



2022 — 14th Edition

California Green Innovation Index

Key Findings

This year marks the release of the 14th edition of Next 10's *California Green Innovation Index*. The 2022 edition continues the shift in format for our readers that we introduced in 2021: a fully online, immersive experience for the *Index* that allows our readers to dig deep into the data, jump straight to the issues most important to their work, and easily find, interact with, and share the most critical climate and clean energy trends facing the state. This year's edition also features sidebars for each of the chapters summarizing the impacts of the Inflation Reduction Act on each of the issue areas.

This overview provides a snapshot of some of this year's key takeaways. You can learn more about these trends and others at GreenInnovationIndex.org. We're excited for you to experience our second online edition of the *California Green Innovation Index*, and we hope it can be useful to your work.



As the world recovers from the COVID-19 pandemic and following a historic federal investment in climate action with the passage of the Inflation Reduction Act, California's clean energy economy remains strong. However, challenges persist for the state to meet its clean energy, transportation, and climate goals. Key takeaways from this year's analysis include:

KEY FINDING 1
PG. 2

California in better position to meet 2030 climate goal.

KEY FINDING 2
PG. 3

Emissions from the transportation sector fell for the third consecutive year.

KEY FINDING 3
PG. 4

Wildfires continue to pose a problem for California.

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Investments in climate in California create economic value and jobs while reducing emissions.

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Electric vehicle adoption continues to rise in California.

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The pace of renewable generation growth in California is slowing.

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The amount of battery storage coming online skyrocketed in 2021.

View the entire index at
greenInnovationIndex.org



California in better position to meet 2030 climate goal.

At the rate of reduction from 2019 to 2020 (-8.7%), the state would need to reduce emissions 2.9 percent annually to meet the SB 32 goal by 2030. This rate is down by half from 2019, when the state needed to reduce emissions by 4.2 percent per year to meet the goal. However, the COVID-19 pandemic-induced lockdowns and the shift to work-from-home arrangements for a large percentage of workforce greatly reduced GHG emissions from the transportation sector in 2020.

