
NEXT 10
2016
California Green Innovation Index
8th edition

Next 10's **CALIFORNIA GREEN INNOVATION INDEX** tracks the state's progress in reducing greenhouse gas (GHG) emissions, spurring technological and business innovation, and growing businesses and jobs that enable the transition to a more resource-efficient economy. The 2016 Index is the eighth edition published by Next 10.

Next 10 is an independent, nonpartisan organization that educates, engages and empowers Californians to improve the state's future.

Next 10 was founded in 2003 by businessman and philanthropist F. Noel Perry. Next 10 is focused on innovation and the intersection between the economy, the environment, and quality of life issues for all Californians.

For more information about the **CALIFORNIA GREEN INNOVATION INDEX,** please visit www.next10.org.

www.next10.org

NEXT 10

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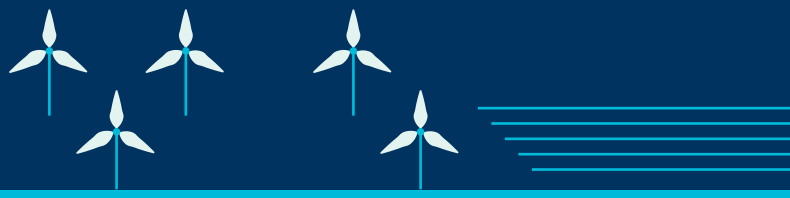
GDP

Gross domestic product
(inflation-adjusted to 2014 dollars)

$2.3 2014 Trillion

2.1% 1990–2014 Average annual growth

$59,589 2014 Per capita GDP



California's Carbon Economy

1.91 2014 **3.09** 1990

Million metric tons of CO_2 equivalent/
Inflation-adjusted GDP

Population

39 2014 Million

1.0% 1990–2014 Average annual growth rate

California Emissions

TOTAL GHG EMISSIONS

441.5 2014[1] **444.3** 2013

Million metric tons of CO_2 equivalent

0.08% 1990–2014 Average annual growth

-0.62% 2013–2014 One year growth

PER CAPITA GHG EMISSIONS

11.38 2014 Metric tons of CO_2 equivalent

TARGETS TOTAL GHG EMISSIONS

431 BY 2020 Million metric tons of CO_2 equivalent

259 BY 2030 Million metric tons of CO_2 equivalent

86 BY 2050 Million metric tons of CO_2 equivalent

Population Data Source: California Department of Finance.

Gross Domestic Product Data Source: Bureau of Economic Analysis.

Greenhouse Gas Data Source: California Air Resources Board, "2016 California Greenhouse Gas Inventory – by Sector and Activity." California Department of Finance.

Carbon Economy: California Air Resources Board, "2016 California Greenhouse Gas Inventory – by Sector and Activity." Bureau of Economic Analysis.

JUNE 2016

Dear Californians,

Which of California's metro regions generates the most industrial-scale solar energy? Which region is number one for residential and commercial solar power? The answers—Fresno and Riverside/San Bernardino/Ontario, respectively—show that clean technology leaders are not only concentrated in areas traditionally thought of as enclaves of innovation, but are at work in every corner of our state.

That's one reason Next 10's eighth edition of the *Green Innovation Index* finds California driving the adoption and implementation of innovative policies designed to decouple economic growth from carbon emissions, while looking beyond its borders to form global partnerships and lead efforts to limit climate change.

In 2015, California spearheaded the Under 2 MOU, an international agreement to cut emissions and limit the increase in global average temperature to below 2 degrees Celsius. As of this writing, the agreement includes a total of 135 jurisdictions, representing 32 countries, six continents, and more than a quarter of the global economy. California also enacted policies at the forefront of national and global climate efforts. SB 350, for example, raises the state's Renewable Portfolio Standard to 50 percent by 2030 and sets a progressive goal to double the rate of energy efficiency savings throughout the economy by 2030. California's energy efficiency codes and standards are estimated to have saved Californians billions of dollars over the past forty years, and SB 350's new efficiency goals will continue to incentivize energy savings.[2]

The state reached 20.1 percent of total electricity from renewables in 2014, compared to 6.8 percent for the U.S. Solar is reaching new heights. In 2015, the state installed more solar capacity than any other state with nearly nine times more solar PV interconnected in 2015 than 2009. California's power mix saw 1,378 percent more energy from solar in 2014 compared to 2009.

California continues to develop and test new clean technologies and business models. The state dominates U.S. clean technology patents, and received more than two-thirds of total U.S. clean technology venture capital investment in 2015.

California's carbon intensity improved as the state released fewer emissions per GDP, GDP increased, and emissions per person continued to decline in 2014. Internationally, California continues its leadership year over year in carbon intensity, ranking the 2nd least carbon-intensive among the world's 50 highest emitters. The three least carbon-intensive economies in the world, France, California and Italy, all saw a reduction in emissions per GDP in 2013.

While transportation continues to account for more than a third of the state's emissions, the growing number of vehicles in the state no longer serves to drive up California's GHG emissions. In 2014, surface transportation emissions dropped even though total vehicle registrations in the state increased. In 2014, zero-emission vehicle registrations doubled over the previous year.

The 2016 *California Green Innovation Index's* regional scorecards detail how our regions play a pivotal role in the state's clean technology success. Places not often thought to be clean technology pacesetters are clean-energy leaders. The aforementioned Riverside/San Bernardino region, for example, not only boasts the most commercial and residential solar installations in California, but also places in the top five regions in the state for the number of EV rebates given out, and ranks number six for clean technology patent filings. These regional trends and statewide policies continue to drive progress in mitigating climate change—and show other states and nations that a cleaner and more prosperous future is possible.

Sincerely,

F. Noel Perry

F. Noel Perry, *Founder*

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At A Glance

CARBON ECONOMY

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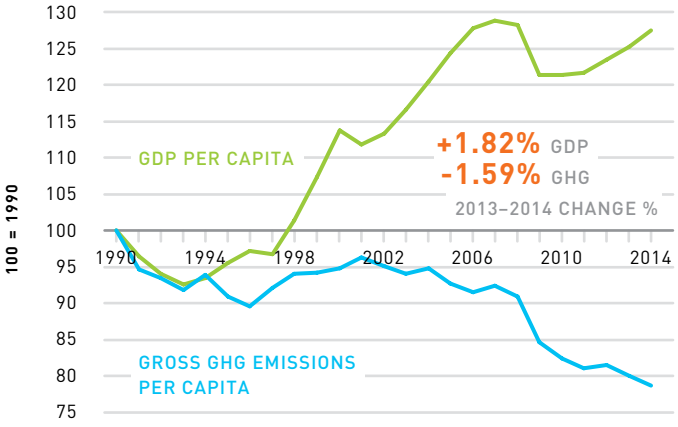
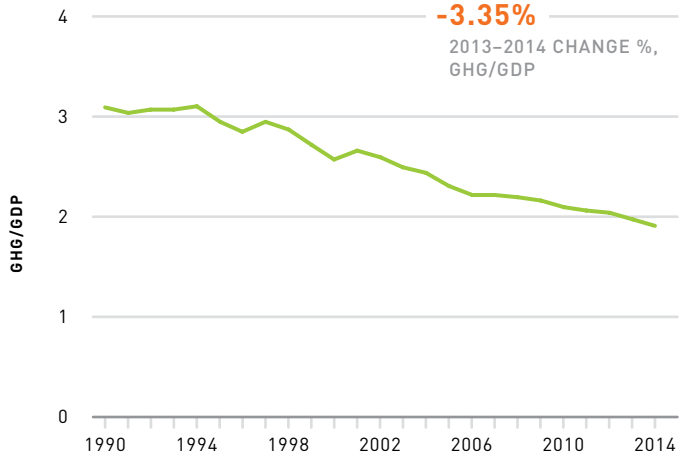
GDP & EMISSIONS
CALIFORNIA



NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Data Source: California Air Resources Board, California Greenhouse Gas Inventory – by Sector and Activity; Bureau of Economic Analysis, U.S. Department of Commerce. NEXT 10 / SF · CA · USA

CARBON ECONOMY
CALIFORNIA



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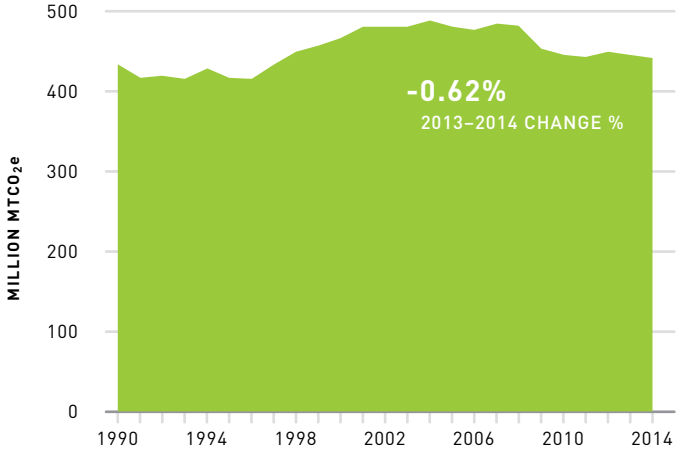
GHG EMISSIONS
CALIFORNIA



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RENEWABLE ENERGY

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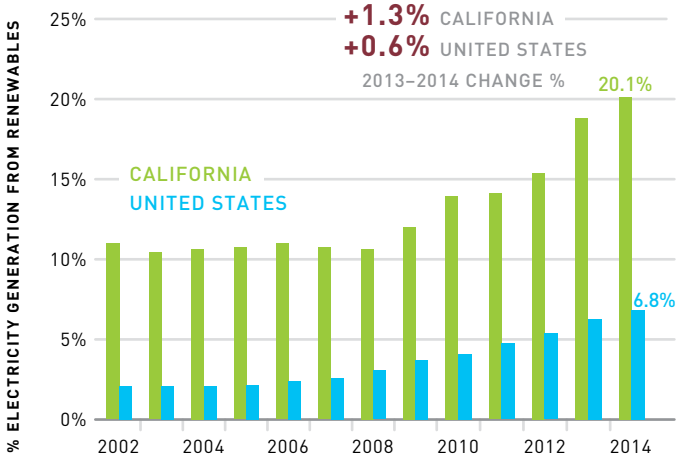
RENEWABLES



NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Data Source: California Energy Commission; Energy Information Administration. NEXT 10 / SF · CA · USA

Acronyms and Terms

BTU: British Thermal Unit (traditional unit of energy)

CA: California

Carbon intensity: Emissions relative to gross domestic product

Emissions per capita: Emissions per person, also known as carbon footprint

TRANSPORTATION

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ALTERNATIVE FUEL AND ZERO EMISSIONS VEHICLE REGISTRATIONS

CALIFORNIA

	% CHANGE 13–14	% CHANGE 12–14
ELECTRIC	93.4%	114.8%
PLUG-IN HYBRID	100.9%	549.5%
NATURAL GAS	13.4%	-12.9%
HYBRID	15.6%	37.8%
HYDROGEN	8.7%	7.4%
TOTAL ALTERNATIVE FUEL VEHICLES	18.7%	43.3%
TOTAL ZEV	97.3%	243.9%
TOTAL VEHICLES	2.3%	0.8%

NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Note: Zero Emission Vehicles include electric, plug-in hybrid, and hydrogen vehicles. Data Source: California Energy Commission.
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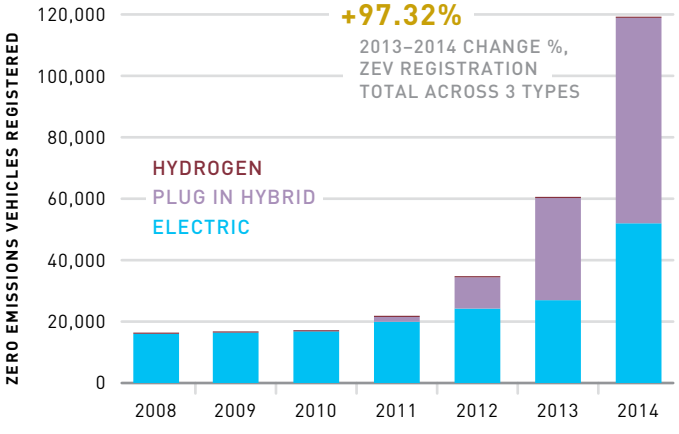
TRENDS IN TOTAL ZERO EMISSION VEHICLE REGISTRATION

CALIFORNIA



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CLEAN TECHNOLOGY INNOVATION

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TOTAL CLEAN TECHNOLOGY PATENT RANKING

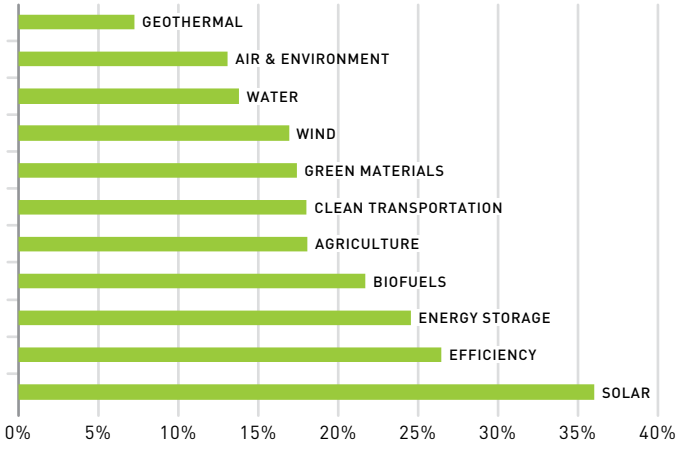
TOP RANKING STATES IN 2015

RANK	STATE	NUMBER OF PATENTS
1	CALIFORNIA	4,052
2	NEW YORK	1,215
3	TEXAS	1,172
4	MICHIGAN	1,150
5	ILLINOIS	800
6	MASSACHUSETTS	768
7	PENNSYLVANIA	683
8	FLORIDA	647
9	WASHINGTON	603
10	OHIO	574

NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Data Source: IP Checkups, CleanTech Patent Edge. NEXT 10 / SF · CA · USA

CALIFORNIA % OF U.S. PATENTS

2013–2015



NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Data Source: IP Checkups, CleanTech Patent Edge.
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GDP: Gross Domestic Product

GHG: Greenhouse Gas Emissions

GW: Gigawatt

IPO: Initial Public Offering

kWh: Kilowatt Hour

M&A: Merger and Acquisition

MOU: Memorandum of Understanding

$MTCO_2e$: Metric Tons of Carbon Dioxide equivalent

MW: Megawatt

U.S.: United States

The Carbon Economy

Why is it Important?

The global economy has traditionally been tethered to carbon-based energy sources, however, recent evidence indicates a shift in emissions from carbon-based energy sources. In 2015, energy-related carbon dioxide emissions in the U.S. were down 12 percent below their 2005 levels.[3] This nationwide drop was due in large part to changes in the electric power sector shifting away from coal and towards less carbon-intensive fuels. U.S. CO_2 emissions from the electricity sector fell significantly in 2015, reaching the lowest level since 1993.

California is leading the charge toward a new economic model by implementing innovative carbon reduction policies and driving technology innovation to reduce greenhouse gas (GHG) emissions, produce clean, cost-effective energy and increase energy efficiency. In California, there is a changing relationship between economic vitality and environmental quality. Statewide policy incentivizes both business innovation and problem solving. While there is still work to be done to meet the state's emission reduction goals, California provides a strong template for sustainable economic growth.

Carbon Economy Indicators

California ranks among the most efficient and least carbon-intensive economies in the world. California's emissions per dollar of gross domestic product (GDP) dropped by 39 percent between 1990 and 2013, meaning that for the same amount of economic activity, the state released significantly fewer emissions. In 2013, California was the fourth least carbon-dependent state economy in the U.S. behind only New York, Connecticut and Massachusetts.

In 2013, $10,000 of economic activity in the U.S. (excluding California) resulted in 3.35 metric tons of CO_2 equivalent ($MTCO_2e$) produced. In California, the same $10,000 of economic activity resulted in only 1.57 $MTCO_2e$ produced—roughly 47 percent less than the rest of the nation. California's economy was less carbon-dependent than the national average, as well as other large states, as illustrated in Figure 3.

California's emissions from energy consumption were comprised of 62 percent petroleum use, 37 percent natural gas and one percent coal in 2013.[4] California's lack of coal use is in stark contrast to comparable states where coal continues to contribute to a sizable percentage of energy-related emissions, such as Ohio (45%), Pennsylvania (43%), and Illinois (42%). While California's coal consumption emissions are low, the percentage of California's energy-related emissions driven by petroleum remains at the top of the pack. In 2013, 62 percent of energy-related emissions in California were produced by extracting, refining and burning petroleum, compared to 47 percent in Florida, 44 percent in Texas, and 33 percent in Illinois.

California's energy profile and its emissions sources are changing and evolving in part due to everything from climate policy to energy markets to Mother Nature.

Greenhouse gas emissions per capita in California were 11.38 $MTCO_2e$ per person in 2014, a 1.6 percent drop from the previous year. Emissions per capita were down 2.9 percent from 2011–2014 and were down 21.3 percent from 1990 to 2014. This continued improvement in per capita GHG emissions occurred while the California economy expanded, with GDP per capita up 27.5 percent since 1990.

California continues to provide evidence that economic growth does not require a growth in GHG emissions. There continues to be a steady decline in the carbon intensity (emissions per GDP) of the California economy, with total emissions (i.e. from

energy and other sources) of 1.91 $MTCO_2e$ per $10,000 of GDP generated in 2014; dipping below 2.00 for the first time. Emissions per GDP in 2014 were down 3.4 percent from 2013 and down 7.3 percent since 2011. From 1990 to 2014 California achieved a 36 percent drop in emissions per GDP.

Total GHG emissions in California fell slightly in 2014 compared to 2013, down 0.62 percent to 441.5 million $MTCO_2e$—this is after a slight increase of 1.5 percent between 2011 and 2012. The recent changes are in part attributable to shifts in the sources of power in the state over the past five years. Ongoing drought conditions since 2011 have precipitated the continued decline of large hydroelectric power generation in the state. Large hydroelectric generation decreased significantly, down 36 percent in 2012 and another 10 percent in 2013. Hydropower provides an emissions-free energy source for Californians and when there is a low availability of hydroelectric power, it is often replaced by electricity from natural gas, though more recently is increasingly coming from renewables such as wind and solar. In 2012, Southern California Edison permanently ceased operations at the San Onofre Nuclear Generation Station (SONGS), cutting 2,200 MW of emissions-free electricity out of the power grid. Despite these fluctuations, the state is on track to meet its 2020 target of reaching 1990 emissions levels.[5]

The transportation sector continued to account for the largest portion (36.9%) of California's greenhouse gas emissions, followed by the industrial (23.6%) and electric power (20.0%) sectors. The California Air Resources Board (ARB) collects GHG emissions data by direct source of emissions rather than by end-user.

→ California Raises the Bar Yet Again in 2015

April 2015: Executive Order B-30-15

Executive Order B-30-15 sets a "midterm" GHG emissions target for 2030, in advance of achieving the 2050 goals put in place by then Governor Schwarzenegger in 2005 with Executive Order S-3-05. California's policies set a progressively higher bar, including:

- 2020: CA returns to 1990 emissions levels
- 2030: CA 40% below 1990 emissions levels
- 2050: CA 80% below 1990 emissions levels

October 2015: SB 350 Clean Energy and Pollution Reduction Act of 2015

SB 350 sets California on a sustained path to clean energy by raising the Renewable Portfolio Standard (RPS) to 50% by the year 2030. For municipal utilities, the CA Energy Commission will oversee implementation and for private utilities the CA Public Utilities Commission will be responsible for regulation. SB 350 also doubles current energy efficiency goals for homes, businesses and factories by 2030 and calls on electric corporations to increase the infrastructure and access to electricity as a transportation fuel in order to promote widespread transportation electrification.

TABLE 1. NATIONAL CARBON ECONOMY RANKING

LOWEST CARBON ECONOMY (EMISSIONS/GDP)

STATE	2013	2012	1990
NEW YORK	1	1	3
CALIFORNIA	4	4	4
FLORIDA	16	18	16
ILLINOIS	23	21	15
PENNSYLVANIA	30	29	32
OHIO	31	30	33
TEXAS	32	32	41

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Transportation 36.9%: Emissions from all transportation sources accounted for 36.9 percent of California's total emissions, up from 36.3 percent of the total in 2013. Almost 70 percent of transportation emissions came from passenger vehicles and 20 percent from heavy-duty trucks. Other sources, including ships and boats, locomotives, off-road vehicles, and domestic (intrastate) aviation, accounted for the remaining ten percent of total transportation emissions.

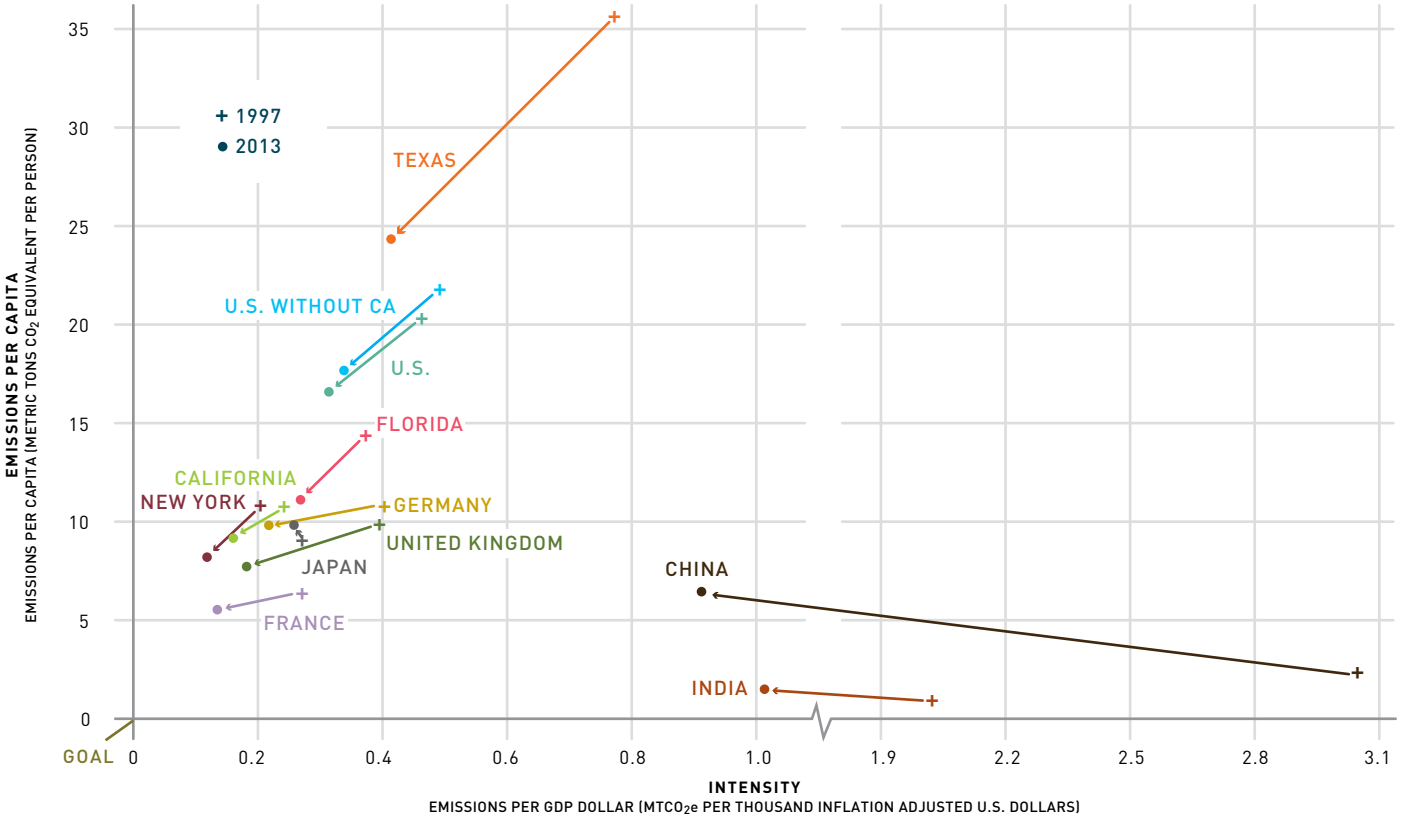
Industrial 23.6%: Industrial activities contributed roughly 24 percent of California's emissions in 2014, up 0.25 percent of the total from 2013. Twenty-eight percent of these emissions came from petroleum refining, with industrial manufacturing (17%) and oil & gas extraction (18%) representing the next largest sources. Other emissions from industrial sources included cogeneration (9%), landfills (8%), cement plants (7%), and wastewater and solid waste treatment (2%).

Electric Power 20.0%: Greenhouse gas emissions related to electricity generation contributed 20 percent to California's total emissions in 2014, down from approximately 20.2 percent of the total in 2013. Of these emissions, in-state electric power generation (including natural gas and other fuels) accounted for 59 percent, while 41 percent was derived from electric power imports.

Agriculture and Forestry 8.2%: Emissions from agriculture & forestry represented roughly eight percent of California's total emissions in 2014, up by just 0.2% from 2013. Livestock emitted 66 percent of total agriculture and forestry emissions. Crop growth and harvesting accounted for 22 percent of emissions, while the remainder (12%) came from other sources such as soil cultivation and agricultural residue burning.

FIGURE 1. GLOBAL FOSSIL FUEL COMBUSTION IN CALIFORNIA AND OTHER REGIONS

CARBON INTENSITY AND EMISSIONS PER CAPITA 1997 TO 2013



NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Note: GDP in Real 2014 U.S. Dollars. Greenhouse gas emissions are from consumption of energy. Data Source: U.S. Energy Information Administration; U.S. Bureau of Economic Analysis, USDA Economic Research Service; U.S. Census Bureau. NEXT 10 / SF · CA · USA

→ Sub-nations Leading Climate Action

On May 19, 2015 Governor Jerry Brown signed the Under 2 MOU agreement alongside leaders from 11 other states and provinces. Under the international agreement, signers set goals to cut emissions and limit the increase in global average temperature to below 2 degrees Celsius, the tipping point scientists warn will cause catastrophic climate impacts.

As of June 12, 2016, there were 135 jurisdictions, representing 32 countries and six continents that have signed or endorsed Under 2 MOU. This group represents more than 783 million people and $21 trillion in GDP.

UK
- City of Bristol
- Greater Manchester
- Scotland
- Wales*

PORTUGAL
- The Azores
- Madeira

SPAIN
- Andalusia
- Basque Country
- Catalonia*
- Navarra

THE NETHERLANDS
- Drenthe
- North Brabant
- North Holland
- South Holland

LUXEMBOURG

FRANCE
- Alsace
- Aquitaine
- The Department of Bas-Rhin
- Midi-Pyrénées
- Pays de la Loire
- Rhône-Alpes

GERMANY
- Baden-Württemberg*
- Bavaria
- Hesse
- North Rhine-Westphalia
- Schleswig-Holstein
- Thuringia

SWITZERLAND
- Basel-Landschaft
- Basel-Stadt

SWEDEN
- Jämtland

ITALY
- Basilicata
- Emilia-Romagna
- Lombardy
- Piedmont
- Sardinia
- Veneto

CZECH REPUBLIC

AUSTRIA
- Lower Austria

HUNGARY
- Budapest

CANADA
- British Columbia*
- Northwest Territories
- Ontario*
- Québec
- City of Vancouver

USA
- City of Austin
- California*
- Connecticut
- City of Los Angeles
- Massachusetts
- Minnesota
- New Hampshire
- New York City
- New York State
- City of Oakland
- Oregon*
- City of Portland
- Rhode Island
- City of Sacramento
- City of San Francisco
- City of Seattle
- Vermont*
- Washington*

CHINA
- Jiangsu Province
- Sichuan
- City of Zhenjiang

JAPAN
- Gifu

MEXICO
- Baja California*
- Chiapas
- Estado de México
- Hidalgo
- Jalisco*
- Mexico City
- Quintana Roo
- Yucatán

COSTA RICA

PANAMA

COLOMBIA
- Guainía
- Guavia

PERU
- Loreto
- San Martín
- Ucayalire

CHILE
- Santiago

BRAZIL
- Acre*
- Amazonas
- Mato Grosso
- Pernambuco
- Rondônia
- City of São Paulo
- State of São Paulo
- Tocantins

NEPAL
- Kathmandu Valley

INDIA
- Telangana

KENYA
- Laikipia County

MOZAMBIQUE
- City of Nampula

AUSTRALIA
- South Australia

SENEGAL
- City of Guédiawaye

NIGERIA
- Cross River State

ASSEMBLÉE DES RÉGIONS ET DISTRICTS DE CÔTE D'IVOIRE

* An asterisk denotes the government is a Founding Signatory

Residential 6.2%: The residential sector comprised 6.2 percent of total emissions in the state in 2014, down 0.9 percent of the total from 2013. Residential sector emissions are largely from combustion of natural gas and other fuels to heat houses and buildings, prepare food, and heat water.

