM10 AND PM2.5 (2015)					
Source/Receptor Area		% Days Exceeding FEDERAL OZONE 8-hr Standard (> 0.075 ppm)	% Days Exceeding STATE OZONE 8-hr Standard (> 0.070 ppm)	% Samples Exceeding STATE PM10 24-hr Standard (> 50 µg/m3)	% Samples Exceeding FEDERAL PM2.5 24-hr Standard (> 35 µg/m3)
#	Location				
RIVERSIDE COUNTY					
22	Norco/Corona	--	--	7	--
23	Metropolitan Riverside County 1	10.8	16.3	19	2.6
23	Metropolitan Riverside County 3	10.1	14.3	45	5.0
24	Perris Valley	8.5	13.7	5	--
25	Elsinore Valley	5.3	9.7	1	--
26	Temecula Valley	1.6	6.3	--	--
29	San Gorgonio Pass	7.0	13.7	3	--
SAN BERNARDINO COUNTY					
32	Northwest San Bernardino Valley	18.1	19.0	4	--
34	Central San Bernardino Valley 1	15.9	16.5	24	2.6
34	Central San Bernardino Valley 2	21.9	22.2	5	1.8
35	East San Bernardino Valley	23.1	23.4	3	--
37	Central San Bernardino Mountains	23.6	23.6	0	--
38	East San Bernardino Mountains	--	--	--	1.7

>/=10%	>/=20%	>/=40%



Findings

Ozone

- In 2015, nearly half of all monitored sites in the South Coast Air Basin (13 out of 28) exceeded federal or state ozone standards during more than 10% of monitored days. Four sites exceeded the state standard more than 20% of monitored days. A majority of the sites exceeding ozone standards were in Riverside and San Bernardino counties, but LA County had exceeding sites, too; specifically, sites in the San Gabriel Valley, Pomona, Santa Clarita Valley and Lancaster exceeded ozone standards more than 10% of the time.
- The overall number of days exceeding the federal 8-hr ozone standard and the maximum 8-hour concentration in the South Coast Air Basin decreased significantly since 2000, although the trend is less clear over the last five years. Year-to-year fluctuations were strongly influenced by large-scale meteorological patterns.
- Over half of the monitoring sites in LA County experienced an increase in the percent of days

AMBIENT AIR QUALITY

exceeding the federal 8-hr ozone standard in 2015 compared to 2013.

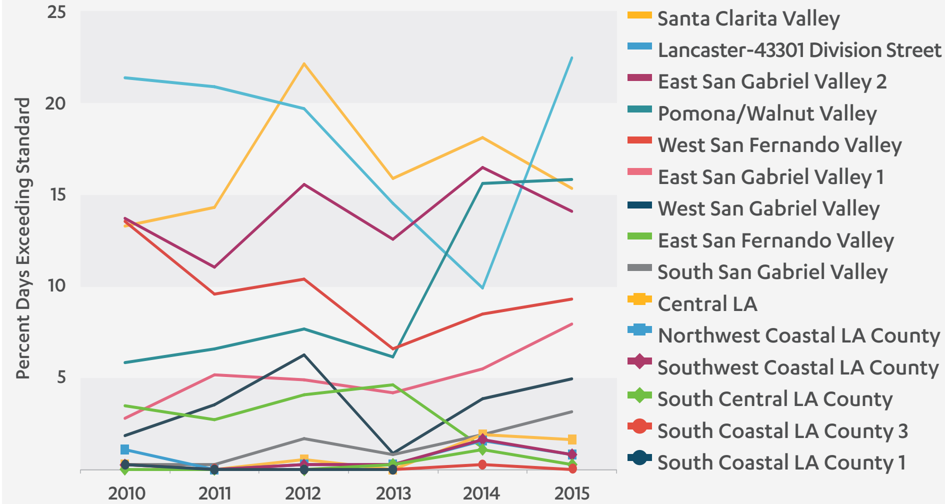
PM10

- Five sites in the South Coast Basin exceeded the state 24-hr standard for PM10 for more than 10% of the samples taken in 2015; two of these sites had exceedances in more than 20% of the samples (one San Gabriel Valley site in LA County), and the Metropolitan Riverside County 3 monitoring site recorded PM10 exceedances for more 45% of the samples taken, more than double the frequency of any other site in the basin.
- Three sites had increased exceedances in recent years compared to 2013, with a particularly high percentage of exceedances in the East San Gabriel Valley in 2014 and 2015.