2000 —————> 2020

GREENHOUSE GAS EMISSIONS DECREASED BY

20%

2010 —————> 2020

IF KEEP THE SAME RATE OF REDUCTION CALIFORNIA WILL REACH THE **2030 GOAL** BY

2040

2019 —————> 2020

CALIFORNIA GHG EMISSIONS FELL

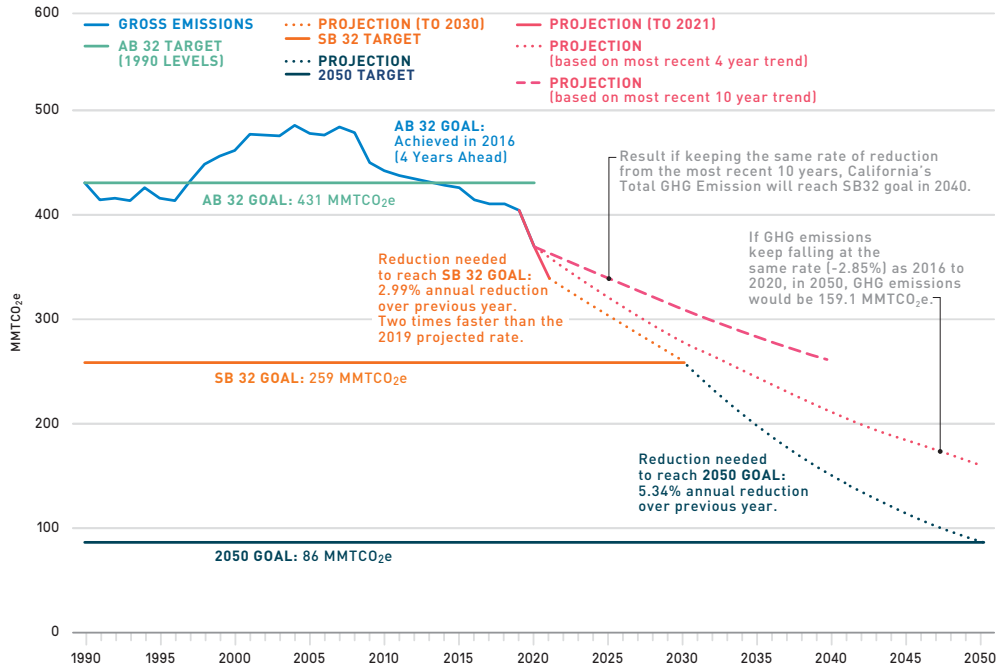
8.7%



At recent rate, **2.9%** annual reduction needed to meet **SB 32 goal by 2030**

FIGURE 1. GHG Emissions and Projected Reduction Goals

CALIFORNIA, 1990-2050



NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Note: Historical emissions data was re-calculated in the 2022 update to the CARB GHG Inventory. Data Source: California Air Resources Board, California Greenhouse Gas Inventory. NEXT 10 / SF - CA - USA

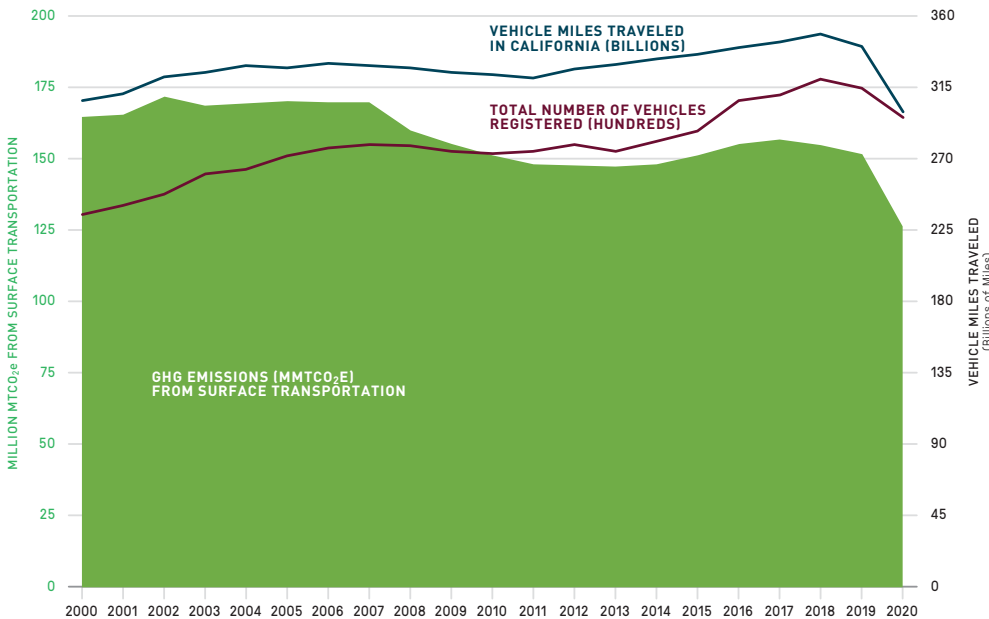
At the current trajectory, the state will take significantly less time to reach its SB 32 and 2050 goals. However, 2020 was an unusual year and it is likely emissions rebounded in 2021 and beyond as the economy re-opened. While California emissions data for 2021 is not yet known, energy-related emissions in the U.S. overall rose 6 percent in 2021 compared to 2020.¹ The U.S. Energy Information Administration also expects energy-related carbon dioxide emissions to increase by 1.8 percent in 2022 and by 0.5 percent in 2023 nationwide.²

Emissions from the transportation sector fell for the third consecutive year.

Due to the restrictions on travel in response to the COVID-19 pandemic, after years of increases in the total number of vehicles registered and vehicle miles traveled (VMT), both figures dropped from 2019 to 2020. The share of GHG emissions from the transportation sector was 37.9 percent in 2020—a reasonably significant decrease from 41.2 percent in 2019. While GHG emissions from transportation in California in 2021 are not yet known, the number of vehicles registered in California saw a significant increase of 3.9 percent in 2021 compared to 2020.³

FIGURE 2. Total Vehicles Registered, Vehicle Miles Traveled and Greenhouse Gas Emissions

CALIFORNIA, 2000–2020



NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Data Source: California Air Resources Board, California Greenhouse Gas Inventory - by Sector and Activity; Federal Highway Administration, U.S. Department of Transportation. NEXT 10 / SF · CA · USA

In 2021, subcompact SUVs saw the highest sales growth year-over-year (41%), followed by compact pickups (+32.2%). The share of newly registered SUVs surpassed 50 percent from 2020 to 2021 for the first time. Previously, in 2020, total new vehicle registrations were down 15.6 percent compared to 2019; in particular, pickup sales (-24.5%) were down more severely than car sales (-18.2%). The arrival of some highly-anticipated electric trucks in 2022—such as the new Ford F-150 BEV⁴ and forthcoming lineups from Rivian⁵—could help spur adoption of electric light-duty trucks and reduce on-road emissions. New incentives in the Inflation Reduction Act are likely to help further the adoption of clean vehicles in the state.

