# 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), and the National Renewable Energy Lab (NREL). The table below summarizes our data sources and methodology.

### DATA SOURCES

| SECTOR | SUBSECTORS | SOURCE | METHODOLOGY | BENCHMARKING SOURCES FOR COMPARISONS |
|---|---|---|---|---|
| Electricity | In-state capacity and generation; out of state imports | For capacity and generation: EIA's Form 923 and EIA's Form 860<br><br>For imports/exports: EIA's State Electricity Profiles Table 10. | Include all utility-owned generation and capacity in-state. No scaling needed.<br><br>Imports and exports from start year are held constant. | Emissions - EPA "State CO2 Emissions from Fossil Fuel Combustion, 1990-2017" &<br>AEO "State CO2 Emissions from Fossil Fuel Combustion" |
| Building Energy Use | All energy use, all building components, residential and commercial buildings | EIA's State Energy Data Systems from 2019 &<br><br>NREL Electrification Futures Study - Reference Scenario | Use EIA's SEDS data to find total energy consumption for residential and commercial buildings. Use NREL's data to forecast changes in energy consumption through 2050 and energy consumption by appliance type. | Energy Use - EIA's "State Energy Data Systems" 2019<br>CO2 Emissions - AEO "State CO2 Emissions from Fossil Fuel Combustion" |

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| Industrial Energy Use | All fuel use for industrial sector | Energy Information Association's Annual Energy Outlook tables on Industrial Energy Use & EIA's "State Energy Data Systems" | Scaled SEDS data down by Census Data (County Business Patterns) employment by industrial subsector and state compared to national employment by industrial sector. | Energy Use - NREL Electrification Futures and EIA's "State Energy Data Systems"<br>Emissions - EPA "State CO2 Emissions from Fossil Fuel Combustion, 1990-2017" &<br>AEO "State CO2 Emissions from Fossil Fuel Combustion" |
| Industrial Process Emissions | Process Emissions | EPA Global Non-CO2 Greenhouse Gas Emissions Projections & Mitigation Potential: 2015-2050 | Scaled down US data to state data using a variety of sources, including data from EPA's FLIGHT tool and EPA's State Inventory Tool Output Dataframe | EPA "State Inventory and Projection Tool" |
| Agriculture, Land Use And Forestry | Livestock emissions<br>Natural carbon sinks and sources (LULUCF) | EPA "State Inventory and Projection Tool" | No scaling needed. EPA reports LULUCF emissions by state. | Emissions - EPA "State CO2 Emissions from Fossil Fuel Combustion, 1990-2017" &<br>AEO "State CO2 Emissions from Fossil Fuel Combustion" |
| Transportation | All energy use, vehicle miles | EIA's State Energy Data Systems from 2019, Energy Information Association's Annual Energy Outlook tables on Industrial Energy Use & NREL Electrification Futures Study - Reference Scenario | Use vehicle stock by type forecasts from NREL. Estimate miles traveled by vehicle type using total energy consumption, average miles traveled nationally by vehicle type, and national vehicle stock fuel efficiency. | Emissions - EPA "State CO2 Emissions from Fossil Fuel Combustion, 1990-2017" &<br>AEO "State CO2 Emissions from Fossil Fuel Combustion" |

## Understanding the Business-as-Usual Projection

**Business-as-Usual:** Energy Innovation and RMI built a forecast of 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.

The table below summarizes the policies included in the BAU and GHG Pollution Reduction Roadmap scenarios.

### SUMMARY OF POLICY ASSUMPTIONS

| Sector | BAU Scenario |
|---|---|
| Electricity | • Assumes all currently planned retirements are completed on time |
| Buildings | • From EIA's Annual Energy Outlook and NREL<br>• Assumes some equipment performance improvements over time, based on market data (described here)[1] |
| On-Road Transportation | • From EIA's Annual Energy Outlook and NREL<br>• Includes 2012 Federal Corporate Average Fuel Economy Standards (CAFE) standards (full text via AEO)<br>• Federal EV subsidies<br>• Economic adoption of EVs[2] |
| Industry | • From EIA's Annual Energy Outlook and NREL<br>• Assumes equipment performance improvements over time (described here)<br>• Does not include implementation of the Kigali Amendment to the Montreal Protocol. |
| Land use/Agriculture | • Agriculture, biomass, and forestry projections |
| Imports/Exports | • Imported electricity emissions held constant |

[1] Efficiency improvements are derived from NREL electrification futures study Reference Case.