Commercial 4.9%: Emissions from commercial fuel combustion and cogeneration heat output accounted for roughly five percent of emissions statewide in 2014, or virtually unchanged from 2013. The vast majority of these emissions were from combustion of natural gas and other fuels for uses such as heating buildings.

High Global Warming Potentials (GWP) 0.18%: High GWP not incorporated into other categories, as well as unclassified fugitive greenhouse gas emissions, made up well below one quarter of one percent of California's total in 2014, unchanged from 2013. These emissions came largely from evaporative losses of chemicals and solvents.

FIGURE 2. GREENHOUSE GAS EMISSIONS BY SOURCE

CALIFORNIA, 2014

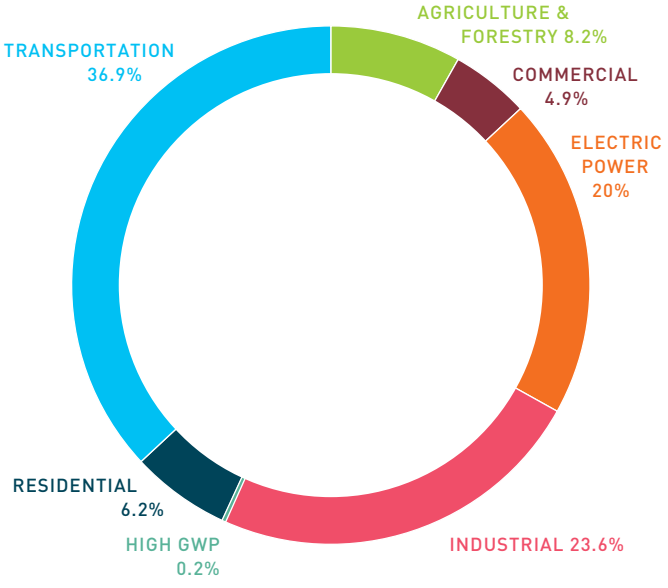


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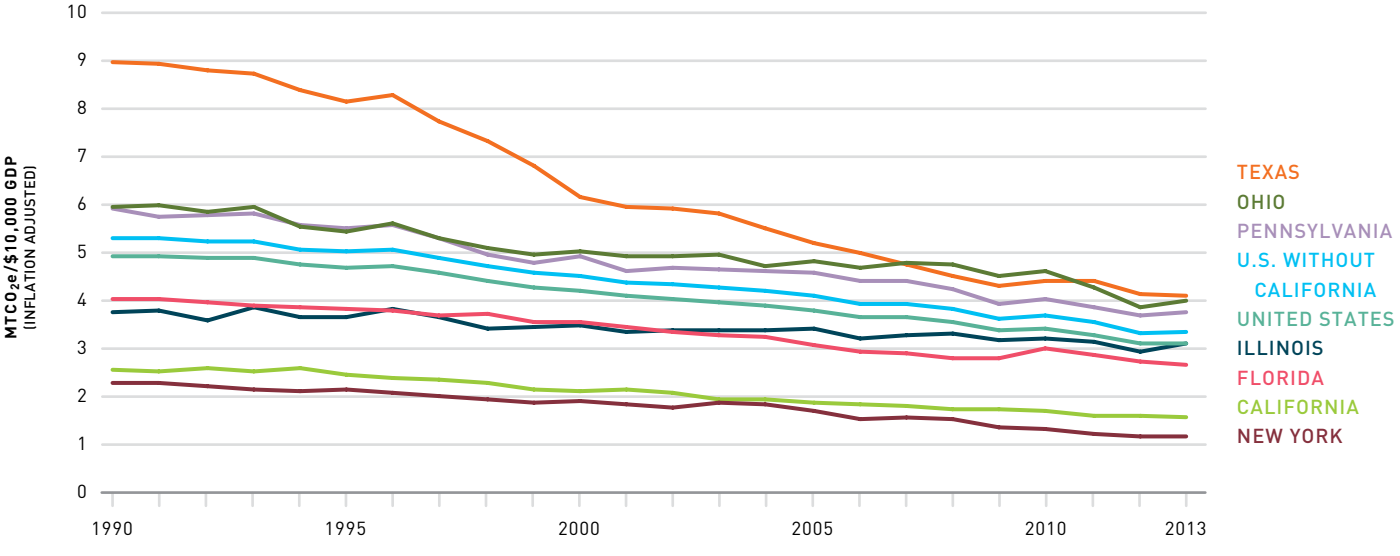
FIGURE 3. THE CARBON ECONOMY IN CALIFORNIA AND OTHER STATES – CARBON EMISSIONS

(METRIC TONS) PER 10,000 DOLLARS GDP (2014 DOLLARS)



NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Data Source: Energy Information Administration, U.S. Department of Energy; Bureau of Economic Analysis, U.S. Department of Commerce.
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FIGURE 4. GREENHOUSE GAS EMISSIONS AND GROSS DOMESTIC PRODUCT

CALIFORNIA RELATIVE TRENDS SINCE 1990: GREENHOUSE GAS EMISSIONS ($MTCO_2e$) AND GDP DOLLARS, PER CAPITA

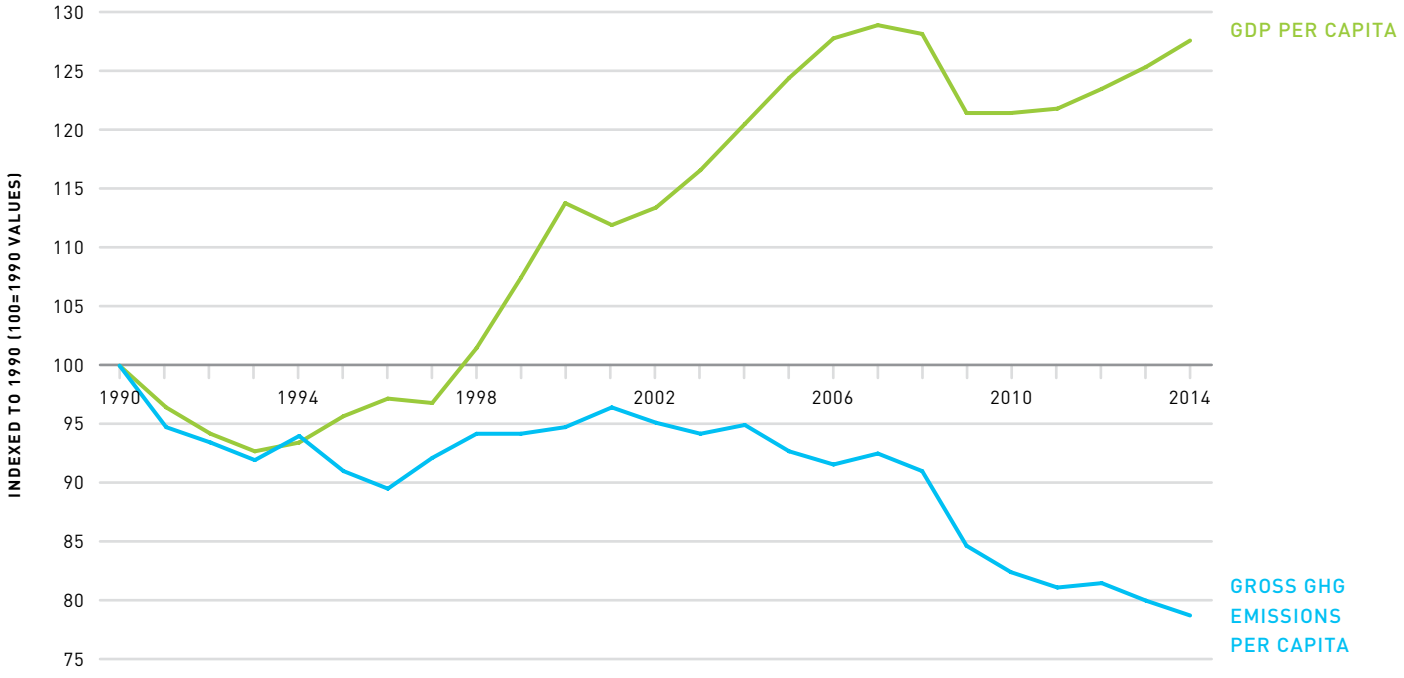

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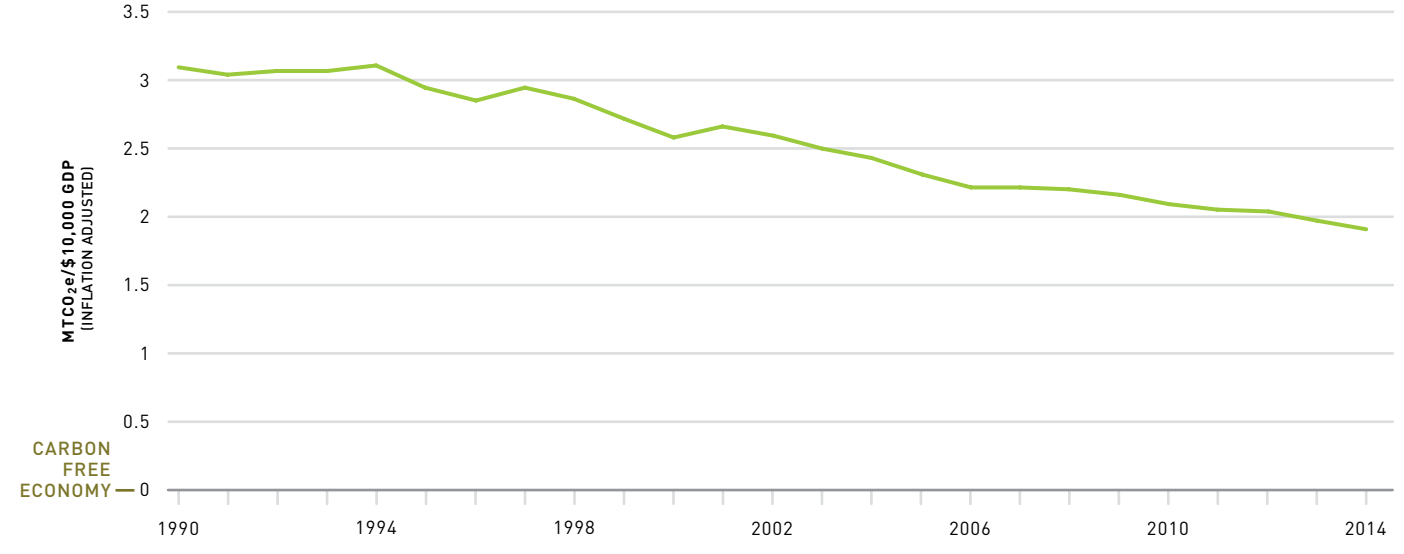
FIGURE 5. THE CARBON ECONOMY

GROSS EMISSIONS RELATIVE TO GROSS DOMESTIC PRODUCT, CALIFORNIA



NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Data Source: California Air Resources Board, California Greenhouse Gas Inventory – by Sector and Activity; Bureau of Economic Analysis, U.S. Department of Commerce. NEXT 10 / SF · CA · USA

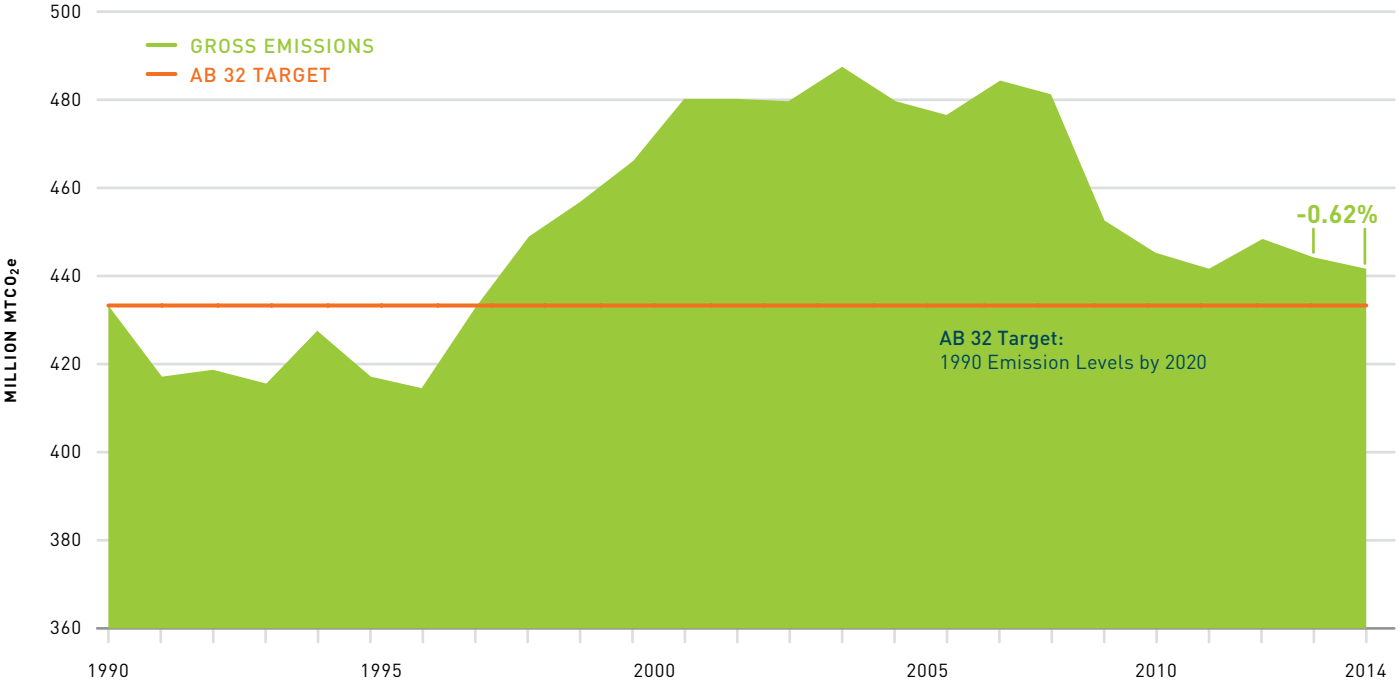
→ Aliso Canyon

SoCal Gas reported a leak at its natural gas storage facility at Aliso Canyon in Los Angeles County in October 2015. For the next four months, the natural gas leak would release an estimated 100,000 metric tons of methane into the atmosphere.[6] Methane is a powerful GHG that has a greater influence upon the climate on a per-ton basis compared to carbon dioxide, though it has a shorter life span in the atmosphere. Therefore, this 100,000 metric tons of methane is equivalent to 8.4 million $MTCO_2e$ if the 20-year global warming potentials (GWP) is used, or 2.84 million $MTCO_2e$ if the 100-year GWP is used.

In order to mitigate the leak's damage, a determination will have to be made as to which measurement better estimates the leak's contribution to global warming. Given California's ambitious policy timeline to combat climate change in the coming decades, the Air Resources Board has asserted that a 20-year horizon is more appropriate than a 100-year horizon.[7,8]

FIGURE 6. TOTAL CALIFORNIA GREENHOUSE GAS EMISSIONS

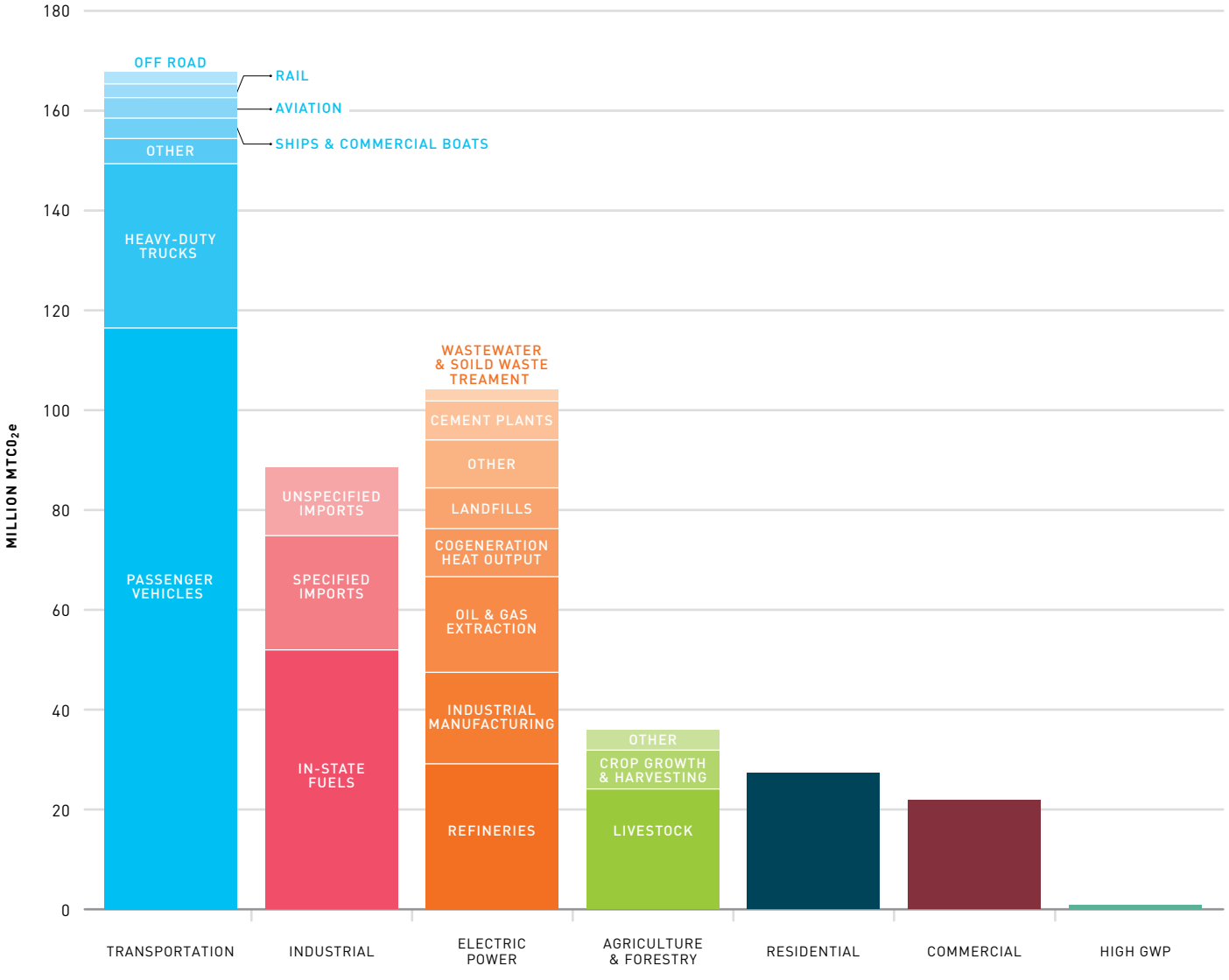
GROSS ANNUAL EMISSIONS



NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Note: Gross greenhouse gas emissions (GHG) includes fossil fuel CO2, with electric imports and international fuels (carbon dioxide equivalents) and noncarbon GHG emissions (in CO_2 equivalents). Noncarbon GHG emissions are made up of Agriculture (CH_4 and N_2O), Soils, ODS substitutes, Semi-conductor manufacture (PFCs), Electric Utilities (SF_6). Cement, Other Industrial Processes, Solid Waste Management, Landfill Gas, and Wastewater, Methane from oil and gas systems, Methane and N_2O from Fossil Fuel Combustion. Data Source: California Air Resources Board, California Greenhouse Gas Inventory – by Sector and Activity. NEXT 10 / SF · CA · USA

FIGURE 7. GREENHOUSE GAS EMISSIONS BY DETAILED SOURCE

CALIFORNIA, 2014



NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Data Source: California Air Resources Board, California Greenhouse Gas Inventory – by Sector and Activity. NEXT 10 / SF · CA · USA

Energy Efficiency

Why is it Important?

Energy—an essential component of economic stability and growth—lights office buildings, provides transportation, and heats and cools the places people call home. Economic growth can be achieved using energy in two ways: acquiring additional resources or 'inputs', or using the current resources more efficiently.

Energy efficiency enables consumers to optimize usage and consume less energy for the same level of service. Energy efficiency also saves businesses, governments, and consumers money while creating investment opportunities across the economy, generating jobs and reducing the environmental impact of energy use.

Energy Efficiency Indicators

Over the last 20 years, California's GDP increased at a much faster rate than its energy use, leading to a continued improvement in energy productivity.

In 2013, California generated $2.93 of GDP (inflation-adjusted) for every 10,000 British Thermal Units (BTU) of energy consumed, while the rest of the U.S. generated $1.64 of economic output with the same amount of energy. As a result, California achieved 1.8 times as much economic activity compared to the rest of the nation when consuming the equivalent amount of energy.

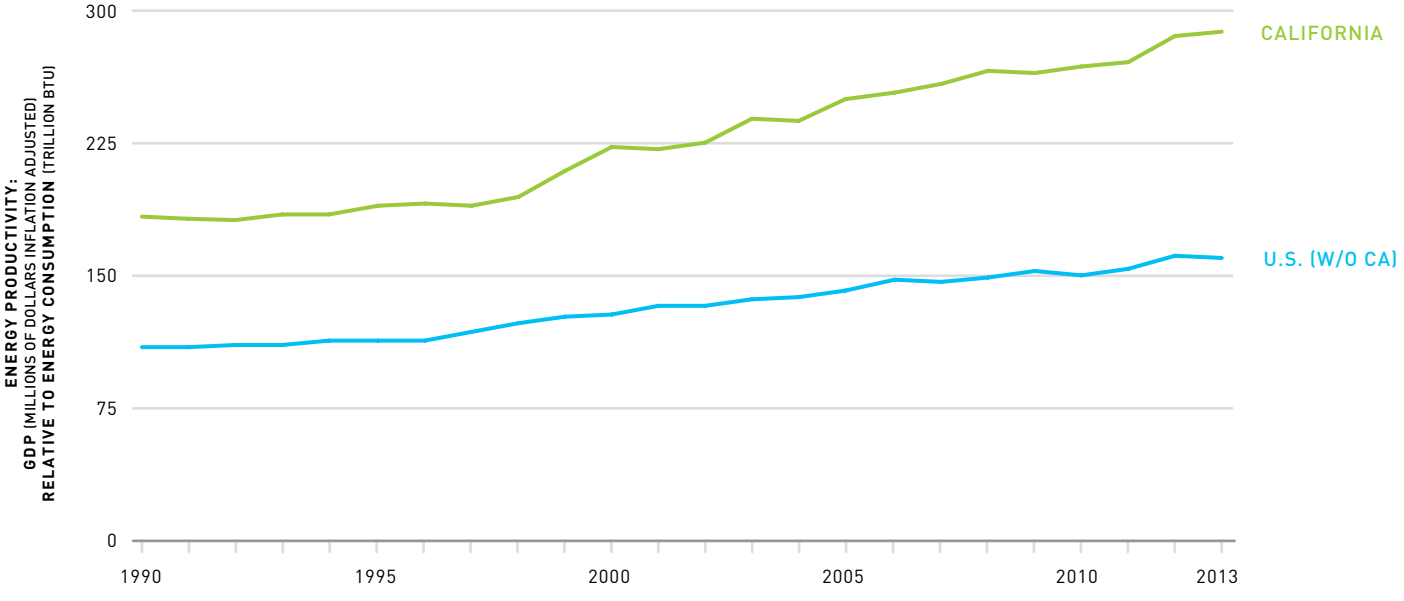
Energy productivity in the U.S. (excluding CA) improved 5.6 percent between 2010 and 2013, and improved 43.1 percent since 1990. California outpaced the rest of the U.S. with a 7.4 percent increase between 2010 and 2013, and 55.8 percent rise since 1990.

California's energy consumption per person declined at a faster rate than the rest of the U.S. over time and continues to serve as a model for other states. In California, per capita energy consumption increased through the mid-to-late 1970s and began a gradual decline in the 1980s, prompted in part by the major energy efficiency policies introduced in the late 1970s. In 2013, per capita energy consumption was down 27.5 percent in California compared to 1970.

Per capita energy consumption in the rest of U.S. also increased in the 1970s at comparable rates to California, then decreased for most of the 1980s before increasing again until 2000. Per capita energy consumption in the

FIGURE 8. ENERGY PRODUCTIVITY

GDP RELATIVE TO TOTAL ENERGY CONSUMPTION: CALIFORNIA AND THE REST OF THE U.S.



NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Data Source: U.S. Energy Information Administration, State Energy Data System; U.S. Department of Commerce, Bureau of Economic Analysis.

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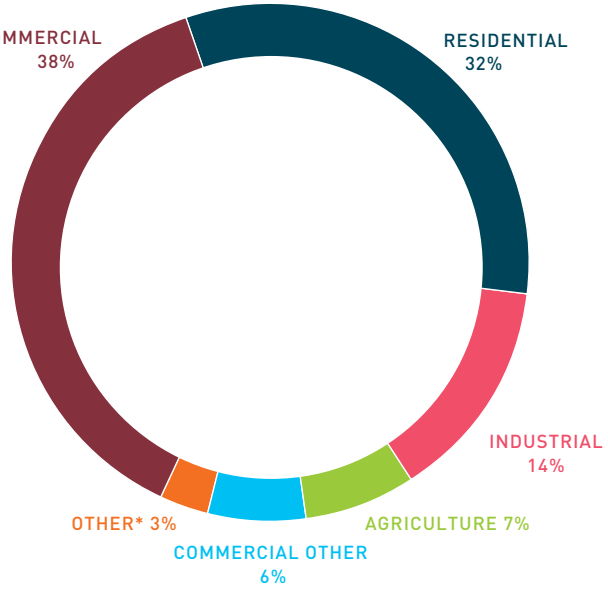
rest of U.S. gradually declined in recent years and is now 5.2 percent lower than in 1970.

Despite a consistent, gradual decline in per capita energy consumption in California, total energy consumption was 50.8 percent higher at its peak in 2006 compared to 1970. Recent improvements positioned the state 39.5 percent higher in total energy consumption in 2013 relative to 1970. The rest of the U.S. exhibited a similar trend: gradual increase in total energy consumption until 2007, where energy consumption was 49 percent higher than in 1970, but has decreased to 43.8 percent higher in 2013 than in 1970.

Electricity in California was used by a variety of sectors in 2014, with the commercial sector consuming more than a third of the electricity (38%). The residential sector was the next largest (32%), followed by the industrial sector (14%). This electricity consumption sector mix remained fairly constant in recent years.

FIGURE 9. ELECTRICITY CONSUMPTION BY SECTOR

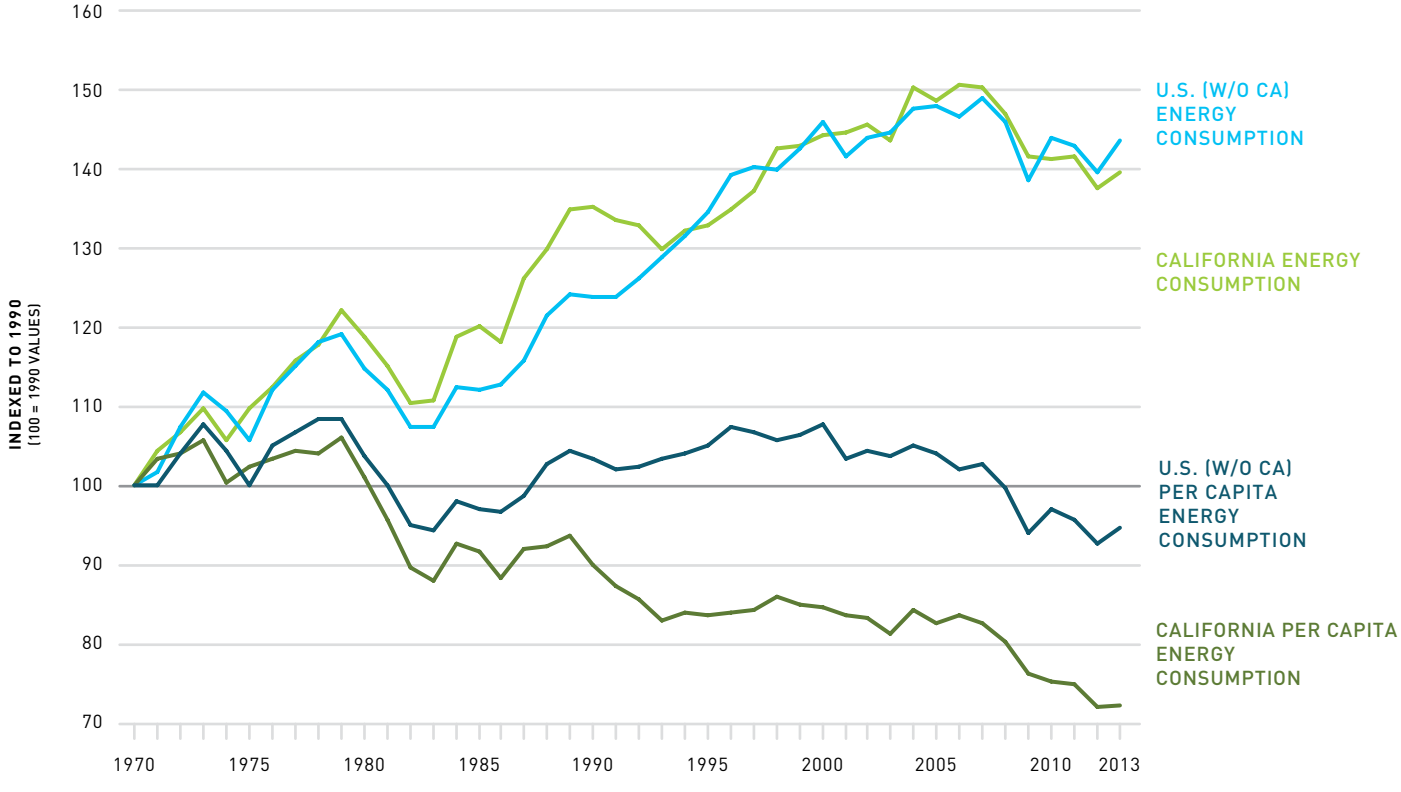
PERCENT OF TOTAL ELECTRICITY CONSUMPTION, CALIFORNIA, 2014



NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. *Other includes Street Lighting and Mining.
Data Source: California Energy Commission. NEXT 10 / SF · CA · USA

FIGURE 10. TOTAL ENERGY CONSUMPTION RELATIVE TO 1970

TOTAL CONSUMPTION AND PER CAPITA: CALIFORNIA AND THE REST OF THE U.S.



NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Data Source: U.S. Energy Information Administration, State Energy Data System; U.S. Census Bureau, Population Estimates Branch.
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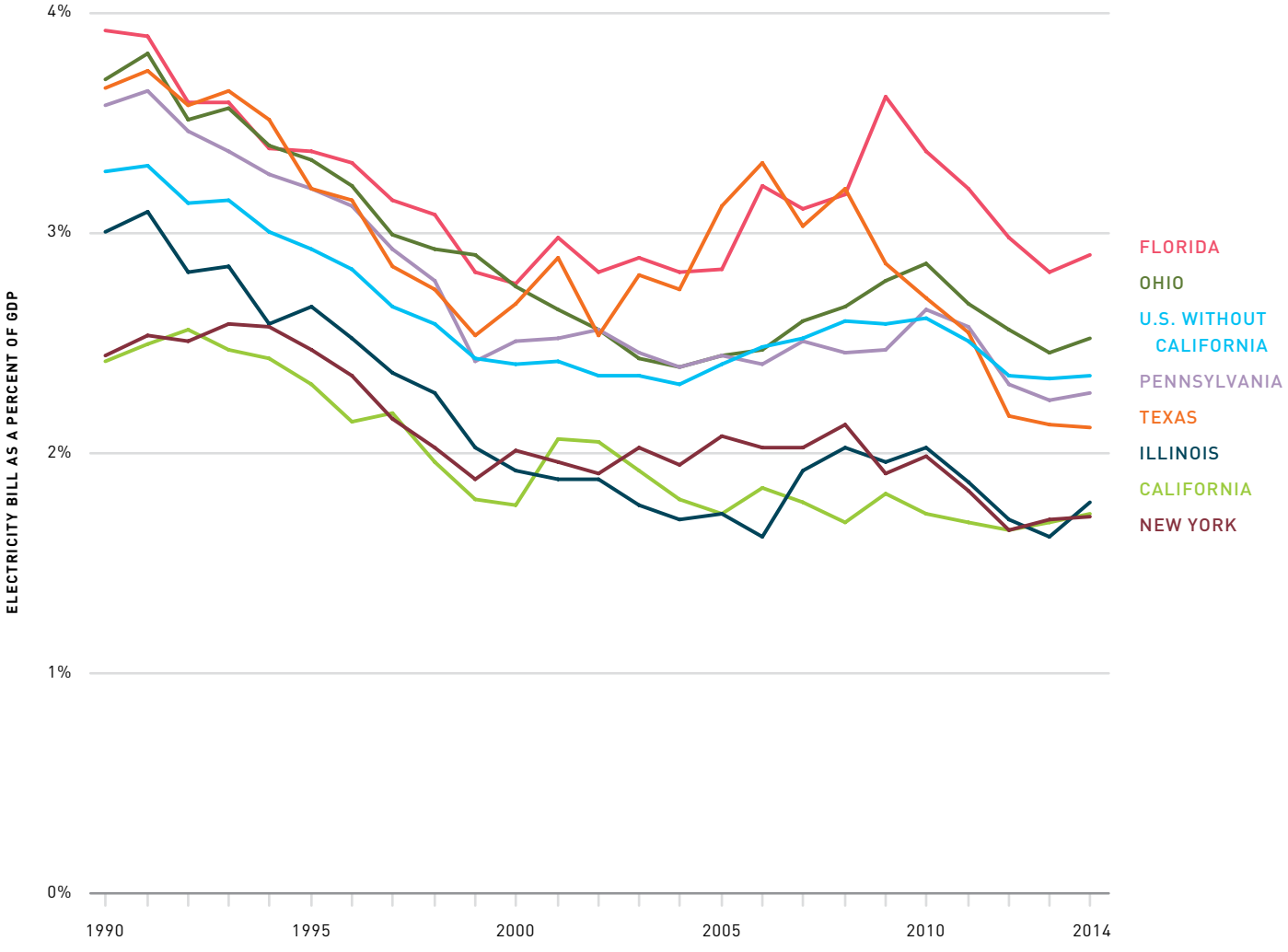
The state's electricity bill as a percent of GDP decreased between 1990 and 2014 in every large state and the rest of the U.S. In California, the electricity bill as a percent of GDP was 2.4 percent in 1990 and dropped to 1.7 percent in 2014. In the rest of the U.S., the electricity bill as a percent of GDP was 3.3 percent in 1990 and 2.4 percent in 2014. California, New York, and Illinois were among states whose electricity bills had the lowest percentage of GDP in 2014, while Florida and Ohio were among the highest. Between 2013 and 2014, several states, including California, Florida, Ohio, Pennsylvania, and Illinois, increased their electricity bill as a share of GDP.

California's electricity bill share of GDP was 0.39 percentage points less than Texas and 1.18 percentage points less than Florida in 2014. In terms of California's GDP, this equates to about $9 billion that Californians did not spend on electricity than if it had the same efficiency as Texas and $27.2 billion not spent if California had the same efficiency as Florida.

California had among the lowest average electricity bills in 2014 for the residential and industrial sectors compared to other large states despite its relatively higher price per kWh. In 2014, California's average monthly residential electricity bill was 20 percent lower than the U.S. average ($91.26 per month

FIGURE 11. STATEWIDE ELECTRICITY BILL AS A PERCENT OF GDP

CALIFORNIA, FLORIDA, ILLINOIS, NEW YORK, OHIO, PENNSYLVANIA, TEXAS, & U.S. WITHOUT CALIFORNIA, 1990–2014



NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Data Source: U.S. Department of Energy, Energy Information Administration; Bureau of Economic Analysis, U.S. Department of Commerce.
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TABLE 2. ELECTRICITY PRICES AND BILLS (INFLATION-ADJUSTED) BY SECTOR

	REGION	PRICE PER kWh	AVERAGE MONTHLY BILL		
		2014	2004	2014	10 YEAR % CHANGE
RESIDENTIAL	CALIFORNIA	$0.16	$86.54	$91.26	5.5%
	FLORIDA	$0.12	$133.59	$129.86	-2.8%
	ILLINOIS	$0.12	$77.21	$88.78	15.0%
	NEW YORK	$0.20	$105.90	$118.63	12.0%
	OHIO	$0.13	$91.93	$112.62	22.5%
	PENNSYLVANIA	$0.13	$98.94	$113.72	14.9%
	TEXAS	$0.12	$142.78	$137.39	-3.8%
	UNITED STATES	$0.13	$101.63	$114.09	12.3%
INDUSTRIAL	CALIFORNIA	$0.12	$5,759.86	$3,700.77	-35.7%
	FLORIDA	$0.08	$4,342.20	$5,795.71	33.5%
	ILLINOIS	$0.07	$12,723.06	$41,506.04	226.2%
	NEW YORK	$0.07	$15,001.59	$12,552.52	-16.3%
	OHIO	$0.07	$13,680.39	$14,927.54	9.1%
	PENNSYLVANIA	$0.07	$10,310.35	$12,320.02	19.5%
	TEXAS	$0.06	$4,666.64	$5,515.68	18.2%
	UNITED STATES	$0.07	$7,470.49	$7,035.84	-5.8%
COMMERCIAL	CALIFORNIA	$0.16	$851.64	$927.85	8.9%
	FLORIDA	$0.10	$658.12	$647.18	-1.7%
	ILLINOIS	$0.09	$684.73	$650.83	-5.0%
	NEW YORK	$0.16	$1,026.78	$983.58	-4.2%
	OHIO	$0.10	$620.28	$621.45	0.2%
	PENNSYLVANIA	$0.10	$609.37	$508.73	-16.5%
	TEXAS	$0.08	$569.17	$662.01	16.3%
	UNITED STATES	$0.11	$632.31	$677.97	7.2%
	REGION		GDP IN MILLIONS		
			2004	2014	10 YR % CHANGE
GROSS DOMESTIC PRODUCT (MILLIONS OF 2014 DOLLARS)	CALIFORNIA		$2,000,970	$2,311,616	15.5%
	FLORIDA		$791,231	$839,944	6.2%
	ILLINOIS		$699,157	$745,875	6.7%
	NEW YORK		$1,174,742	$1,404,518	19.6%
	OHIO		$557,879	$583,261	4.5%
	PENNSYLVANIA		$602,102	$662,890	10.1%
	TEXAS		$1,166,736	$1,648,036	41.3%
	UNITED STATES		$15,119,850	$17,316,314	14.5%

NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Data Source: U.S. Department of Energy, Energy Information Administration; Bureau of Economic Analysis, U.S. Department of Commerce.
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in California vs. $114.09 per month for the U.S. average), and industrial bills were 47.4 percent less than the U.S. average ($3,700.77 per month in California vs. $7,035.84 per month for the U.S. average). In contrast, California's average monthly commercial electricity bill was 37 percent higher than the U.S. average ($927.85 per month in California vs. $677.97 per month for the U.S. average).

Renewables

Why is it Important?

Renewable energy is an unlimited source of energy that leverages replenishable natural resources, and produces fewer emissions when compared to fossil fuel energy. Therefore, renewable energy offers a way to increase or maintain an energy supply while reducing greenhouse gas emissions and environmental impacts from energy use. Indicators that track trends in renewable energy illustrate California's shift to a cleaner energy supply.

"Our research shows a transition to a reliable, low-carbon, electrical generation and transmission system can be accomplished with commercially available technology and within 15 years."

– National Oceanic and Atmospheric Administration, 2016[9]

RENEWABLE ELECTRICITY GENERATION

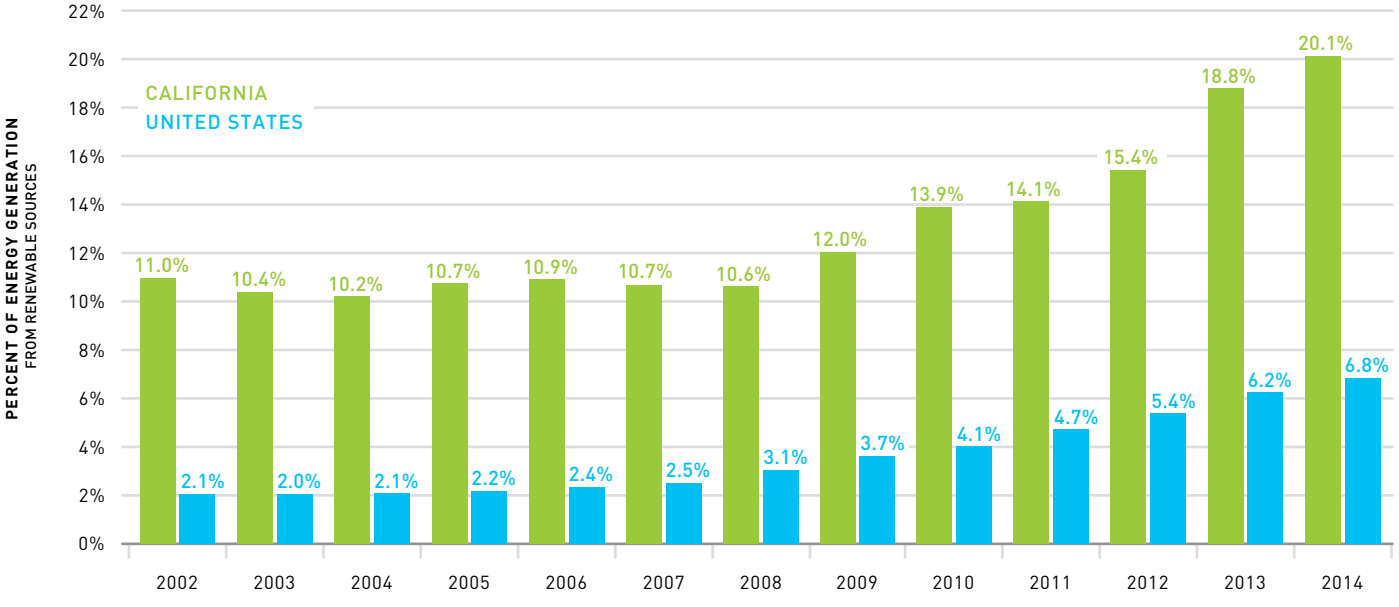
In 2015, the rapid shift of the U.S. power sector away from carbon-intensive fuels[10] continued to accelerate as a record number of coal plants discontinued operations.[11] California installed 3,266 megawatts (MW) of solar photovoltaic (PV) in 2015 alone, more than any other state in the U.S.[12] In 2015, natural gas production[13] and consumption hit an all-time high in the U.S., replacing more emissions-heavy energy sources such as coal.

In 2002, California established a Renewable Portfolio Standard (RPS)—a state mandate for utilities to source clean energy. The 2002 RPS began with a requirement to source 20 percent of California's electricity from renewable sources by 2017. The state has since set more aggressive goals to reach 33 percent by 2020 and 50 percent by 2030.

Twenty-nine states now boast an RPS[14] and collectively serve as a major driver of solar and wind infrastructure. Along with California, New York has increased its RPS to 50 percent by 2030 and Hawaii has set a target of 100 percent by 2045. While many states continue to lead, others are falling behind.

FIGURE 12. PERCENT OF TOTAL ENERGY GENERATION FROM RENEWABLE SOURCES

CALIFORNIA AND UNITED STATES, 2002–2014



NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Data Source: California Energy Commission; Energy Information Administration. NEXT 10 / SF · CA · USA

In 2015,[15] West Virginia repealed its state RPS, which would have required 25 percent renewables by 2025, and Kansas replaced its RPS with a voluntary goal.[16]

In 2014, California increased renewable electricity to reach 20.1 percent of total electricity generation, up 1.3 percentage points compared to 18.8 percent in 2013. The U.S. experienced a slower increase of 0.6 percentage points compared to 2013 and trails California with only 6.8 percent of total electricity generation from renewable sources in 2014.

In 2014, renewable electricity increased 7.4 percent from the year before, with the biggest jump in solar (+133%), while small hydro dropped 27 percent. Renewables, as a percentage of California's power mix, doubled between 2002 and 2014, reaching roughly 59,803 gigawatt hours (GWh) in 2014. Wind comprised the largest proportion of renewable electricity generation (40%) in 2014, followed by geothermal (22%) and solar (21%). From 2009 to 2014, total electricity from biomass increased 10 percent, wind increased 155 percent, and solar increased an astounding 1,378 percent.

Recent data from the California Independent Systems Operator indicates that grid-connected, utility-scale solar provided 15,592 GWh in 2015. Just four years earlier, solar was only able to provide 1,000 GWh. The large increase in 2015 also marks the first time solar energy eclipsed wind generation, providing 6.7 percent of the system's power compared to wind's 5.3 percent.[17] Rapid advances in technology and manufacturing have continued to drive down the cost of installed solar PV systems in the U.S., with 2015 costs down 48 percent from 2010.[18]

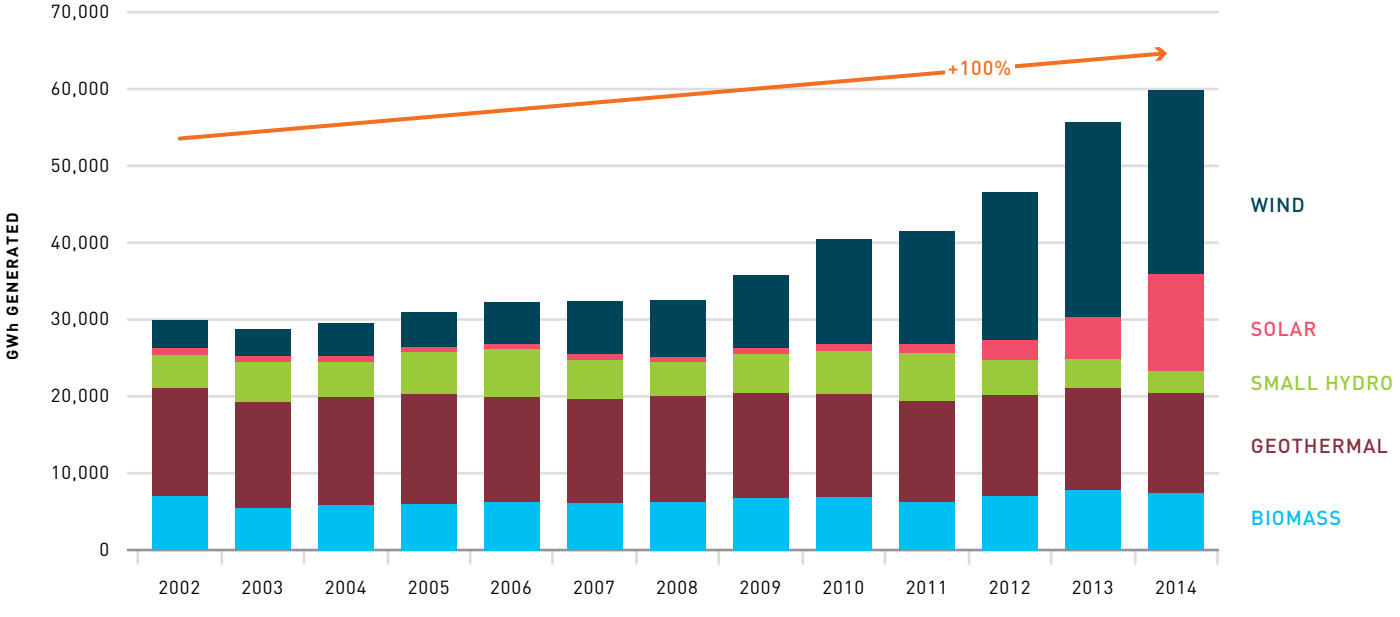
In 2014, roughly 25 percent of retail electricity sales were served by renewable energy sources. In order to achieve its RPS of 33 percent of electricity generation from renewables by 2020, California's investor-owned utilities are poised to increase renewable electricity generation by about 38 percent between 2015 and 2020, as illustrated in the operational and on-schedule system capacity in Figure 15. Currently, estimates place the growth at 14,197 GWh between 2015 and 2020.

SOLAR AND WIND

In 2014, California saw more than 2,000 MW of PV capacity additions, bringing the total solar capacity to 5,939 MW by year's end. In-state generation of solar jumped from 4,291 GWh in 2013 to 10,557 GWh in 2014. California continued to see explosive growth in renewable solar power in 2015.

FIGURE 13. CALIFORNIA RENEWABLE ELECTRICITY GENERATION

GIGAWATT HOURS BY SOURCE



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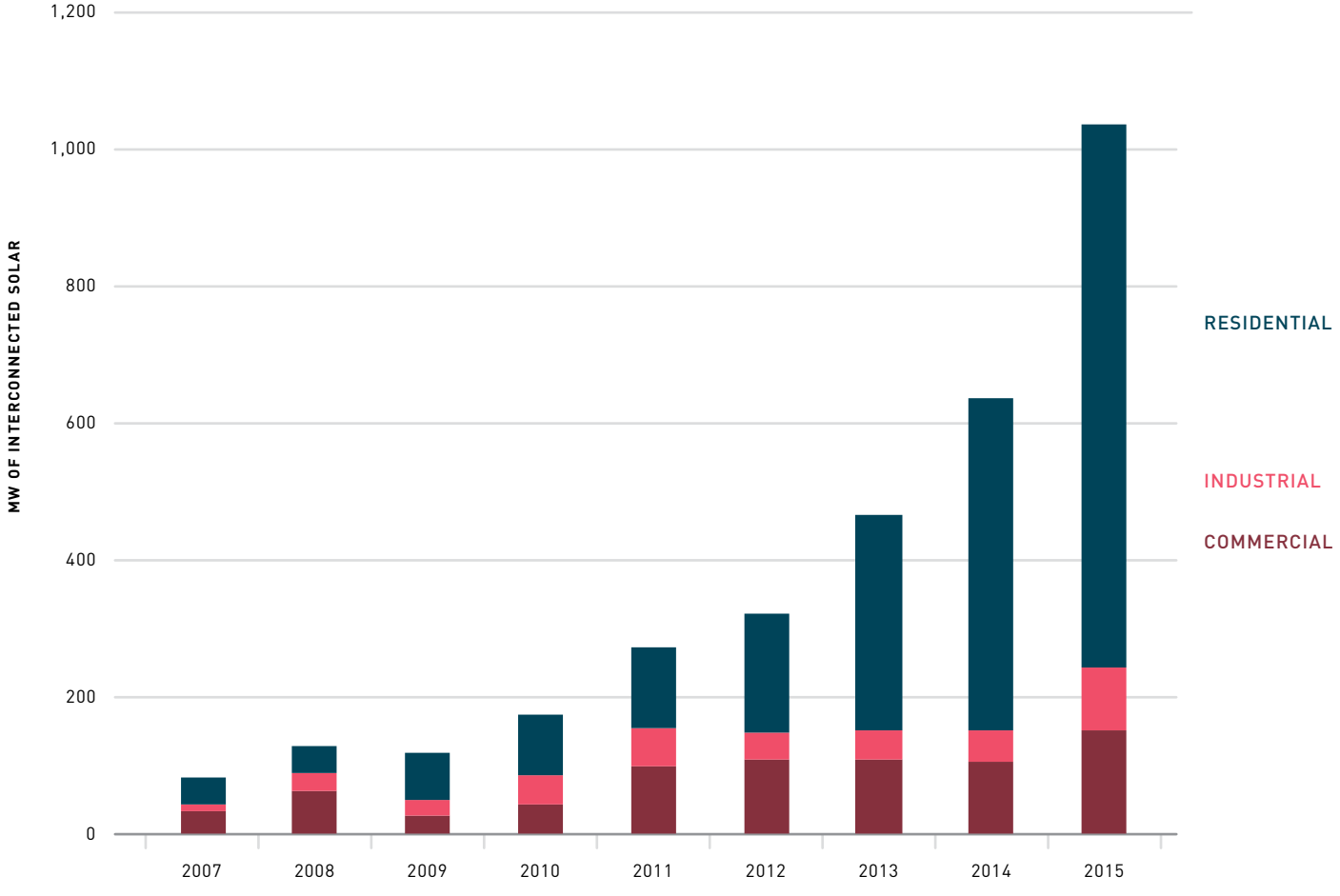
California's growth, while seemingly an overnight success, is due in major part to the state's public policies including the RPS, Net Energy Metering (NEM) and the U.S. Investment Tax Credit (ITC). 2015 saw the installation of an additional 3,266 MW of capacity bringing the state's total to 13,243 MW. Total solar investments in California during 2015 were estimated to be at $7.27 billion.[19] To place California's remarkable solar boom in context, a report from the Solar Energy Industries Association (SEIA) recently noted that as of 2015, "California has 10 times more installed solar capacity than the entire nation had in 2007."[20]

California posted impressive growth in new solar PV interconnections in 2015, with an increase of 62 percent, or 401 MW, from 2014. The residential sector had the largest total MW increase with 312 additional MWs interconnected, representing a 65 percent increase, compared to 2014. Total MWs interconnected in the industrial sector almost doubled from 2014 to 2015. Although the year-over-year growth in the commercial sector is smaller, 42 percent, it is still impressive, considering that the total MWs interconnected had been somewhat stagnant for the past few years.

California wind facilities increased their generation by almost 2.5 percent (303 GWh) during 2014, reaching a total of 12,997 GWh. Wind generation capacity eased upward by 107 MW to 5,917 MW in 2014. In 2015, the state added 194 MW of wind capacity bringing California's cumulative wind capacity to 6,108 MW and the U.S. cumulative capacity to 74,472 MW at the end of 2015.

