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## **Decade of data charts California's emissions reductions amidst one of longest economic expansions in state history**

*Policies drive record-setting investment & innovation, but transportation emissions keep rising*

*Riverside takes top regional ranking for residential solar installations, as San Diego slips*

SAN FRANCISCO — In advance of the Global Climate Action Summit, a new study tracks the difference a decade can make in climate action. The tenth edition of the [California Green Innovation Index](#) presents robust findings of emissions reductions and economic growth, while highlighting critical challenges ahead.

The *Index* compares state and environmental indicators with the U.S. and the rest of the world, and finds that in the ten years since California passed its first climate law, emissions fell by 11 percent, even as its economy grew by almost 16 percent during one of the longest economic expansions in the state's history. In comparison, the U.S. economy grew by 11.6 percent during this period, while emissions decreased by 10.2 percent. The European Union (EU-28) was the only major economy to cut emissions more than California, but its real economic output grew by only 8.8 percent.

"This year's *Index* tells a comprehensive but complex story of the transition to a decarbonized economy," said F. Noel Perry, businessman and founder of Next 10. "On the one hand, California is a world leader in innovation and climate policy, which has resulted in strong economic growth and emissions reductions. On the other hand, population growth, oil prices and increased commutes are driving transportation emissions up at a time when the federal government is attempting to curtail our ability to control those emissions. As subnational, national and international leaders gather in San Francisco, this *Index* provides important data and impetus for increased collaboration across state and national lines in the transition to a clean energy economy."

"Over the course of a decade, comprehensive, consistent policy in California created market certainty. That drove investment and advanced technology. California is third only to China and the U.S. as a whole in attracting clean technology investment," said Adam



Fowler, director of research at Beacon Economics, the independent research and consulting firm that compiled the *Index* for Next 10. “But progress doesn’t always follow a straight line. Both California and the U.S. have experienced dips in VC investment and a decline in patent generation in the past year, while some of our major economic competitors have seen increases. Command of clean technology markets may well determine economic success in the 21<sup>st</sup> century, so it’s not a time to slow down.”

**Top statewide findings from the 2018 Index include:**

**Cleantech innovation**

- California has generated more than \$22 billion in clean technology venture capital investment from 2007 to 2017 and is third only to the U.S. as a whole and China.
- In 2017, \$2.5 billion was invested in clean energy technology in the United States, with 57.2 percent (\$1.4 billion) going to California companies.
  - Transportation technologies received the largest share [\$610 million in US; \$459m in CA].
- California on its own produced more than 5 percent of the world’s clean tech patents in 2017, making it the fifth largest global contributor.
  - The U.S. (including California) produced 29 percent of global patents.
  - The EU-28 produced 20 percent of global patents, followed by Japan (13 percent), South Korea (6 percent), California (5.4 percent) and China (4 percent).
- However, California and the U.S. saw a decline in patents in 2016-2017, while the world saw an 11.2 percent gain.
  - EU-28, which ranks second globally for most clean tech patents, saw a surge of over 40 percent from 2016-2017, while Japan and South Korea (spots 3 and 4, respectively) declined.
  - California leads the nation in clean tech patents [18.6% ] followed by Texas [6.5%], New York [5.5%], Michigan [5.1%] and Massachusetts [4.2%].
- Globally, the number of clean technology patents increased 243.8 percent between 2007 and 2017.
  - The number of patents produced in California increased 342 percent in this period.
- From 2015 to 2016, total capacity for thermal energy storage systems and battery energy storage systems in California increased more than threefold, representing a major surge in storage growth.

**Renewable energy**

- California has increased its renewable electricity generation (from in-state and out-of-state sources) by 130 percent compared to ten years ago.
- Solar has been the dominant driver in increasing renewable electricity generation in California. The state’s cumulative solar capacity stands at almost 6,000 GW— an almost 2,500 percent increase compared to ten years ago when it had a mere 227.6 GW of cumulative capacity.



- But for the first time in *Index* history, new capacity installed did not exceed the previous year. In 2017, new net energy metering (NEM) solar photovoltaic (PV) capacity was 1,134.4 MW, down 10.5 percent from 2016.
- Wind generation remains the largest renewable energy source in California when including imports. Despite having one of the lowest average wind speeds compared to other states, California had the 18<sup>th</sup> highest share of electricity generated from wind in 2016.
  - In 2016, in-state electricity generation from wind totaled 13,499 GWh, a 10.7 percent increase compared to 2015. Compared to ten years ago, cumulative wind capacity installed is up by 128 percent.
  - On the other hand, capacity decreased by 107 MW between 2016 and 2017, bringing California's cumulative wind capacity down to 5,555 MW as of the end of 2017.
- In 2016, California had a Renewable Energy Portfolio standard goal of 25 percent; it reached 25.5 percent of total electricity generation, up 3.6 percent compared to 2015.
  - At this pace, California is poised to meet its 2020 RPS goal of 33 percent.
- In 2017, all three investor-owned utilities were far ahead of the state's RPS goals. RPS generation was 33.7 percent, 33.9 percent, and 46.3 percent for PG&E, SCE, and SDG&E, respectively.
- Globally, renewable energy generation increased 339 percent between 2005 and 2015, led primarily by a massive boom in solar electricity as technologies improved while costs fell.
  - Solar generation increased globally by 6,327 percent, while wind power increased 701 percent.
  - China's solar generation increased by a whopping 61,049 percent, followed by India (29,584 percent), EU-28 (7,235 percent), and the U.S. (4,424 percent).