— 2020 —

Share of GHG emissions from transportation sector:

37.9%

2019 ————— 2020

VMT in California fell by **12%** and the number of vehicles registered fell by **5.9%**



TRANSPORTATION SECTOR: GHG EMISSIONS DROPPED

16.5%

FROM ON-ROAD VEHICLES

EMISSIONS FROM THE LIGHT-DUTY PASSENGER CARS **DECREASED BY**

19.8%

Wildfires continue to pose a problem for California.

— 2020 —

EMISSIONS FROM WILDFIRES IN CALIFORNIA TOTALED

127.7
MMTCO₂E

MORE THAN ANY OTHER ECONOMIC SECTOR EXCEPT FOR TRANSPORTATION

ABOUT

65
MMTCO₂E

OF REDUCTIONS HAVE BEEN ACHIEVED ACROSS ALL SECTORS IN CALIFORNIA IN THE PREVIOUS

18 YEARS



"Wildfires

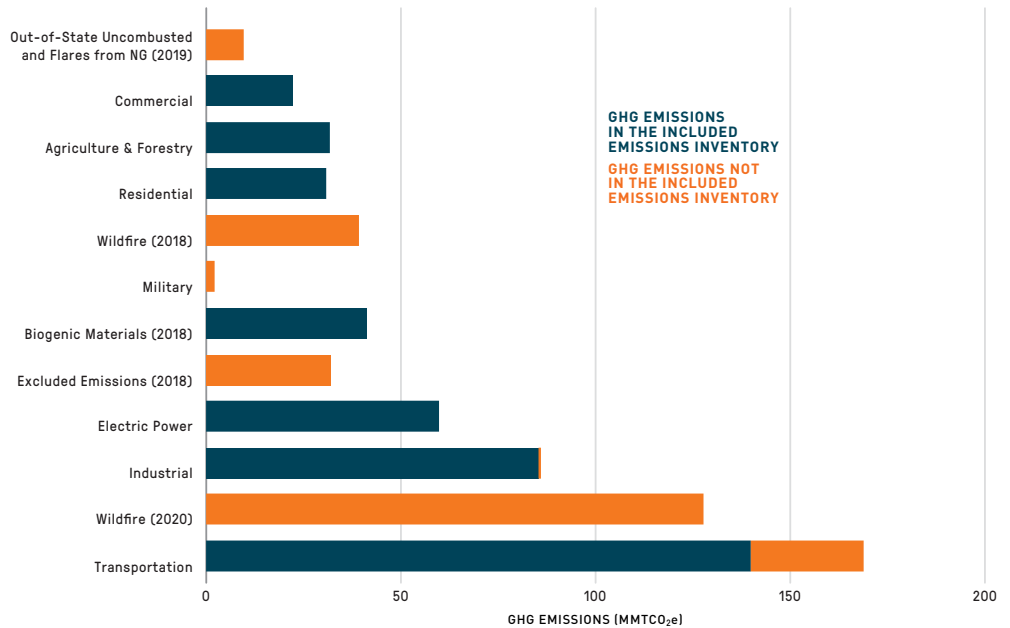
in **2020 alone** released almost as many emissions as all of the passenger vehicles in California generate in a typical year."

— [California wildfires reversed years of climate change progress in 2020 alone, study says.](#)

October 19, 2022. Sacramento Bee

Emissions stemming from wildfires are producing more GHGs than ever, and totaled 127.7 MMTCO₂e in 2020. Wildfires are a natural part of forest cycles and therefore not included in the GHG inventory.⁶ However, the increase in number and severity of wildfires in recent years is concerning, both in terms of human losses and emissions. While the amount of emissions from wildfires in 2021 are not yet known, there were significant fires across the state.