FIGURE 14. NEW SOLAR PV INTERCONNECTIONS

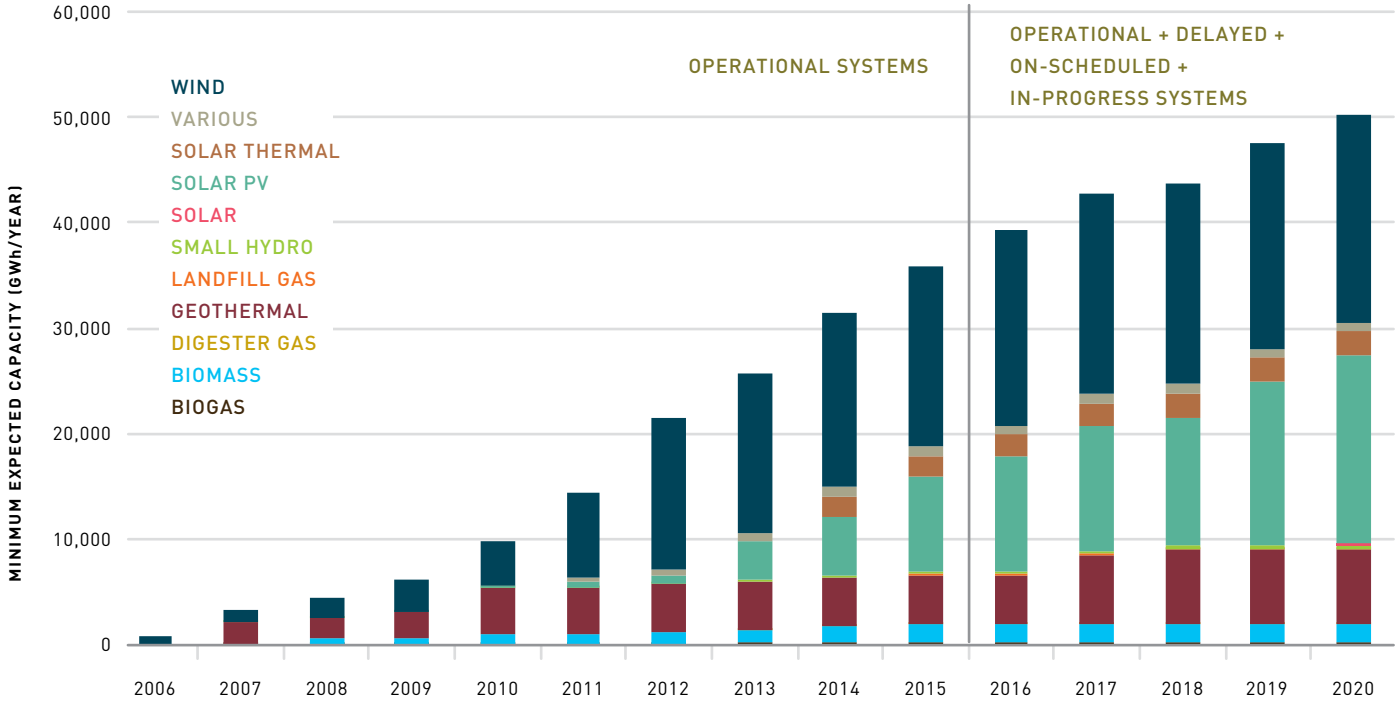
INTERCONNECTED SOLAR PV THROUGH NET ENERGY METERING, CALIFORNIA



NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Note: The data set only includes interconnected solar PV Net Energy Metering (NEM) projects and presents the current "state of the world" in terms of how many interconnected solar PV projects and how many MW are installed in a in a given geographic area. Calculations based on 'Application Approved Date.' Data Source: California Energy Commission; California Public Utilities Commission. NEXT 10 / SF · CA · USA

FIGURE 15. CUMULATIVE OPERATIONAL CAPACITY OF RENEWABLES PORTFOLIO STANDARD PROJECTS

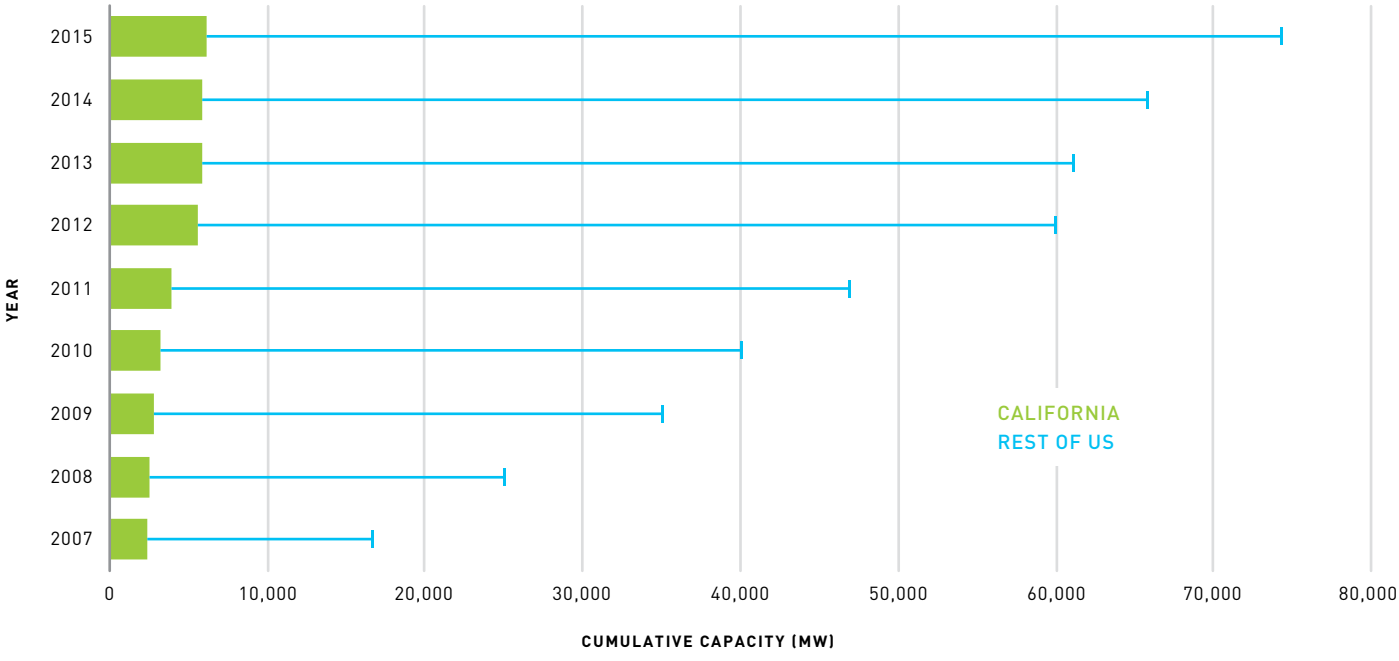
BY INVESTOR OWNED UTILITIES



NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Note: Data does not include figures where year is "N/A." Data Source: California Public Utlities Commission. NEXT 10 / SF · CA · USA

FIGURE 16. WIND CAPACITY

CALIFORNIA AND UNITED STATES



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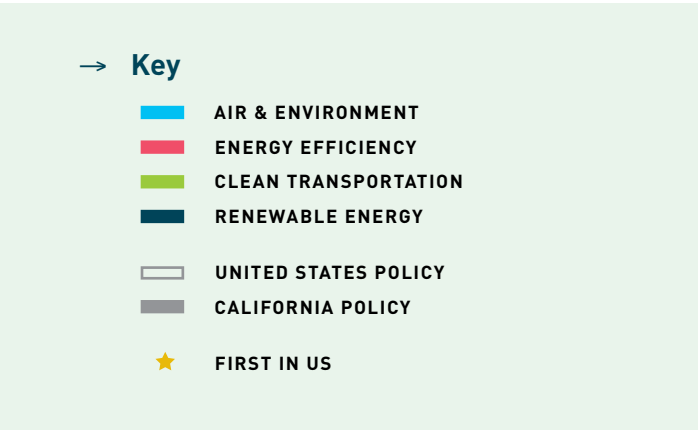
California Policy Timeline



1947
Los Angeles Air Pollution Control District created ★

1963
Clean Air Act

1965
National Emissions Standards Act

1967
California Air Resources Board established ★

1970
Environmental Protection Agency created by Presidential Executive Order

1974
California Energy Commission created

1975
Congress enacts the Corporate Average Fuel Economy (CAFE) regulations to improve average fuel economy of cars and light trucks in the U.S.

1977
★ Efficiency standards for appliances (Title 20)

1978
Efficiency standards for new buildings (Title 24) ★

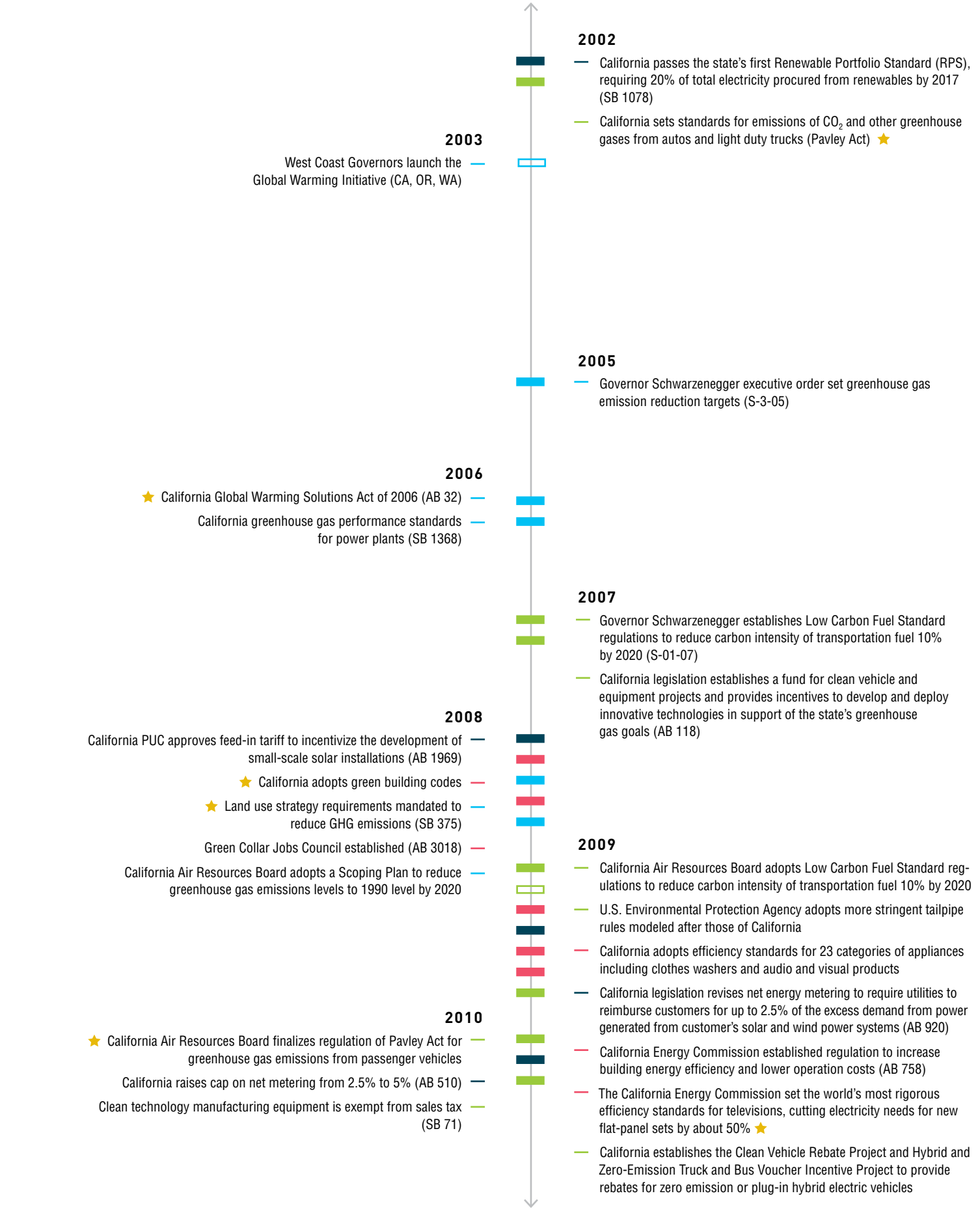
1982
California Public Utilities Commission (PUC) orders separation of electricity sales from revenues for the investor owned utilities, which removes barriers to energy efficiency investments (decoupling) ★

1987
National Appliance Energy Conservation and Efficiency Act

2000
★ California Climate Action Registry established (SB 1771)

2000–2001
California energy crisis

2001
Flex Your Power initiated


2002
California passes the state's first Renewable Portfolio Standard (RPS), requiring 20% of total electricity procured from renewables by 2017 (SB 1078)
California sets standards for emissions of CO_2 and other greenhouse gases from autos and light duty trucks (Pavley Act) ★
2003
West Coast Governors launch the Global Warming Initiative (CA, OR, WA)
2005
Governor Schwarzenegger executive order set greenhouse gas emission reduction targets (S-3-05)
2006
★ California Global Warming Solutions Act of 2006 (AB 32)
California greenhouse gas performance standards for power plants (SB 1368)
2007
Governor Schwarzenegger establishes Low Carbon Fuel Standard regulations to reduce carbon intensity of transportation fuel 10% by 2020 (S-01-07)
California legislation establishes a fund for clean vehicle and equipment projects and provides incentives to develop and deploy innovative technologies in support of the state's greenhouse gas goals (AB 118)
2008
California PUC approves feed-in tariff to incentivize the development of small-scale solar installations (AB 1969)
★ California adopts green building codes
★ Land use strategy requirements mandated to reduce GHG emissions (SB 375)
Green Collar Jobs Council established (AB 3018)
California Air Resources Board adopts a Scoping Plan to reduce greenhouse gas emissions levels to 1990 level by 2020
2009
California Air Resources Board adopts Low Carbon Fuel Standard regulations to reduce carbon intensity of transportation fuel 10% by 2020
U.S. Environmental Protection Agency adopts more stringent tailpipe rules modeled after those of California
California adopts efficiency standards for 23 categories of appliances including clothes washers and audio and visual products
California legislation revises net energy metering to require utilities to reimburse customers for up to 2.5% of the excess demand from power generated from customer's solar and wind power systems (AB 920)
California Energy Commission established regulation to increase building energy efficiency and lower operation costs (AB 758)
The California Energy Commission set the world's most rigorous efficiency standards for televisions, cutting electricity needs for new flat-panel sets by about 50% ★
California establishes the Clean Vehicle Rebate Project and Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project to provide rebates for zero emission or plug-in hybrid electric vehicles
2010
★ California Air Resources Board finalizes regulation of Pavley Act for greenhouse gas emissions from passenger vehicles
California raises cap on net metering from 2.5% to 5% (AB 510)
Clean technology manufacturing equipment is exempt from sales tax (SB 71)

2011

- U.S. Department of Transportation, U.S. Environmental Protection Agency and California Air Resources Board announce a unified timeframe for CAFE and greenhouse gas standards for cars and trucks model year 2017–2025 so that automakers can work towards a single national program
- California legislation increases the state's RPS to 33% of electricity delivered to utility retail customers from renewable resources by 2020 (SB X1-2)
- California legislature passes the Renewable Energy Equity Act (SB 489), which expands the net energy metering program to all eligible forms of renewable energy, allowing small-scale renewable energy producers to participate
- Governor Brown announces the Clean Energy Jobs Plan which calls for 12,000 MW to come from localized energy sources and 8,000 MW of large scale renewable & necessary transmission lines by 2020
- The Obama administration and 13 major automakers agree to raise CAFE standards up from 27 to an average of 54.5 miles per gallon by 2025
- California legislation extends the Self-Generation Incentive Program (AB 1150), which helps customers switch to clean energy and provides a bridge for clean energy technologies to scale up and drive down costs
- California legislation aims to reduce pollution and waste by more than 15 million tons annually; establishing a new statewide goal of 75% source reduction, recycling and composting by 2020 (AB 341)
- The Western Climate Initiative Inc., a nonprofit corporation with officials from Canada and California, is formed to support the implementation of greenhouse gas emissions trading programs
- California leads the nation in solar energy installations, with a total of over 1,000 MW installed at homes and businesses in the state, nearly a third of total installations in 2011

2012

- California Air Resources Board passes the Advanced Clean Car Rules to be attained by 2025, including a mandate for manufacturers to produce 1.4 million zero-emission vehicles, in addition to a 75% reduction in smog-forming pollutants and a 34% reduction in greenhouse gas emissions
- Governor Brown reinforces the Air Resources Board's clean car rules by issuing an executive order for 1.5 million zero-emission vehicles and supporting infrastructure to be operating in California by 2025 (B-16-12)
- California PUC potentially doubles the amount of solar power utilities will purchase from homeowners and businesses by adjusting how electricity generation is calculated under the net metering program
- California Air Resources Board issues final regulations on the Low Carbon Fuel Standard
- California established the Greenhouse Gas Reduction Fund as a special fund to collect cap-and-trade auction revenues (SB 1018)
- U.S. Environmental Protection Agency and the National Highway Traffic Safety Administration issued a final rule that raises average CAFE standards for cars and light-duty trucks to 54.5 miles per gallon by 2025
- California passes two laws to establish a process for spending revenue generated from the cap-and-trade program, with an emphasis on improving air quality and benefiting disadvantaged communities (AB 1532 and SB 535)
- California standardizes and limits the fees city and county governments can charge on building permits for rooftop solar (SB 1222)
- Voters pass Prop 39, the Clean Energy Jobs Act, to provide an estimated $500 million annually for five years for energy efficiency and clean energy programs, such as retrofits of schools and government buildings
- California Air Resources Board conducts its first quarterly auction for emissions allowances in the cap-and-trade program as authorized by AB 32
- California PUC approves nearly $2 billion in energy efficiency program financing over the next two years
- ★ California PUC approves a plan to distribute 85% of revenue from the sale of GHG allowances from the state's three investor owned utilities to households in a semi-annual credit on their energy bill, a type of "climate dividend"

2013

- Governor Brown releases the Zero Emission Vehicle Action Plan that identifies specific strategies and actions that state agencies will take to meet milestones of the executive order for 1.5 million zero-emission vehicles in California by 2025
- California PUC mandates that the state's three investor owned utilities add a combined 1.3 gigawatts of energy storage by 2020 ★
- California signs three national and international agreements to cooperate on reducing greenhouse gases and align policies, with China, Quebec, and the Northwestern states/provinces of Oregon, Washington and British Columbia
- California extends to 2024 key auto emissions reductions programs, including the Alternative and Renewable Fuel and Vehicle Technology Program, Air Quality Improvement Program, and the Carl Moyer Program (AB 8)
- California PUC adopts the Efficiency Savings and Performance Incentive program for investor owned utilities to earn up to $89 million a year as a reward for helping customers achieve long-term energy savings
- California improves access to electric vehicle charging stations through two laws, requiring infrastructure for stations at new multi-family housing and non-residential developments, and simplifying access to stations (AB 1092 and SB 454)
- U.S. Environmental Protection Agency proposes a carbon emissions standard for new fossil fuel-fired electric utility power plants
- California creates a voluntary green tariff that allows utility ratepayers who cannot install their own renewable energy generation to purchase energy from shared renewable facilities and receive bill credits (SB 43)
- California joins seven other states in an initiative to put 3.3 million zero-emission vehicles on the road by 2025
- California protects net metering and removes the 33% ceiling on the RPS (AB 327)

2014

- California Energy Commission announces it will update energy efficiency standards for 15 appliances over the next two years
- California Air Resources Board approves the first update to the 2008 Scoping Plan with key focus areas to reduce greenhouse gas emissions levels to 1990 level by 2020
- California extends the property tax exclusion for solar systems to 2025 (SB 871)
- California extends the Self-Generation Incentive Program funding to 2019, which helps customers switch to clean energy and provides a bridge for clean energy technologies to scale up and drive down costs (SB 861)
- California passes a law to streamline permitting and inspection for small solar systems to help lower soft costs of installing solar (AB 2188)
- California lawmakers pass a bundle of bills to grow the electric vehicle market, including providing a higher incentives for low-income individuals and improving access to charging stations for property renters
- California passes law to accelerate the development and deployment of zero- and near-zero emissions trucks, buses, and freight vehicle and equipment (SB 1204)
- California holds its first joint carbon auction with the Canadian province of Quebec, creating the biggest carbon market in North America

2015

- The California cap-and-trade program starts to cover fuel distributors, including distributors of heating and transportation fuels
- Governor Brown signs an Executive Order for an interim target of reducing GHG emissions 40% below 1990 levels by 2030 (B-30-15)
- California spearheaded and signed the Under 2 MOU along with other sub-national governments that commits signatories to limit emissions to a level that would limit global warming to less than 2°C
- California passes a law to increase the RPS for renewable energy to 50% and double energy efficiency in buildings (SB 350)
- At the Conference of Parties (COP 21) in Paris, parties to the U.N. Framework Convention on Climate Change reached a landmark agreement to limit global warming to less than 2°C and implement programs to support that goal

2016

- The U.S. Supreme Court ruled to support the Federal Energy Regulatory Commission's Order 745, which is expected to open the demand response market to reduce energy use
- California PUC enacted a new Net Energy Metering tariff for net-metered customers to earn retail-rate payments for their surplus solar energy and starts a move towrads time of use rates
- The U.S. Supreme Court halted the Environmental Protection Agency's implementation of the Clean Power Plan, a federal program to reduce GHG emissions, while the program is being fought in a lower court

Cap-and-Trade Overview

CALIFORNIA CAP-AND-TRADE PROGRAM ENABLING CLIMATE INVESTMENTS

California's cap-and-trade program is one of the state's signature programs designed to meet AB 32's requirement to reduce emissions to 1990 levels by 2020. The cap-and-trade program involves setting a limit or "cap" on emissions from covered entities in the geographic area, and issuing "allowances" that gives entities permission to emit units of emissions. Private entities may trade these allowances to match their emissions levels, and can achieve their limit of emissions by buying extra allowances or upgrading to more efficient technologies. Launched in 2013, as of this writing California has held 15 quarterly auctions of emissions allowances, including seven joint auctions with Quebec, covering 85 percent of the state's emissions. As of February 2016, the auctions have generated more than $4 billion in proceeds for the Greenhouse Gas Reduction Fund (GGRF).[21]

The seventh joint auction, held on May 18, 2016, resulted in the sale of 7.26 million or just under 11 percent of the 67.675 million of the 2016 vintage permits and 914,000 of the 10 million or about nine percent of the 2019 vintage permits.[22] Media reports offer speculation from experts that regulated entities may be cutting emissions successfully and therefore do not need the permits, or that permit buyers may fear the outcome of a California Chamber of Commerce lawsuit against the program.

In 2012, the Legislature and Governor Brown established a framework to invest cap-and-trade auction proceeds through three bills—Assembly Bill (AB) 1532, SB 535, and SB 1018. These established the GGRF where California auction proceeds are deposited. These funds are appropriated through the California budget for climate investments that maximize benefits to the state while reducing GHG emissions. Climate investments fall under four broad categories: low carbon transportation and infrastructure, strategic planning and sustainable infrastructure, energy efficiency and clean energy, and natural resources and waste diversion. In addition, SB 535 requires that a minimum of 25 percent of investments are allocated to projects that benefit disadvantaged communities, with a minimum of 10 percent of these projects located within those disadvantaged communities.

TABLE 3. APPROPRIATIONS FOR CALIFORNIA CLIMATE INVESTMENTS FY 2013–14 THROUGH 2015–16

PROGRAM	APPROPRIATIONS TOTAL ($M)
HIGH SPEED RAIL PROJECT	$850
TRANSIT AND INTERCITY RAIL CAPITAL PROGRAM	$265
LOW CARBON TRANSIT OPERATIONS PROGRAM	$145
AFFORDABLE HOUSING AND SUSTAINABLE COMMUNITIES	$610
LOW CARBON TRANSPORTATION	$325
LOW-INCOME WEATHERIZATION PROGRAM	$154
ENERGY EFFICIENCY FOR PUBLIC BUILDINGS	$20
CLIMATE SMART AGRICULTURE	$75
WATER ENERGY EFFICIENCY	$70
WETLANDS AND WATERSHED RESTORATION	$27
SUSTAINABLE FORESTS	$42
WASTE DIVERSION	$31
TOTAL APPROPRIATIONS	$2,614

NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Data Source: California Air Resources Board, "2016 California Climate Investments, Annual Report." NEXT 10 / SF · CA · USA

As of December 2015, more than $2.6 billion in climate investments were appropriated for GHG reduction programs. These investments span a variety of programs, including high speed rail ($850 million) and affordable housing and sustainable communities ($610 million) (Table 3). Of these total appropriations, $1.7 billion has been awarded to specific projects, and $912 million worth of projects have been implemented. These awarded funds went to projects that had $5.7 billion in additional sources, leveraging more than $3 for every dollar from the GGRF. Climate investments have been dispersed across 2,500 projects and 63,000 rebates or vouchers, and are expected to reduce GHG emissions by 14 million $MTCO_2e$.

The climate investments awarded to date have exceeded SB 535 goals, with 39 percent of projects located in disadvantaged communities ($356 million) and 51 percent of all projects benefitting disadvantaged communities ($469 million), not including high speed rail. Projects have been distributed across the state, covering 87 percent of California's disadvantaged community census tracts so far.[23]

For example, the San Joaquin Valley has a project to help low-income residents with old, polluting cars. It has supported the repair of 13,000 vehicles and the replacement 600 vehicles with clean alternatives. Sacramento has a project designed to help 1,600 low-income residents install home solar systems and energy efficiency measures that will save $45.7 million and generate 400 jobs. National City in San Diego County will receive 201 affordable apartment units for low-income households located near public transit and in a walkable community.[24]

In addition, Governor Brown's FY 2016–17 budget request proposed $3.1 billion in funding from the GGRF, which includes funds not appropriated from the previous year. These additional climate investments will enhance current programs, increase benefits, and further reduce GHG emissions.

Transportation

After the OPEC oil embargo in the 1970s and the subsequent nightly news reports with images of people in long lines at gas stations, the federal government adopted Corporate Average Fuel Economy (CAFE) standards for personal vehicles. The adoption of these standards doubled the fuel economy of personal vehicles within a ten-year period. However, rapid advances in vehicle fuel economy began to stagnate in the mid-1980s.

This period of stagnation was only interrupted by the passage in the U.S. Congress of the 2007 Energy Independence and Security Act (EISA), which required standards be set to achieve an average fuel economy increase from 27.5 to 35 miles per gallon by 2020. The subsequent rulemaking process and agreement with automakers resulted in a 2012 set of standards that required passenger vehicles to achieve 54.5 miles per gallon by 2025. Fuel economy standards are important, but they are only part of the story for addressing rising transportation emissions.

In April 2016, the Obama administration proposed a new rule[25] that would, for the first time, link the use of highways and roads with the carbon pollution that comes from their usage. This proposed rule, modeled after California's 2008 law SB 375, will serve as the foundation for coordinated transportation and land use planning while promoting sustainable communities.[26]

Why is it Important?

California has a vast transportation network that is vital in facilitating economic activity in the state and around the world. Most transportation in California relies on burning petroleum, and in order to meet the state's goals for reducing emissions, it continues to be important to find cleaner ways to create and transport California's products.

In California alone, the transportation sector accounts for more than a third of the state's GHG emissions. Therefore, it is important to measure progress in making trips more efficient and in the adoption of alternative fuel vehicles that will reduce emissions.

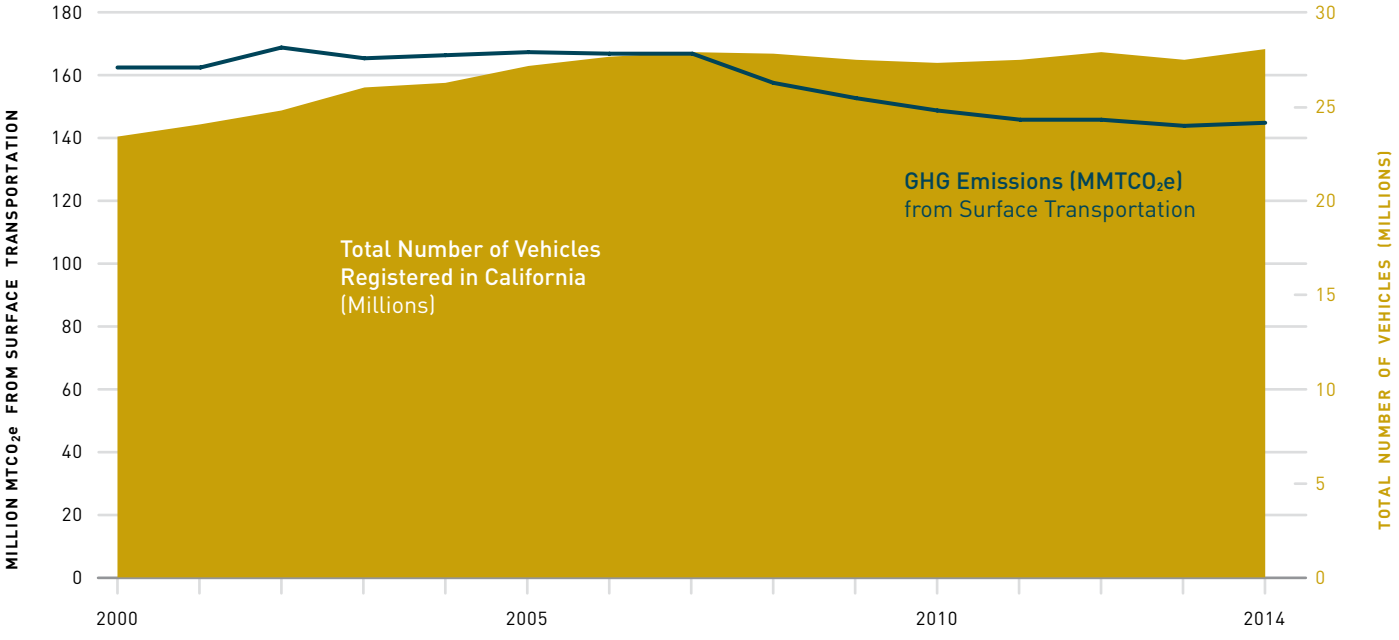
California is making strides in its efforts to reduce GHG and criteria emissions from transportation through several programs targeting light-, medium-, and heavy-duty vehicles. The state's Advanced Clean Cars program, for example, is a suite of regulations that work together to meet GHG reductions in light-duty vehicles and advancing the zero emissions vehicles (ZEV) marketplace. The ZEV program requires auto manufacturers to produce an increasing number of ZEVs so that by model year 2025, 15.4 percent of all cars sold in California will be ZEVs. Governor Jerry Brown has set a target of putting 1.5 million electric vehicles on the road by 2025. Battery Electric Vehicles (BEVs) in California have the additional benefit of accessing an electric grid that continues to be the cleanest in the country.[27] The least carbon-intensive grids today, including parts of California and New York, allow a BEV to emit lower GHG emissions than a gasoline-powered vehicle that gets more than 85 miles per gallon. As the electric grid continues to push toward more renewables, BEVs will require even less emissions.

The Governor aims to increase these efforts, as illustrated in the proposed budget for 2016–2017, which includes $1 billion from the state's AB 32 cap-and-trade funds to promote electric vehicles ($500 million toward consumer rebates) and to add to public transportation spending ($400 million). These proposals move the state towards the Governor's goal of cutting oil use by 50 percent by 2030. Currently, the California ARB estimates that existing state policies will result in a 25 percent reduction in oil consumption by 2030.

