**State Energy Policy Simulator (EPS) Documentation**

# Estimating Economy-wide Emissions

The US State Energy Policy Simulators (EPS) account for emissions produced in the following sectors: electricity generation, building energy consumption, industrial energy consumption, industrial process emissions, agriculture process emissions, land use change, and transportation.

Our primary sources are federal data sets from the Environmental Protection Agency (EPA), Energy Information Association (EIA), the California Air Resources Board (CARB), California Energy Commission (CEC), and the National Renewable Energy Lab (NREL). The table below summarizes our data sources and methodology.

## DATA SOURCES

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| **SECTOR** | **SOURCE** | **METHODOLOGY** | **BENCHMARKING SOURCES FOR COMPARISONS** |
| Electricity | For capacity and generation: EIA’s [Form 923](https://www.eia.gov/electricity/data/eia923/) and EIA’s [Form 860](https://www.eia.gov/electricity/data/eia860/)  E3, [RESOLVE](https://files.cpuc.ca.gov/energy/modeling/PSP%20RESOLVE%20Updates.pdf) modeling for California Public Utilities Commission’s 2022 long-term planning process.  For imports/exports: EIA’s State Electricity Profiles [Table 10](https://www.eia.gov/electricity/state/nevada/state_tables.php). As well as the California Energy Commission’s annual data on [Total System Generation](https://www.energy.ca.gov/data-reports/energy-almanac/california-electricity-data/2020-total-system-electric-generation/2020).  [Senate Bill 846](https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=202120220SB846#99INT): delays retirement of California’s nuclear generation capacity for 2030 and 2031. | Include all utility-owned generation and capacity in-state. No scaling needed.  Imports and exports from start year are held constant, apart from fossil combustion-based generation, which ramps down over time (2025 for coal, 2045 otherwise). | California Air Resources Board – [California 2019 GHG Inventory](https://ww2.arb.ca.gov/ghg-inventory-data)  Emissions - EPA “[State CO2 Emissions from Fossil Fuel Combustion, 1990-2017](https://www.epa.gov/statelocalenergy/state-co2-emissions-fossil-fuel-combustion-1990-2017)” &  AEO “[State CO2 Emissions from Fossil Fuel Combustion](https://www.epa.gov/statelocalenergy/state-co2-emissions-fossil-fuel-combustion-1990-2017)” |
| Building Energy Use | National Renewable Energy Laboratory, Electrification Futures: [End-Use Electric Technology Cost and Performance Projections Through 2050](file:///C:\Users\olivia\Downloads\Paige%20Jadun%20et%20al.,)  California Energy Commission, Integrated Energy Policy Report  California Energy Commission, [Building Decarbonization Assessment](https://www.energy.ca.gov/publications/2021/california-building-decarbonization-assessment)  California Pathways [Modeling](https://ww2.arb.ca.gov/our-work/programs/ab-32-climate-change-scoping-plan/2022-scoping-plan-documents) | Use CEC IEPR data for building energy use for electricity and natural gas; use NREL data for other fuels. | Energy Use - EIA’s “[State Energy Data Systems](https://www.eia.gov/state/seds/seds-data-fuel.php?sid=NV)” 2019  CO2 Emissions - AEO “[State CO2 Emissions from Fossil Fuel Combustion](https://www.epa.gov/statelocalenergy/state-co2-emissions-fossil-fuel-combustion-1990-2017)” |
