Crosswalk between the *Inventory U.S. Greenhouse Gas Emissions and Sinks by U.S. State: 1990-2022* and the State Inventory Tool (SIT, January 2024 edition)

The EPA recognizes that a number of states rely on the State Inventory Tool (SIT) to prepare their state GHG inventory estimates. The SIT includes default activity data and estimates that states can use as a starting point for compiling a state-level GHG inventory. For many sectors/sources, the default data included in SIT align with EPA's *newly disaggregated Inventory of U.S. Greenhouse Gas Emission and Sinks by State* (hereafter *Inventory by State*).

Some differences exist between default data in SIT and the annual *Inventory by State* estimates due to differences in methods, data, and level of completeness.

- For the industrial processes and product use (IPPU) sector, SIT has limited state-specific default data and instead encourages users to either enter data/estimates from EPA's GHGRP or add additional emission sources.
- In some cases, in SIT, state-level data has been unavailable (e.g., because it is confidential business data, or the use of national level modeling that currently does not provide state-level outputs) or lags in state data compared to availability of national level data.
- SIT's time series typically runs around 1 to 2 years behind the national inventory (e.g., SIT might cover 1990-2021, while the national U.S. Inventory covers 1990-2022). Therefore, the default approaches in SIT may not fully reflect the latest updates for some categories reflected in the *Inventory by State* data (e.g., use of GHGRP data) and may not reflect all industrial categories reflected in the *Inventory by State*.
- In addition, the SIT provides two alternate approaches to estimating emissions (calculating CO_2 from transportation based on vehicle miles traveled (VMT) and calculating emissions from electricity consumption), which are not based on national *Inventory* methods.

Table 1 below provides a detailed crosswalk and summary of key differences where methods/data, and or completeness differ by IPCC sector/category.

The versions of SIT published in January 2024 implemented several updates that brought it into closer alignment with the *Inventory by State* data.

- The Stationary Consumption module now excludes the use of fuels for industrial processes, which are accounted for in the IPPU module. This aligns the Stationary Consumption module with previous adjustments to the CO_2FFC module.
- The Wastewater module now includes updated emission factors from the most recent U.S. Greenhouse Gas Inventory.

- The Coal, IPPU, Land Use Land Change and Forestry, Solid Waste, and Natural Gas and Oil modules have been updated to include Additional Emissions tabs for users to input any emissions data from sources that are not included in the modules.

EPA is continuing to evaluate how to use the additional state level data and/or methodological approaches available through the national *Inventory* disaggregation in the *Inventory by State* to supplement or improve the embedded calculations and defaults in SIT. SIT users will retain the ability to customize the tool with their own data in lieu of using defaults. EPA will continue to coordinate with states agencies and organizations currently using SIT on how to prioritize and implement updates to SIT. The SIT is released annually with updates, and the next update aligning the tool's default information with the latest state-by-state GHG data is planned for January 2025.

Table 1. Crosswalk Between the GHG Inventory by State and State Inventory Tool (SIT) Methods and Data by UN/IPCC Reporting Sector/Categories

UN/IPCC Sector, Source and/or Sink category	Gas(es)	Included in SIT (Y/N/P)	Uses same data/ method (Y/N)	Key Differences	Plans to align SIT with *Inventory by State* data
Energy					
Fossil Fuel Combustion *Transportation* *Electric Power* *Industrial* *Residential* *Commercial* U.S. Territories	CO_2	Y	Mostly Y with some differences in adjustments	The main differences between the SIT and *Inventory by State* totals are: SIT includes non-energy uses of fossil fuels with fossil fuel combustion. SIT includes an optional module to estimate emissions associated with electricity consumption. SIT provides an alternate approach to estimating CO_2 emissions from transportation based on vehicle miles traveled (VMT).	* (Exploring ways to further align the US Inventory and SIT)
Non-Energy Use of Fossil Fuels	CO_2	Y	Y	Included with Fossil Fuel Consumption in SIT.	NA