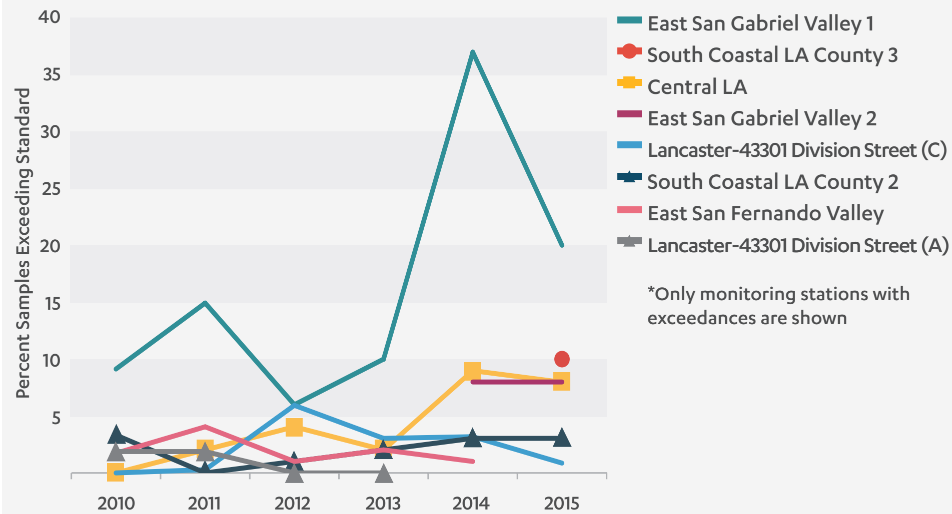
PM2.5

- Basin-wide, annual average PM2.5 concentrations decreased almost every year since 2001, for a total decrease of 57% between 2001 and 2015. Two sites exceeded the annual average standard of 12.0 ug/m3 in 2015: Central LA and Metropolitan Riverside County. In comparison, in 2001 all eight LA County monitoring stations exceeded the 15 ug/m3 standard in effect at the time.
- While most monitored sites in the South Coast Basin had some percentage of samples that exceeded the Federal 24-hr PM2.5 standard, the highest level was 5% at a site in Riverside County. No site in LA County exceeded the standard for more than 3% of samples.
- For sites with PM2.5 data in LA County, 80% had an increased percentage of samples exceeding the Federal standard in 2015 compared to 2013; although in all cases no more than 3% of samples exceeded the standard.

Percent Days Exceeding State 8-hour Standard for Ozone in LA County (2010-2015)



Percent Samples Exceeding State 24-hour Standard for PM10 in LA County* (2010-2015)

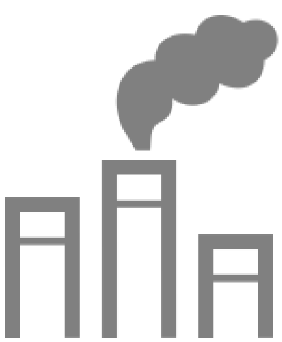


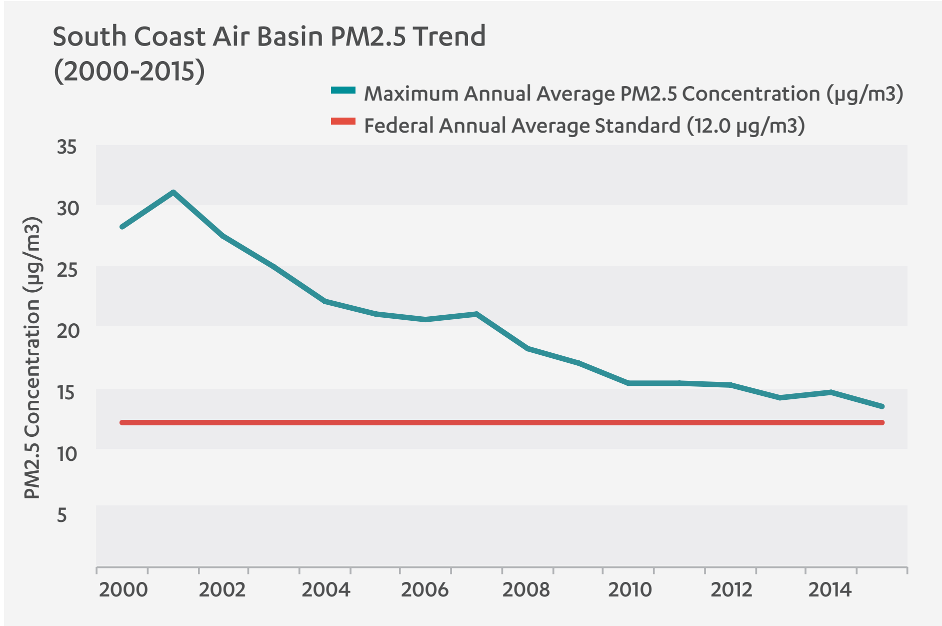
*Only monitoring stations with exceedances are shown

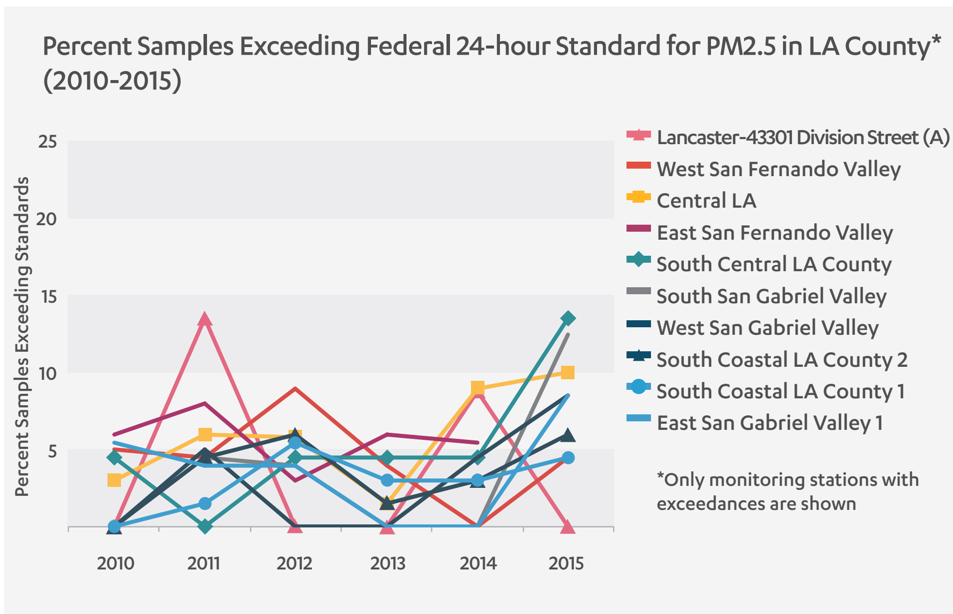
AMBIENT AIR QUALITY

Data Limitations

- Monitoring locations differ in terms of monitoring frequency, pollutants, and sampling techniques, which is why we chose to show the percent of days or samples that exceeded standards instead of the absolute number. This allowed for comparisons between locations and across years.
- Ambient air quality is a result of multiple factors including anthropogenic pollution (e.g., transportation emissions, power plant emissions, manufacturing facility emissions) and weather conditions (e.g., rainfall, temperature, winds). The naturally high year-to-year variability of meteorological conditions in Southern California impacts air quality, although it is beyond the scope of this report to determine the extent to which it affected ambient air quality trends.
- Although multiple 8-hour exceedances can occur within the same day, for regulatory purposes this is counted as a single "exceedance day."
- Due to the intricacies of data validation protocols, exceedances shown here may not be identical to exceedances identified by the EPA for purposes of attainment determinations.
- We did not have the capacity to include data from ambient air toxic monitoring conducted by SCAQMD, but will consider including this in subsequent report cards covering air quality.