| Industrial Energy Use | California Pathways [Modeling](https://ww2.arb.ca.gov/our-work/programs/ab-32-climate-change-scoping-plan/2022-scoping-plan-documents)  California Energy Commission, [Integrated Energy Policy Report](https://www.energy.ca.gov/data-reports/reports/integrated-energy-policy-report/2021-integrated-energy-policy-report/2021-iepr)  Plant-level fuel combustion data in [CARB GHG Inventory](https://ww2.arb.ca.gov/applications/greenhouse-gas-emission-inventory-0)  EIA [Form 860](https://www.eia.gov/electricity/data/eia860/) - Schedule 2, Plant Data, or Combined Heat and Power | CARB data by industrial sector and fuel used for start year (2019). Energy use forecasted using E3’s 2022 Pathways modeling. | Energy Use - NREL Electrification Futures and EIA’s “[State Energy Data Systems](https://www.eia.gov/state/seds/seds-data-fuel.php?sid=US)”  Emissions - EPA “[State CO2 Emissions from Fossil Fuel Combustion, 1990-2017](https://www.epa.gov/statelocalenergy/state-co2-emissions-fossil-fuel-combustion-1990-2017)” &  AEO “[State CO2 Emissions from Fossil Fuel Combustion](https://www.epa.gov/statelocalenergy/state-co2-emissions-fossil-fuel-combustion-1990-2017)” |
| Industrial Process Emissions | California Pathways [Modeling](https://ww2.arb.ca.gov/our-work/programs/ab-32-climate-change-scoping-plan/2022-scoping-plan-documents) | Emissions from E3’s 2022 Pathways modeling. | EPA “[State Inventory and Projection Tool](https://www.epa.gov/statelocalenergy/state-inventory-and-projection-tool)” |
| Agriculture, Land Use And Forestry | CARB Wildfire Emission [Estimates for 2020](https://ww2.arb.ca.gov/sites/default/files/2021-07/Wildfire%20Emission%20Estimates%20for%202020%20_Final.pdf) & [other studies](https://onlinelibrary.wiley.com/doi/epdf/10.1111/gcb.14677)  The Nature Conservancy report, [Natural Climate Solutions for the U.S.](https://nature4climate.org/u-s-carbon-mapper/) | No scaling needed. Use emissions data from sources. | Emissions - EPA “[State CO2 Emissions from Fossil Fuel Combustion, 1990-2017](https://www.epa.gov/statelocalenergy/state-co2-emissions-fossil-fuel-combustion-1990-2017)” &  AEO “[State CO2 Emissions from Fossil Fuel Combustion](https://www.epa.gov/statelocalenergy/state-co2-emissions-fossil-fuel-combustion-1990-2017)” |
| Transportation | CARB, EMFAC emissions and fleet [database](https://arb.ca.gov/emfac/)  Advanced Clean Cars policy update included in BAU per August 2022 CARB approval. | No scaling needed, EMFAC reports vehicles by type, emissions, and miles traveled.  BAU representation of EV adoption due to Advanced Clean Cars draws on announced policy schedule, see [ES-Figure 1](https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2022/accii/isor.pdf). | Emissions - EPA “[State CO2 Emissions from Fossil Fuel Combustion, 1990-2017](https://www.epa.gov/statelocalenergy/state-co2-emissions-fossil-fuel-combustion-1990-2017)” &  AEO “[State CO2 Emissions from Fossil Fuel Combustion](https://www.epa.gov/statelocalenergy/state-co2-emissions-fossil-fuel-combustion-1990-2017)” |