UN/IPCC Sector, Source and/or Sink category	Gas(es)	Included in SIT (Y/N/P)	Uses same data/ method (Y/N)	Key Differences	Plans to align SIT with *Inventory by State* data
Stationary Combustion (excluding CO_2)	CH_4, N_2O	Y	Y	SIT uses IPCC default emission factors for electric power sector and *Inventory by State* uses factors by fuel and combustion type. SIT does not adjust for construction and agriculture fuel use consumption in the industrial sector.	*(SIT will switch to emissions factors by fuel and combustion type and will consider adding an adjustment for construction and agricultural fuel use.)
Mobile Combustion (excluding CO_2)	CH_4, N_2O	Y	Y	SIT activity data includes jet fuel bunkers.	*(EPA will update bunker fuel data to match the Fossil Fuel Combustion CO_2 module.)
Coal Mining	CH_4, CO_2	P	Y	SIT uses an apportionment approach for underground mine methane emissions for 1991 and 1992 as data were previously unavailable. Default data is not available in SIT for fugitive CO_2 emissions from coal mining.	*, Δ
Abandoned Underground Coal Mines	CH_4	Y	Y	SIT uses the same general method as the *Inventory by State* but calculates emissions on an individual mine-by-mine basis. The AMM model used for the national Inventory and the *Inventory by State* uses @Risk Monte Carlo simulation software and estimates emissions by basin, state (for reporting years 2020 and onward), and abandoned mine status type, resulting in slightly different estimates.	NA
Petroleum Systems	CO_2, CH_4, N_2O	P	N	Default data is not available in SIT for all states for all sources. Different approach for vented and flared gas. Different years of data.	*
Natural Gas Systems	CO_2, CH_4, N_2O	P	N	Not all *Inventory by State* sources included in SIT (e.g., meters in distribution segment). SIT includes gathering and gas processing under transmission. In the *Inventory by State* they are included under production and processing. Different approach for vented and flared gas. Different years of data.	*, Δ
Abandoned Oil and Gas Wells	CO_2, CH_4	N	N	This source category is not included in SIT.	Δ
Incineration of Waste	CO_2, CH_4, N_2O	Y	Y	Included in SIT Waste module.	NA
Wood Biomass and Biofuels Consumption (memo item)		N	N	NA	NA

UN/IPCC Sector, Source and/or Sink category	Gas(es)	Included in SIT (Y/N/P)	Uses same data/ method (Y/N)	Key Differences	Plans to align SIT with *Inventory by State* data
International Bunker Fuels (memo item)		P	Y	SIT bunker fuel calculations are completed in the CO_2FFC module.	NA
Industrial Processes and Product Use					
Cement Production	CO_2	Y	Y for 1990-2009 N for 2010-2022	*Inventory by State* uses GHGRP emissions data adjusted for CEMS for 2010-2022.	*
Lime Production	CO_2	P	N	Default data is not available in SIT for all states for all years. *Inventory by State* uses the following approaches for state-level estimates - 2010-2022: GHGRP emissions adjusted for CEMS (to exclude combustion emissions - 1990-2009: facility count to disaggregate national emissions. .	*
Glass Production	CO_2	N	N	This source category is not included in SIT. Some emissions could be partially reflected in SIT in estimating emissions for soda ash consumption.	Δ
Other Process Uses of Carbonates	CO_2	P	N	SIT includes under Limestone and Dolomite Use. SIT includes soda ash consumption emissions with production, instead of in Other Process Uses of Carbonates which *Inventory by State* does. The *Inventory by State* now also includes carbonate use for ceramics and non-metallurgical magnesia production.	*(EPA is evaluating moving and/or relabeling these categories within SIT to be consistent with the *GHG Inventory by State*.)
Ammonia Production	CO_2	Y	Y, similar for 1990-2009 N, differ for 2010-2022	For 1990-2009, *Inventory by State* and SIT use the same USGS capacity data. SIT allocates state production by multiplying state % by national production and assumes all feedstock is natural gas, whereas the *Inventory by State* multiplies state % by the national GHGI emissions, which accounts for differences in emissions from production using natural gas and petroleum coke. *Inventory by State* doesn't account for petroleum coke more granularly yet (1 facility in KS). The *Inventory by State* uses GHGRP emissions data for 2010-2022.	*
Urea Consumption for Non-Agricultural Purposes	CO_2	Y	N	The *Inventory by State* allocates emissions based on populations data and SIT assumes the same percentage as agricultural urea use.	*
Nitric Acid Production	N_2O	P	N	Default data is not available in SIT for relevant states for all years	*
Adipic Acid Production	N_2O	P	N	Default data is not available in SIT for relevant states for all years	*

