New Mexico Energy Policy Simulator (EPS) Documentation

1 Estimating Economy-wide Emissions in the 2018 Business as Usual (BAU) Scenario

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 national data sources are federal data sets from the Environmental Protection Agency (EPA), Energy Information Administration (EIA), and the National Renewable Energy Lab (NREL). We supplemented with state data from the inventory and Pathways report by Center for the New Energy Economy at Colorado State University (CNEE) and Energy + Environmental Economics (E3) ("E3 Pathways Report").[1] In some sectors, additional external data sources were used indirectly to benchmark or calibrate the emissions, including Rhodium Group's ClimateDeck.[2] The table below summarizes our data sources and methodology. These data are used directly to develop the Business as Usual (BAU) Scenario.

Table 4: 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 For imports/exports: EIA's State Electricity Profiles Table 10.	Include all utility-owned generation and capacity in-state, including power plants on tribal land. No scaling needed. Assumes all planned retirements *as of 2018* are completed on time. (Escalante and San Juan are retired in the 2021 Current Policy Scenario.) Imports and exports from start year are held constant.	EPA "State CO2 Emissions from Fossil Fuel Combustion 1990-2018" EIA State Electricity Profile (2019) Rhodium Group ClimateDeck (2020)

[1] CNEE and E3, *New Mexico Greenhouse Gas Emissions Inventory and Forecast*, 2020. https://cnee.colostate.edu/wp-content/uploads/2021/01/New-Mexico-GHG-Inventory-and-Forecast-Report_2020-10-27_final.pdf
Note one departure from the E3 Pathways Report in treatment of the oil and gas combustion CO_2 emissions trajectory. Projected growth was aligned with the downscaled national projection from the Annual Energy Outlook, resulting in a modest growth in oil and gas combustion CO_2 in the BAU, rather than using the aggressive reductions projected from the Western Regional Air Partnership analysis.

[2] https://rhg.com/data_story/climate-deck/

Sector	Subsectors	Source	Methodology	Benchmarking Sources for Comparisons
Building Energy Use	All energy use, all building components, residential and commercial buildings	E3 Pathways Report	Take fuel-level consumption data for commercial/residential buildings directly from E3 report. Proportion to demand technologies based on NREL Electrification Futures Study. Assumes some equipment performance improvements over time, based on market data (described here)[3]	EIA "State Energy Data System" (2020) "State CO2 Emissions from Fossil Fuel Combustion", EPA State Inventory Tool Rhodium Group ClimateDeck (2020)
Industrial Energy Use	All fuel use for industrial sector, including oil & gas extraction and refining	E3 Pathways Report EIA Annual Energy Outlook Crude Oil Production (Table 58, Gulf Coast Petroleum Administration for Defense District [PADD]) EIA State Energy Data Systems, Natural Gas Consumed as Refinery Fuel	Take fuel-level consumption data from E3 report. Proportion to industrial sectors based on industrial output multiplied by energy intensity. For oil and gas production: oil production is first benchmarked to WESTAR-WRAP for 2018, and then interpolated to 2020 based on historic national crude production. Then 2021-2050 projected based on growth trajectory from AEO. Assumes equipment performance improvements over time (described here)	NREL Electrification Futures and EIA's "State Energy Data Systems" EPA "State CO2 Emissions from Fossil Fuel Combustion 1990-2018" Climate TRACE, including state-specific data[4], for oil & gas emissions
Industrial Process Emissions	Process Emissions	E3 Pathways Report	Take data directly from E3 report, no scaling needed. Does not include implementation of the Kigali Amendment to the Montreal Protocol.	Climate TRACE, including state-specific data[5], for oil & gas emissions

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

[4] Frances Reuland (RMI), personal communication, Sep 2021

[5] Ibid.

Sector	Subsectors	Source	Methodology	Benchmarking Sources for Comparisons
Agriculture, Land Use and Forestry	Livestock emissions Natural carbon sinks and sources (LULUCF)	EPA "State Inventory and Projection Tool"	No scaling needed. EPA reports LULUCF emissions by state.	EPA "State CO2 Emissions from Fossil Fuel Combustion 1990-2018"
Transportation	All energy use, vehicle miles	EIA's State Energy Data Systems from 2019 Energy Information Association's Annual Energy Outlook tables on Energy Use (2021) NREL Electrification Futures Study - Reference Scenario	Use vehicle stock by type forecasts from NREL. Estimate miles traveled by vehicle type using total energy consumption from SEDS, average miles traveled nationally by vehicle type, and national vehicle stock fuel efficiency. 2021 AEO includes 2020 updated Corporate Average Fuel Economy Standards (CAFE) Includes federal EV subsidies and economic adoption of EVs[6]	EPA "State CO2 Emissions from Fossil Fuel Combustion 1990-2018" Rhodium "Taking Stock 2021: US Emissions Outlook Under Current Policy"

2 Understanding the 2018 Business-as-Usual Projection and Additional Policy Scenarios

2018 Business-as-Usual: The BAU Scenario is the model's foundation, capturing projected changes based on economic growth, technology and cost changes, and existing policy commitments. The BAU is chosen to represent pre-existing trends and state and federal policies present in 2018. This allows us to isolate the impacts of recent state policies since 2018.