## **TRANSPORTATION: A CRITICAL CHALLENGE**

"The data show a formidable challenge when it comes to reducing emissions from the transportation sector. Cars are getting cleaner in California, but transportation emissions still increased in 2016 because there were more cars on the road, and more miles driven," commented Perry. "California has been investing in solving that challenge for years – building a strong industry around clean transportation that could command the worldwide transportation market. The question is whether the federal government gets in the way. Federal challenges to California's authority to set vehicle emission standards pose not just an emissions risk, but an economic risk as well."

### *Emissions Increase*

- In 2016, California's transportation sector accounted for 40.5 percent of the state's total greenhouse gas emissions — the highest percentage since 2006. On-road passenger vehicles accounted for 68.4 percent of the transportation sector's GHG emissions.



- California's population grew 9.2 percent from 2006 to 2016, resulting in over three million more vehicles registered over the time period.
- Vehicle miles traveled (VMT) reached a record high of 340 billion in 2016. Lower oil prices and longer commutes due to rising housing costs are chiefly to blame.
- Public transportation ridership fell for the second year in a row. Compared to 2016, total trips dropped 4.2 percent.
- Emissions from light-duty vehicles shot up in 2016, as did emissions from heavy-duty trucks, while overall heavy-duty emissions were 13.1 percent below 2008's level, due in part to cleaner buses.

#### *California leads nation in cleaner vehicles; China leads the world*

- But it's not all bad news. For the first time in state history, conventional internal combustion engine vehicles fueled by gasoline and diesel accounted for less than 90 percent of all on-road vehicles registered in California in 2017.
- California sold about 47 percent of all electric vehicles ever sold in the U.S. and the number of zero-emission vehicles (ZEVs) registered in California rose 38.6 percent between 2016-17.
  - China accounted for 49 percent of total ZEV sales [2017] – the most in the world, and double the number of ZEV sales in Europe, the next top adopter.

#### **Other highlights of California's clean economy**

- Between 2015 and 2016, California's total GHG emissions fell 2.7 percent, primarily due to electricity generation GHG reductions.
  - To meet the state's 2030 emission reduction goals, California will have to achieve just over 4 percent annual declines between 2020-2030.
- California's dependence on electricity from natural gas fell 18.3 percent in 2016 compared to the previous year.
- California ranks 18<sup>th</sup> among world's top 50 polluters [2015], and has the world's fifth largest economy.
- Per capita electricity consumption decreased 14.1% between 2005-2015 in California, and 21.2 percent since 1990, despite the proliferation of electronic devices.
  - National per capita consumption was down 9.5 percent since 1990.
- Despite having one of the highest electricity rates per kilowatt hour, California's average monthly residential electricity bills were 15.4 percent lower than the national average in 2016 due to decades of investment in energy efficiency and a temperate climate.
- The carbon intensity (emissions relative to GDP) of the California economy continues to decline, with emissions of 0.165 MTCO<sub>2</sub>e per \$1,000 of GDP generated in 2016, a 5.5 percent improvement compared to 2015 and a 23.6 percent improvement over 2006.
- California is one of the least carbon-intensive states. California's emissions from fossil fuel consumption per dollar of GDP dropped by 42 percent between 1990 and 2015.



- In 2015, California generated \$3.29 of GDP for every 10,000 British Thermal Units of energy consumed, while the rest of the U.S. generated \$1.75 of economic output for the same amount of energy consumed.
- Nationwide in 2017, electricity production from coal slipped by 3 percent while renewable production (excluding conventional hydropower) increased 4.8 percent compared to 2016.
- In 2016, California had an RPS goal of 25 percent; it reached 25.5 percent of total electricity generation, up 3.6 percent compared to 2015. At this pace, California is poised to meet its 2020 RPS goal of 33 percent.
  - Twenty-nine states and Washington, D.C. now have RPS policies in place.

### **Regional rankings**

The *California Green Innovation Index* breaks out how different parts of the state are performing in terms of clean energy, clean technology innovation, and other aspects of the clean economy.