FIGURE 3. GHG Emissions Not in the Included Emissions Inventory Comparison



NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Note: GHG Emission estimates for all items are expressed as MMTCO₂e under 100-year global warming potential time horizon, except for wildfire estimates. Data Source: California Air Resources Board, California Greenhouse Gas Inventory - by Sector (for Included, Excluded, and Biogenic Materials GHG Emissions); California Air Resources Board (for 2018 Wildfire GHG Emission Estimates and GHG Out-of-state emission estimates from releases of uncombusted gas and flaring associated with natural gas consumed in California, pursuant to AB 2195); the European Centre for Medium-Range Weather Forecasts (for 2020 Wildfire GHG Emission Estimates). NEXT 10 / SF - CA - USA

Although there were fewer severe fires in 2022, wildfires continue to pose a challenge for the state. Emissions from fires are not included in the statewide inventory as forests both serve as a source of emissions (from fires) and a sink of emissions, but increasingly wildfires are an increasing net source of emissions. The California Air Resources Board is now starting a process to include wildfire emissions in its future Scoping Plan, which focuses on the pathway to achieving carbon neutrality by 2045.

Investments in climate in California create economic value and jobs while reducing emissions.

The 2022 *Index* examined four climate-related programs in California—the Clean Vehicle Rebate Project (CVRP), the Affordable Homes and Sustainable Communities (AHSC) program, and two sub-programs within the Electric Program Investment Charge (EPIC) Program related to grid and building decarbonization. The report found they create significant economic output and value added. While these four programs represent a small amount of overall climate spending in California, it is clear that investments in climate-related programs produce significant economic benefits in addition to GHG emissions reductions.

Table 1. Summary of Economic Impacts of Highlighted Programs

	CUMULATIVE OUTCOMES	CLEAN VEHICLES REBATE PROJECT	AFFORDABLE HOUSING AND SUSTAINABLE COMMUNITIES PROGRAM	EPIC: GRID DECARBONIZATION & DECENTRALIZATION PROGRAM	EPIC: BUILDING DECARBONIZATION
BUDGETARY	ALLOCATED	\$995,100,000	\$3,653,000,000	NOT APPLICABLE	NOT APPLICABLE
	IMPLEMENTED	\$974,000,000	\$1,337,000,000	\$219,000,000	\$232,000,000
	PERCENT ALLOCATED	97.88%	36.60%	NOT APPLICABLE	NOT APPLICABLE
	NUMBER OF PROJECTS	404,937	112	437 (ACROSS EPIC)	
ECONOMIC IMPACT	JOBS (IMPLAN)	822	6,543	451	705
	LABOR INCOME (IMPLAN)	\$475,039,143	\$1,162,067,930	\$48,698,374	\$82,663,682
	VALUE ADDED (IMPLAN)	\$714,749,475	\$1,538,919,030	\$199,520,469	\$221,953,767
	OUTPUT (IMPLAN)	\$1,743,031,309	\$2,914,010,152	\$325,022,005	\$368,940,163

NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Note: Dollar amounts allocated and implemented are cumulative over the life of the respective programs. The IMPLAN analysis was conducted using the cumulative investment amounts. Data Source: California Climate Investments; California Energy Commission. NEXT 10 / SF · CA · USA

California and the federal government are in alignment when it comes to climate change policy. The Inflation Reduction Act (IRA) passed in August 2022 is particularly historic, as it is the largest climate investment in U.S. history to-date, directing \$369 billion toward climate and clean energy over the next 10 years.⁷ Additionally, the Infrastructure Investment and Jobs Act (IIJA) passed in 2021 includes \$385 million for California to support existing efforts to create a 6,600 mile statewide electric vehicle charging network that will connect 1.2 million chargers by 2030. The IRA is projected to cut U.S. net GHG emissions by 31 to 44 percent below 2005 levels and create 1.5 million new jobs nationwide by 2030.

Using the cumulative implemented investment amounts for all four programs **(\$2.762 billion)** the programs generated economic output of **\$5.35 billion** and created **8,521 total jobs**.

CUMULATIVE CVRP INVESTMENT OVER THE LIFE OF THE PROGRAM RESULTED IN GHG EMISSIONS REDUCTIONS OF AN ESTIMATED

6,702,548 MTCO_{2e},

WHILE THE AHSC PROGRAM REDUCED EMISSIONS BY

2,514,667 MTCO_{2e}.