Along with setting ambitious new goals for renewable electricity generation and reducing GHG emissions, SB 350 included provisions that direct the electric utilities in California to pursue investments that will accelerate widespread transportation electrification in order to reduce dependence on petroleum.[28] The expanded role for utilities in providing EV charging infrastructure will provide an important infrastructure investment toward the state's goal of 1.5 million electric vehicles on the road by 2025.[29]

FIGURE 17. TOTAL VEHICLES AND GREENHOUSE GAS EMISSIONS

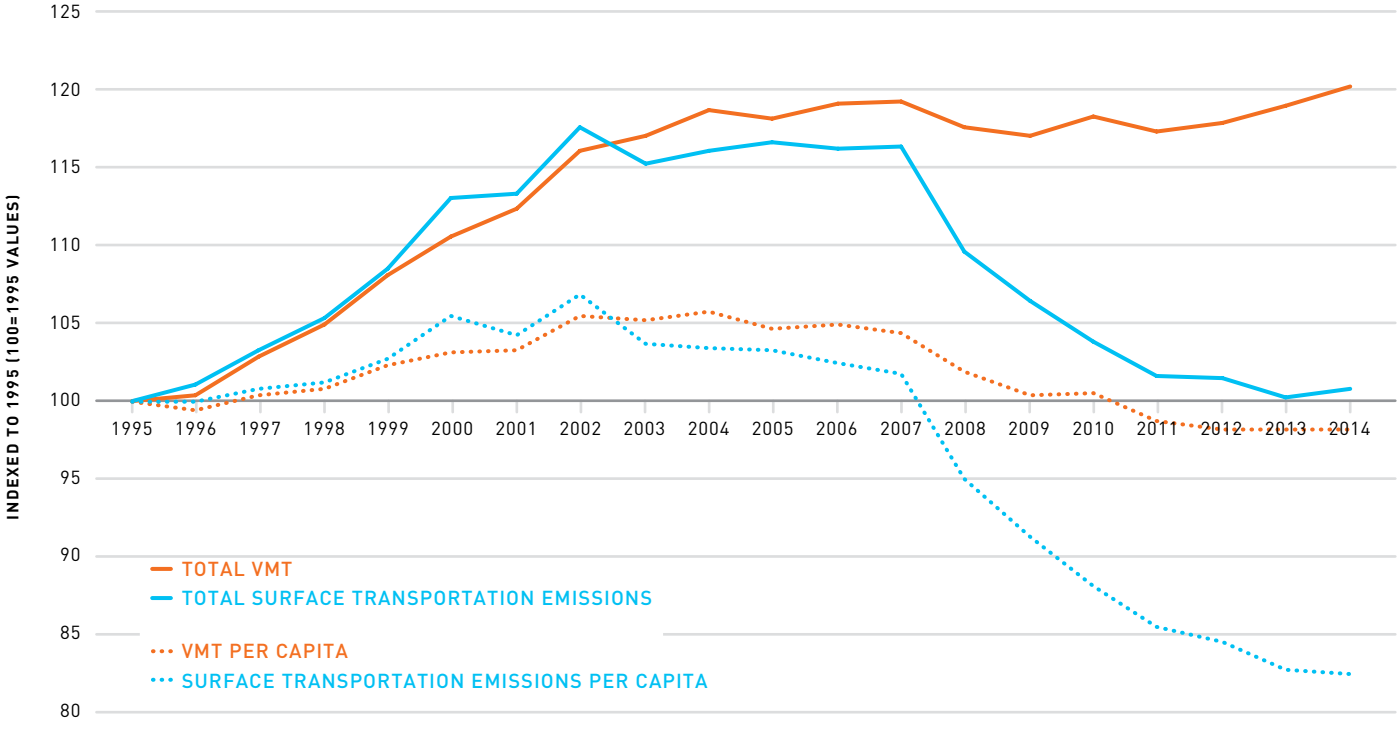
CALIFORNIA



NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Note: Total number of vehicles are for all vehicles registered in California including cars and trucks. Data Source: California Air Resources Board, California Greenhouse Gas Inventory – by Sector and Activity; California Energy Commission. NEXT 10 / SF · CA · USA

FIGURE 18. VEHICLE MILES TRAVELED AND GREENHOUSE GAS EMISSIONS FROM SURFACE TRANSPORTATION

TOTAL VMT AND EMISSIONS AND PER CAPITA / CALIFORNIA



NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Data Source: California Air Resources Board, California Greenhouse Gas Inventory – by Sector and Activity; California Department of Transportation; California Department of Finance. NEXT 10 / SF · CA · USA

Transportation Indicators

Greenhouse gas emissions from surface transportation in California were 144.8 million $MTCO_2e$ in 2014. This represents a drop of 0.8 percent from 2011 but a 0.9 percent increase relative to 1995. This emissions decrease was achieved while total vehicle registrations in the state increased 2.2 percent from 2011 to 2014.

Total vehicle miles traveled (VMT) increased slightly in 2014 compared to 2013 (+1.0%). VMT per capita decreased 0.5 percent between 2011 and 2014.

California's Low Carbon Fuel Standard (LCFS), which took effect in 2011, has replaced more than 1.2 billion gallons of diesel fuel and 5.3 billion gallons of gasoline with low-carbon and renewable fuels.[30]

California leads the nation in building the ZEV marketplace because of the aforementioned ZEV mandate requiring automakers to sell an increasing percentage of ZEVs in California. While California has more ZEVs on the road than any other state, it is not alone in attempts to increase the number of electric and alternative fuel vehicles. Section 177 of the Clean Air Act allows other states to adopt California's automotive emissions rules and so far, nine other states and the District of Columbia have all said they will follow California with a ZEV requirement of their own. In 2013, governors from eight states, including California, Oregon and six Northeast and mid-Atlantic states, who together represent 23 percent of the U.S. auto market, signed an MOU with a goal to put 3.3 million electric vehicles on the road by 2025.

In 2012 there were 34,547 ZEVs registered in California. The number of ZEVs rose to 60,206 in 2013 and to 118,801 in 2014, marking a 244 percent increase over the three-year period. This growth in ZEVs was driven by a 115 percent increase in electric vehicles and a 550 percent increase in plug-in hybrid vehicles. During the same period (2012–2014) traditional gasoline vehicle registration rose only 0.8 percent.

Clean vehicle rebates are one way California promotes adoption of cleaner vehicles. These rebates, funded through the state's climate investments program, provide up to $6,500 per vehicle for eligible ZEVs. In 2015, the San Jose-Sunnyvale-Santa Clara metro area received the highest number of clean vehicle rebates per 1 million people, with 3,866, followed by San Francisco-Oakland-Hayward with 2,216. Los Angeles-Long Beach-Anaheim claimed 1,327 and San Diego-Carlsbad received 1,014 rebates per 1 million people in 2015. Growth in clean vehicle rebates was not uniform across the state, with drops in 2015 from 2014 in Chico (-40%), and Santa Maria-Santa Barbara down 15 percent.

In the larger metro areas, growth from 2014–2015 was largely stable. In the Northern part of the state, San Francisco-Oakland-Hayward saw a 10 percent increase while San Jose-Sunnyvale-Santa Clara inched up seven percent. In Southern California, Los Angeles saw a seven percent increase and Oxnard-Thousand Oaks-Venture experienced a three percent increase in clean vehicle rebate claims. Since 2012, the type of vehicle receiving a rebate has shifted from a majority plug-in hybrid vehicles to a majority battery electric vehicles. In 2015, battery electric vehicle rebates increased 27 percent from the previous year while plug-in hybrid rebates saw a 21 percent decline.

TABLE 4. VEHICLE MILES TRAVELED

CALIFORNIA, 2014

VMT (MILLIONS)	VMT PER CAPITA	2013–2014 PER CAPITA CHANGE
332,857.1983	8,580	0.024%

NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Data Source: California Department of Transportation. NEXT 10 / SF · CA · USA

TABLE 5. ALTERNATIVE FUEL AND ZERO EMISSIONS VEHICLE REGISTRATIONS

CALIFORNIA

	2014	% CHANGE 13–14	% CHANGE 12–14
BATTERY ELECTRIC	51,740	93.4%	114.8%
PLUG-IN HYBRID	66,887	100.9%	549.5%
NATURAL GAS	28,915	13.4%	-12.9%
HYBRID	798,751	15.6%	37.8%
HYDROGEN	174	8.7%	7.4%
TOTAL ALTERNATIVE FUEL VEHICLES	946,467	21.9%	46.2%
TOTAL ZEV	118,801	97.3%	243.9%
TOTAL VEHICLES	28,090,446	2.3%	0.8%

NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Note: Zero Emission Vehicles include electric, plug-in hybrid, and hydrogen vehicles. Data Source: California Energy Commission.
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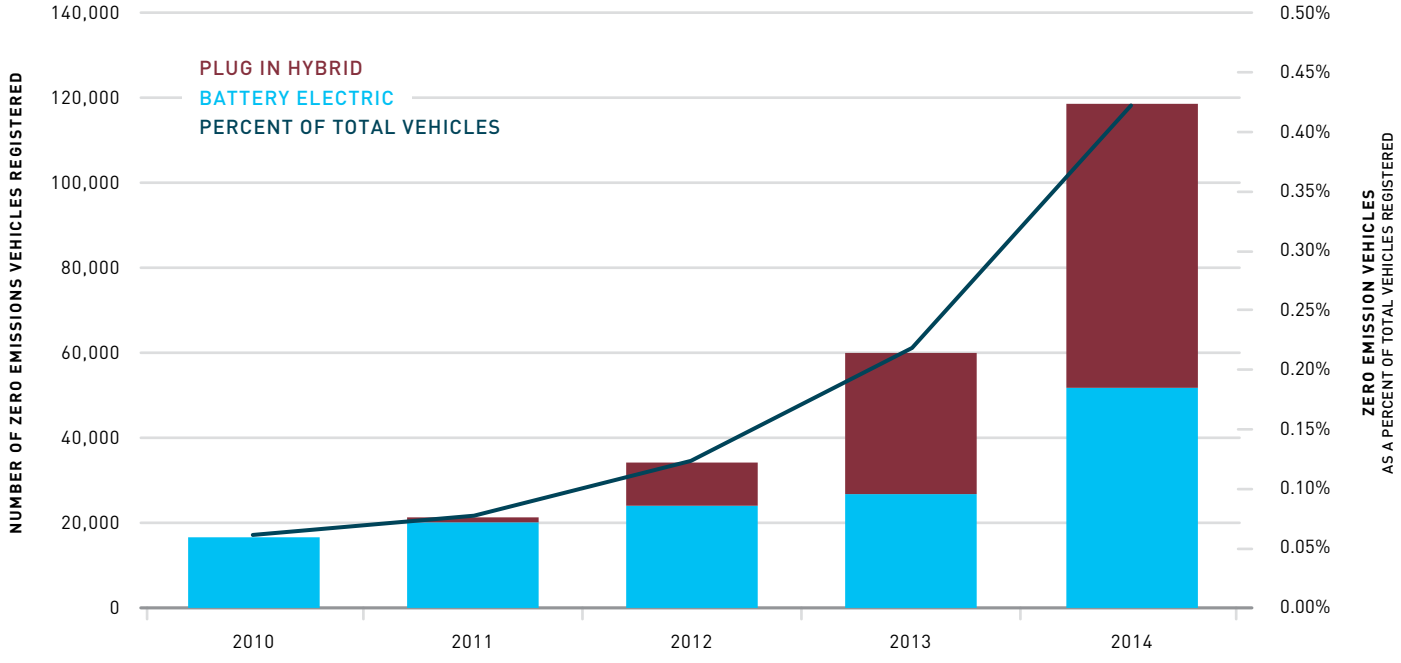
FIGURE 19. TRENDS IN TOTAL ZERO EMISSIONS VEHICLE REGISTRATIONS

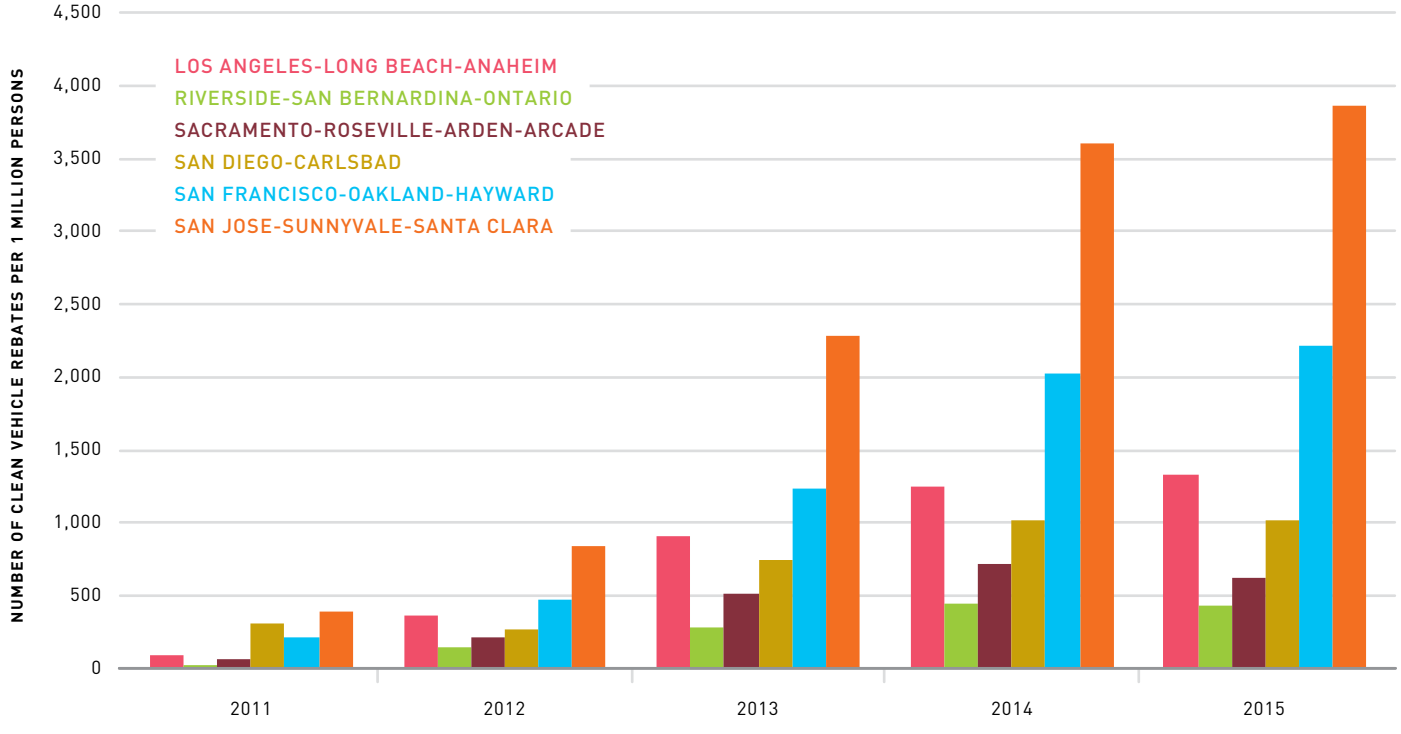
CALIFORNIA



NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Data Source: California Energy Commission. NEXT 10 / SF · CA · USA

FIGURE 20. CLEAN VEHICLE REBATES PER 1 MILLION PERSONS BY SELECTED MSAs

2011–2015



NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Note: Data does not include figures where year is "N/A." Data Source: Center for Sustainable Energy. California Air Resources Board Clean Vehicle Rebate Project, Rebate Statistics. NEXT 10 / SF · CA · USA

Clean Technology Innovation

Why is it Important?

New innovations in technology and business continue to be critical in helping California shift from a carbon-based economy to a cleaner and more efficient economy. Investments in companies specializing in clean technology help to advance research, development, and commercialization of new products and services for broad economic integration and consumption. Patent registrations are an additional measure serving to highlight the knowledge accumulated through previous investment in research and development activities. Patent filings represent future potential growth in clean technology, and together with investment data, illustrate the continuing role California plays in leading the transition to a clean economy.

CLEAN TECHNOLOGY PATENTS

California continues to lead the U.S. in clean technology patent innovations overall and in most segments. Patent registrations have been somewhat insulated from the decrease in venture capital in recent years, in part because a substantial portion of patent activity has come from long-established corporations, as well as research institutions, which are not dependent on private venture funding.

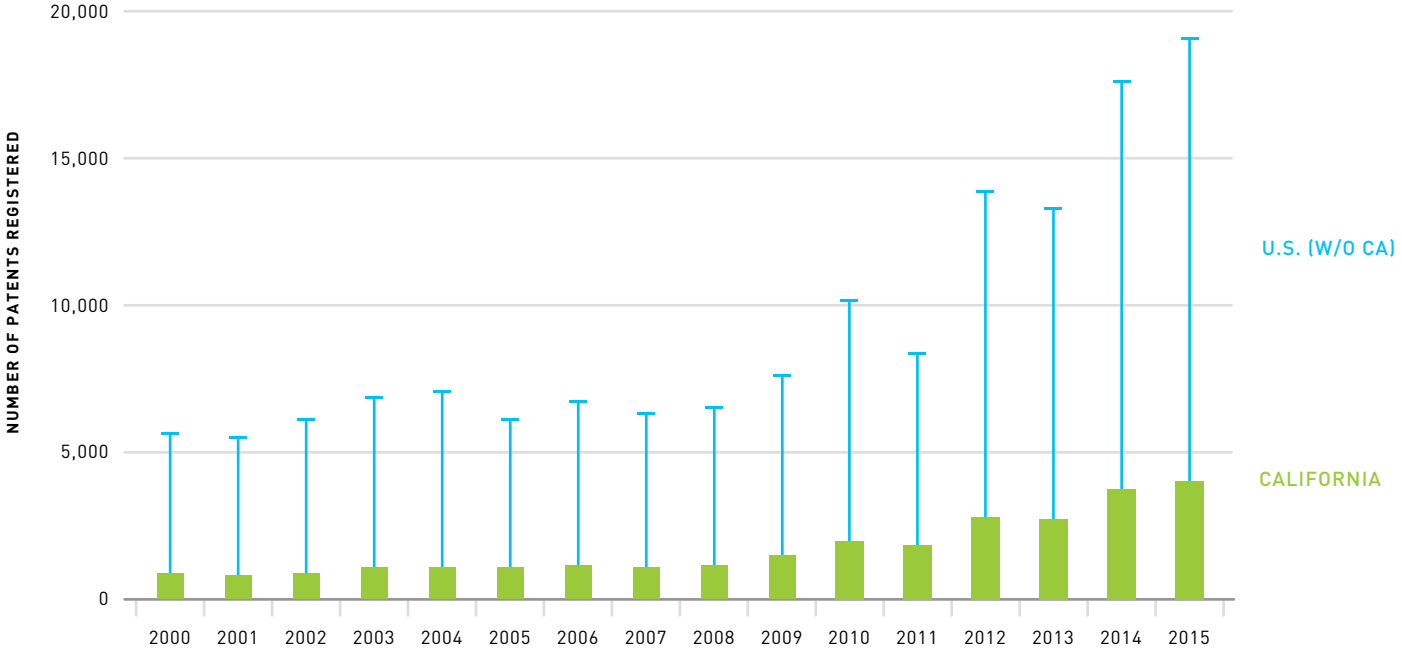
Clean technology patent registrations rose by 8.1 percent between 2014 and 2015 in the U.S. and increased 8.0 percent in California. California had a total of 4,052 clean tech patents in 2015, while the rest of the U.S. had 15,044 patents.

California patent registrations were up in Green Materials (+25.5%), Clean Transportation (+25.9%), Energy Storage (+19.9%), and Wind (+17.2%) between 2014 and 2015. Patent registrations decreased in Air & Environment (-27.2%), Energy Efficiency (-15.6%), and Water (-12.5%) over the same time period.

California registered more clean technology patents in 2015 than any other state, followed by New York (#2), Texas (#3), Michigan (#4), and Illinois (#5). While California secured the top rank in every technology segment, the other top 10 spots in each segment tended to fluctuate between several states.

Transportation: With 438 patents registered in 2015, California had nearly as many patents in transportation than

FIGURE 21. U.S. CLEAN TECHNOLOGY PATENT REGISTRATIONS BY RESIDENCE OF FIRST INVENTOR
2000–2015, CALIFORNIA VS. REST OF U.S.



NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Data Source: IP Checkups, CleanTech Patent Edge. NEXT 10 / SF · CA · USA

the next two states combined (461 transportation patents in total between Michigan and Illinois).

Biofuels: California had 193 patents registered, which is more than twice as many as its runner-up Illinois. Delaware, which is the sixth least populous state, tied with Colorado for fifth with 21 patents registered.

Solar: California dominated the solar patent segment with 435 patents registered, more than five times as many patents as the next state, New York, which had 83 patents registered. New Mexico, a relatively low population state, secured the number seven spot with 38 patents, edging out fellow sunny state Florida's 33 patents.

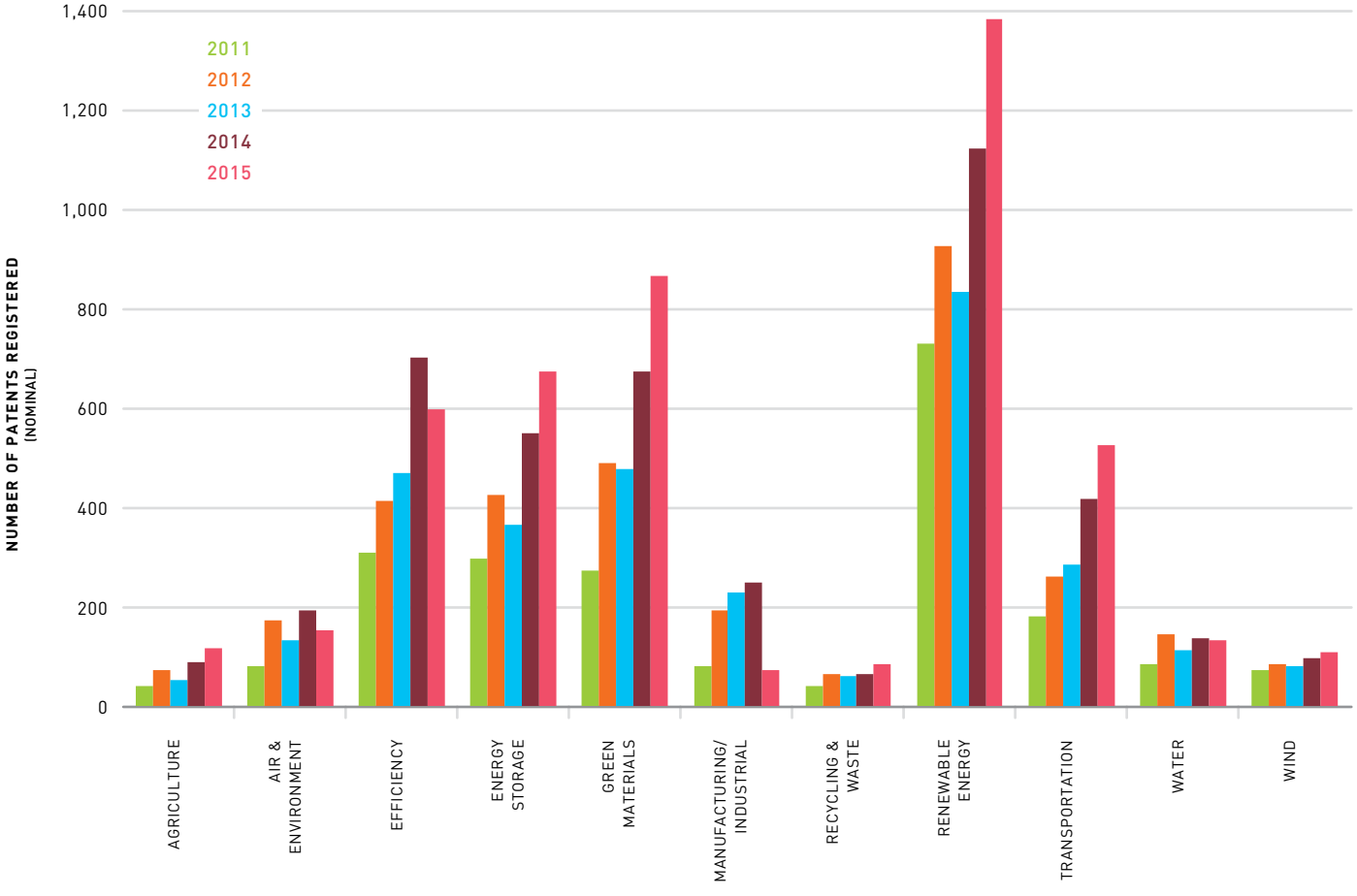
Wind: While California was king with 75 patents registered, South Carolina retained its number two spot from the previous year with 48 patents registered.

Efficiency: California had the lion's share of efficiency patents in 2015 (25.8% of all efficiency patents in the U.S. In 2015). With 540 patents registered, California had more than the next five states combined.

Green Materials: California had the most number of green material patents registered in 2015 with 680 patents, which is just slightly less than the next three states combined (764 patents between New York, Texas, and Pennsylvania).

FIGURE 22. CALIFORNIA CLEAN TECHNOLOGY PATENT REGISTRATIONS BY SEGMENT

2011–2015



NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Data Source: IP Checkups, CleanTech Patent Edge. NEXT 10 / SF · CA · USA

TABLE 6. TOTAL CLEAN TECHNOLOGY PATENT RANKING

TOP RANKING STATES IN 2015

RANK	STATE	NUMBER OF PATENTS
1	CALIFORNIA	4,052
2	NEW YORK	1,215
3	TEXAS	1,172
4	MICHIGAN	1,150
5	ILLINOIS	800
6	MASSACHUSETTS	768
7	PENNSYLVANIA	683
8	FLORIDA	647
9	WASHINGTON	603
10	OHIO	574

NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Data Source: IP Checkups, CleanTech Patent Edge. NEXT 10 / SF · CA · USA

TABLE 7. EFFICIENCY PATENT RANKING

TOP RANKING STATES IN 2015

RANK	STATE	NUMBER OF PATENTS
1	CALIFORNIA	540
2	NEW YORK	122
3	TEXAS	113
4	MASSACHUSETTS	90
5	NORTH CAROLINA	87
6	FLORIDA	82
6	MICHIGAN	82
8	NEW JERSEY	75
9	PENNSYLVANIA	68
10	GEORGIA	67

NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Data Source: IP Checkups, CleanTech Patent Edge. NEXT 10 / SF · CA · USA

TABLE 8. ENERGY STORAGE PATENT RANKING

TOP RANKING STATES IN 2015

RANK	STATE	NUMBER OF PATENTS
1	CALIFORNIA	495
2	MICHIGAN	204
3	NEW YORK	147
4	MASSACHUSETTS	72
5	ILLINOIS	70
6	TEXAS	64
7	CONNECTICUT	61
8	WASHINGTON	56
9	OHIO	54
10	WISCONSIN	49

NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Data Source: IP Checkups, CleanTech Patent Edge. NEXT 10 / SF · CA · USA

TABLE 9. GREEN MATERIALS PATENT RANKING

TOP RANKING STATES IN 2015

RANK	STATE	NUMBER OF PATENTS
1	CALIFORNIA	680
2	NEW YORK	313
3	TEXAS	249
4	PENNSYLVANIA	202
5	MASSACHUSETTS	196
6	MINNESOTA	177
7	MICHIGAN	141
8	OHIO	134
9	WASHINGTON	133
10	NEW JERSEY	130

NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Data Source: IP Checkups, CleanTech Patent Edge. NEXT 10 / SF · CA · USA

TABLE 10. BIOFUELS PATENT RANKING

TOP RANKING STATES IN 2015

RANK	STATE	NUMBER OF PATENTS
1	CALIFORNIA	193
2	ILLINOIS	77
3	TEXAS	63
4	MASSACHUSETTS	55
5	COLORADO	21
5	DELAWARE	21
7	GEORGIA	20
7	IOWA	20
7	MICHIGAN	20
7	NEW JERSEY	20

NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Data Source: IP Checkups, CleanTech Patent Edge. NEXT 10 / SF · CA · USA

TABLE 11. SOLAR PATENT RANKING

TOP RANKING STATES IN 2015

RANK	STATE	NUMBER OF PATENTS
1	CALIFORNIA	435
2	NEW YORK	83
3	COLORADO	51
3	TEXAS	51
5	MASSACHUSETTS	41
6	MICHIGAN	39
7	NEW MEXICO	38
8	PENNSYLVANIA	34
9	FLORIDA	33
10	NEW JERSEY	26

NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Data Source: IP Checkups, CleanTech Patent Edge. NEXT 10 / SF · CA · USA

TABLE 12. WIND PATENT RANKING

TOP RANKING STATES IN 2015

RANK	STATE	NUMBER OF PATENTS
1	CALIFORNIA	75
2	SOUTH CAROLINA	48
3	NEW YORK	47
4	COLORADO	20
4	TEXAS	20
6	VIRGINIA	19
7	WASHINGTON	16
8	FLORIDA	14
9	MASSACHUSETTS	13
9	OHIO	13

NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Data Source: IP Checkups, CleanTech Patent Edge. NEXT 10 / SF · CA · USA

TABLE 13. TRANSPORTATION PATENT RANKING

TOP RANKING STATES IN 2015

RANK	STATE	NUMBER OF PATENTS
1	CALIFORNIA	438
2	MICHIGAN	292
3	ILLINOIS	169
4	TEXAS	123
5	FLORIDA	104
6	WASHINGTON	94
7	NEW YORK	77
7	PENNSYLVANIA	77
9	WISCONSIN	70
10	INDIANA	67

NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Data Source: IP Checkups, CleanTech Patent Edge. NEXT 10 / SF · CA · USA

TABLE 14. WATER PATENT RANKING

TOP RANKING STATES IN 2015

RANK	STATE	NUMBER OF PATENTS
1	CALIFORNIA	84
2	TEXAS	47
3	KENTUCKY	37
4	PENNSYLVANIA	34
5	MICHIGAN	32
6	FLORIDA	31
7	ILLINOIS	28
8	NEW YORK	25
8	OHIO	25
10	NEW JERSEY	23

NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Data Source: IP Checkups, CleanTech Patent Edge. NEXT 10 / SF · CA · USA

TABLE 15. AIR & ENVIRONMENT PATENT RANKING

TOP RANKING STATES IN 2015

RANK	STATE	NUMBER OF PATENTS
1	CALIFORNIA	115
2	MICHIGAN	81
3	TEXAS	53
4	NEW YORK	45
5	MASSACHUSETTS	41
6	PENNSYLVANIA	34
7	OHIO	33
8	ILLINOIS	31
9	FLORIDA	30
10	INDIANA	25

NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Data Source: IP Checkups, CleanTech Patent Edge. NEXT 10 / SF · CA · USA

TABLE 16. MULTIPLE CATEGORIES PATENT RANKING

TOP RANKING STATES IN 2015

RANK	STATE	NUMBER OF PATENTS
1	CALIFORNIA	483
2	TEXAS	173
3	MICHIGAN	153
4	NEW YORK	142
5	MASSACHUSETTS	124
6	ILLINOIS	110
7	PENNSYLVANIA	97
8	FLORIDA	96
9	OHIO	94
10	WASHINGTON	88

NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Data Source: IP Checkups, CleanTech Patent Edge. NEXT 10 / SF · CA · USA

CLEAN TECHNOLOGY INVESTMENTS

Investment fuels clean technology innovation, allowing companies and researchers to create and improve new, ground-breaking products and services. These types of investments are becoming more diversified, with new types of financing emerging as more investors gain an understanding of the technologies and value proposition of clean technology.

