**Minnesota Energy Policy Simulator (EPS) Summary Documentation**

# Estimating Economywide Emissions for Minnesota

The Minnesota Energy Policy Simulator (EPS) accounts 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). We supplemented national data with state-specific estimates of agricultural emissions and emissions associated with land use change. 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](https://www.eia.gov/electricity/data/eia923/) and EIA’s [Form 860](https://www.eia.gov/electricity/data/eia860/)  For imports/exports: EIA’s State Electricity Profiles [Table 10.](https://www.eia.gov/electricity/state/minnesota/state_tables.php) | No scaling needed. Added all utility-owned generation and capacity in-state. | **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)” & Minnesota’s GHG Inventory |
| BUILDING ENERGY USE | All energy use, all building components, residential and commercial buildings | [NREL Electrification Futures Study - Reference Scenario](https://www.nrel.gov/analysis/electrification-futures.html) | No scaling needed. NREL reports total energy use by fuel type and demand technology in MN for each year 2017-2050. | **Energy Use -** EIA’s “[State Energy Data Systems](https://www.eia.gov/state/seds/seds-data-fuel.php?sid=US)” 2018  **CO2 Emissions -** AEO “[State CO2 Emissions from Fossil Fuel Combustion](https://www.epa.gov/statelocalenergy/state-co2-emissions-fossil-fuel-combustion-1990-2017)” & Minnesota’s GHG Inventory |
| INDUSTRIAL ENERGY USE | All fuel use for industrial sector | [Energy Information Association’s Annual Energy Outlook tables on Industrial Energy Use](https://www.eia.gov/outlooks/aeo/tables_ref.php) &  EIA’s “[State Energy Data Systems](https://www.eia.gov/state/seds/seds-data-fuel.php?sid=US)” | Scaled down by Census Data ([County Business Patterns](https://www.census.gov/programs-surveys/cbp/data/tables.html)) employment by industrial subsector and state compared to national employment by industrial sector | **Energy Use -** NREL Electrification Futures and SEDS  **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)” & Minnesota’s GHG Inventory |
| INDUSTRIAL PROCESS EMISSIONS | Process Emissions | [EPA Global Non-CO2 Greenhouse Gas Emissions Projections & Mitigation Potential: 2015-2050](https://www.epa.gov/global-mitigation-non-co2-greenhouse-gases/global-non-co2-greenhouse-gas-emission-projections) | Scaled down US data to state data using a variety of sources, including data from EPA’s [FLIGHT](https://ghgdata.epa.gov/ghgp/main.do) tool and [EPA’s State Inventory Tool Output Dataframe](https://www.epa.gov/statelocalenergy/download-state-inventory-and-projection-tool) | **Emissions** - Minnesota’s GHG Inventory and [E3’s Pathways Report](https://www.ethree.com/wp-content/uploads/2020/01/MN_PATHWAYS_Final-Report_2019-06-26.pdf) |
| AGRICULTURE | Process Emissions | [Minnesota’s Greenhouse Gas Inventory Data](https://www.pca.state.mn.us/air/greenhouse-gas-emissions-data) | Note that for agricultural emissions we took an average of emissions for years 2005, 2010, 2015, 2016 and reallocated emissions from “cultivated histosols” to the land use sector | **Emissions** - Minnesota’s GHG Inventory and [E3’s Pathways Report](https://www.ethree.com/wp-content/uploads/2020/01/MN_PATHWAYS_Final-Report_2019-06-26.pdf) |
| LAND USE AND FORESTRY |  | [Minnesota’s Greenhouse Gas Inventory Data](https://www.pca.state.mn.us/air/greenhouse-gas-emissions-data) | Include forestry, land use sector emissions and “cultivated histosols” from the agricultural sector | **Emissions** - Minnesota’s GHG Inventory |
| TRANSPORTATION | All energy use, vehicle miles | [NREL Electrification Futures Study - Reference Scenario](https://www.nrel.gov/analysis/electrification-futures.html) | No scaling needed. NREL reports miles by vehicle type and total energy use by fuel type in MN for each year 2017-2050. | **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)” & Minnesota’s GHG Inventory |

# Understanding the Business-as-Usual and Current Trajectory Projections

**Business-as-Usual:** Energy Innovation and RMI built a forecast of Minnesota’s economywide greenhouse gas emissions through 2050 using publicly available, national models of energy consumption (EIA’s Annual Energy Outlook, NREL’s Electrification Future Study) and direct emissions data from Minnesota Pollution Control Agency’s Greenhouse Gas Inventory.[[1]](#footnote-2) The BAU Scenario is the model’s foundation, capturing projected changes based on economic growth, technology and cost changes, and existing policy commitments.