AT THE STATE LEVEL, CALIFORNIA COMMITTED TO HISTORIC INVESTMENTS IN CLIMATE OF

~ \$54 billion
OVER LAST TWO YEARS

Electric vehicle adoption continues to rise in California.

In September 2020, California adopted a rule of 100 percent of in-state sales of new passenger cars and trucks must be zero-emission by 2035.⁸ For California to reach the previous goal of 1.5 million ZEVs by 2025, it needs to increase adoption by 12.8 percent year-over-year from 2021 to 2025, revised downwards from the previously 18 percent requirements. The target of 50 percent ZEV sales share in 2030 by President Biden may also help supercharge ZEV adoption nationwide, including in California.⁹



2021

THE INCREASE OF ZERO-EMISSION-VEHICLE REGISTRATIONS REACHED

2.8%

THE HIGHEST REGISTRATION AMOUNT RECORDED SINCE 2015

2021

NEW REGISTRATIONS OF OF BEVS REACHED THE HIGHEST LEVEL TO-DATE WITH

9.5%

2021

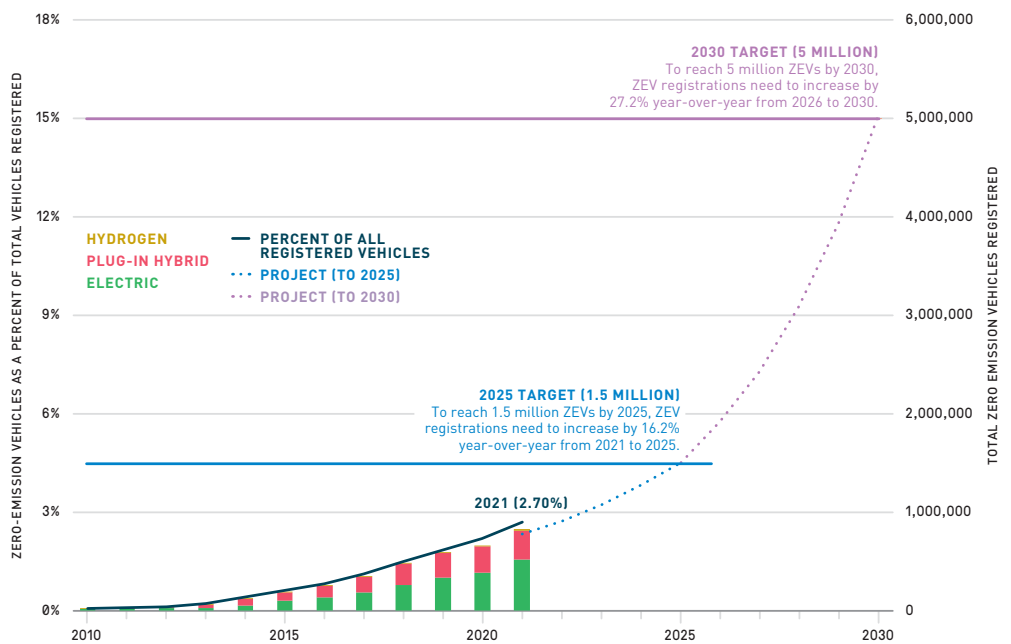
NEW REGISTRATIONS OF PHEVS REACHED THE HIGHEST LEVEL SO FAR

3.3%

OF NEW REGISTRATIONS

FIGURE 4. Trends in Total Zero-Emission Vehicle Registrations and Projected Needs to Meet 2025 and 2030 Goals