INDICATOR • STATIONARY SOURCE TOXIC EMISSIONS

Introduction

Toxic air emissions from stationary sources are a leading indicator for air quality. A look at these types of emissions provides information on the sources, mass emissions, and spatial distributions of a variety of toxic chemical constituents in LA County.

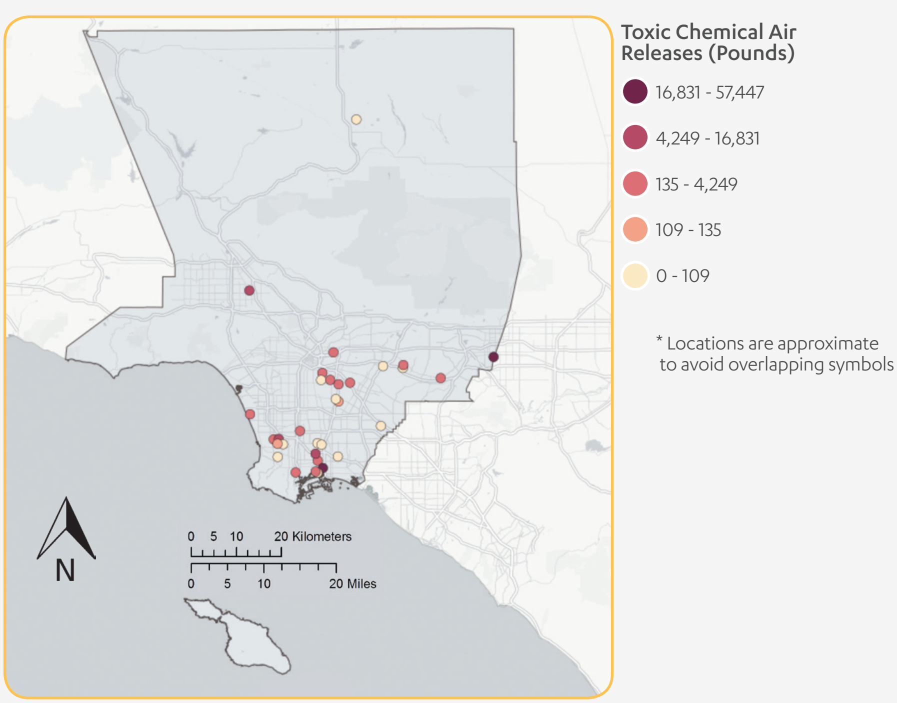
Data

We used the Toxic Release Inventory (TRI) data submitted to EPA on an annual basis by facilities that are subject to the TRI reporting requirements.[142] We used the TRI Explorer Tool to identify air emissions (both stack and fugitive) from TRI-reporting facilities in the County from 2010-2015 for the following types of chemicals. While the list may not include every one of the possible chemicals in the categories described, it does include all of the chemicals that were emitted in LA County.[143] The pollutants chosen also met the following qualifications:

- Chemicals listed as both a Federally-defined Hazardous Air Pollutant (HAP)[144] and a carcinogen (as designated in the TRI database); and
- Metals that are designated either a HAP or a carcinogen.

The three facilities emitting the most of each chemical in 2015 were identified and mapped.

Top Three TRI Emitters for Listed Toxic Chemicals in LA County (2015)*



Findings

- Of the 25 chemicals listed, and for the 6-year period shown, 10 chemicals have decreasing emissions trends, 11 chemicals have no clear trend, two have somewhat increasing trends, and two have strong increasing trends (polycyclic aromatic compounds and chloroform).
- In total, close to 200,000 pounds of the 25 listed chemicals were emitted to air during 2015. While this was 20% less than in 2010, total emissions in intervening years have not consistently decreased, and 2014 total emissions were higher than in 2010. Therefore, we concluded that there was no clear trend of improvement in overall air emissions for these hazardous and carcinogenic chemicals over the last six years.
- Styrene was the only chemical with emissions of more than 100,000 pounds in 2015.
- Throughout the last six years, there were significant increases in the annual air emissions of certain chemicals, lasting for one or two years and followed by a return to previous levels (highlighted in blue in the table). These spikes may have been the result of fugitive emissions associated with site cleanup activities.
- A significant reduction in total reported methylene chloride released in the County starting in 2014 was associated with an order-of-magnitude reduction in emissions of that pollutant from Polypeptide Laboratories in Torrance; the facility reported that it had developed a lower-hazard solvent replacement. However, overall emissions of this chemical in 2015 were still similar to levels prior to 2012.
- The top three emitting facilities comprised 46% to 100% of the 2015 annual emissions for the listed pollutants, indicating that emissions were strongly concentrated around, or specific to, a limited number of industrial processes. The top three top emitters included Tesoro Los Angeles Refinery in Carson (8), Chevron Products in El Segundo (7), and ExxonMobil Oil Corp in Torrance (5). The number in parentheses indicates the number of times these facilities appeared in the top three list. Due to the complexity of this information, the accompanying map simply shows the locations of all facilities listed in the "Top Three" table. To explore facility locations by chemical, visit the map gallery associated with this report.[145]

STATIONARY SOURCE TOXIC EMISSIONS

Total Air Releases in LA County, 2010 - 2015 (pounds)
Blue indicates order of magnitude increases from previous years