UN/IPCC Sector, Source and/or Sink category	Gas(es)	Included in SIT (Y/N/P)	Uses same data/ method (Y/N)	Key Differences	Plans to align SIT with *Inventory by State* data
Caprolactam, Glyoxal, and Glyoxylic Production	N_2O	N	N	This source category is not included in SIT. Note, *Inventory by State* only includes emissions from caprolactam. When glyoxal and glyoxylic acid are included in the national *Inventory*, they will be added also to the *Inventory by State*.	Δ
Carbide Production and Consumption	CO_2, CH_4	N	N	This source category is not included in SIT.	Δ
Titanium Dioxide Production	CO_2	N	N	This source category is not included in SIT.	Δ
Soda Ash Production	CO_2	Y	Y except for emissions from soda ash consumption	Emissions from production are calculated using the same data and method. SIT includes soda ash consumption emissions with production, instead of in Other Process Uses of Carbonates as allocated in the *Inventory by State*.	*
Petrochemical Production	CO_2, CH_4	N	N	This source category is not included in SIT.	Δ
Production of Fluorochemicals Other than HCFC-22	HFCs, PFCs, SF_6, NF_3	N	N	This source category is not included in SIT.	Δ
HCFC-22 Production	HFC-23	P		Default production data is not available in SIT.	*
Carbon Dioxide Consumption	CO_2	N	N	This source category is not included in SIT.	Δ
Phosphoric Acid Production	CO_2	N	N	This source category is not included in SIT.	Δ
Iron and Steel Production & Metallurgical Coke Production	CO_2, CH_4	P	N	SIT includes data on total steel production from AISI for 1997-2010 (and proxies 2010 data through current year). Data is available for some states directly and some as groups of states. SIT averages production by type and across groups of states evenly. *Inventory by State* uses similar AISI data for 1990-2010 but allocates across groups of states based on Census data. For 2010-2022, *Inventory by State* uses GHGRP data to allocate including more detail on process types e.g., BOF/EAF split.	*
Ferroalloy Production	CO_2, CH_4	N	N	This source category is not included in SIT.	Δ

UN/IPCC Sector, Source and/or Sink category	Gas(es)	Included in SIT (Y/N/P)	Uses same data/ method (Y/N)	Key Differences	Plans to align SIT with *Inventory by State* data
Aluminum Production	CO_2, CF_4, C_2F_6	P	N	Default data is not available in SIT for relevant States for all years. *Inventory by State* uses GHGRP data, and historical Voluntary aluminum Industry Partnership and production capacity to allocate to the states. The SIT tool is based on national averages of emission factors and technology type. The SIT tool does give the user the ability to import GHGRP data for 2010 and subsequent years of inventory time series; state emissions should be the same for 2010 and subsequent years of inventory time series if this feature is used.	*
Magnesium Production and Processing	CO_2, HFCs, SF_6	P	N	Default data is not available in SIT for all states for all years. The SIT tool is based on national averages of emission factors, magnesium production and technology type. *Inventory by State* uses GHGRP data, and historical data from the SF6 Emission Reduction Partnership for the Magnesium Industry and are based on reported gas consumption. *Inventory by State* also include process types that are not included in the SIT, including wrought, anode and permanent.	*(production data) Δ (process types)
Lead Production	CO_2	N	N	This source category is not included in SIT.	Δ
Zinc Production	CO_2	N	N	This source category is not included in SIT.	Δ
Electronics Industry	N_2O, HFCs, PFCs, SF_6, NF_3	Y	N	*Inventory by State* uses GHGRP data, historical PFC reduction partnership data, and production capacity data to develop national estimates and disaggregate to the state. The SIT tool uses the values of state and national semiconductor shipments.	*
Substitution of Ozone Depleting Substances	HFCs, PFCs	Y	Y	NA	NA
Electrical Transmission and Distribution	SF_6	Y	N	The *Inventory by State* uses transmission miles and GHGRP data to allocate to the states. The SIT tool uses state and national electricity sales.	*
SF$_6$ and PFCs from Other Product Use	SF_6, PFCs	N	N	This source category is not included in SIT.	Δ
N$_2$O from Product Uses	N_2O	N	N	This source category is not included in SIT.	Δ
Agriculture					
Enteric Fermentation	CH_4	Y	Y (SIT state-level emission factors are based on national *Inventory* outputs)	NA	NA