Santa Rosa, for example, shot from 23<sup>rd</sup> place to first in terms of industrial-sector solar installations, while San Francisco rose from 17<sup>th</sup> to 2<sup>nd</sup> place. Overall, industrial-sector solar installations declined significantly between 2016 and 2017.

Riverside, which was in third place for residential solar last year, rose to first place, swapping places with San Diego, which slipped from first to third. Visalia-Porterville took top honors in commercial solar, rising from sixth place last year, while San Diego retained the number-two spot.

Regional highlights of this year's *Index* include:

#### **Clean Vehicle Rebates**

- An income cap that increased lower-income incentives for clean vehicle rebates took effect Nov. 1, 2016; as a result, there were more clean vehicle rebates per capita in lower-income regions and less in higher-income areas in 2017 compared to 2016.
- Los Angeles-Long Beach-Anaheim maintained its top spot for clean vehicle rebates with 19,562 in 2017, an increase of 11.2 percent year over year.
- San Francisco-Oakland-Hayward and San Jose-Sunnyvale-Santa Clara maintained their second- and third-place rankings, respectively, but with respective declines of a 3.3 percent and 14 percent compared to 2016.
- On a percentage basis, smaller, inland metros saw the largest increases in 2017: Visalia-Porterville (+215%), Hanford-Corcoran (+85%), and Chico (+66%).
- On a per capita basis, San Jose-Sunnyvale-Santa Clara held onto the top spot, with 2.9 rebates per 1,000 people. Santa Rosa-Petaluma overtook the San Francisco region to finish second, with 2 rebates per 1,000 people.

#### **Commute Time by Driving**

- Workers who drive alone continued to see their commute times increase across California.
- Drivers in Santa Maria-Santa Barbara had the lowest average commute time in 2016, spending just 18.3 minutes behind the wheel. Workers from Redding (19.6



minutes) and Hanford-Corcoran (20.6 minutes) also enjoyed relatively short commutes.

- Drivers in large metro areas spent the most time driving to and from work. Workers in Riverside-San Bernardino-Ontario had the longest average commute of 31.6 minutes, which is likely due to the increased number of “super commuters” (who spend more than 90 minutes commuting) to the Los Angeles-metro area. Stockton-Lodi (31 minutes) and San Francisco-Oakland-Hayward (30.4 minutes) had the next-longest average commute times.

### **Public Transportation**

- Unlinked passenger trips (UPTs) on public transportation (defined as trips on one transit vehicle, not including connections) continued to decline throughout California.
- Hanford-Corcoran is the only MSA where public transportation trips per capita have increased for four consecutive years.
- San Francisco-Oakland-Hayward still had, by far, the highest rate of public transit ridership (98 per capita) in 2017; however, it has fallen below 100 UPTs per person for the first time since 2011.
- Los Angeles-Long Beach-Anaheim had the next highest number of UPTs per capita at 42, a 5.9 percent decrease compared to 2016. San Diego-Carlsbad, which finished third with 30 UPTs per capita, recorded a 4.4 percent decline compared to 2016.

### **Solar PV Capacity**

- Sunny Southern California metro areas had the most solar photovoltaic capacity installed in 2017.
- Riverside-San Bernardino-Ontario added the most solar PV capacity in 2017 with 173.4 megawatt (MW) of capacity installed across all sectors combined, followed by Los Angeles-Long Beach-Anaheim with 152.2 MW installed and San Diego-Carlsbad with 135.4 MW installed.
- Riverside was number one in the state for residential and solar installations, beating out San Diego, which slipped from number one to number three in residential solar capacity in 2017.
- Cumulatively, Los Angeles-Long Beach-Anaheim had the highest solar PV installed with 866.1 MW as of the end of 2017, followed closely by Riverside-San Bernardino-Ontario (828.3 MW) and San Diego-Carlsbad (770.8 MW).
- On a per capita basis, however, the Central Valley had the most per capita solar PV capacity installed. In 2017, Madera had the most capacity installed per person (0.14 MW/person), followed by Visalia-Porterville (0.13 MW/person) and Hanford-Corcoran (0.11 MW/person).

### **About Next 10**

*Next 10 is an independent, nonpartisan organization that educates, engages and empowers Californians to improve the state's future. With a focus on the intersection of the economy, the environment, and quality of life, Next 10 employs research from leading experts on complex state issues and creates a portfolio of nonpartisan educational materials to foster a deeper understanding of the critical issues affecting our state.*



**About Beacon Economics**

[Beacon Economics](#) is one of California's leading economic research and consulting firms. Through its Sustainable Growth and Development practice, Beacon partners with policymakers, communities, businesses, and elected officials to data-drive discourse and decision-making processes around sustainability, economic growth, and equity. Beacon leverages its quantitative and qualitative competences as well as its policy-related expertise to help clients translate their goals into measurable metrics for success.