Pollutant	2010	2011	2012	2013	2014	2015	6-year Trend
Styrene	194,796	162,252	162,433	137,599	161,271	154,164	Decreasing
Benzene	18,305	21,195	18,013	15,863	15,107	16,635	Decreasing
Ethylbenzene	13,818	14,988	15,187	13,577	13,453	13,579	No clear trend
Naphthalene	5,636	5,976	8,935	5,124	4,701	4,564	No clear trend
Vinyl Acetate	5,495	6,057	5,581	3,354	1,938	1,827	Decreasing
Manganese and Manganese Compounds	689	3	792	744	46,520	1,183	Somewhat increasing
Methylene Chloride / Dichloromethane	949	1,268	20,932	30,943	2,457	1,137	No clear trend
1,3-Butadiene	2,608	1,962	1,895	1,203	994	1,074	Decreasing
Polycyclic Aromatic Compounds	171	254	668	782	708	769	Strongly increasing
Nickel and Nickel Compounds	886	928	781	1,208	1,681	746	No clear trend
Di(2-Ethylhexyl) Phthalate	2,809	277	989	1,442	710	703	No clear trend
Lead and Lead Compounds	1,269	781	829	855	764	550	Decreasing
Formaldehyde	2,103	1,813	2,091	716	900	547	Decreasing
Perchloroethylene / Tetrachloroethylene	1,176	906	472	407	394	428	Decreasing
Ethylene Oxide	340	384	679	530	240	225	No clear trend
Chromium and Chromium Compounds	135	477	229	585	1,033	221	Somewhat increasing
Mercury and Mercury Compounds	215	226	126	214	201	146	Decreasing
Chloroform	0	0	0	73	128	103	Strongly increasing
Ethyl Acrylate	58	56	59	44	48	42	No clear trend
Cobalt and Cobalt Compounds	17	47	52	46	59	41	No clear trend
Trichloroethylene	284	283	250	250	250	36	Decreasing
1,2-Butylene Oxide	10	500	10	10	10	17	No clear trend
Propylene Oxide	21	24	144	114	6	10	No clear trend
Arsenic and Arsenic Compounds	5	1,207	198	9	10	2	Decreasing
Hydrazine	1	1	1	1	1	1	No clear trend
TOTALS	251,822	221,888	241,355	215,702	253,601	198,750	No clear trend

Decreasing	Strongly increasing
Somewhat increasing	No clear trend

STATIONARY SOURCE TOXIC EMISSIONS

Top Three Emitters in LA County During 2015 for each of the 25 Toxic Chemicals

Chemical	Facility	Pounds	% of Total	Facility	Pounds	% of Total	Facility	Pounds	% of Total
Styrene	Custom Fibreglass Manufacturing Co., Long Beach	57,447	37%	GB Manufacturing Inc Calif Acrylic Ind Inc (DBA Cal Spas), Pomona	21,494	14%	Americh Corp., North Hollywood	16,831	11%
Benzene	ExxonMobil Oil Corp - Torrance Refinery, Torrance	5,400	32%	Tesoro LA Refinery-Carson Operations, Carson	4,326	26%	Chevron Products Co Div of Chevron USA Inc, El Segundo	1,530	9%
Ethylbenzene	Tesoro LA Refinery-Carson Operations, Carson	3,841	28%	ExxonMobil Oil Corp - Torrance Refinery, Torrance	2,660	20%	Chevron Products Co Div of Chevron USA Inc, El Segundo	2,000	15%
Naphthalene	Tesoro LA Refinery-Carson Operations, Carson	2,488	55%	Phillips 66 LA Refinery Wilmington Plant, Wilmington	520	11%	Chevron Products Co Div of Chevron USA Inc, El Segundo	420	9%
Vinyl Acetate	Arkema Coating Resins Plant, Torrance	1,500	82%	Engineered Polymer Solutions Inc., City of Commerce	327	18%			
Manganese and Manganese Compounds	Tesoro LA Refinery-Carson Operations, Carson	1,171	99%	Shultz Steel Co., South Gate	6	0.5%	Holliday Rock-Palmdale, Littlerock	5	0.4%
Methylene Chloride / Dichloromethane	IPS Corp., Gardena	977	86%	Polypeptide Laboratories Inc., Torrance	135	12%	Bachem Americas Inc., Torrance	10	1%
1,3-Butadiene	Ultramar Inc Wilmington Refinery, Wilmington	308	29%	Phillips 66 LA Refinery Wilmington Plant, Wilmington	241	22%	ExxonMobil Oil Corp - Torrance Refinery, Torrance	202	19%
Polycyclic Aromatic Compounds	Chemoil Terminals Corp., Carson	304	40%	Tesoro LA Refinery-Carson Operations, Carson	194	25%	Lunday-Thagard Co DBA World Oil Refining, South Gate	116	15%
Nickel and Nickel Compounds	Phillips 66 LA Refinery Wilmington Plant, Wilmington	131	18%	Chevron Products Co Div of Chevron USA Inc., El Segundo	130	17%	ExxonMobil Oil Corp - Torrance Refinery, Torrance	124	17%
Di(2-Ethylhexyl) Phthalate	American Renolit Corp La., Commerce	255	36%	Natvar, City of Industry	250	36%	Teknor Apex Co., City of Industry	198	28%
Lead and Lead Compounds	U.S. Navy San Clemente Island, San Clemente Island	109	20%	Tesoro Wilmington Calciner, Wilmington	89	16%	Owens-Brockway Glass Container Inc Plant 23, Vernon	55	10%
Formaldehyde	Polychemie Inc., Los Angeles	374	68%	Air Products & Chemicals Inc., Los Angeles	173	32%			