UN/IPCC Sector, Source and/or Sink category	Gas(es)	Included in SIT (Y/N/P)	Uses same data/ method (Y/N)	Key Differences	Plans to align SIT with *Inventory by State* data
Manure Management	CH_4, N_2O	Y	Y (SIT simplifies waste management system categories into dry versus liquid)	NA	NA
Rice Cultivation	CH_4	Y	N	For the *Inventory by State*, EPA is implementing a combination of IPCC Tier 1 and Tier 3 approaches, utilizing the Daycent process model to run Tier 3 components. Rice cultivation emissions are estimated for the 13 states who cultivate rice. The SIT tool simplifies the calculation between ratoon and primary area of rice, multiplied by a seasonal emission factor. The SIT tool estimates rice emissions for 8 states.	*
Liming	CO_2	Y	Y		*
Urea Fertilization	CO_2	Y	Y	NA	NA
Field Burning of Agricultural Residues	CH_4, N_2O	Y	Y	Default data is not available in SIT for all crops for all years.	*
Agricultural Soil Management	N_2O	P	N	Default data is not available in SIT for all crops for all years. For the *Inventory by State*, EPA is implementing a combination of IPCC Tier 1 and Tier 3 approaches, utilizing Daycent process model to run Tier 3 components. SIT uses a version of the Tier 1 method for both Direct and Indirect N_2O emissions estimation.	*
Land Use, Land-Use Change, and Forestry					
Forest Land Remaining Forest Land (subcategories italicized below)	CO_2, CH_4, N_2O	See below	See below	See below	NA
Changes in Forest Carbon Stocks	*CO_2*	*Y*	*Y*	SIT Tool provides estimation for "Wood Products and Landfills". The *Inventory by State* does not currently include data for harvested wood products at the state-level.	NA
Non-CO$_2$ Emissions from Forest Fires	*CH_4, N_2O*	*Y*	*P*	For the *Inventory by State*, non-CO_2 emissions from forest fires includes emissions from both forest land remaining forest land and land converted to forest land because it is not possible to report them separately at this time. Default activity data (acres burned) is not available in SIT, states must enter this data to calculate emissions.	*

UN/IPCC Sector, Source and/or Sink category	Gas(es)	Included in SIT (Y/N/P)	Uses same data/ method (Y/N)	Key Differences	Plans to align SIT with *Inventory by State* data
N₂O Emissions from Forest Soils	*N₂O*	*N*	*N*	These source and sink categories are not included in SIT. For the *Inventory by State*, N_2O emissions from forest soils includes emissions from both forest land remaining forest land and land converted to forest land because it is not possible to report them separately at this time.	NA
Non-CO₂ Emissions from Drained Organic Soils	*CH₄, N₂O*	*N*	*N*	These source and sink categories are not included in SIT. For the *Inventory by State*, non-CO_2 emissions from drained organic soils includes emissions from both forest land remaining forest land and land converted to forest land because it is not possible to report them separately at this time.	NA
Land Converted to Forest Land (subcategories italicized below)	CO_2	See below	See below	NA	NA
Changes in Forest Carbon Stocks	*CO₂*	Y	Y	NA	NA
Cropland Remaining Cropland	CO_2	Y	N	SIT aggregates changes in aboveground biomass, belowground biomass, deadwood, litter, soil mineral and soil organic carbon stocks from Cropland Remaining Cropland, Land Converted to Cropland, Grassland Remaining Grassland, and Land Remaining Grassland under the "Ag Soil C Flux" category in SIT. SIT sources default data for agricultural soil carbon flux from the U.S. *Inventory* and apportions agricultural soil carbon flux to each state based on the last year of available state-level data from the national GHGI. For the *Inventory by State*, EPA apportioned states based on the last three (3) years of available state data in line with the annual data currently available in the USDA National Resources Inventory (NRI).	NA
Changes in Mineral and Organic Soil Carbon Stocks	*CO₂*	Y	N		NA
Land Converted to Cropland (subcategories italicized below)	CO_2	Y	N		NA
Changes in all Ecosystem Carbon Stocks	*CO₂*	Y	N		NA
Grassland Remaining Grassland (subcategories italicized below)	CO₂, CH₄, N₂O,	Y	N		NA
Changes in Mineral and Organic Soil Carbon Stocks	*CO₂*	Y	N		NA
Non-CO₂ Emissions from Grassland Fires	*CH₄, N₂O*	*N*	*N*		Δ
Land Converted to Grassland (subcategories italicized below)	CO_2	Y	N		NA