CALIFORNIA, 2010-2021



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

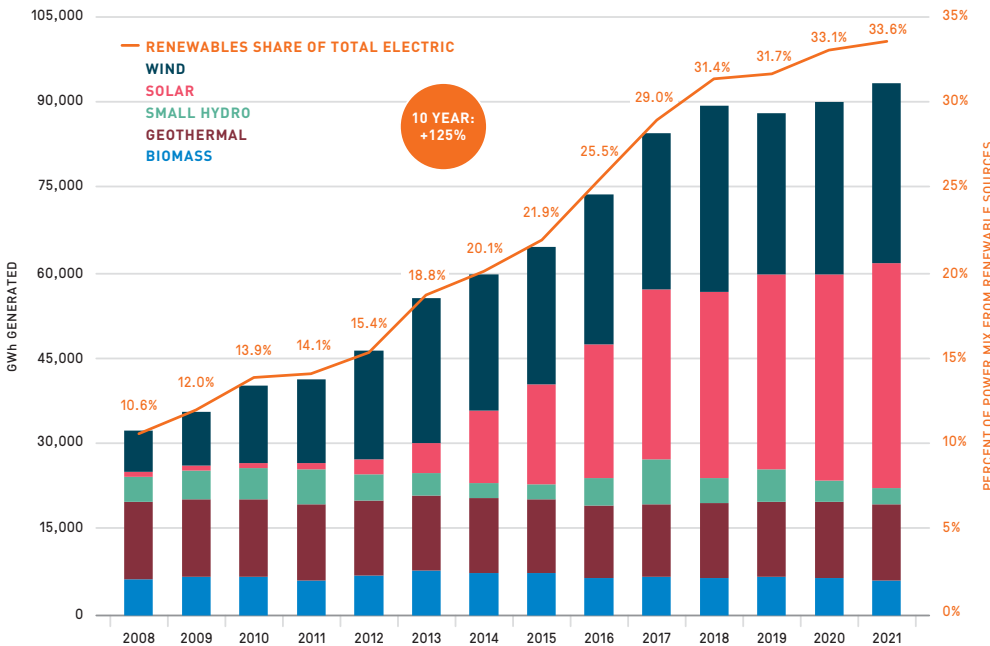
Pre-pandemic, the continuous downward revisions suggested that the state could potentially meet the imminent 2025 goal. However, chip and battery shortages have arisen during the pandemic, which could have longer-term adverse effects on ZEV adoption, especially as demand for ZEVs continues to increase globally. California Air Resources Board has identified annual zero-emission vehicle requirements—from 2026 to 2029, ZEV registrations are expected to grow at a pace of eleven percent, and by eight percent from 2029 to 2035. If the current upward ZEV adoption trend continues, California will likely be in a better position to achieve the GHG emissions reduction target of 40 percent below 1990 levels by 2030.

The pace of renewable generation growth in California is slowing.

Electricity generation from renewables exceeded 93,000 gigawatt-hours (GWh) in 2021—only about 3,000 GWh more than 90,000 GWh in 2018. The ongoing drought has significantly hampered electricity generation from hydroelectric, and small hydro’s share of generation in 2021 (1%) is one of the lowest since the Renewable Portfolio Standard (RPS) program’s inception in 2002. Electricity generation from biomass, geothermal, and small hydro totaled 22,320 GWh in 2021—the lowest it has been since 2008. So far, solar has dominated renewable generation, accounting for over 80 percent of the state’s increased renewable energy from 2014 to 2021.

FIGURE 5. California Renewable Electricity Generation

GIGAWATT-HOURS BY SOURCE, 2008–2021



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

While electricity generation from renewable sources has remained largely flat, the increase in total RPS percentage is due to the decrease in out-of-state imports of natural gas (9.1% lower in 2021 than 2020). To offset the lost hydro-electric power, California now imports 30.1 percent of its electricity supply from neighboring markets, with about 61 percent of that coming from the Southwest and 39 percent from the Northwest. Comparatively, electricity from renewable sources made up 13.8 percent of total generation in the U.S. in 2021. Therefore, California still has a sizable lead in generation from renewables, but the pace of growth has slowed in California (+2.2%) compared to the U.S. (+3.5%) relative to 2008.

— 2021 —
 PERCENTAGE OF TOTAL POWER MIX* FROM RENEWABLE SOURCES **ROSE 0.5% TO**
33.6%
 *In-state generation plus imports

Solar and wind are the largest renewable sources, making up **14.2% and 11.4%** respectively, of the state’s total power mix

2021 —————> 2026
 For **CALIFORNIA** to meet its **2026 GOAL** of **50%** of generation from RPS-eligible renewable sources, the share of electricity generation from renewables would need to **increase 8.3%** each year.



The amount of battery storage coming online skyrocketed in 2021.

More utility-scale storage, such as lithium-ion battery and long-duration, is needed to make the grid better at incorporating renewables and reduce curtailments that have been trending upwards in recent years. California had the most considerable utility-scale batteries added to the grid in the U.S., reaching 2,359 MW as of 2021. Still, batteries only make up a small portion of the current power mix in California. Pledged to achieve zero-carbon electricity by 2045, California must seek additional tools to advance its long-duration energy storage resources to ensure grid reliability.