[2] Electric vehicle adoption in the BAU case is based on economic adoption modeled in the EPS, with more details available here: https://us.energypolicy.solutions/docs/transportation-sector-main.html. EPS transportation data, such as vehicle prices, is largely taken from EIA, and the resulting EV adoption curve rates are similar to other studies, including the "Electric Vehicle Outlook 2020": https://about.bnef.com/electric-vehicle-outlook/#toc-viewreport.

# Example Climate Mitigation Scenarios

## US NDC SCENARIO

Energy Innovation developed a "US NDC Scenario," which is designed to put the US, nationally, on an emissions trajectory broadly consistent with limiting global warming to 1.5°C by 2100. This national scenario has been downscaled to each state, adjusting for differences in the state technology mix compared to the national technology mix. This policy scenario is illustrative and is meant to represent one set of policies that could be used to reduce emissions in line with a 1.5°C scenario.

## POLICY ASSUMPTIONS IN THE US NDC SCENARIO

| Sector | US 1.5 Degree Scenario |
|---|---|
| Electricity | • Clean Electricity Standard of 80% by 2030, 100% by 2035<br>• Accelerate deployment of storage, transmission, and demand response<br>• No new construction of coal and natural gas plants<br>• Power plant retirements<br>• Electricity Sector CCS |
| Buildings | • 100% electric new appliances and buildings by 2030 ("building component electrification")<br>• 15% of existing buildings are retrofit by 2050<br>• Efficiency improvement with ambition extended to 2050, plus additional efficiency improvements for building heating equipment and appliances |
| On-Road Transportation | • 100% electric new light-duty vehicle, motorbike, and bus sales by 2035<br>• 100% electric new medium- and heavy-tuy truck sales by 2045<br>• 60% improvement in fuel economy standards for internal combustion engine light-duty vehicles by 2035, as well as a 50% improvement for buses, a 50% improvement for medium- and heavy-duty freight vehicles, a 60% improvement for aircraft, and a 25% improvement for rail and ships<br>• 20% light-duty vehicle miles traveled reduced or shifted from BAU by 2050<br>• 6.3% reduction in truck freight transport by 2050 |
| Industry | • 100% achievement of cement clinker substitution by 2030<br>• 100% achievement of HFC emissions reductions from the Kigali Amendment to the Montreal Protocol<br>• 14% improvement in industrial energy intensity/efficiency by 2050<br>• 100% by 2050 shift from fossil fuels to a mix of electricity and hydrogen, varying by industrial potential for each fuel type, by 2050<br>• 10% reduction in cement demand and 15% reduction in iron and steel demand from improved material efficiency policies by 2050 |

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|---|---|
| | • 100% achievement of potential emissions reductions from methane capture and destruction in natural gas and oil, coal mining, water, and waste sectors by 2030<br>• 100% of hydrogen is produced via electrolysis by 2030<br>• 50% remaining industrial CO2 emissions captured and sequestered through CCS by 2050 |
| Land use/ Agriculture | • 100% achievement of potential additional carbon uptake from afforestation/reforestation measures, improved forest management, cropland measures, and livestock measures (such as requiring anaerobic digesters) by 2030 |

## 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.[3] 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 EPS models for 20 U.S. states.

The EPS model is available for download online here.[4] And full documentation on methodology and assumptions are available online here.[5]

## Contact

If you have questions about using the EPS, we recommend first watching our video series, available here.[6] For further information on the EPS, contact us at policy@energyinnovation.org. For more information on RMI analysis and our state advocacy support network contact us at BeyondCarbon_Support@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.

[3] https://energyinnovation.org/2020/07/28/hal-harveys-insights-and-updates-congressional-climate-plan-is-a-bet-your-country-moment/
[4] https://us.energypolicy.solutions/docs/download.html
[5] https://us.energypolicy.solutions/docs/index.html
[6] https://us.energypolicy.solutions/docs/video-series.html