STATIONARY SOURCE TOXIC EMISSIONS

Top Three Emitters in LA County During 2015 for each of the 25 Toxic Chemicals									
Chemical	Facility	Pounds	% of Total	Facility	Pounds	% of Total	Facility	Pounds	% of Total
Perchloroethylene / Tetrachloroethylene	Phillips 66 LA Refinery Wilmington Plant, Wilmington	230	54%	Tesoro LA Refinery-Carson Operations, Carson	79	18%	Chevron Products Co Div of Chevron USA Inc., El Segundo	76	18%
Ethylene Oxide	Sterigenics-LA Facility, Vernon	220	98%	Solvay USA Inc., Long Beach	5	2%			
Chromium and Chromium Compounds	Chevron Products Co Div of Chevron USA Inc., El Segundo	78	35%	Lockheed Martin Aeronautics Co., Palmdale	45	20%	Tesoro LA Refinery-Carson Operations, Carson	18	8%
Mercury and Mercury Compounds	ExxonMobil Oil Corp - Torrance Refinery, Torrance	91	62%	Tesoro LA Refinery-Carson Operations, Carson	22	15%	Chevron Products Co Div of Chevron USA Inc., El Segundo	15	10%
Chloroform	Phenomenex Inc., Torrance	103	100%						
Ethyl Acrylate	Plaskolite West LLC., Compton	42	100%						
Cobalt and Cobalt Compounds	Ultramar Inc Wilmington Refinery, Wilmington	21	51%	Certified Alloy Products Inc., Long Beach	10	24%	Miller Castings Inc., Whittier	10	24%
Trichloroethylene	IPS Corp., Gardena	36	100%						
1,2-Butylene Oxide	IPS Corp., Gardena	17	100%						
Propylene Oxide	Solvay USA Inc., Long Beach	10	100%						
Arsenic and Arsenic Compounds	Quemetco Inc., City of Industry	1.76	100%						
Hydrazine	Heraeus Precious Metals NA LLC., Santa Fe Springs	0.98	100%						

STATIONARY SOURCE TOXIC EMISSIONS

- Enforcement actions and changes to facility operations contributed to reduced emissions in some cases. Exide and Owens-Brockway Glass Container were the highest emitters of lead in 2014. Exide was permanently closed due to chronic air quality and hazardous materials regulatory compliance issues. The state committed over $175 million to cleanup over 10,000 contaminated residences in proximity to the Exide facility.

Data Limitations

- TRI reporting is required by federal law for facilities that meet all three of the following criteria: (1) be in a specific industrial sector identified in the regulations (e.g., manufacturing, mining, power generation); (2) employ 10 or more full time-equivalent employees; (3) manufacture or process more than 25,000 lbs of a TRI-listed chemical, or otherwise use more than 10,000 lbs of a listed chemical in a given year (except for persistent, bioaccumulative and toxic (PBT) chemicals, which have much lower reporting thresholds). Of the 25 TRI chemicals mentioned in this report, polycyclic aromatic compounds, lead and lead compounds, and mercury and mercury compounds are PBTs. Polycyclic aromatic compounds and lead and lead compounds have 100 lb annual reporting thresholds for each of the above activities; whereas mercury and mercury compounds have a 10 lb reporting threshold.
- TRI regulations do not require facilities to conduct any additional monitoring beyond what is required by other regulations.
- For some chemicals in some reporting years, values shown differ from those shown in the previous Report Card. This may be due to revisions to the TRI data based on EPA or facility corrections of information reported in previous years.

INDICATOR • ASTHMA-RELATED EMERGENCY DEPARTMENT VISITS AND HOSPITALIZATIONS

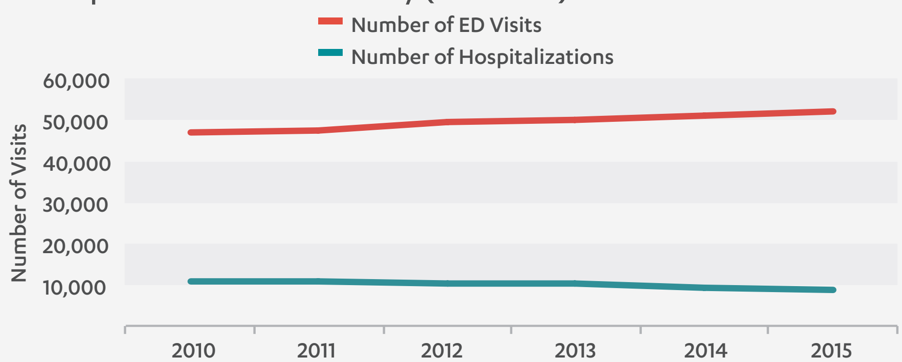
Introduction

Several recent systematic and comprehensive literature reviews found that asthma in children is exacerbated by exposure to traffic-related air pollutants,[146,147,148] and confirmed the association between air pollutants and significantly increased risks of asthma emergency department visits and hospitalizations.[149] Air pollutants of concern include particulate matter (particularly diesel exhaust particles), nitrogen oxides, ozone, carbon monoxide, volatile organic compounds, and other hazardous air pollutants.

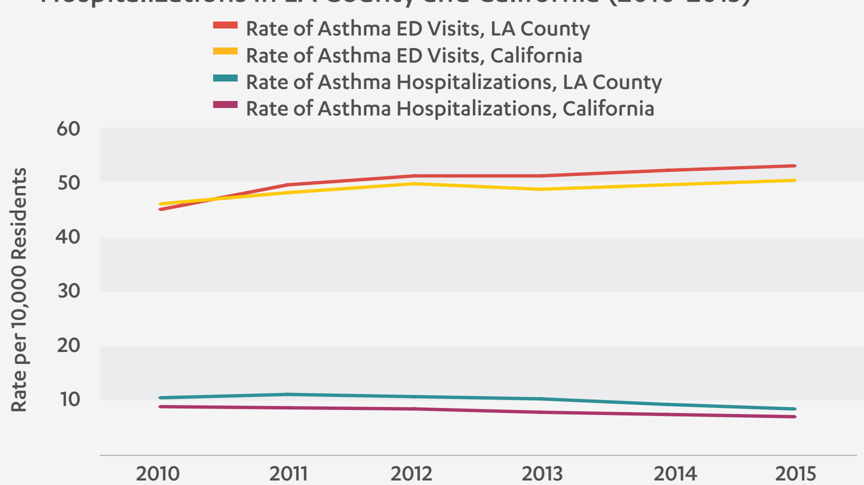
Data

We used data from California Breathing, a program of the California Department of Public Health's Environmental Health Investigations Branch working to implement the Strategic Plan for Asthma in California.[150] They use the number of annual emergency department and hospitalization visits from the Office of Statewide Health Planning and Development to calculate age-adjusted rates (per 10,000 residents) of asthma-related visits based on a primary diagnosis.[151]