2021

Cumulative interconnected battery storage increased **more than 7.5 times** the previous year, with approximately **64,693** MEGAWATTS (MW) of energy storage

BATTERY & SOLAR PV STORAGE DOMINATE WITH

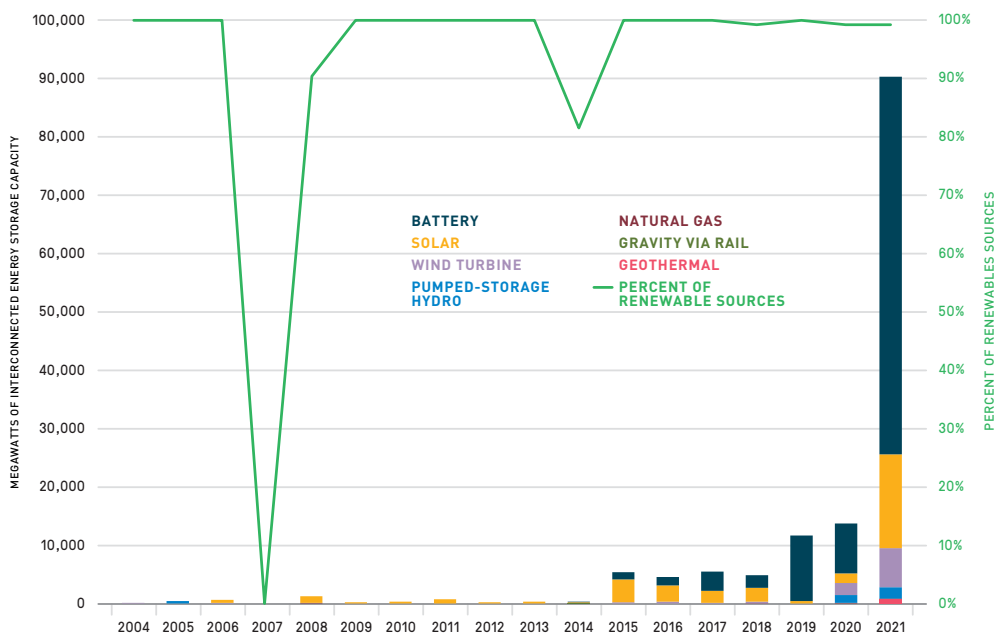
73.3%
&
18.8%
RESPECTIVELY.

Under California's landmark **2019 ENERGY STORAGE PROCUREMENT MANDATE (AB 1144)**

investor-owned utilities have surpassed the 2024 procurement target of **1,325MW** installed energy storage capacity MW by **78%**

FIGURE 6. Grid Generation Full and Partial Capacity in the CAISO Queue

MEGAWATT BY SOURCE, 2004-2021



NEXT 10 CALIFORNIA GREEN INNOVATION INDEX. Note: Full Capacity Deliverability Status ("FCDS") means that the generator is requesting that its entire output be deliverable. Partial means something less than its entire output. Active project is in study through Construction phases. Data Source: California Energy Commission. NEXT 10 / SF - CA - USA

The California battery storage industry proliferated in 2021 and the landscape of energy storage projects in California is rapidly evolving. Solar PV and battery storage dominate the growth share by 73.3 percent and 18.8 percent, respectively. CAISO has been building battery storage to meet future GHG reduction needs, which is crucial to provide operational flexibility and address demand shortfall. They still have a way to go to ensure they can substantially produce adequate levels of resources, in the long run, to meet the 15 GW energy storage target by 2032. New tax credits and incentives in the IRA should help spur further growth in storage.

About Next 10's California Green Innovation Index

Next 10's *California Green Innovation Index* tracks the state's progress in reducing greenhouse gas emissions, spurring technological and business innovation, and growing businesses and jobs that enable the transition to a more resource-efficient economy. The 2022 *Index* is the 14th 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.