Total investment in clean technology companies continued to grow in 2015 for both the U.S. and California. This investment includes venture capital, debt/loans, grants from private and public resources, private and public equity, and follow-on public offerings. For the U.S., total investment in clean technology companies was $14.5 billion, up five percent compared to 2014. For California, investment continued its impressive trajectory in recent years to reach $9.8 billion in 2015, up 35 percent compared to 2014.

Of the total clean technology investment in the U.S. in 2015, 67 percent of it was invested in California. Venture capital is one of the primary ways for startup companies to secure

the necessary capital to create new, innovative products and services. While other types of investors are also important to grow and expand the clean technology market, venture capitalists play a unique and vital role due to their tolerance of early stage, high-risk investments and management expertise. Indeed, while overall venture capital investment has fluctuated in recent years, companies are still emerging and receiving early-stage investment, with venture capital continuing to constitute the largest type of investment in clean technology.

California continues to lead the U.S. in venture capital investments, with its clean tech companies receiving the majority of all clean tech venture capital investment in the U.S. in 2015. California clean technology companies alone received more than two-thirds of total U.S. venture capital

TABLE 17. INVESTMENT IN CLEAN TECHNOLOGY COMPANIES

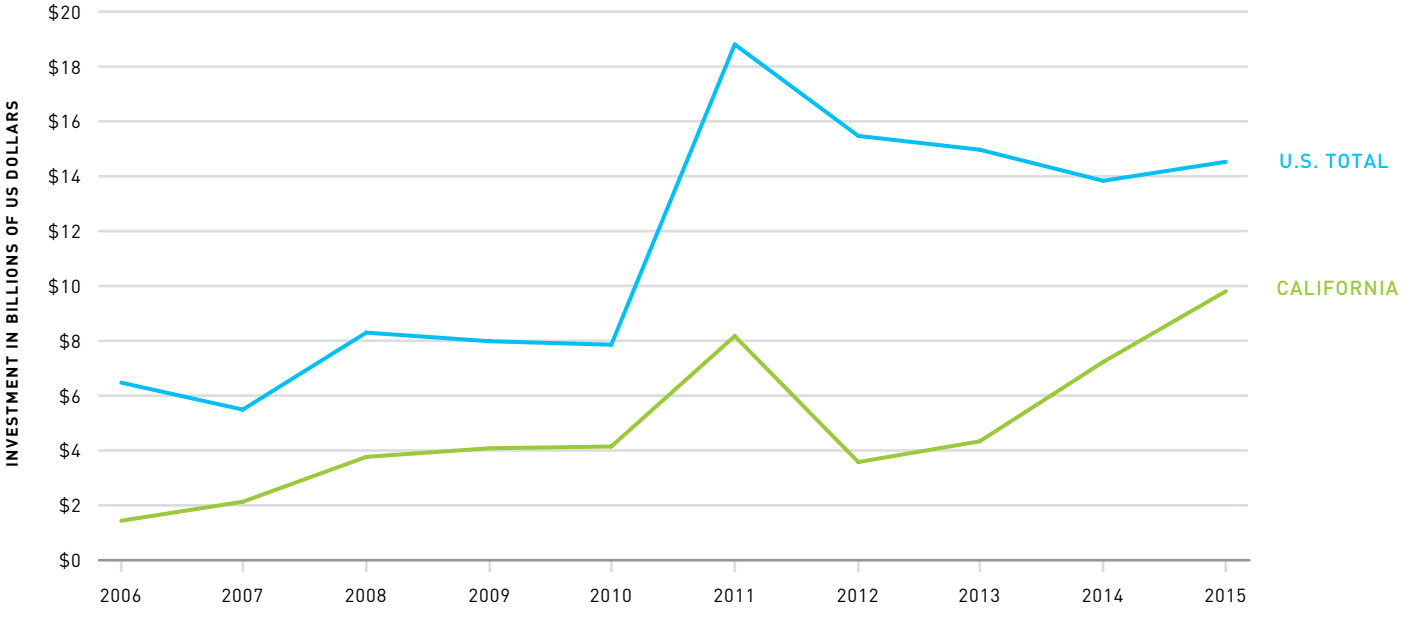
TOP 10 STATES

STATE	RANK	TOTAL FUNDING	VENTURE CAPITAL	% VENTURE CAPITAL
CALIFORNIA	1	$9,779,411,594	$5,600,697,214	57%
MASSACHUSETTS	2	$816,123,072	$700,886,072	86%
MISSOURI	3	$595,802,378	$2,800,000	<1%
TEXAS	4	$496,643,500	$420,483,500	85%
NEW JERSEY	5	$422,758,905	$97,163,405	23%
NEW YORK	6	$201,526,000	$179,989,000	89%
WASHINGTON	7	$197,085,007	$150,009,707	76%
COLORADO	8	$132,180,000	$81,095,000	61%
MARYLAND	9	$101,380,000	$61,350,000	61%
FLORIDA	10	$93,582,891	$67,832,891	72%

NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Data Source: Cleantech Group, LLC. NEXT 10 / SF · CA · USA

FIGURE 23. INVESTMENT IN CLEAN TECHNOLOGY COMPANIES

U.S. & CA, 2006–2015



NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Note: Total investment number excludes project finance. Data Source: Cleantech Group, LLC. NEXT 10 / SF · CA · USA

investment in 2015. California also received the largest amount in most of the segments in 2015 except for solar, geothermal, and fuel cells & hydrogen.

After a substantial increase in 2014, U.S. venture capital investment in clean technology declined 11 percent to $7.9 billion in 2015. As for California, venture capital investment in clean technology also declined slightly to $5.6 billion in 2015, or an eight percent decline compared to 2014. However, much of the surge in 2014 was due to a $3 billion investment for the ride sharing company Uber,[31] which accounted for about half of California's total venture capital investment. Taking into account the 2014 'Uber effect' makes the 2015 investment totals all the more impressive.

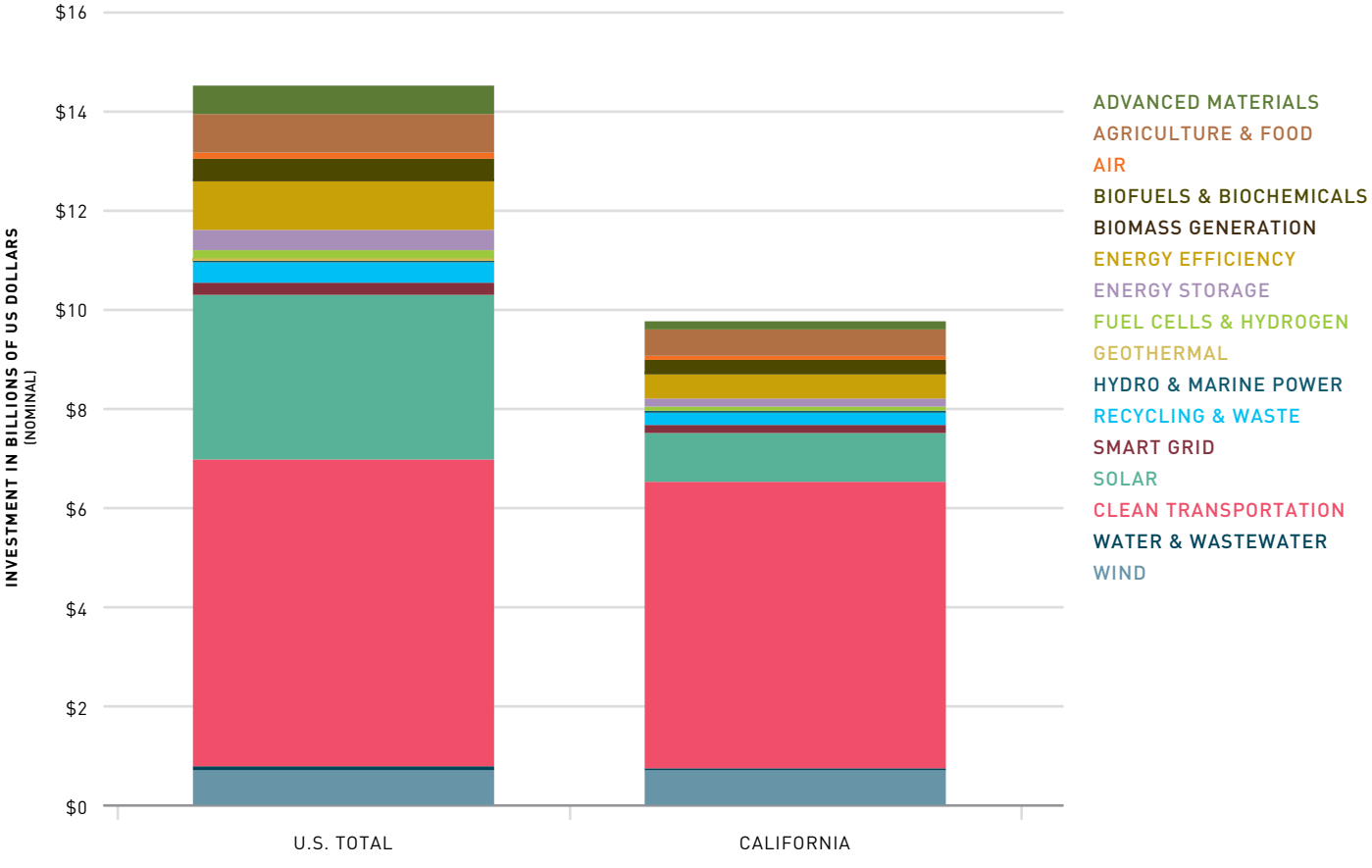
Clean Transportation: U.S. clean technology venture capital investment is spread across a variety of technology types. Continuing last year's trend, clean transportation in the U.S. received the majority of VC investment in 2015, with $3.7 billion, or 47 percent of the total. As for California, clean transportation also received the majority of VC investment in 2015, with $3.4 billion, or 60 percent of the total California clean tech investment.

Energy Efficiency: Despite a 30 percent decrease between 2014 and 2015, energy efficiency continued to be the next biggest segment of clean tech investment in the U.S. with $900 million in 2015. California energy efficiency investment suffered a 33 percent decline between 2014 and 2015, down to $480 million.

Agriculture & Food: Despite a 19 percent decrease compared to 2015, agriculture & food overtook solar to become the third largest clean tech category to receive venture capital investment in the U.S. with $800 million received in 2015. In California, the segment experienced a

FIGURE 24. TOTAL INVESTMENT IN CLEAN TECHNOLOGY COMPANIES

BY SEGMENT FOR U.S. AND CALIFORNIA, 2015



NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Data Source: Cleantech Group LLC. NEXT 10 / SF · CA · USA

three percent increase in venture capital investment over 2014, surpassing energy efficiency to become the second largest segment with $490 million received in 2015.

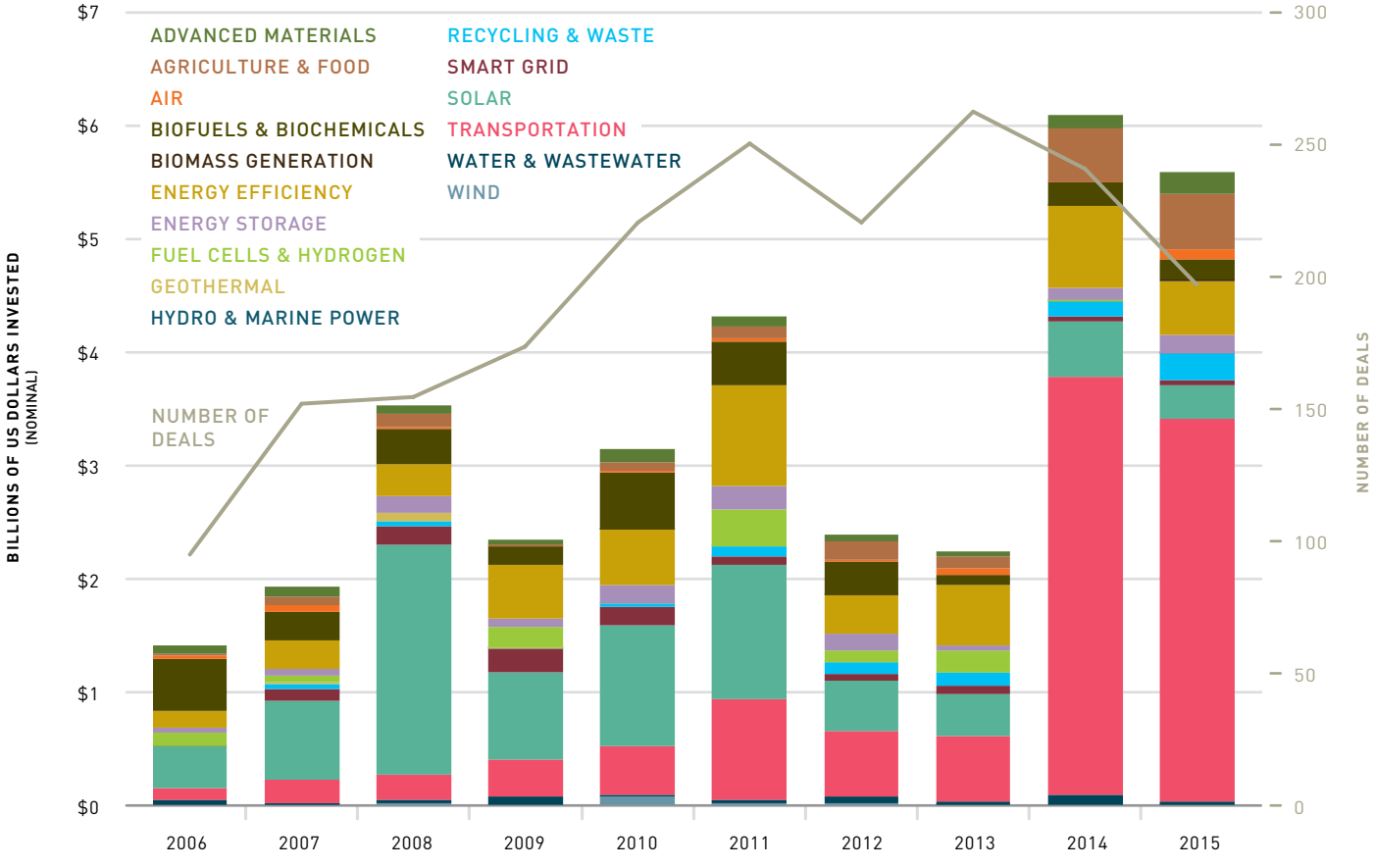
Solar: Solar fell from third place in 2014, finishing as the fourth largest type of clean technology to receive venture capital investment in both the U.S. and California in 2015. In the U.S., solar saw a 33 percent decline in venture capital investment compared to 2014 and received $750 million in 2015. In California, venture capital investment in solar decreased by 40 percent compared to 2014, receiving $290 million in 2015.

In 2015, a few small types of technology received more than double the amount of venture capital investment than in 2014. In 2015, investment in air and environment increased by 102 percent in the U.S. (with $95 million received), and by 15 times in California (with $93 million received). Investment in advanced materials increased by 104 percent in the U.S. and by 81 percent in California compared to 2014, with $449 million and $197 million received in 2015, respectively.

MERGERS & ACQUISITIONS

After a surge in 2010 and 2011, U.S. merger and acquisition (M&A) activities in clean technology companies continued to decline in 2015 to reach a total of 64, or a 35 percent decline from 2014. In California, M&A activities in clean technology companies also declined significantly to a total of just 20, or a 39 percent decline compared to 2014. Massachusetts, home of several world-class research institutions, had the second most M&A activities in 2015 with just seven M&As, down slightly from eight M&As in 2014. Of the 50 U.S. states and the District of Columbia, 29 of them had no M&A activity in 2015. Solar and energy efficiency companies saw the most M&A activity in 2015, with 11 and 14 M&As in the U.S., respectively.

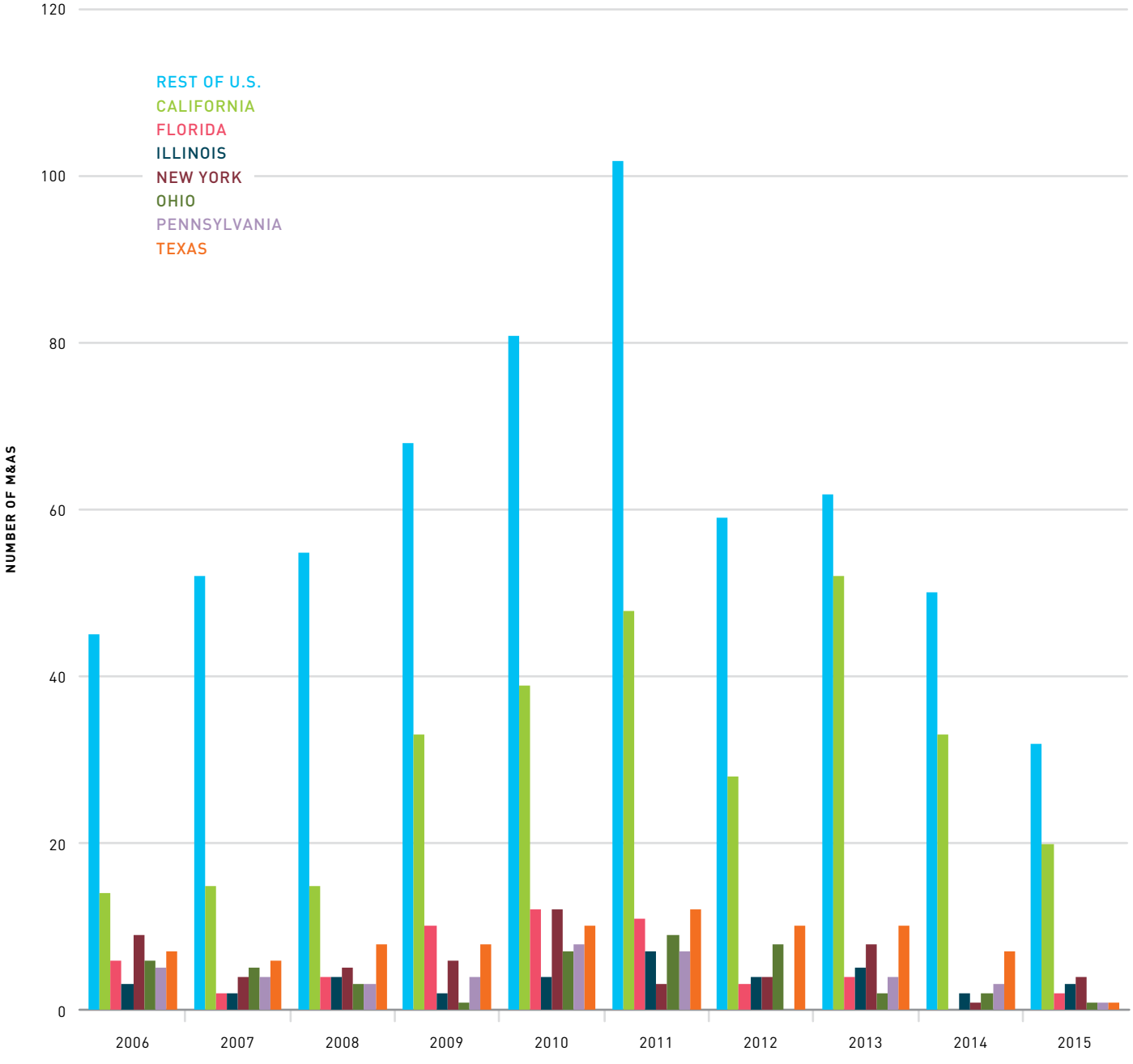
FIGURE 25. VENTURE CAPITAL INVESTMENT IN CLEAN TECHNOLOGY BY SEGMENT
CALIFORNIA



NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Data Source: Cleantech Group LLC. NEXT 10 / SF · CA · USA

FIGURE 26. MERGERS & ACQUISITIONS OF CLEAN TECHNOLOGY COMPANIES

BY STATE OF TARGETED COMPANY, 2006–2015



NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Data Source: Cleantech Group, LLC. NEXT 10 / SF · CA · USA

Agriculture & Livestock

CALIFORNIA TACKLING METHANE EMISSIONS FROM DAIRY AND LIVESTOCK

The reduction of CO_2 emissions from fossil fuels is a key aspect of combating climate change, however, other greenhouse gases such as methane (CH_4) are also important target for reducing emissions. Methane as a greenhouse gas is estimated to be 25 times more potent at trapping heat than CO_2 over a 100-year period, and is responsible for about 20 percent of current global warming. Methane is the second largest source of GHG emissions worldwide and continues to increase globally.[32]

In California, more than half of the state's methane is emitted by the dairy and livestock industries. As Figure 27 indicates, approximately 30 percent of methane emissions are from non-dairy livestock (beef) and dairy enteric fermentation, which are emissions exhaled, belched, and expelled by animals. The remaining 25 percent of livestock emissions are the result of manure management practices.

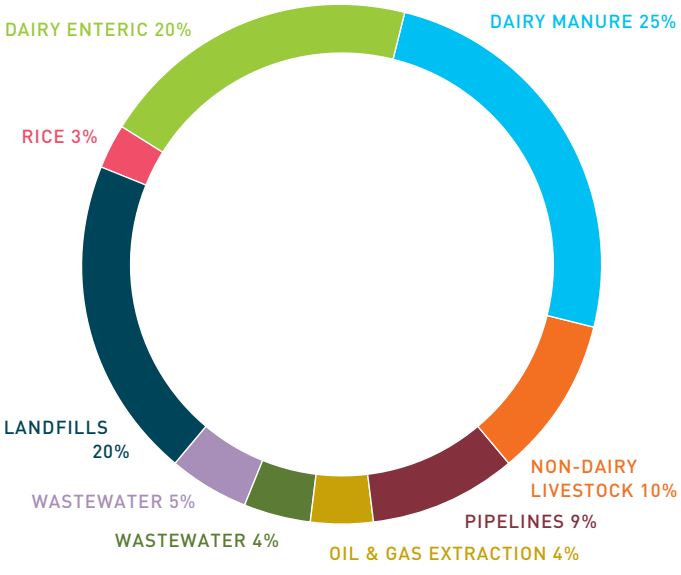
The U.S. Environmental Protection Agency estimates GHG emissions from livestock manure management systems in the U.S. have grown 54 percent since 1990.[33] This is the result of the continued increase in lagoon storage of milk cow manure. In California, livestock accounted for roughly two thirds of emissions from the agriculture sector and the California ARB estimates dairy and livestock emissions account for five percent of the state's overall GHG emissions.[34]

From 2000–2014 GHG emissions attributed to livestock manure management climbed 22.6 percent, while emissions from dairy anaerobic lagoons increased 34.3 percent. Meanwhile the agriculture and forestry sector overall saw emissions grow 11% from 32.1 million $MTCO_2e$ to 36.1 million $MTCO_2e$.[35]

California has the largest number of dairy cows in the United States, and also has a higher per-milking-cow rate of methane emissions due to the pervasive use of lagoon waste systems.[36] In 2000, the California dairy industry produced 32.4 billion pounds of milk and the lagoon systems associated with the dairy farm systems emitted 6.66 million $MTCO_2e$. By 2014, total milk production had increased 23.8 percent to 42.3 billion pounds and dairy anaerobic lagoon emissions increased by 34.3 percent to 8.96 million $MTCO_2e$. This increase of 2.3 million $MTCO_2e$ over the 14-year period is equivalent to the GHG emissions from 485,837 passenger vehicles driven for a year.[37]

FIGURE 27. METHANE EMISSIONS BY SOURCE

CALIFORNIA, 2013



NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Data Source: The Proposed Short-Lived Climate Pollutant Reduction Strategy, California Air Resources Board, 2016, p. 58. NEXT 10 / SF · CA · USA

Methane has been in the headlines recently with the Southern California Gas Aliso Canyon storage facility leak outside Los Angeles. The nearly four-month leak resulted in the largest-known release of methane in U.S. history.[38] Currently, the leak is estimated to have released 2.4 million $MTCO_2e$ into the atmosphere (using a 100-year GWP).[39] While this leak is a notable safety and emissions concern, if the Aliso Canyon leak continued to release emissions at the rate of 2.4 million $MTCO_2e$ every 16 weeks, it would have released an estimated 7.8 million $MTCO_2e$ over the period of a year—still falling short of the 8.71 million $MTCO_2e$ released by dairy waste lagoons in 2013.

SPURRING INNOVATION AND LEADING THE WAY

In April 2016 the California ARB released The Proposed Short-Lived Climate Pollutant Reduction Strategy that sets ambitious planning targets to reduce methane emissions by 40 percent below 2013 levels by 2030. The plan aims to reduce emissions from dairy manure management by 20 percent in 2020, 50 percent in 2025 and by 75 percent in 2030.[40] It is proposed that 2016–2017 state budget would allocate expenditures from the cap-and-trade program to meet these goals, with $100 million for waste diversion and $35 million for dairy digester development.