Number of Asthma-Related Emergency Department (ED) Visits and Hospitalizations in LA County (2010-2015)



Rate* of Asthma-Related Emergency Department (ED) Visits and Hospitalizations in LA County and California (2010-2015)



*Age-adjusted rate per 10,000 residents

Findings

Emergency Department Visits:

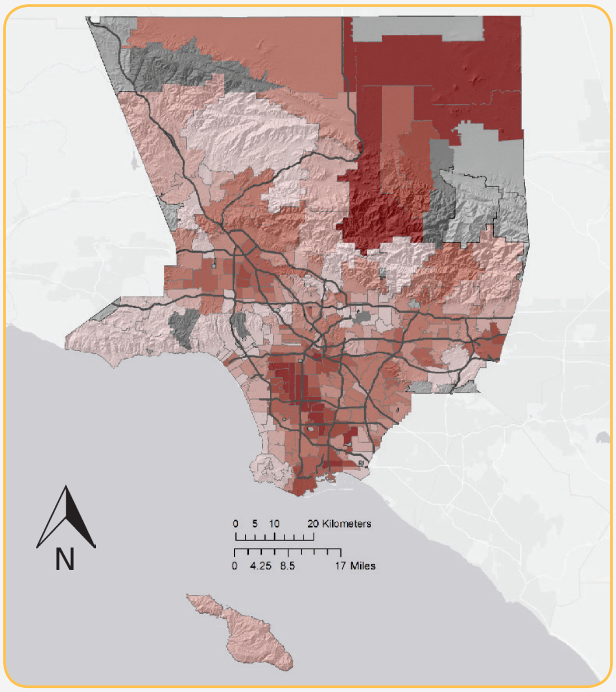
- In 2015, there were 52,227 asthma-related emergency department (ED) visits in LA County, which represents a countywide age-adjusted rate of 53 per 10,000 residents.
- Between 2010 and 2015, the total number of asthma-related ED visits rose by 11% and the age-adjusted rate per 10,000 residents rose by 18%; this is twice as much as the statewide rate increase.
- LA County's annual rate of ED visits was lower than the statewide rate in 2010, but surpassed the state's rate each year since, and ranked 25th highest of the 58 counties in age-adjusted rate of ED visits due to asthma in 2014.[152]
- In 2015, asthma ED visits disproportionately impacted children of all ages (0-17 years) in LA County, for whom rates were more than twice as high as for adults in all age groups.
- The spatial distribution of rates of asthma-related ED visits showed particularly high impacts in zip codes in northeast LA County, and in south LA County areas around dense transportation corridors. The highest rates (115-134 ED visits per 10,000 residents) were more than twice as high as the county average, and were at least five times as high as rates in the least impacted zip codes.

Hospitalizations:

- In 2015, there were 8,544 asthma-related hospitalizations, or an age-adjusted rate of 8.5 per 10,000 residents.
- From 2010 to 2015, the total number of asthma-related hospitalizations dropped by 21% and the age-adjusted rate per 10,000 residents dropped by 19%, which was slightly less than the statewide rate decrease of 22%.
- LA County's annual rate of hospitalizations was consistently higher than that of California as a whole since 2010, and LA County ranked seventh-highest in the state for age-adjusted rate of hospitalizations due to asthma in 2014.[153]
- The age breakdown for asthma-related hospitalizations differed from those of ED visits. Hospitalization impacts were concentrated among very young children (ages 0-4 years) and older adults (65+); these groups had rates two- to three-times as high as the rest of the population.

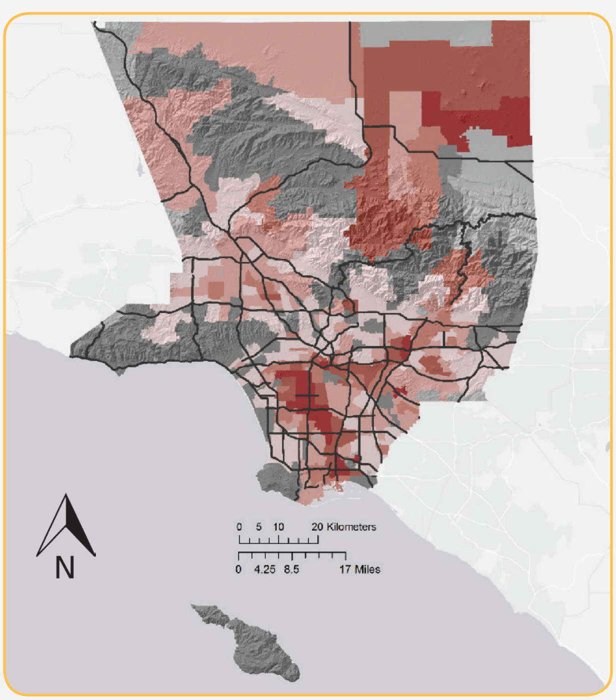
ASTHMA-RELATED EMERGENCY DEPARTMENT VISITS AND HOSPITALIZATIONS

Age-Adjusted Rate of Asthma-Related Emergency Department Visits per 10,000 Residents by Zip Code in LA County (2015)



Age-Adjusted Rate of Asthma ED Visits per 10,000 Residents
- 99 - 135
- 77 - 99
- 60 - 77
- 45 - 60
- 34 - 45
- 23 - 34
- 6.9 - 23
- Data Not Available
- Insufficient Data
- LA County Freeways

Age-Adjusted Rate of Asthma-Related Hospitalizations per 10,000 Residents by Zip Code in LA County (2015)