# Understanding the Scenarios

**Business-as-Usual Scenario:** Energy Innovation forecasted economy-wide greenhouse gas emissions through 2050 using publicly available, national models of energy consumption (EIA’s Annual Energy Outlook, NREL’s Electrification Future Study). The BAU Scenario is the model’s foundation, capturing projected changes based on economic growth, technology and cost changes, and existing policy commitments.

**Committed Policy Scenario:** includes a broader array of policies beyond the policies with clear statutory authority and enforceability included in the BAU Scenario. This Committed Policy Scenario evaluates the combined emissions effects of what policymakers have indicated they want to do, even if the policy approach is not yet clear or backed by law. This includes CARB’s current proposal for changes to its Advanced Clean Cars program, electrification of heavy-duty trucks, improved mode shifting and fuel efficiency, and a higher carbon price that extends beyond 2030.

**Deeper Decarbonization Scenario:** shows a holistic, cost-effective policy pathway that reduces emissions in the buildings, industry, transportation, and electricity sectors. This scenario highlights a set of policies that achieve substantial near term GHG reductions by 2030 and result in an 86 percent reduction in 2020 emissions by 2045.

## SUMMARY OF BAU SCENARIO POLICY ASSUMPTIONS

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| --- | --- |
| **Sector** | **Assumptions** |
| Cross-cutting | The BAU Scenario includes a carbon price created by the state’s cap-and-trade program based on a projection forward of recent price trends, reaching $54/ton in 2030. In 2031 and later years, the carbon price stays constant in this scenario, reflecting the 2030 sunset of explicit legislative authority under Senate Bill 398. |
| Electricity | * Consistent with the CPUC’s 2022 decision setting a GHG emissions planning target of 38 million metric tons (MMT) in 2030 for the electric sector, dropping to 35 MMT by 2032. The CPUC’s modeling found this results in the use of about 73% Renewables Portfolio Standard resources and 86% GHG-free resources by 2032.[[1]](#footnote-1) * Reflecting the current focus on adding resources contributing to system reliability, BAU electricity system development adds off-shore wind, long-duration storage, and geothermal power.[[2]](#footnote-2) * After 2032, policy requirements approximate Senate Bill 100’s 2045 carbon-neutrality requirement. |
| Transportation | * Current Advanced Clear Cars standards through 2025. These are equivalent to average light-duty vehicle tailpipe emissions required under the 2012 federal Corporate Average Fuel Economy standards. * ZEV adoption reaches approximately 5 million in 2030 as in BAU modeling by the Institute for Transportation Studies, University of California, Davis.[[3]](#footnote-3) * The state’s Advanced Clean Trucks policy, which sets a ZEV sales standard for medium- and heavy-duty vehicles, reaching about 60% of EVs in new truck sales in 2035. * State and federal EV subsidies. * The state’s long-standing Low Carbon Fuel Standard, requiring an overall 20% reduction in carbon intensity in 2030. |
| Industry | * Process and fugitive emissions fall as required by Senate Bills 617 and 1383, which set statewide emissions targets of 40% below 2013 levels by 2030 for methane and F-gases, and 50% below 2013 levels by 2030 for anthropogenic black carbon. * Cement and concrete sector-related GHG emissions fall 40% below 2019 levels by 2035, induced by Senate Bill 596.[[4]](#footnote-4) |
| Buildings | * Building energy efficiency calibrated to 2021 Integrated Energy Policy Report’s Mid Demand Case for [Natural Gas](https://efiling.energy.ca.gov/GetDocument.aspx?tn=241226) and High Demand Case for [Electricity](https://efiling.energy.ca.gov/GetDocument.aspx?tn=241215).[[5]](#footnote-5) * Building electrification assumptions reflect the 2022 Scoping Plan Reference Scenario. By 2030, high-efficiency heat pumps comprise at least 15% of building appliance new sales, including replacements in existing buildings. Starting in 2026, 25% of new construction is all-electric. |

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## SUMMARY OF COMMITTED POLICIES SCENARIO ASSUMPTIONS

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| --- | --- |
| **Sector** | **Assumptions** |
| Cross-cutting | Instead of plateauing at $54/ton in 2030, as in the BAU Scenario, the carbon allowance price created by the state’s cap-and-trade program continues increasing in 2031 and later years, reaching $258/ton in 2050. |
| Electricity | * Same as BAU Scenario |
| Transportation | * Electrification of cars and light trucks: ZEVs grow to 68% of new vehicle sales in 2030, reaching 100% in 2035. This reflects CARB’s current proposal for changes to its Advanced Clear Cars program. * Electrification of trucks: electric-drive medium- and heavy-duty trucks and buses reach 100% of new vehicle sales in 2040. * Internal combustion new car and light-truck vehicle efficiency: fuel economy improves 2% annually from 2026 to 2035. * Internal combustion new truck vehicle efficiency: fuel economy grows 2% annually from 2028 to 2035. * Sustainable Communities Strategies, comparable to the EPS’s mode-shifting policy level, reduce average vehicle miles traveled per person as in the proposed Scoping Plan scenario. Motor vehicle travel demand per person falls by 19% in 2035 and by 22% in 2045 compared to 2019 levels. |
| Industry | * Same as BAU Scenario |
| Buildings | * Same as BAU Scenario |