**Current Trajectory:** The Current Trajectory scenario provides an additional baseline reflecting very recently passed or imminently planned policies. Current Trajectory policies have been reviewed with in-state partners. In Minnesota, the primary source of additional policies was the Xcel’s draft Integrated Resource Plan.[[2]](#footnote-3)

The Minnesota EPS model includes three built-in policy scenarios. The first is a **business-as-usual (BAU) scenario**, which represents all policy that is currently enacted in Minnesota. The **Current Trajectory** **scenario** includes planned policy and utility IRPs that are not yet implemented but are in progress. Once these policies are implemented, they will become part of the **BAU** **scenario**. The table below summarizes the policies included in the BAU and Current Trajectory scenarios.

## Summary of Policy Assumptions

|  |  |  |
| --- | --- | --- |
| **Sector** | **BAU Scenario** | **Reference Scenario** |
| Electricity | * From EIA’s Annual Energy Outlook and NREL * Includes Minnesota’s [Renewables Portfolio Standard](https://programs.dsireusa.org/system/program/detail/2401) * Assumes all currently planned retirements are completed on time (incl. Sherco 1 by 2025, Sherco 2 by 2022, Sherco 3 by 2034) * Assume existing nuclear power plants are retired at the time their current permits expire (Monticello 2030 and Prairie Island 2033/34)[[3]](#footnote-4) | * Nuclear power plants extended add’l 10 years: Monticello through 2040, Prairie Island through 2033 (Unit 1) and 2034 (Unit 2)[[4]](#footnote-5) * Retire 2 coal units early: King in 2028, Sherco 3 in 2030 * Assume 1500 MW demand response by 2034 above the BAU case * Clean energy standard adds 1200 MW wind by 2034, 4000 MW of solar by 2034 |
| Buildings | * From EIA’s Annual Energy Outlook and NREL * [Assumes some equipment performance improvements over time](https://www.nrel.gov/docs/fy18osti/70485.pdf), based on market data (described [here](https://www.nrel.gov/docs/fy18osti/70485.pdf))[[5]](#footnote-6) | * Energy efficiency savings included in Xcel’s IRP |
| On-Road Transportation | * From EIA’s Annual Energy Outlook and NREL * Includes 2012 Federal Corporate Average Fuel Economy Standards (CAFE) standards ([full text via AEO](https://www.eia.gov/outlooks/aeo/assumptions/pdf/summary.pdf)) * Federal EV subsidies * Economic adoption of EVs[[6]](#footnote-7) | * *Same as BAU* |
| Industry | * From EIA’s Annual Energy Outlook and NREL * Assumes equipment performance improvements over time (described [here](https://www.nrel.gov/docs/fy18osti/70485.pdf)) * Does not include implementation of Kigali Amendment to the Montreal Protocol. | * *Same as BAU* |
| Land use/Agriculture | * Agriculture, biomass, and forestry projections | * *Same as BAU* |
| Imports/Exports | * Imported electricity emissions held constant | * Imported natural gas and coal electricity emissions decrease by 50% by 2030 * Assume no reductions in production, reductions in state consumption increase exports |

# Defining Targets shown in the tool

The EPS model shows two greenhouse gas reduction targets.

**Minnesota’s targets:** Minnesota’s Next Generation Energy Act (NEGA) set economy-wide greenhouse gas reduction targets. The act requires the state to reduce greenhouse gas emissions 30% below a 2005 baseline (not shown) and 80% by 2050.