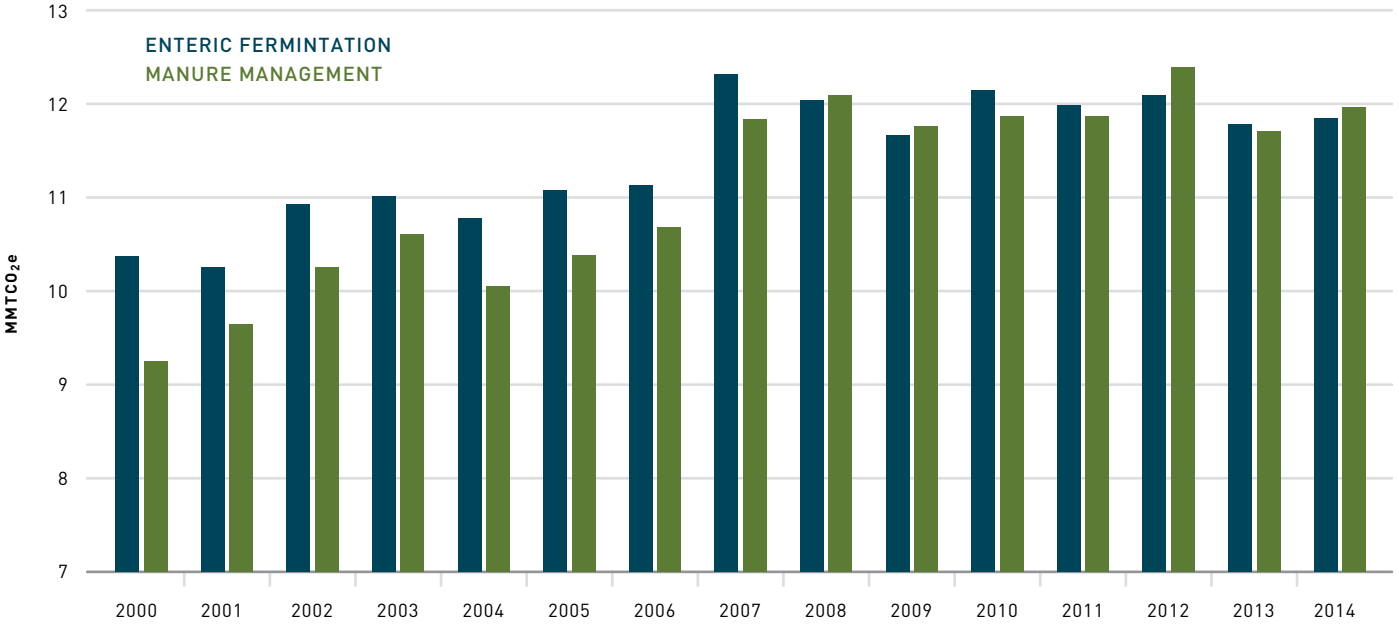
The California Department of Food and Agriculture (CDFA) began funding dairy digester projects in 2014. These digesters capture the decomposition of dairy manure to produce biogas that can be used as fuel or to generate electricity, in addition to reducing odor, pathogens, and waste. The CDFA awarded $12 million in 2014 and $11.1 million in 2015 to implement new emissions reducing technology on California dairy operations. The five projects funded in 2015 are expected to reduce emissions by 1.37 million $MTCO_2e$ over ten years.[41]

Nationally, the installation of digester projects have slowed due in part to low natural gas prices and the decline in costs associated with wind and solar. Digester systems generate electricity from dairy manure, and after installation costs, have the potential to generate revenue for the dairy operation through electricity sales to utilities.[42]

California and New York are currently the only two states where installations are expected to rebound due to state financial incentives. Along with the CDFA, the California Energy Commission awarded San Joaquin Valley dairies $8 million to build innovative biogas projects that will both reduce methane emissions and generate electricity that will be delivered to PG&E. The projects are scheduled for completion in 2019 and will bring California's dairy digester total to 22, placing the state behind Wisconsin, New York and Pennsylvania.[43, 44]

These programs and incentives to reduce emissions from dairy and livestock are a key part of meeting California's GHG reduction targets.

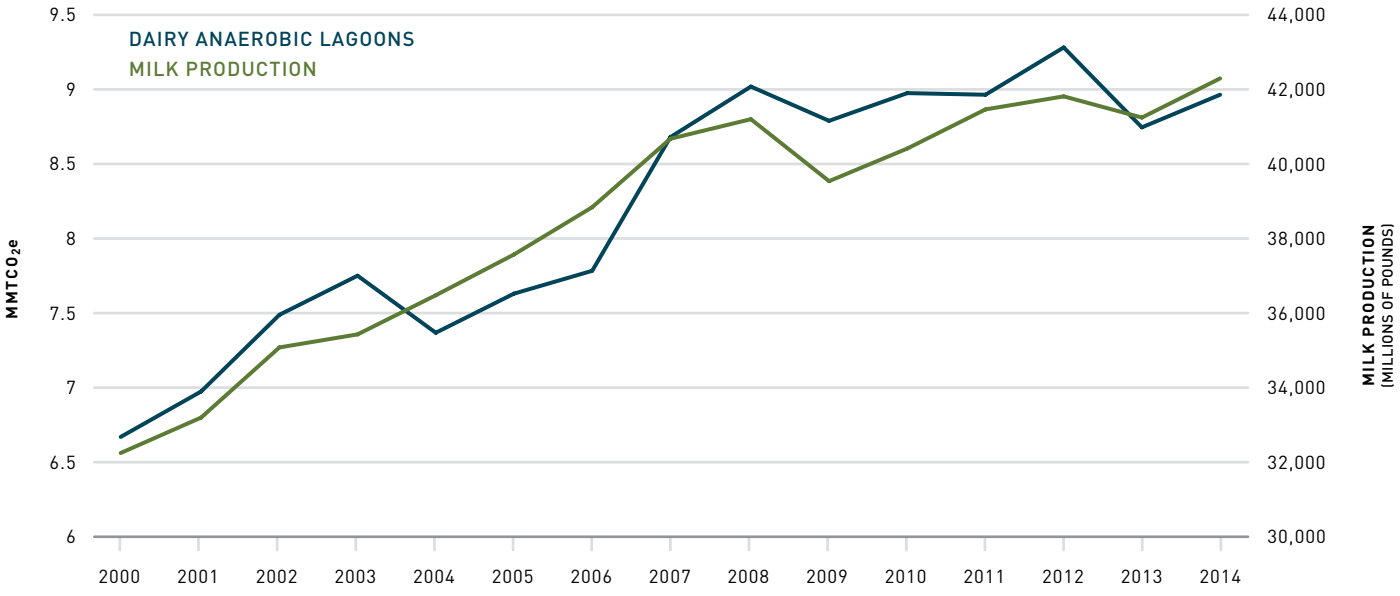
FIGURE 28. LIVESTOCK EMISSIONS IN CALIFORNIA



NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Data Source: California Air Resources Board, California Greenhouse Gas Inventory. NEXT 10 / SF · CA · USA

FIGURE 29. METHANE EMISSIONS FROM DAIRY ANAEROBIC LAGOONS

CALIFORNIA



NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. *Manure Management, Cattle, Anaerobic Lagoon, Dairy Cows, N_2O. Data Source: USDA National Agricultural Statistics Service; California Air Resources Board, California Greenhouse Gas Inventory. NEXT 10 / SF · CA · USA

Regional Scorecards

The regional scorecards provide a snapshot of 26 metro areas in 2014, ranking them across a range of indicators, including commute times, recent GDP growth, energy productivity and clean tech patent filings. As the scorecards indicate, diverse metro areas are embracing clean technology. These regional scorecards serve as an important reminder that no one part of the state has a monopoly on helping California achieve a cleaner more efficient economy.

Electricity Productivity

SAN FRANCISCO-OAKLAND-HAYWARD ranks first for electricity productivity, with San Diego-Carlsbad coming in third and Los Angeles-Long Beach-Anaheim ranked fourth. Merced ranked last and Madera ranked second-to-last in terms of electricity productivity.

Solar PV Capacity Additions

RIVERSIDE-SAN BERNARDINO-ONTARIO has emerged as the state's top region for commercial and residential solar power. **FRESNO** ranks number one for industrial solar power.

Solar rankings for Los Angeles are toward the bottom of the rankings when you factor in the region's large population. On a per capita basis, the Los Angeles area ranks twenty-fourth for solar in residential, commercial, and industrial solar capacity in 2014.

On a per-capita basis, Hanford-Corcoran boasts the most commercial and industrial solar energy. Yuba City ranks number one for residential solar energy on a per-capita basis, and Chico ranks number two.

Clean Vehicle Rebates

LOS ANGELES-LONG BEACH-ANAHEIM earns the top slot for clean vehicle rebates with 17,623 in 2015, a 7.75 percent increase from 2014. Riverside-San Bernardino-Ontario ranks fifth for the number of clean vehicle rebates. Hanford-Corcoran ranks last in clean vehicle rebates compared to the 25 other regions in California, with rebates issued in the region dropping 36 percent between 2014 and 2015.

Commute Times

Despite LA's reputation for horrendous traffic, commute times by driving are longer in four other metro areas including: San Francisco-Oakland-Hayward; Riverside-San Bernardino-Ontario; Stockton-Lodi, and Vallejo-Fairfield. Riverside-San Bernardino-Ontario drivers suffer the longest commute times.

Clean Technology Patents

SAN JOSE-SUNNYVALE-SANTA CLARA tops the rankings in green technology patents, filing 1,168 in 2015, more than the San Francisco-Oakland-Hayward and Sacramento-Roseville-Arden-Arcade areas combined. San Diego comes in fourth in green technology patents.

REGIONAL ECONOMIC & ENVIRONMENTAL INDICATORS

REGION	GDP	GDP PER CAPITA	POPULATION	ELECTRICITY PRODUCTIVITY	NATURAL GAS PRODUCTIVITY	ELECTRICITY CONSUMPTION PER CAPITA: RESIDENTIAL	ELECTRICITY CONSUMPTION PER CAPITA: NON-RESIDENTIAL	NATURAL GASCONSUMPTION PER CAPITA: RESIDENTIAL	NATURAL GASCONSUMPTION PER CAPITA: NON-RESIDENTIAL	GREEN TECHNOLOGY PATENTS	CLEAN VEHICLE REBATES	COMMUTE TIME BY DRIVING	SOLAR INSTALLED: COMMERCIAL	SOLAR INSTALLED: INDUSTRIAL	SOLAR INSTALLED: RESIDENTIAL
BAKERSFIELD	8	12	8	23	22	15	26	9	25	11	14	8	6	3	5
CHICO	21	22	20	16	17	23	3	14	7	21	22	3	15	17	13
EL CENTRO	22	21	21	19	16	22	16	1	13	23	25	10	26	25	26
FRESNO	9	15	7	14	18	20	17	8	18	16	9	4	5	1	6
HANFORD-CORCORAN	25	16	25	24	24	12	25	4	23	25	26	5	8	9	21
LOS ANGELES-LONG BEACH-ANAHEIM	1	3	1	4	5	6	12	12	14	3	1	22	3	6	3
MADERA	26	24	24	25	20	19	23	2	21	22	19	13	16	11	19
MERCED	20	26	19	26	26	18	24	3	24	18	21	20	9	7	18
MODESTO	14	17	11	20	21	24	19	11	20	13	16	19	21	22	24
NAPA	19	5	26	7	6	13	14	25	11	18	18	7	18	20	25
OXNARD-THOUSAND OAKS-VENTURA	7	6	9	6	2	8	7	17	1	7	7	18	17	16	10
REDDING	23	20	22	21	11	26	11	5	3	23	23	2	22	24	23
RIVERSIDE-SAN BERNARDINO-ONTARIO	5	23	3	18	14	16	8	6	8	6	5	26	1	5	1
SACRAMENTO-ROSEVILLE-ARDEN-ARCADE	6	8	5	12	4	25	9	22	5	5	6	17	11	15	7
SALINAS	13	9	16	9	10	1	10	16	12	15	17	11	19	21	16
SAN DIEGO-CARLSBAD	4	4	4	3	3	7	6	18	9	4	4	12	2	13	2
SAN FRANCISCO-OAKLAND-HAYWARD	2	2	2	1	9	3	15	26	22	2	2	23	4	4	4
SAN JOSE-SUNNYVALE-SANTA CLARA	3	1	6	2	1	4	21	19	10	1	3	16	10	10	8
SAN LUIS OBISPO-PASO ROBLES-ARROYO GRANDE	17	11	17	10	15	9	5	23	15	16	14	6	14	23	14
SANTA CRUZ-WATSONVILLE	18	14	18	5	8	5	1	13	4	9	10	15	24	26	22
SANTA MARIA-SANTA BARBARA	10	7	14	11	12	2	20	20	16	8	13	1	25	12	20
SANTA ROSA	11	10	12	8	7	14	2	24	6	10	8	14	12	18	17
STOCKTON-LODI	12	18	10	17	19	11	13	15	17	13	11	25	13	8	9
VALLEJO-FAIRFIELD	15	13	15	13	25	10	18	21	26	12	12	24	23	14	12
VISALIA-PORTERVILLE	16	25	13	22	23	17	22	7	19	20	19	9	7	2	11
YUBA CITY	24	19	23	15	13	21	4	10	2	25	24	21	20	19	15

BAKERSFIELD

METRIC	RANK	2014	2001–14 %
GDP (Real, in millions)	8	$39,989	56.9%
GDP PER CAPITA	12	$46,038	21.4%
POPULATION	8	13,868,610	29.3%
ELECTRICITY PRODUCTIVITY (GDP/kWh Consumed)	23	3.03	
NATURAL GAS PRODUCTIVITY (GDP/BTU Consumed)	22	93.17	
ELECTRICITY CONSUMPTION PER CAPITA: RESIDENTIAL (kWh/1,000 Person)	15	2.64	8.5%
ELECTRICITY CONSUMPTION PER CAPITA: NON-RESIDENTIAL (kWh/1,000 Person)	26	12.54	-23.8%
NATURAL GAS CONSUMPTION PER CAPITA: RESIDENTIAL (kWh/1,000 Person)	9	0.10	-19.3%
NATURAL GAS CONSUMPTION PER CAPITA: NON-RESIDENTIAL (kWh/1,000 Person)	25	0.40	-89.9%
COMMUTE TIME BY DRIVING (Minutes per day)	8	22.9	
METRIC	RANK	2015	2014–15 %
GREEN TECHNOLOGY PATENTS	11	24	26.3%
CLEAN VEHICLE REBATES	14	213	19.0%
SOLAR CAPACITY INSTALLED: COMMERCIAL (AC, KW)	6	9,448	
SOLAR CAPACITY INSTALLED: INDUSTRIAL (AC, KW)	3	9,052	
SOLAR CAPACITY INSTALLED: RESIDENTIAL (AC, KW)	5	45,701	

LOS ANGELES-LONG BEACH-ANAHEIM

METRIC	RANK	2014	2001–14 %
GDP (Real, in millions)	1	$866,745	23.9%
GDP PER CAPITA	3	$65,817	17.2%
POPULATION	1	13,169,061	5.7%
ELECTRICITY PRODUCTIVITY (GDP/kWh Consumed)	4	9.55	
NATURAL GAS PRODUCTIVITY (GDP/BTU Consumed)	5	254.34	
ELECTRICITY CONSUMPTION PER CAPITA: RESIDENTIAL (kWh/1,000 Person)	6	2.11	10.6%
ELECTRICITY CONSUMPTION PER CAPITA: NON-RESIDENTIAL (kWh/1,000 Person)	12	4.78	-6.6%
NATURAL GAS CONSUMPTION PER CAPITA: RESIDENTIAL (kWh/1,000 Person)	12	0.11	-30.6%
NATURAL GAS CONSUMPTION PER CAPITA: NON-RESIDENTIAL (kWh/1,000 Person)	14	0.15	-5.8%
COMMUTE TIME BY DRIVING (Minutes per day)	22	28.4	
METRIC	RANK	2015	2014–15 %
GREEN TECHNOLOGY PATENTS	3	774	-3.3%
CLEAN VEHICLE REBATES	1	17,623	7.8%
SOLAR CAPACITY INSTALLED: COMMERCIAL (AC, KW)	3	14,647	
SOLAR CAPACITY INSTALLED: INDUSTRIAL (AC, KW)	6	6,708	
SOLAR CAPACITY INSTALLED: RESIDENTIAL (AC, KW)	3	125,908	

CHICO		
RANK	2014	2001–14 %
21	$6,891	14.1%
22	$30,915	4.7%
20	222,901	8.9%
16	4.65	
17	164.27	
23	3.22	8.9%
3	3.44	9.4%
14	0.11	0.4%
7	0.08	41.9%
3	20.7	
RANK	2015	2014–15 %
21	4	100.0%
22	24	-40.0%
15	3,486	
17	945	
13	11,989	

EL CENTRO		
RANK	2014	2001–14 %
22	$5,655	31.7%
21	$31,243	4.7%
21	180,998	25.7%
19	3.88	
16	168.28	
22	3.01	-13.1%
16	5.04	-15.9%
1	0.04	-10.1%
13	0.15	171.2%
10	23.3	
RANK	2015	2014–15 %
23	1	N/A
25	8	-11.1%
26	0	
25	30	
26	18	

FRESNO		
RANK	2014	2001–14 %
9	$37,149	30.2%
15	$38,561	9.3%
7	963,375	19.1%
14	4.86	
18	127.68	
20	2.79	8.2%
17	5.14	1.6%
8	0.10	-9.5%
18	0.20	-10.2%
4	21.2	
RANK	2015	2014–15 %
16	11	0.0%
9	496	-2.4%
5	9,932	
1	11,132	
6	41,905	

HANFORD-CORCORAN		
RANK	2014	2001–14 %
25	$5,275	28.6%
16	$35,180	12.4%
25	149,942	14.4%
24	2.90	
24	79.48	
12	2.51	15.8%
25	9.61	96.6%
4	0.09	-19.3%
23	0.36	5.1%
5	22.0	
RANK	2015	2014–15 %
25	0	N/A
26	7	-36.4%
8	6,802	
9	4,585	
21	5,174	

MADERA		
RANK	2014	2001–14 %
26	$4,729	49.3%
24	$30,637	21.3%
24	154,354	23.1%
25	2.84	
20	98.69	
19	2.74	5.8%
23	8.04	28.9%
2	0.05	3.0%
21	0.26	-64.2%
13	24.8	
RANK	2015	2014–15 %
22	2	-66.7%
19	46	7.0%
16	3,345	
11	3,693	
19	5,915	

MERCED		
RANK	2014	2001–14 %
20	$7,225	28.6%
26	$27,309	4.1%
19	264,567	23.5%
26	2.39	
26	57.35	
18	2.70	7.3%
24	8.72	-17.6%
3	0.09	-3.3%
24	0.39	175.5%
20	27.4	
RANK	2015	2014–15 %
18	7	250.0%
21	41	41.4%
9	5,816	
7	4,969	
18	8,341	

MODESTO		
RANK	2014	2001–14 %
14	$18,049	19.9%
17	$34,259	3.7%
11	528,157	15.7%
20	3.82	
21	98.19	
24	3.26	4.0%
19	5.72	-3.5%
11	0.10	-7.2%
20	0.24	-28.7%
19	26.7	
RANK	2015	2014–15 %
13	13	62.5%
16	187	125.3%
21	1,887	
22	518	
24	3,396	

NAPA		
RANK	2014	2001–14 %
19	$8,805	22.5%
5	$63,312	10.5%
26	139,074	10.9%
7	8.42	
6	251.76	
13	2.60	0.1%
14	4.92	14.0%
25	0.13	-1.5%
11	0.12	-37.4%
7	22.7	
RANK	2015	2014–15 %
18	7	75.0%
18	114	-12.3%
18	2,830	
20	661	
25	3,161	

METRIC	OXNARD-THOUSAND OAKS-VENTURA RANK	2014	2001–14 %
GDP (Real, in millions)	7	$46,892	37.0%
GDP PER CAPITA	6	$55,666	24.1%
POPULATION	9	842,385	10.4%
ELECTRICITY PRODUCTIVITY (GDP/kWh Consumed)	6	8.54	
NATURAL GAS PRODUCTIVITY (GDP/BTU Consumed)	2	501.47	
ELECTRICITY CONSUMPTION PER CAPITA: RESIDENTIAL (kWh/1,000 Person)	8	2.26	12.7%
ELECTRICITY CONSUMPTION PER CAPITA: NON-RESIDENTIAL (kWh/1,000 Person)	7	4.26	-10.8%
NATURAL GAS CONSUMPTION PER CAPITA: RESIDENTIAL (kWh/1,000 Person)	17	0.11	-34.7%
NATURAL GAS CONSUMPTION PER CAPITA: NON-RESIDENTIAL (kWh/1,000 Person)	1	0.00	-100.0%
COMMUTE TIME BY DRIVING (Minutes per day)	18	26.2	
METRIC	RANK	2015	2014–15 %
GREEN TECHNOLOGY PATENTS	7	83	16.9%
CLEAN VEHICLE REBATES	7	853	4.0%
SOLAR CAPACITY INSTALLED: COMMERCIAL (AC, KW)	17	3,016	
SOLAR CAPACITY INSTALLED: INDUSTRIAL (AC, KW)	16	974	
SOLAR CAPACITY INSTALLED: RESIDENTIAL (AC, KW)	10	17,800	

METRIC	SAN DIEGO-CARLSBAD RANK	2014	2001–14 %
GDP (Real, in millions)	4	$206,817	30.2%
GDP PER CAPITA	4	$64,783	16.2%
POPULATION	4	3,192,457	12.0%
ELECTRICITY PRODUCTIVITY (GDP/kWh Consumed)	3	10.39	
NATURAL GAS PRODUCTIVITY (GDP/BTU Consumed)	3	332.10	
ELECTRICITY CONSUMPTION PER CAPITA: RESIDENTIAL (kWh/1,000 Person)	7	2.14	11.1%
ELECTRICITY CONSUMPTION PER CAPITA: NON-RESIDENTIAL (kWh/1,000 Person)	6	4.09	3.7%
NATURAL GAS CONSUMPTION PER CAPITA: RESIDENTIAL (kWh/1,000 Person)	18	0.11	-7.9%
NATURAL GAS CONSUMPTION PER CAPITA: NON-RESIDENTIAL (kWh/1,000 Person)	9	0.08	11.1%
COMMUTE TIME BY DRIVING (Minutes per day)	12	24.6	
METRIC	RANK	2015	2014–15 %
GREEN TECHNOLOGY PATENTS	4	513	27.6%
CLEAN VEHICLE REBATES	4	3,273	1.2%
SOLAR CAPACITY INSTALLED: COMMERCIAL (AC, KW)	2	15,169	
SOLAR CAPACITY INSTALLED: INDUSTRIAL (AC, KW)	13	2,801	
SOLAR CAPACITY INSTALLED: RESIDENTIAL (AC, KW)	2	132,007	

REDDING		
RANK	2014	2001–14 %
23	$5,592	2.3%
20	$31,285	-5.2%
22	178,742	7.9%
21	3.63	
11	193.75	
26	4.04	4.5%
11	3.63	-14.0%
5	0.09	2.6%
3	0.07	6.7%
2	19.1	
RANK	2015	2014–15 %
23	1	-66.7%
23	22	-42.1%
22	1,648	
24	217	
23	4,905	

RIVERSIDE-SAN BERNARDINO-ONTARIO		
RANK	2014	2001–14 %
5	$133,983	24.5%
23	$30,699	-5.0%
3	4,364,342	31.0%
18	4.43	
14	170.75	
16	2.64	4.2%
8	4.29	6.5%
6	0.10	-36.0%
8	0.08	-37.2%
26	31.3	
RANK	2015	2014–15 %
6	91	-1.1%
5	1,892	-2.5%
1	16,454	
5	7,642	
1	137,683	

SACRAMENTO-ROSEVILLE-ARDEN-ARCADE		
RANK	2014	2001–14 %
6	$112,703	27.2%
8	$50,895	5.7%
5	2,214,441	20.4%
12	6.70	
4	261.89	
25	3.30	-0.0%
9	4.29	-4.5%
22	0.12	-65.8%
5	0.07	-13.7%
17	26.0	
RANK	2015	2014–15 %
5	125	7.8%
6	1,389	-12.3%
11	4,675	
15	1,153	
7	35,606	

SALINAS		
RANK	2014	2001–14 %
13	$20,897	8.9%
9	$49,196	3.7%
16	424,774	5.0%
9	7.99	
10	208.86	
1	1.61	-5.0%
10	4.55	1.5%
16	0.11	-4.5%
12	0.13	31.9%
11	24.0	
RANK	2015	2014–15 %
15	12	-29.4%
17	160	-14.4%
19	2,488	
21	586	
16	8,861	

SAN FRANCISCO-OAKLAND-HAYWARD		
RANK	2014	2001–14 %
2	$411,969	27.5%
2	$91,520	17.1%
2	4,501,407	8.3%
1	13.08	
9	212.86	
3	2.04	-1.2%
15	4.96	0.8%
26	0.14	-9.9%
22	0.29	38.2%
23	29.1	
RANK	2015	2014–15 %
2	967	11.0%
2	10,095	10.9%
4	12,312	
4	8,400	
4	64,747	

SAN JOSE-SUNNYVALE-SANTA CLARA		
RANK	2014	2001–14 %
3	$213,819	63.8%
1	$111,020	48.3%
6	1,925,947	10.4%
2	12.56	
1	515.60	
4	2.05	-4.4%
21	6.79	-1.1%
19	0.11	-13.0%
10	0.10	-17.1%
16	25.9	
RANK	2015	2014–15 %
1	1,168	6.0%
3	7,531	8.3%
10	5,350	
10	3,995	
8	31,162	

SAN LUIS OBISPO-PASO ROBLES-ARROYO GRANDE		
RANK	2014	2001–14 %
17	$13,121	29.7%
11	$48,070	18.7%
17	272,955	9.3%
10	7.62	
15	170.50	
9	2.30	-8.4%
5	4.01	16.6%
23	0.12	-21.8%
15	0.16	31.2%
6	22.2	
RANK	2015	2014–15 %
16	11	-8.3%
14	213	28.3%
14	3,834	
23	255	
14	10,269	

SANTA CRUZ-WATSONVILLE		
RANK	2014	2001–14 %
18	$11,245	-8.3%
14	$41,753	-12.8%
18	269,322	5.2%
5	9.11	
8	230.19	
5	2.05	-3.7%
1	2.53	-29.8%
13	0.11	-6.7%
4	0.07	-16.7%
15	25.7	
RANK	2015	2014–15 %
9	62	-10.1%
10	449	8.7%
24	1,307	
26	0	
22	5,047	

SANTA MARIA-SANTA BARBARA

METRIC	RANK	2014	2001–14 %
GDP (Real, in millions)	10	$23,930	25.0%
GDP PER CAPITA	7	$55,074	15.5%
POPULATION	14	434,510	8.2%
ELECTRICITY PRODUCTIVITY (GDP/kWh Consumed)	11	7.01	
NATURAL GAS PRODUCTIVITY (GDP/BTU Consumed)	12	193.72	
ELECTRICITY CONSUMPTION PER CAPITA: RESIDENTIAL (kWh/1,000 Person)	2	1.85	0.8%
ELECTRICITY CONSUMPTION PER CAPITA: NON-RESIDENTIAL (kWh/1,000 Person)	20	6.00	20.1%
NATURAL GAS CONSUMPTION PER CAPITA: RESIDENTIAL (kWh/1,000 Person)	20	0.12	-31.2%
NATURAL GAS CONSUMPTION PER CAPITA: NON-RESIDENTIAL (kWh/1,000 Person)	16	0.17	45.3%
COMMUTE TIME BY DRIVING (Minutes per day)	1	18.6	
METRIC	**RANK**	**2015**	**2014–15 %**
GREEN TECHNOLOGY PATENTS	8	68	36.0%
CLEAN VEHICLE REBATES	13	243	-14.1%
SOLAR CAPACITY INSTALLED: COMMERCIAL (AC, KW)	25	293	
SOLAR CAPACITY INSTALLED: INDUSTRIAL (AC, KW)	12	3,524	
SOLAR CAPACITY INSTALLED: RESIDENTIAL (AC, KW)	20	5,653	

VALLEJO-FAIRFIELD

METRIC	RANK	2014	2001–14 %
GDP (Real, in millions)	15	$18,055	26.5%
GDP PER CAPITA	13	$42,465	18.9%
POPULATION	15	425,169	6.4%
ELECTRICITY PRODUCTIVITY (GDP/kWh Consumed)	13	5.62	
NATURAL GAS PRODUCTIVITY (GDP/BTU Consumed)	25	78.68	
ELECTRICITY CONSUMPTION PER CAPITA: RESIDENTIAL (kWh/1,000 Person)	10	2.36	7.6%
ELECTRICITY CONSUMPTION PER CAPITA: NON-RESIDENTIAL (kWh/1,000 Person)	18	5.19	8.6%
NATURAL GAS CONSUMPTION PER CAPITA: RESIDENTIAL (kWh/1,000 Person)	21	0.12	-2.1%
NATURAL GAS CONSUMPTION PER CAPITA: NON-RESIDENTIAL (kWh/1,000 Person)	26	0.42	-70.0%
COMMUTE TIME BY DRIVING (Minutes per day)	24	30.8	
METRIC	**RANK**	**2015**	**2014–15 %**
GREEN TECHNOLOGY PATENTS	12	22	69.2%
CLEAN VEHICLE REBATES	12	277	-0.4%
SOLAR CAPACITY INSTALLED: COMMERCIAL (AC, KW)	23	1,416	
SOLAR CAPACITY INSTALLED: INDUSTRIAL (AC, KW)	14	1,217	
SOLAR CAPACITY INSTALLED: RESIDENTIAL (AC, KW)	12	12,421	

SANTA ROSA		
RANK	2014	2001–14 %
11	$23,804	9.7%
10	$48,351	3.2%
12	492,320	6.3%
8	8.09	
7	233.08	
14	2.60	7.9%
2	3.37	2.9%
24	0.13	-1.0%
6	0.08	-10.2%
14	25.5	
RANK	2015	2014–15 %
10	44	22.2%
8	762	3.4%
12	4,554	
18	711	
17	8,371	

STOCKTON-LODI		
RANK	2014	2001–14 %
12	$23,491	22.4%
18	$33,148	-0.1%
10	708,678	22.6%
17	4.50	
19	119.70	
11	2.48	1.4%
13	4.90	-23.3%
15	0.11	-6.6%
17	0.17	-53.0%
25	31.2	
RANK	2015	2014–15 %
13	13	-7.1%
11	281	15.2%
13	4,505	
8	4,922	
9	25,380	

VISALIA-PORTERVILLE		
RANK	2014	2001–14 %
16	$13,632	26.6%
25	$29,711	2.5%
13	458,827	23.5%
22	3.04	
23	89.90	
17	2.67	7.2%
22	7.12	11.5%
7	0.10	-25.9%
19	0.23	54.4%
9	23.3	
RANK	2015	2014–15 %
20	5	25.0%
19	46	12.2%
7	7,940	
2	10,511	
11	16,879	

YUBA CITY		
RANK	2014	2001–14 %
24	$5,472	21.7%
19	$32,297	1.0%
23	169,429	20.5%
15	4.81	
13	187.46	
21	2.89	10.8%
4	3.83	-17.4%
10	0.10	0.8%
2	0.07	-82.2%
21	28.0	
RANK	2015	2014–15 %
25	0	N/A
24	17	-34.6%
20	2,463	
19	708	
15	9,887	

NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Most Recent Year is 2014 for all metrics EXCEPT for Green Technology Patents, Clean Vehicle Rebates, and Solar Capacity Installed, where Most Recent Year is 2015. Real GDP: Inflation adjusted GDP where base year is 2014. Solar Capacity Installed: Unit based on alternate current in megawatts.