## SUMMARY OF DEEPER DECARBONIZATION SCENARIO ASSUMPTIONS

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| **Sector** | **Assumptions** |
| Cross-cutting | Same as Committed Policies Scenario |
| Electricity | * Ratcheting up the clean energy standard in tandem with electricity grid reliability investments causes sector emissions to fall to 30 MMT CO2e compared to 38 MMT in the BAU Scenario. By 2035, the electricity sector’s emissions fall to around 4 MMT CO2e. * Electricity grid reliability investments in this scenario include doubling battery storage capacity, doubling transmission capacity, and adding 5,900 megawatts (MW) of demand response capacity. Associated reliability resource costs are included in clean energy standard policy costs. |
| Transportation | * Electrification of cars, light trucks, and buses: ZEVs reach 100% of new vehicle sales in 2030. * Electrification of medium- and heavy-duty trucks: ZEVs reach 100% of new vehicle sales in 2032. * Electrification of tractor trailer-type freight trucks (colloquially known as “semis”): ZEVs reach 100% of new vehicle sales in 2035. |
| Industry | * Switching to lower carbon fuels, prioritizing electrification, switching to electricity from fossil fuel combustion. When electrification is technically infeasible or cost prohibitive, industry energy demand switches to hydrogen produced by electrolysis (i.e., using electricity). * Grid-connected electricity supplies hydrogen production in this scenario, in contrast to the 2022 Draft Scoping Plan analysis, which assumes electricity for hydrogen production is from dedicated solar PV facilities, disconnected from the electricity grid. * Emissions reductions even beyond SB 617 requirements for short-lived climate pollutants. Faster phase switch to low global warming potential refrigerants consistent with the Kigali Amendment to the Montreal Protocol. Additional reduction in methane leakage associated with natural gas use. * CCS to capture industrial process emissions otherwise difficult to mitigate in three industries, cement, chemicals, and ferrous metals production. . |
| Buildings | * Electric building components reach 100% in 2030, covering new buildings and appliance replacements in existing buildings. |

# About Us

### The Energy Policy Simulator is a non-partisan, open-source, and peer-reviewed model. The EPS was developed to evaluate the impacts of climate and energy policies on emissions, costs and savings, and fuel consumption. The EPS model is used by policymakers to select and refine climate legislation. For example, the EPS model was used to assess the impact of climate policies for the U.S. House Select Committee on the Climate Crisis.[[6]](#footnote-6) EPS users input climate policies and the model then analyzes interacting policy impacts to forecast environmental and economic outcomes. The model generates a variety of data outputs including greenhouse gas emissions, criteria pollutant emissions, capital and operating cash flow changes, and macroeconomic changes to GDP and jobs. RMI and Energy Innovation are currently developing “beta” EPS models for all 48 continental U.S. states.

### The EPS model is available for download online [here](https://us.energypolicy.solutions/docs/download.html).[[7]](#footnote-7) And full documentation on methodology and assumptions are available online [here](https://us.energypolicy.solutions/docs/index.html).[[8]](#footnote-8)

# Contact

If you have questions about using the EPS, we recommend first watching our video series, available [here](https://us.energypolicy.solutions/docs/video-series.html).[[9]](#footnote-9) For further information on the EPS, contact us at [policy@energyinnovation.org](mailto:policy@energyinnovation.org). For more information on RMI analysis and our state advocacy support network contact us at [USAnalysis@rmi.org](mailto:USAnalysis@rmi.org).

The US state EPS models were developed as a partnership between Energy Innovation and Rocky Mountain Institute (RMI), with RMI work supported by Bloomberg Philanthropies.

1. California Public Utilities Commission, “Attachment A Modeling Assumptions 2022-23 TPP, Decision Adopting 2021 Preferred System Plan,” February 15, 2022, <https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M451/K485/451485713.PDF>. [↑](#footnote-ref-1)
2. California Public Utilities Commission, “Attachment A Modeling Assumptions 2022-23 TPP.” [↑](#footnote-ref-2)
3. Kelly L. Fleming and Austin L. Brown, “Carbon Neutrality Study 1: Driving Transportation Emissions to Zero in California,” 2020, <https://doi.org/10.7922/G2222S1B>. [↑](#footnote-ref-3)
4. SB 596 requires CARB, by July 1, 2023, to develop a comprehensive strategy for the state’s cement sector to achieve net-zero emissions of GHGs associated with cement used within the state no later than December 31, 2045. The bill establishes an interim target of 40 percent below the 2019 average GHG intensity of cement by December 31, 2035. [↑](#footnote-ref-4)
5. California Energy Commission, “IPER 2021.” [↑](#footnote-ref-5)
6. https://energyinnovation.org/2020/07/28/hal-harveys-insights-and-updates-congressional-climate-plan-is-a-bet-your-country-moment/ [↑](#footnote-ref-6)
7. https://us.energypolicy.solutions/docs/download.html [↑](#footnote-ref-7)
8. https://us.energypolicy.solutions/docs/index.html [↑](#footnote-ref-8)
9. https://us.energypolicy.solutions/docs/video-series.html [↑](#footnote-ref-9)