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

On eve of climate summit, 10th edition of California Green Innovation Index compares state, national and international progress on key economic and environmental indicators

SAN FRANCISCO — As leaders from around the world prepare to gather in San Francisco for the Global Climate Action Summit, 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 21st century, so it's not a time to slow down.”



Top global findings from the 2018 *Index* include:

- Total global emissions rose by 15 percent between 2005 and 2015, led by China, India and Iran.
- 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).
 - Solar generation increased by 2,571 percent in California, and wind energy generation increased 442 percent.
 - But for the first time in *Index* history, California experienced a decline in solar generation growth, with the new net energy metering solar installations down 10.5 percent from 2016, signals that the industry may be maturing.
 - However, any slowdown is expected to be resolved in 2020 when a new mandate from the California Energy Commission requiring all new homes in California to have rooftop solar takes effect.

Clean technology innovation

- Globally, clean tech investment increased 121.2 percent between 2007 and 2017, with an annual investment of \$7.78 billion in 2017.
 - California's global share has ranged from 46 percent to 18 percent depending on the year.
- California is third only to China and the U.S. as a whole in clean technology investment rankings, generating more than \$22 billion in clean technology venture capital investment from 2007 to 2017.
- 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].
- The U.S. (including California) was a global leader in clean tech patents in 2017, producing 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).
- 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 2016-2017, the world saw an 11.2 percent gain in clean tech patents, while both the U.S. and CA saw a decline.
 - 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%].
- China had the largest international improvement in energy productivity between 2005 and 2015, with a 48.7 percent gain, followed by the U.K. at 36 percent and India at 35.9 percent.
 - California improved its energy productivity by 23.4 percent during this time.

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. California ranks 18th among world's top 50 polluters [2015]. To meet the state's 2030 emission reduction goals, California will have to achieve just over 4 percent annual declines between 2020-2030.
- Per capita electricity consumption decreased 14.1% between 2005-2015 in California, and 21.2 percent since 1990, despite the proliferation of electronic devices, a result of greater energy efficiency. National per capita consumption was down 9.5 percent since 1990.
- 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.
- 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.

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.

The annual *California Green Innovation Index* features a wealth of data illuminating the intersection between climate change and the economy. Other highlights include:

- California's dependence on electricity from natural gas was down 18.3 percent in 2016 compared to the previous year.
- The carbon intensity (emissions relative to GDP) of the California economy continues to decline, with emissions of 0.165 MTCO₂e 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.
- California's Renewable Portfolio Standard (RPS) began in 2002, and has served as an example for other states. 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.
 - 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.
 - Twenty-nine states and Washington, D.C. now have RPS policies in place.
- 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 18th 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.



- On the other hand, cumulative capacity decreased by 107 MW between 2016 and 2017, bringing California's cumulative wind capacity down to 5,555 MW at the end of 2017.

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.