Age-Adjusted Rate of Asthma Hospitalizations per 10,000 Residents
- 17 - 33
- 13 - 17
- 10 - 13
- 6.8 - 10
- 2.7 - 6.8
- Data Not Available
- Insufficient Data
- LA County Freeways

Asthma-Related Emergency Department Visits in LA County (2015)

	Age	Number of ED Visits Due to Asthma	Age-Adjusted Rate (per 10,000 residents)
Children	0-4	6,693	98.7
	5-17	13,847	85.0
Adults	18-64	26,914	41.2
	65+	4,773	38.8
Totals:	All Ages	52,227	53.1

Asthma-Related Hospitalizations in LA County (2015)

	Age	Number of Hospitali-zations Due to Asthma	Age-Adjusted Rate (per 10,000 residents)
Children	0-4	1,276	18.7
	5-17	1,363	8.4
Adults	18-64	3,635	5.4
	65+	2,270	18.7
Totals:	All Ages	8,544	8.5

- Similar to the spatial distribution of ED visits, rates of asthma-related hospitalizations were particularly high in northeastern zip codes, and in south and southeast LA County areas around dense transportation corridors. The highest rates (17-33 hospitalizations per 10,000 residents) were 2-4 times as high as the county average, and were at least six times as high as rates in the least impacted zip codes.

Overall:
- While there appear to be only small differences between LA County and California rates, an assessment at this spatial scale masks underlying details and points to the importance of assessing spatial distributions at the zip code level. Our maps were consistent with CalEnviroScreen data that show a high number of census tracts in LA County scoring in the highest percentile in the state for asthma rates. There are clearly dramatic asthma rate inequities in certain parts of LA County, including the Antelope Valley and the corridor from south LA to the port complex.

Data Limitations

- Rates of emergency department visits and hospitalizations only represent a portion of asthma-related impacts. Overall asthma rates, days of school missed due to asthma, and medication use are just some of the other health and societal impacts.
- Changes in the rates of asthma cases may be due to factors unrelated to air quality.

HIGHLIGHT

Urban Heat Island

The term urban heat island (UHI) refers to the phenomenon of higher ambient temperatures in urban areas compared to rural areas. UHI is caused by several primary factors: (1) high absorption of solar radiation by urban structures (buildings, paved roads); (2) reduced cooling through evapotranspiration by vegetation; and (3) anthropogenic heat produced by dense populations. Heat produced by energy use is a significant contributor to UHI, which can in turn increase energy consumption as people use more air conditioning to maintain thermal comfort. UHI increases ground level air pollution and can lead to greater rates of heat-related illness, hospitalizations, and mortality. Increased nighttime temperatures are a key characteristic of the UHI effect and are associated with negative health outcomes, but some mitigation measures targeted at reducing nighttime temperatures may also result in increased daytime temperatures in the near-surface zone.[154] Urban greening is an approach to UHI mitigation that can also achieve air quality and social co-benefits. Vegetative approaches to offsetting UHI will have implications for water use, and therefore multiple endpoints must be assessed to fully understand the outcome of mitigation measure. The increasing use of recycled water for park irrigation is an important step to address this concern. Many efforts already underway, such as increased energy efficiency in buildings, cool roofs, and electric vehicle usage, will contribute to a reduction in UHI. An upcoming review paper by UCLA's California Center for Sustainable Communities will identify critical considerations for policy makers around UHI mitigation (Ricklefs et al., in work).

grade C

for air quality & human health impacts

The 2015 ERC assessed ambient air quality and stationary source toxic emissions through 2013. Since that time, the region experienced a severe drought that undoubtedly impacted air quality. Ozone and PM levels are up, and in some areas like Riverside and San Bernardino Counties, and the San Gabriel Valley in LA County, they are at levels of critical concern. With regard to toxic emissions, there were some improvements in lead emissions that were accompanied with a state investment in cleanup. However, there are growing concerns with chromium-6 emissions in Paramount, and TRI-reported emissions trends for many contaminants are up, with the biggest polluters concentrated in the southwest part of the County. As such, concerns remain with respect to local impacts of toxic emissions from manufacturing facilities and the effectiveness of state and local agencies in monitoring and regulating these emissions.

We explored the impact of air quality and other emissions on human health by looking at asthma-related trips to the hospital and found that emergency department visits increased between 2010 and 2015, while hospitalizations for asthma slightly decreased. Although the downward trend of asthma-related hospitalizations is positive, the concurrently rising number of asthma-related emergency visits suggests that asthma cases overall are not necessarily decreasing, and that patients may be seeking treatment in different ways, although there are additional complex factors that contribute to people becoming hospitalized. These visits and hospitalizations disproportionately impacted children and the elderly, and occurred more often in residents living in lower income communities near traffic arteries, and in valleys and areas of the basin impacted by higher temperatures and the urban heat island effect. The increases in emergency visits and hospitalization are both higher in LA County compared to the state as a whole. It is important to note that asthma isn't the only consequence of poor air quality. Recent research shows that PM2.5 and combinations of NO2, NO, and PM2.5 impact birth weight in LA County.[155,156] Air quality also impacts the heart, overall lung function, and other birth outcomes.

The region has made unquestionable progress over the past 40 years on air quality, with impressive reductions in diesel particulates and other toxins. Just recently, SCAQMD passed a $16 billion smog-reduction plan to further reduce emissions in the region, but unfortunately the plan does not impose targeted regulations for ports, warehouses, and rail yards, which are some of the biggest polluters.[157] Implementation of the plan requires further approval by CARB and the EPA, as well as money to pay for it. These efforts could not come soon enough, because the reality is that the LA basin is still the smoggiest region in the nation. The air quality challenges that the region faces are exacerbated by climate change.[158] And a recent investigation showed that housing development around LA County freeways is on the rise despite evidence that living within 1000 feet of these roadways is harmful to your health.[159] In order to ensure social and environmental justice for all of the County's inhabitants, the region must ramp up efforts to reduce toxicity and particulate emissions from all sources, with targeted efforts in areas that have been disproportionately affected. Overall, we need more protective policies, stricter enforcement of regulations, better monitoring and reporting, and more research on the cumulative effects of toxic exposure on human health and wellbeing.