Advisors to the California Green Innovation Index

Next 10 thanks the following expert advisors for their generous time and guidance on this project over the last twelve editions:

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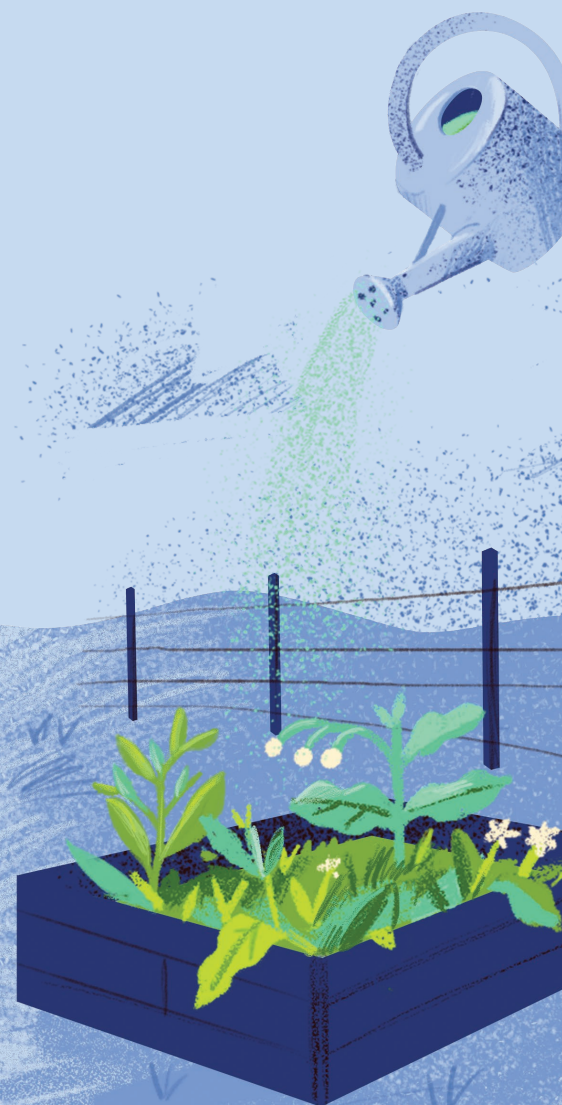
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Endnotes

- ¹ "U.S. energy-related CO2 emissions rose 6% in 2021." U.S. Energy Information Administration. May 13, 2022. Available at: <https://www.eia.gov/todayinenergy/detail.php?id=52380>
- ² "EIA expects U.S. energy-related carbon dioxide emissions to increase in 2022 and 2023." U.S. Energy Information Administration. January 20, 2022. Available at: <https://www.eia.gov/todayinenergy/detail.php?id=50958>
- ³ Vehicle registration data from the California Energy Commission, California Department of Motor Vehicles - Quarterly vehicle registration database.
- ⁴ The most recent announcement from Ford is as of September 2021, which can be viewed here: <https://media.ford.com/content/fordmedia/fna/us/en/news/2022/09/02/ford-2022-august-sales.html>
- ⁵ According to Rivian's website: <https://rivian.com/r1t>
- ⁶ According to California Air Resources Board, wildfire emissions contribute to climate change. It is important to note that emissions from wildfires are not part of the included emissions inventory, which is concerned with GHG emissions from fossil fuel combustion and other anthropogenic emissions. For more information, please visit CARB's webpage: <https://ww2.arb.ca.gov/resources/documents/frequently-asked-questions-wildfire-emissions>
- ⁷ Lacerda, Leonardo and Darci Vetter. "The U.S. Strengthened its Climate Pledge. Will Other Countries Follow Suit?" The Nature Conservancy. September 6, 2022. Available at: <https://www.nature.org/en-us/what-we-do/our-insights/perspectives/inflation-reduction-act-will-world-follow-suit/>
- ⁸ In September 2020, Governor Newsome signed Executive Order N-79-20, which shall be a goal of the State that 100 percent of in-state sales of new passenger cars and trucks will be zero-emission by 2035. Executive Order N-79-20 can be viewed here: <https://www.gov.ca.gov/wp-content/uploads/2020/09/9.23.20-EO-N-79-20-Climate.pdf>
- ⁹ The White House. FACT SHEET: President Biden Announces Steps to Drive American Leadership Forward on Clean Cars and Truck. August 05, 2021. Retrieved from: <https://www.whitehouse.gov/briefing-room/statements-releases/2021/08/05/fact-sheet-president-biden-announces-steps-to-drive-american-leadership-forward-on-clean-cars-and-trucks/>



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