Fall 2021 Proposed Policy: This scenario reflects "bankable" actions that have taken place since 2018 plus any policies that have been proposed in previous climate action plans or other processes. Bankable actions include all new legislation, newly announced generating plant retirements, enforceable commitments, and regulations that are already in place, focusing on incremental state legislation. This can also be considered a *projected* policy scenario: it includes optimistically extrapolated current policies of unknown impact. It also includes some additional federal policies expected to be fully reinstated under the Biden Administration.

The table below summarizes the policies included in the BAU and Fall 2021 Proposed Policy Scenarios.

Measures that change from the previous scenario shown in brown.

[6] 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.

SUMMARY OF POLICY ASSUMPTIONS

Sector	Strategy	Expressed as	2018 BAU	Fall 2021 Proposed Policy
Electricity	Coal retirements	MW Retired	1540 MW in 2031 (Four Corners)	250 MW in 2020 (Escalante) + 850 MW in 2022 (San Juan) + 1540 MW in 2030 (Four Corners)[7]
	Clean electricity	% Clean Energy Standard (CES)	20% by 2020	20% by 2020 80% by 2030 100% by 2040[8]
	Renewable integration	Demand response (DR), storage, and transmission	*Downscaled projections from AEO*	4% of storage potential in 2022 (300 MW for San Juan replacement) + 12% by 2030; 100% of DR potential by 2030; 10% increased transmission by 2040[9]
	Distributed solar	Carve-out and Subsidy for distributed solar	None	Distributed solar subsidy of 10%; Distributed solar carve-out increases to 5% of retail sales by 2030
Buildings	Energy efficiency	% energy reduction relative to BAU	None	20% by 2030[10]
	Energy efficiency	% of buildings retrofit	BAU building stock turnover	5% of buildings additionally retrofit by 2050[11]

[7] Note that the accelerated retirement of Four Corners Power Plant in the Proposed Policy Scenarios does not reflect a policy of the state, which does not have full jurisdiction over the Four Corners Power Plant. Instead, RMI removed this capacity from these scenarios to ensure that the emissions trajectory could be easily compared to New Mexico's decarbonization goals, which does not include Four Corners as an emissions source.

[8] Displacement of remaining uncontrolled natural gas power used for occasional balancing and reliability is modelled as use of gas with CCS increasing to 100% by 2050. Solutions for the last 10% of clean electricity are uncertain and are not modelled in detail in the EPS.

[9] Assumed to account for grid modernization roadmap (HB 233) and increased transmission (via HB 50)

[10] Assumed to account for utility efficiency programs, efficient building code, and Sustainable Building Tax Credit

[11] Assumed to account for Sustainable Building Tax Credit: note this would be several-fold the historic uptake of low income weatherization programs.

Sector	Strategy	Expressed as	2018 BAU	Fall 2021 Proposed Policy
Buildings Continued	Building electrification	% electric fuel appliance switching sales[12]	None	100% for space and water heating by 2030[13]
Transportation	Fuel efficiency	Light duty vehicle (LDV) fuel economy	AEO 2021	Increased 15% by 2026 ("California Compromise")[14]
	Smart growth	% Passenger LDV vehicle miles traveled (VMT) reduction from BAU	None	20% by 2030[15]
	Vehicle electrification	Number of new (DCFC) EV chargers	None	140 per 100,000 by 2030[16]
	Vehicle electrification	ZEV sales standard for HDVs	None (sales reach 22% by 2030 from economic adoption)	Same as 2018 BAU
	Vehicle electrification	ZEV sales standard for HDVs	None	100% by 2045[17]

[12] This is the percent of appliances which would have been fossil in BAU which are instead replaced by electric appliances, via natural replacement (at end of life) or new construction.

[13] A portion of this is assumed to account for Sustainable Building Tax Credit

[14] This represents 51 vs. 44 mpg for new cars.

[15] Extension of current state and regional planning and travel safety measures, specifically extrapolating the goal noted in the 2019 New Mexico Climate Strategy of 15% reduction below 2015 LDV VMT by 2027; reaching 20% would require a complete suite of land use and transportation policies.

[16] Assumes new federal and state investment aligns with that in the US NDC scenario. Note that the EPS EV chargers represents the number of plugs, not the number of charging locations.