Overall Conclusions

Despite Los Angeles County's C student status, there is reason for optimism in the quest to make Los Angeles the world's first sustainable megacity. The historic passage of Measure M will provide $120 billion in funding to help transform the region's transportation infrastructure. In addition, the recent passage of the 12-cent gas tax (SB 1, Beall, 2017) will provide $52 billion for California's transportation needs over the next decade. As a result of this unprecedented influx of funding, Los Angeles County has an opportunity to utilize these funds to transform the region to a low carbon, multi-mobility transportation infrastructure. Continued innovation in affordable, longer range, electric vehicles, such as the Chevrolet Bolt and the long-awaited Tesla Model 3, as well as the addition of efficient and/or electric autonomous vehicles from the ride sharing industry could accelerate the region's transition to a decarbonized transportation future. As a result of this transition, air quality could improve dramatically, especially for those residents and workers adjacent to highly used transportation corridors.

Continued progress towards a higher percentage of renewable energy is required because of the passage of SB 350 (de León, 2015), which mandates that by 2030 at least half of the state's electricity must come from renewable energy sources; and that energy efficiency savings in buildings must double. Furthermore, the recent unanimous approval of the Los Angeles Community Choice Energy program by the LA County Board of Supervisors, which includes $10 million in funding to launch the program, means that the County may see an even quicker transition to a higher percentage of renewable energy. However, significantly more investments must be made in energy storage to better integrate renewables into the grid and eliminate the need for natural gas peaker power plants.

Compliance with SB 1383 (Lara, 2016) will result in a 50% reduction in emissions of black carbon and a 40% reduction in methane and hydrofluorocarbons emissions by 2030. Continued progress towards greening the ports and replacing diesel engines with electric engines or renewable gas powered, ultra-low emissions engines will greatly improve air quality in some of the most polluted areas of the basin. Unfortunately, the recent gas tax legislation provides a loophole for diesel trucks so that they will not be required to make this transition any time soon, which will result in a major air quality setback. As such, continued vigilance to ensure this transition occurs quickly, and that the region's controversial Air Quality Management Plan (2017) results in Clean Air Act standards attainment for ozone and particulate matter is necessary to meet Sustainable LA goals for 100% renewable energy and enhanced human health.

Major challenges lie ahead to dramatically improve energy, GHG emissions, and air quality in a number of key areas. Because of tough energy efficiency requirements in Title 24 and the associated zero net energy (ZNE) requirements for new buildings, there will be major reductions in energy use and GHG emissions from buildings constructed in the coming decades. However, until there are far more effective incentives to retrofit existing buildings to energy efficiency, the pace of energy use and GHG reductions from buildings will be moderate. Current retrofit programs, like the PACE program and even Proposition 39, are too small to be truly transformative. The UCLA Energy Atlas will continue to be an essential tool to track energy use and inform related investments and policies.

Another major impediment will be to reduce consumption of gasoline and natural gas. There has been only minimal progress in the reduction of fossil fuel consumption despite the proliferation of distributed solar, increased mileage in newer cars, and an increase in the numbers of electrified vehicles. And more regulatory and monitoring resources are needed to achieve a major reduction in toxics emissions throughout LA County.

The good news is that since UCLA launched the Sustainable LA Grand Challenge in 2013, regulatory changes have almost exclusively favored a transition to lower carbon cities, lower carbon transportation, and improved air quality. In addition, California and the Los Angeles region are investing heavily in these areas and innovative companies are providing numerous transportation, renewable energy, storage, and efficient technologies that will enable this transformation to occur more easily. However, this 2017 Sustainable LA Energy & Air Quality Environmental Report Card demonstrates that despite the promise of progressive regulations, unprecedented investments, and innovative technologies, LA County has a long way to go before becoming an A student.

CONCLUSIONS

ABOUT THE UCLA SUSTAINABLE LA GRAND CHALLENGE

In 2013, Chancellor Gene Block announced UCLA's premier Grand Challenge – the Sustainable LA Grand Challenge,[160] *Thriving in a hotter Los Angeles* – to address the societal problem of urban sustainability in the 21st century. UCLA Grand Challenges are novel approaches to university research in that the research is organized around addressing a single ambitious goal. Sustainable LA aims to transform Los Angeles County to the first sustainable megacity though multidisciplinary team building, facilitating collaborations, producing game-changing work, and creating and fostering partnerships across sectors and in the community.

The Sustainable LA Grand Challenge was developed in response to the challenges posed by the regional-specific effects of climate change, combined with an increasing urban population in Los Angeles County. UCLA research predicts a hotter Los Angeles with more frequent and dangerous heat waves, increased wildfire risk, and less snowpack to feed the region's local water supplies.[161] At the same time, the County will absorb an estimated 1.5 million more residents by 2050 and must determine a pathway to provide this growing population with reliable energy and water, and an environment that will enhance their health and well-being. Sustainable LA aims to address these challenges by capitalizing on UCLA's research strengths to develop a blueprint for transitioning Los Angeles County to **100% renewable energy, 100% local water, and enhanced ecosystem and human health by 2050** in a way that will secure the County's long-term welfare and economic prosperity while preserving its cultural identity.[162]

UCLA has more than 180 faculty and researchers from across disciplines who have expressed interest and are involved in the research necessary to inform a sustainability implementation plan for Los Angeles County by 2020 that will be developed together with local and state government, businesses, community groups, non-government agencies, and other stakeholders. The Sustainable LA Grand Challenge will strengthen partnerships with stakeholders and galvanize the next generation of sustainability leaders committed to improving the region's environment, economy and social equity – serving as a model for other universities and urban areas around the globe.

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