Data Sources: Solar, California Solar Statistics: Vehicle Rebates: California Clean Vehicle Rebate Project; Patents: IPCheckups, CleanTech Patent Edge; Gas Consumption: California Energy Commission; Electric Consumption: California Energy Commission; Population: U.S. Census Bureau; Commute Time: U.S. Census Bureau, American Community Survey; GDP: U.S. Department of Commerce, Bureau of Economic Analysis.

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International Scorecard

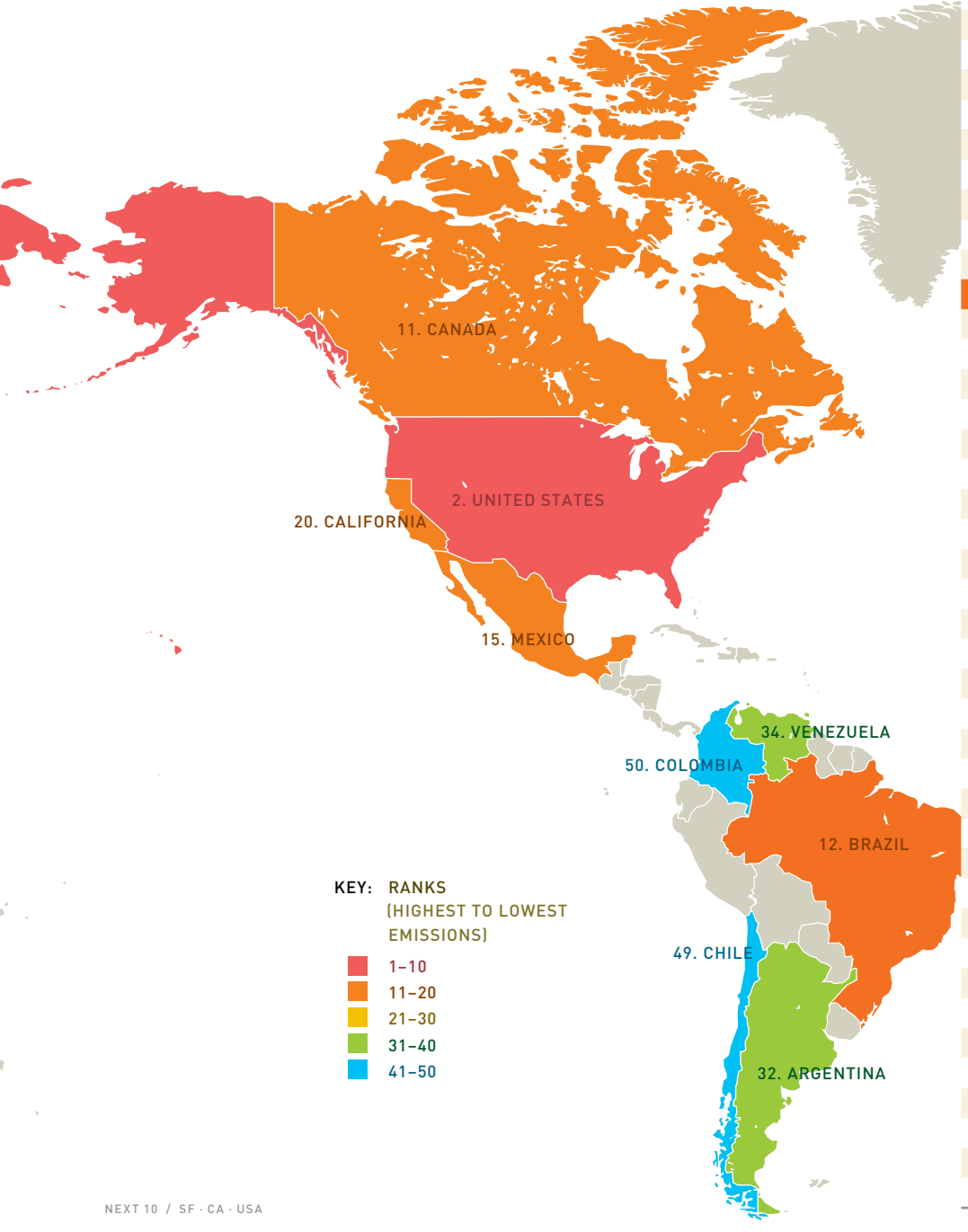
In 2015, global leaders took an unprecedented step to address climate change by agreeing to limit global temperature increase to 2 degrees Celsius at the United Nations Climate Change Conference in Paris. This goal will require strong action by countries and sub-national entities around the globe, and many are already taking steps in energy policy towards this outcome.

The international scorecard tracks the 49 largest GHG emitting countries, along with California, on indicators of the carbon economy, energy efficiency, and renewable energy. This scorecard demonstrates the scope of efforts in California and other countries and reveals areas of opportunity for improvement. In particular, while developed countries do well in terms of economic-related indicators, they often do poorly in per capita indicators compared to less developed countries.

In 2013, China remained the largest GHG emitter, followed by the U.S. and European Union (EU-28), while California remained the 20th largest emitter.

NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. *OECD Member Countries. Analysis and data sources the same as in previous sections; rankings are out of the top 50 polluters of GHG emissions from energy consumption.

When treated as a country, California moved up in the international rankings to be the fourth most energy productive economy in the world in 2013, up from fifth in 2012, and unseating Japan, which fell out of the top five. The three least carbon-intensive economies in the world, France, California and Italy, all held their spots in 2013, while continuing to improve their carbon economies, dropping .9, .9, and .21 respectively ($MTCO_2e$/US $10,000 GDP).



TOTAL GHG EMISSIONS FROM ENERGY CONSUMPTION RANKING

TOTAL EMISSIONS IN 2013

RANK	REGION	MILLION $MTCO_2e$
1	CHINA	8686.9
2	UNITED STATES*	5401.7
3	EU-28*	3759.7
4	INDIA	1886.5
5	RUSSIA	1726.3
6	JAPAN*	1257.1
7	GERMANY*	805.0
8	SOUTH KOREA*	651.0
9	IRAN	611.8
10	SAUDI ARABIA	593.6
11	CANADA*	564.3
12	BRAZIL	534.5
13	UNITED KINGDOM*	488.0
14	SOUTH AFRICA	481.9
15	MEXICO*	455.3
16	INDONESIA	442.4
17	AUSTRALIA*	385.2
18	FRANCE*	366.5
19	ITALY*	362.2
20	CALIFORNIA*	353.1
21	POLAND*	321.5
22	TURKEY*	318.7
23	THAILAND	300.7
24	TAIWAN	294.9
25	UKRAINE	291.1
26	SPAIN*	275.8
27	UNITED ARAB EMIRATES	244.6
28	NETHERLANDS*	233.0
29	SINGAPORE	215.8
30	MALAYSIA	207.8
31	EGYPT	206.6
32	ARGENTINA	202.2
33	KAZAKHSTAN	198.5
34	VENEZUELA	188.5
35	PAKISTAN	144.9
36	VIETNAM	141.7
37	BELGIUM*	141.0
38	IRAQ	137.5
39	ALGERIA	128.2
40	UZBEKISTAN	108.7
41	KUWAIT	107.2
42	CZECH REPUBLIC*	103.2
43	NIGERIA	96.7
44	QATAR	91.6
45	HONG KONG	89.7
46	PHILIPPINES	87.8
47	GREECE*	78.4
48	ROMANIA	75.8
49	CHILE*	75.7
50	COLOMBIA	73.6

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RANKING SUMMARY OF THE TOP 50 POLLUTERS OF GHG EMISSIONS FROM ENERGY CONSUMPTION

RANK	TOTAL GHG EMISSIONS FROM ENERGY CONSUMPTION RANKING		CARBON ECONOMY RANKING	GHG EMISSIONS PER CAPITA RANKING	ENERGY PRODUCTIVITY RANKING
	TOTAL EMISSIONS IN 2013	2013 GDP PER CAPITA, US$	CARBON INTENSITY ($MTCO_2e$/GDP) IN 2013	EMISSIONS PER CAPITA ($MTCO_2e$/PERSON) IN 2013	ENERGY PRODUCTIVITY (GDP/BTU) IN 2013
1	CHINA	$7,003	FRANCE*	NIGERIA	NIGERIA
2	UNITED STATES*	$52,923	CALIFORNIA*	PAKISTAN	UNITED KINGDOM*
3	EU-28*	$35,177	ITALY*	PHILIPPINES	ITALY*
4	INDIA	$1,525	UNITED KINGDOM*	VIETNAM	CALIFORNIA*
5	RUSSIA	$14,590	NIGERIA	INDIA	AUSTRALIA*
6	JAPAN*	$38,660	COLOMBIA	COLOMBIA	GERMANY*
7	GERMANY*	$46,155	SPAIN*	INDONESIA	FRANCE*
8	SOUTH KOREA*	$26,669	EU-28*	EGYPT	COLOMBIA
9	IRAN	$6,407	GERMANY*	BRAZIL	EU-28*
10	SAUDI ARABIA	$27,630	BRAZIL	ALGERIA	SPAIN*
11	CANADA*	$53,198	AUSTRALIA*	ROMANIA	JAPAN*
12	BRAZIL	$11,900	JAPAN*	UZBEKISTAN	HONG KONG
13	UNITED KINGDOM*	$42,784	NETHERLANDS*	MEXICO*	NETHERLANDS*
14	SOUTH AFRICA	$6,986	BELGIUM*	IRAQ	GREECE*
15	MEXICO*	$10,594	CHILE*	TURKEY*	CHILE*
16	INDONESIA	$3,625	CANADA*	CHILE*	PHILIPPINES
17	AUSTRALIA*	$70,250	UNITED STATES*	THAILAND	BELGIUM*
18	FRANCE*	$42,611	PHILIPPINES	ARGENTINA	BRAZIL
19	ITALY*	$34,702	HONG KONG	FRANCE*	UNITED STATES*
20	CALIFORNIA*	$58,360	GREECE*	SPAIN*	MEXICO*
21	POLAND*	$13,570	ARGENTINA	ITALY*	ARGENTINA
22	TURKEY*	$10,638	MEXICO*	CHINA	TURKEY*
23	THAILAND	$6,225	TURKEY*	UKRAINE	INDONESIA
24	TAIWAN	$20,344	ROMANIA	VENEZUELA	ROMANIA
25	UKRAINE	$4,039	VENEZUELA	MALAYSIA	IRAQ
26	SPAIN*	$28,905	QATAR	GREECE*	VENEZUELA
27	UNITED ARAB EMIRATES	$70,733	INDONESIA	EU-28*	CANADA*
28	NETHERLANDS*	$51,423	CZECH REPUBLIC*	IRAN	QATAR
29	SINGAPORE	$55,353	SOUTH KOREA*	UNITED KINGDOM*	POLAND*
30	MALAYSIA	$10,913	IRAQ	POLAND*	CZECH REPUBLIC*
31	EGYPT	$3,189	ALGERIA	SOUTH AFRICA	SOUTH KOREA*
32	ARGENTINA	$14,418	POLAND*	CALIFORNIA*	KUWAIT
33	KAZAKHSTAN	$13,073	KUWAIT	CZECH REPUBLIC*	TAIWAN
34	VENEZUELA	$15,401	TAIWAN	JAPAN*	MALAYSIA
35	PAKISTAN	$1,196	PAKISTAN	GERMANY*	ALGERIA
36	VIETNAM	$1,851	UNITED ARAB EMIRATES	KAZAKHSTAN	UNITED ARAB EMIRATES
37	BELGIUM*	$46,771	MALAYSIA	RUSSIA	SINGAPORE
38	IRAQ	$6,700	SINGAPORE	BELGIUM*	KAZAKHSTAN
39	ALGERIA	$5,506	THAILAND	TAIWAN	THAILAND
40	UZBEKISTAN	$1,982	EGYPT	HONG KONG	PAKISTAN
41	KUWAIT	$64,616	SAUDI ARABIA	SOUTH KOREA*	CHINA
42	CZECH REPUBLIC*	$19,636	VIETNAM	NETHERLANDS*	SAUDI ARABIA
43	NIGERIA	$2,980	RUSSIA	CANADA*	EGYPT
44	QATAR	$93,078	KAZAKHSTAN	UNITED STATES*	VIETNAM
45	HONG KONG	$38,934	CHINA	AUSTRALIA*	INDIA
46	PHILIPPINES	$2,782	INDIA	SAUDI ARABIA	RUSSIA
47	GREECE*	$22,232	IRAN	SINGAPORE	SOUTH AFRICA
48	ROMANIA	$8,792	SOUTH AFRICA	KUWAIT	IRAN
49	CHILE*	$16,070	UKRAINE	QATAR	UKRAINE
50	COLOMBIA	$8,308	UZBEKISTAN	UNITED ARAB EMIRATES	UZBEKISTAN

NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. *OECD Member Countries. Analysis and data sources the same as in previous sections; rankings are out of the top 50 polluters of GHG emissions from energy consumption.

RANK	ENERGY PER CAPITA RANKING	ELECTRICITY PER CAPITA RANKING	TOTAL RENEWABLE ELECTRICITY GENERATION RANKING	SHARE OF ELECTRICITY FROM RENEWABLE SOURCES RANKING
	TOTAL ENERGY CONSUMPTION PER CAPITA (BTU/PERSON) IN 2013	ELECTRICITY CONSUMPTION PER CAPITA (kWh/PERSON) IN 2013	TOTAL RENEWABLE ELECTRICITY IN 2013	SHARE OF RENEWABLES (RENEWABLE ELECTRICITY/TOTAL ELECTRICITY) IN 2013
1	NIGERIA	NIGERIA	EU-28*	SPAIN*
2	PHILIPPINES	PAKISTAN	UNITED STATES*	GERMANY*
3	PAKISTAN	PHILIPPINES	CHINA	ITALY*
4	INDIA	INDONESIA	GERMANY*	CALIFORNIA*
5	VIETNAM	INDIA	SPAIN*	EU-28*
6	INDONESIA	COLOMBIA	INDIA	GREECE*
7	COLOMBIA	ALGERIA	ITALY*	BELGIUM*
8	EGYPT	VIETNAM	JAPAN*	UNITED KINGDOM*
9	IRAQ	UZBEKISTAN	CALIFORNIA*	PHILIPPINES
10	ALGERIA	EGYPT	UNITED KINGDOM*	NETHERLANDS*
11	BRAZIL	IRAQ	BRAZIL	POLAND*
12	ROMANIA	MEXICO*	FRANCE*	CHILE*
13	MEXICO*	ROMANIA	CANADA*	BRAZIL
14	TURKEY*	THAILAND	POLAND*	CZECH REPUBLIC*
15	THAILAND	BRAZIL	AUSTRALIA*	UNITED STATES*
16	UZBEKISTAN	TURKEY*	INDONESIA	AUSTRALIA*
17	CHILE*	IRAN	NETHERLANDS*	INDONESIA
18	CHINA	ARGENTINA	MEXICO*	JAPAN*
19	ARGENTINA	UKRAINE	BELGIUM*	THAILAND
20	GREECE*	VENEZUELA	PHILIPPINES	INDIA
21	MALAYSIA	CHINA	THAILAND	FRANCE*
22	SOUTH AFRICA	POLAND*	GREECE*	CHINA
23	UKRAINE	CHILE*	TURKEY*	MEXICO*
24	POLAND*	SOUTH AFRICA	CZECH REPUBLIC*	CANADA*
25	ITALY*	MALAYSIA	CHILE*	ROMANIA
26	VENEZUELA	KAZAKHSTAN	SOUTH KOREA*	COLOMBIA
27	SPAIN*	ITALY*	TAIWAN	TURKEY*
28	IRAN	GREECE*	ARGENTINA	ARGENTINA
29	UNITED KINGDOM*	SPAIN*	COLOMBIA	SINGAPORE
30	EU-28*	UNITED KINGDOM*	ROMANIA	TAIWAN
31	KAZAKHSTAN	EU-28*	EGYPT	EGYPT
32	JAPAN*	HONG KONG	MALAYSIA	MALAYSIA
33	FRANCE*	CZECH REPUBLIC*	SOUTH AFRICA	SOUTH KOREA*
34	GERMANY*	RUSSIA	SINGAPORE	SOUTH AFRICA
35	HONG KONG	NETHERLANDS*	IRAN	IRAN
36	TAIWAN	GERMANY*	RUSSIA	VIETNAM
37	CALIFORNIA*	FRANCE*	UKRAINE	UKRAINE
38	RUSSIA	CALIFORNIA*	VIETNAM	RUSSIA
39	SOUTH KOREA*	JAPAN*	SAUDI ARABIA	SAUDI ARABIA
40	NETHERLANDS*	BELGIUM*	UNITED ARAB EMIRATES	UNITED ARAB EMIRATES
41	BELGIUM*	SINGAPORE	KAZAKHSTAN	KAZAKHSTAN
42	AUSTRALIA*	SAUDI ARABIA	VENEZUELA	VENEZUELA
43	UNITED STATES*	TAIWAN	PAKISTAN	PAKISTAN
44	SAUDI ARABIA	SOUTH KOREA*	IRAQ	IRAQ
45	CANADA*	AUSTRALIA*	ALGERIA	ALGERIA
46	SINGAPORE	UNITED STATES*	UZBEKISTAN	UZBEKISTAN
47	KUWAIT	QATAR	KUWAIT	KUWAIT
48	UNITED ARAB EMIRATES	CANADA*	NIGERIA	NIGERIA
49	QATAR	UNITED ARAB EMIRATES	QATAR	QATAR
50	CZECH REPUBLIC*	KUWAIT	HONG KONG	HONG KONG

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Endnotes

1 The California Air Resources Green House Gas Inventory provides estimates of the amount of GHGs emitted to the atmosphere by human activities within California. This project utilizes the 2015 edition of the inventory. The inventory includes estimates for carbon dioxide (CO_2), methane (CH4, nitrous oxide (N_2), sulfur hexafluoride (SF_6), hydrofluorocarbons (HFCs), and perfluorocarbons (PFCs), which are often referred to as the "six Kyoto gases," and nitrogen trifluoride (NF_3). Note: In each new edition of the inventory recalculations are made to correct errors, incorporate new methodologies or, most commonly, to reflect changes in statistical data supplied by other agencies. Emission estimates are recalculated for all previous years to maintain a consistent time-series following IPCC recommendations for developing GHG inventories. The 2015 inventory may report a different emission level for an earlier year than previous inventory versions.

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Appendix

GENERAL REFERENCES

Inflation Adjustment

Inflation-adjusted figures are converted into current dollars using the U.S. city average Consumer Price Index (CPI) of all urban consumers, published by the Bureau of Labor Statistics.

Gross Domestic Product

Nominal gross domestic product (GDP) data for California, U.S. states and the U.S. are sourced from the Bureau of Economic Analysis, U.S. Department of Commerce. Country GDP is at market prices in current 2013 dollars, expressed per U.S. dollar, from the World Bank's World Development Indicators.

Population

Population data from California used to calculate per capita figures are from the California Department of Finance's: E-4 Population Estimates for Cities, Counties and the State, with 2000 and 2010 Census Counts. U.S., state and "U.S. without California" population data are from the U.S. Census Bureau, Population Estimates Branch. Country population data are from the U.S. Department of Agriculture's Economic Research Service, calculated from the Census Bureau International Population Database.

THE CARBON ECONOMY

Global Fossil Fuel Combustion, Carbon Economy, and Emissions Per Capita in California and Other Regions

Data for carbon dioxide emissions from the consumption of energy are from the U.S. Department of Energy – Energy Information Administration (EIA), International Energy Statistics. State level emissions data come from EIA's State CO_2 Emissions. Data for carbon dioxide emissions from the consumption of energy include emissions due to the consumption of petroleum, natural gas, and coal, and also from natural gas flaring. Energy consumption data are based on the consumption of each primary energy source, and data are gathered from a variety of national and organization reports that collate data from energy users. Carbon dioxide emissions are calculated for each individual fuel by applying carbon emission coefficients to convert to million $MTCO_2e$ dioxide emitted per quadrillion BTU of fuel consumed. Calculations used GDP and Population data where applicable, as described above.

Emissions data only include energy-related emissions, and therefore do not include emissions from sources such as agriculture, waste combustion, and industrial gases, because it is the most up-to-date information available. While these other emissions are important to track and reduce, the *Green Innovation Index* focuses on energy emissions, given the importance of energy-related indicators and the availability of recent data. A comparison of World Resources Institute's 2011 total world emissions data shows that energy-related emissions account for about 75 percent of global emissions. In addition, the ranking for the top emitters are similar when comparing total and energy-related emissions, and the rankings of the top six emitters are identical.

GHG Emissions and Gross Domestic Product, Total California Greenhouse Emissions, Emissions by Source, Emissions by Detailed Source

Greenhouse gas (GHG) emissions data for these figures are from California Air Resources Board's "California Greenhouse Gas Inventory – by Sector and Activity" (May 2015). The 1990–1999 emissions include "gross emissions" and the 2000–2012 emissions are "included emissions" only. Calculations used GDP and Population data where applicable, as described above.

ENERGY EFFICIENCY

Energy Productivity and Energy Consumption per Capita

Energy data are from the U.S. Department of Energy – EIA, International Energy Statistics and State Energy Data System. Data is for total primary energy consumption, in British Thermal Units (BTU), of petroleum, dry natural gas, coal, and net nuclear, hydroelectric, and non-hydroelectric renewable electricity. Energy productivity divides GDP by total energy consumption. Primary energy is in the form that it is first accounted for in a statistical energy balance, before any transformation to secondary or tertiary forms of energy (for example, coal is used to generate electricity). Calculations used GDP and Population data where applicable, as described above.

Electricity Consumption per Capita

Electricity consumption data are from the U.S. Department of Energy – EIA, International Energy Statistics and State Energy Data System. For the United States, total electric power consumption is equal to the data in the Total column under End Use from Table 8.1 of the EIA's Annual Energy Review. For all other countries except the United States, total electric power consumption is equal to total net electricity

generation, plus electricity imports, less electricity exports and less electricity transmission and distribution losses. Data are reported as net consumption as opposed to gross consumption. Net consumption excludes the energy consumed by the generating units. Calculations used Population data where applicable, as described above.

RENEWABLE ENERGY

Renewable Energy Generation

Data for total electricity generation and renewable electricity generation by source are from the U.S. Department of Energy – EIA, International Energy Statistics. Data are for both utility and nonutility sources, and are reported as net generation (as opposed to gross generation). Renewable electricity data are for non-hydroelectric renewable, including geothermal, solar, tide, wave, wind, biomass and waste.

California renewable energy data is from the California Energy Commission, "Net System Power Reports" 2002–2013, Total System Power in Gigawatt Hours (GWh). U.S. data in the California section on total electricity generation data is from the U.S. Department of Energy, EIA, Electric Power Monthly reports. Annual totals from "Table 1.1 Net Generation by Energy Source: Total (All Sectors)," and "Table 1.1.A. Net Generation by Other Renewables: Total (All Sectors)." Because of different renewable energy definitions between California and the U.S., data represented for the U.S. do not include any hydro.

Renewable Portfolio Standard Cumulative Operational Capacity

Data are from the California Public Utilities Commission "RPS Project Status Table 2016 Feb" released on February 24, 2016. Projects include those Approved and Online, Approved in Development, Delayed but likely to be completed per CPUC, and those in the Renewable Auction Mechanism and Investor-Owned Utility Solar Photovoltaic programs. Projects are classified as operational, online, in progress, and on schedule. Years are based on the online date/contracted delivery date, though those with a status of in progress, delayed, or on schedule (i.e. not classified as online) with pre-2014 dates were labeled as 2014.

New Solar Installations, New Solar Installations by Sector

Solar capacity installed data are provided by Solar Energy Industries Association® (SEIA) and California Solar Initiative. SEIA data were taken from the U.S. Solar Market Insight Reports, 2007–2015. California Solar Initiative (CSI) data include municipal utility, and other utility-scale installations and Net Energy Metering (NEM) Interconnection Data.

Wind Installations

Wind capacity installed and cumulative data are provided by the American Wind Energy Association. Data is taken from quarterly and annual U.S. Wind Industry Market Reports, 2006–2015.

TRANSPORTATION

Emissions, Surface Transportation, VMT

Total Vehicles and GHG Emissions from Surface Transportation and Vehicle Miles Traveled CARB's "California Greenhouse Gas Inventory—by Sector and Activity." Surface Transportation emissions sources include passenger vehicles, motorcycles and light and heavy duty trucks. Vehicle Miles Traveled (VMT) is defined as total distance traveled by all vehicles during a selected time period in geographic segment. VMT estimates for 1995–2007 are from the California Department of Transportation's "2008 California Motor Vehicle Stock, Travel and Fuel Forecast." VMT data for 2008–2013 are from the California Department of Transportation's Highway Performance Monitoring System's "California Public Road Data." Calculations use Population data sources where applicable.

Alternative Vehicle Registrations

Data are from the California Energy Commission (CEC), compiled using vehicle registration data by fuel type from the California Department of Motor Vehicles. Alternative fuel-types include all hybrid (gasoline and diesel), electric, plug-in hybrid, hydrogen, propane, and natural gas. Zero emission fuel-types include electric, plug-in hybrid, and hydrogen.

CLEAN TECHNOLOGY INNOVATION

Investment, M&As, and IPOs in Clean Technology

Clean technology investment data are provided by Cleantech Group's i3 database and includes disclosed investment deals in private companies. Data is through February 2016. VC data includes Seed, Series A-E+, and Growth Equity series types. Debt includes loan guarantees from the federal government, as well as structured debt and loans from private investors such as banks, investment funds, and financial services groups. Totals may not be the same across charts because of different investment types included. Dollar amounts are unadjusted for inflation (nominal). M&As are by location of the targeted

company (e.g. not the buyer) in the year the deal was announced. IPOs are by location of the company and in the year the IPO was listed.

Clean Technology Patents

Global Clean Technology Patents are sourced from IP Checkups through the CleanTech Patent Edge™ database, which includes clean technology patent data including both granted patents and published patent applications from the U.S. Patent and Trade Office (USPTO) and the European Patent Office (EPO), and published patent applications from the World Intellectual Property Organization (WIPO, which includes 188 member countries). Patent counts by country included in this analysis reflect the location of the first named inventor in the earliest published patent within a patent family, as defined in INPADOC (International Patent Documentation). Inventors frequently file on the same invention in multiple patent systems (such as USPTO and also EPO), and analysis at the patent family level (i.e. the set of related patents for an invention, across systems) rather than at the individual patent level reduces double-counting of the same intellectual property. If country of first inventor was unclear and could not be interpolated from other documentation, the patent family was excluded from the analysis.

IP Checkups classifies patents into clean technology segments based on patent classification codes and key word searches. Some patents fell into multiple segment and sub definitions, and if these segments were equally applicable—as defined by IP Checkups and Beacon Economics—a patent was termed "multiple." Ranking analyses by segment includes any patent families classified into that segment, including those within family members which also apply to other segments. In contrast, total clean technology analysis includes only the dominant segment category, or the "multiple" designation to reduce double-counting. Assignee companies reflect the assignee at time of patent publication.

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