[17] Consistent with California's Advanced Clean Trucks rule, similar to implementation in the US NDC scenario.

Sector	Strategy	Expressed as	2018 BAU	Fall 2021 Proposed Policy
Transportation Continued	Clean vehicle fuels	LCFS Carbon Intensity Reduction	0%	20%
Industry	Fugitive methane abatement	% of potential abatement of oil and gas methane[18]	Flat emissions based on 2018 Inventory Baseline scenario	60% for all methane leaks by 2025 and 100% by 2028[19]
	Energy efficiency	Oil & gas industries % reduction of fossil fuel consumption from BAU	None	10% by 2030[20]
	F-gas abatement	% of potential HFC reduction from BAU[21]	None	100% substitution potential by 2035 and recycling and destruction potential by 2050
	Oil & gas fuel decarbonization	% of petroleum refining CO_2 captured	None	50% by 2030
	Oil & gas fuel decarbonization	% of oil & gas extraction electrified	None	50% by 2030
Land use and Agriculture	All strategies	All EPS measures except for changes in diet	None	100% of potential mitigation by 2050

[18] Potential is based on IEA Methane Tracker; 100% of potential equates to about 75% reduction of methane by 2030 below 2020 for the US as a whole.

[19] Includes conservative estimate for impact of the EMNRD rule, given existing uncertainties in measurement and projection, plus additional future policy action to reduce leakage.

[20] Assumed to account for federal NSPS and off-road diesel standards

[21] Potential HFC reduction in the EPS roughly matches that corresponding to the Kigali agreement and federal EPA draft rules based on December 2020 legislation

3 Example Climate Mitigation Scenario: US NDC Scenario

In addition to the scenarios that RMI designed for New Mexico, the EPS also contains a "US NDC Scenario." The US NDC Scenario was designed by Energy Innovation to result in an emissions pathway that meets the United States' Nationally Determined Contribution to decarbonization broadly consistent with limiting global warming to 1.5°C by 2100.[22] This pathway puts the US on track to reducing emissions 50 percent below a 2005 baseline by 2030 and achieving net zero emissions by 2050. 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.

Table 8: Policy Assumptions in the US NDC Scenario

Sector	US NDC Scenario
Electricity	• Clean Electricity Standard of 80% by 2030, 100% by 2035 • Accelerate deployment of storage, transmission, and demand response • No new construction of coal and natural gas plants • Power plant retirements eliminate coal by 2030 • Electricity Sector CCS applied to remaining gas plants run for occasional balancing and reliability
Buildings	• 100% electric new appliances and buildings by 2030 ("building component electrification") • 15% of existing buildings are retrofit by 2050, in addition to natural turnover • Efficiency improvement with ambition extended to 2050, plus additional efficiency improvements for building heating equipment and appliances
Transportation	• 100% electric new light-duty vehicle, motorbike, and bus sales by 2035 • 100% electric new medium- and heavy-duty truck sales by 2045 • 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 • 20% light-duty vehicle miles traveled reduced or shifted from BAU by 2050 • 6.3% reduction in truck freight transport by 2050

[22] Energy Innovation, "A 1.5°C NDC For Climate Leadership By The United States", 2021. https://energyinnovation.org/publication/a-1-5-celsius-pathway-to-climate-leadership-for-the-united-states/

Sector	US NDC Scenario
Industry	• 100% achievement of cement clinker substitution by 2030 • 100% achievement of HFC emissions reductions from the Kigali Amendment to the Montreal Protocol • 14% improvement in industrial energy intensity/efficiency by 2050 • 100% by 2050 shift from fossil fuels to a mix of electricity and hydrogen, varying by industrial potential for each fuel type, by 2050 • 10% reduction in cement demand and 15% reduction in iron and steel demand from improved material efficiency policies by 2050 • 100% achievement of potential emissions reductions from methane capture and destruction in natural gas and oil, coal mining, water, and waste sectors by 2030 • 100% of hydrogen is produced via electrolysis by 2050 • 50% remaining industrial CO2 emissions captured and sequestered through CCS by 2050
Land use and 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

4 About the Energy Policy Simulator

If you have questions about using the EPS, we recommend first watching our video series, available here.[23] 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 USAnalysis@rmi.org.

The US EPS model is available for download online here.[24] And full documentation on methodology and assumptions are available online here.[25] The US state EPS models were developed as a partnership between Energy Innovation and RMI. RMI's work supporting the state of New Mexico is funded by the US Climate Alliance. RMI's development work related to the New Mexico EPS is supported by Bloomberg Philanthropies.

[23] https://us.energypolicy.solutions/docs/video-series.html

[24] https://us.energypolicy.solutions/docs/download.html

[25] https://us.energypolicy.solutions/docs/index.html