RMI has also conducted a literature review of global 1.5 degrees C guidance[[7]](#footnote-8) and national pathways analyses for limiting warming to 1.5 degrees, with a focus on required action by 2030. These targets have been translated to sectoral percentage reduction targets relative to 2005, and these have been applied to state level to provide a benchmark for policy evaluation and discussion. Note that these targets are approximate, and should not be considered equivalent to a comprehensive state decarbonization assessment, which may well find that some sectors can feasibly reduce emissions more quickly, or that some states as a whole may feasibly reduce emissions more quickly than the US average due to their local economic conditions.

We have also provided an illustrative policy scenario. This policy bundle is illustrative only, meant to support conversations about economy wide decarbonization over the coming decade. The **2030** **1.5C Targets scenario** is an example of policies that would enable Minnesota to meet 2030 greenhouse gas reduction targets consistent with limiting emissions to 1.5C.

1. **2030 1.5C Targets:** Minnesota needs to reduce economy-wide greenhouse gas emissions by 60% by 2030. The following table summarizes the assumptions embedded in the 2030 1.5C targets scenario.

|  |  |
| --- | --- |
| **Sector** | **2030 1.5C Targets Scenario (2030 metrics)** |
| Industry | * 8% efficiency gains in all industries (by 2035) * 100$/ton carbon tax * 70% reduction of methane leakage * 77% reduction of F-gas emissions by 2050 |
| Electricity | * 90% Clean Energy Standard * $100/ton carbon tax * Increase demand response and transmission * No new natural gas plants after 2030 |
| Buildings | * All new appliance sales are electric * Retrofit 25% of existing buildings |
| On-Road Transportation | * 100% new light duty vehicles & buses are electric * 40% of all new freight HDVs electric and 20% hydrogen * 13% reduction of vehicles miles traveled from 2020 levels |
| Land use/Agriculture | * *Same as BAU* |
| Imports/Exports | * Reduce imports from coal and gas plants |

# Calculating Policy Impacts

### Calculating Impacts of Policies (Emissions, Jobs, Health Impacts)

For addition information on Energy Innovation’s Energy Policy Simulator, please view the tutorial [here](https://us.energypolicy.solutions/docs/video-series.html).

### About the EPS

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.[[8]](#footnote-9) 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](https://us.energypolicy.solutions/docs/download.html).[[9]](#footnote-10) And full documentation on methodology and assumptions are available online [here](https://us.energypolicy.solutions/docs/index.html).[[10]](#footnote-11)

# Contact

For further information on the EPS, contact us here [policy@energyinnovation.org](mailto:policy@energyinnovation.org). 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).[[11]](#footnote-12)

1. https://www.pca.state.mn.us/air/greenhouse-gas-emissions-data [↑](#footnote-ref-2)
2. https://www.xcelenergy.com/staticfiles/xe-responsive/Company/Rates%20&%20Regulations/The-Resource-Plan-No-Appendices.pdf [↑](#footnote-ref-3)
3. Minnesota EPS reflects Sherco 3 retirement as of 2034. [↑](#footnote-ref-4)
4. Ibid. [↑](#footnote-ref-5)
5. Efficiency improvements are derived from NREL electrification futures study Reference Case. Energy Efficiency policies – including those in Minnesota such as building rebates-- are not explicitly included in the BAU. [↑](#footnote-ref-6)
6. Electric vehicle adoption in the BAU case is based on economic adoption modeled in the EPS, following XXX. [↑](#footnote-ref-7)
7. See IPCC [Global Warming of 1.5°C](https://www.ipcc.ch/sr15/) and [UNEP 2019 Emissions Gap](https://www.unenvironment.org/resources/emissions-gap-report-2019) [↑](#footnote-ref-8)
8. https://energyinnovation.org/2020/07/28/hal-harveys-insights-and-updates-congressional-climate-plan-is-a-bet-your-country-moment/ [↑](#footnote-ref-9)
9. https://us.energypolicy.solutions/docs/download.html [↑](#footnote-ref-10)
10. https://us.energypolicy.solutions/docs/index.html [↑](#footnote-ref-11)
11. https://us.energypolicy.solutions/docs/video-series.html [↑](#footnote-ref-12)