UN/IPCC Sector, Source and/or Sink category	Gas(es)	Included in SIT (Y/N/P)	Uses same data/ method (Y/N)	Key Differences	Plans to align SIT with *Inventory by State* data
Changes in All Ecosystem Carbon Stocks	CO_2	Y	N		NA
Wetlands Remaining Wetlands (subcategories italicized below)	CO_2, CH_4, N_2O	See below	See below		Δ
Changes in Organic Soil Carbon Stocks in Peatlands	CO_2,	N	N	These source and sink categories are not included in SIT. SIT currently offers an "Additional Emission Sources" tab where a user can enter any additional emissions sources they would like to include in their inventory.	
Changes in Biomass, DOM, and Soil Carbon Stocks in Coastal Wetlands	CO_2,	N	N		
CH_4 Emissions from Coastal Wetlands Remaining Coastal Wetlands	CH_4	N	N		
N_2O Emissions from Coastal Wetlands Remaining Coastal Wetlands	N_2O	N	N		
Non-CO_2 Emissions from Peatlands Remaining Peatlands	CH_4, N_2O	N	N		
Flooded Land remaining Flooded Land	CH_4	N	N		
Land Converted to Wetlands (subcategories italicized below)	CO_2, CH_4	See below	See below		Δ
Changes in Biomass, DOM, and Soil Carbon Stocks	CO_2	N	N	Carbon flux from Forest Land Converted to Wetlands was added to sit in June 2023. However, the carbon flux from other land uses converted to wetlands is not included in SIT due to lack of default data.	
CH_4 Emissions from Land Converted to Coastal Wetlands	CH_4	N	N		
Lands converted to Flooded Lands	CH_4, CO_2	N	N		

UN/IPCC Sector, Source and/or Sink category	Gas(es)	Included in SIT (Y/N/P)	Uses same data/ method (Y/N)	Key Differences	Plans to align SIT with *Inventory by State* data
Settlements Remaining Settlements (subcategories italicized below)	CO$_2$, N$_2$O	See below	See below	See below.	See below
Changes in Organic Soil Carbon Stocks	*CO$_2$*	*N*	*N*	These source and sink categories are not included in SIT.	Δ
Changes in Settlement Tree Carbon Stocks (i.e., urban trees)	*CO$_2$*	*Y*	*N*	SIT uses default urban area data multiplied by a state-specific estimate of the percent of urban area with tree cover to estimate the total area of urban tree cover. This default data, from Nowak et al. 2005, Nowak and Greenfield 2012, Nowak and Greenfield 2018, and the U.S. Census, represents urban area tree coverage for years 1990, 2000, 2010, and 2020. Estimates of urban area in the intervening years (1990-1999; 2001-2009; 2011-2019) and subsequent years (2021) are interpolated and extrapolated, respectively. State-specific net carbon sequestration rates are taken from Nowak et al. 2013 and multiplied by urban area to calculate CO$_2$ flux. For the *Inventory by State*, the methods and data are consistent with the national *Inventory*, as national estimates are built from the state level and estimated by the U.S. Forest Service. See Chapter 6.10 of the national *Inventory* for more information.	NA
Changes in Yard Trimming and Food Scrap Carbon Stocks in Landfills (LFYTFS)	*CO$_2$*	*Y*	*Y*	NA	NA
N$_2$O Emissions from Settlement Soils	*N$_2$O*	*Y*	*N*	For N$_2$O emissions from Settlement Soils, SIT calculation is based on the Total Synthetic Fertilizer Applied to Settlements. The *Inventory by State* is based on the amount of N in synthetic commercial fertilizers applied to settlement soils, the amount of N in biosolids applied to non-agricultural land and surface disposal, and the area of drained organic soils within settlements. EPA apportioned states based on the last three (3) years of available state data in line with the annual data currently available in the USDA National Resources Inventory (NRI).	*
Land Converted to Settlements (subcategories italicized below)	CO$_2$	See below	See below	These source and sink categories are not included in SIT.	Δ

UN/IPCC Sector, Source and/or Sink category	Gas(es)	Included in SIT (Y/N/P)	Uses same data/ method (Y/N)	Key Differences	Plans to align SIT with *Inventory by State* data
Changes in all Ecosystem Carbon Stocks	CO_2	*N*	*N*		
Waste					
Landfills (municipal and industrial)	CH_4,	P	N	Municipal: SIT default data are based on national landfilling rates and state population. *Inventory by State* uses GHGRP data that is scaled up to account for non-reporting landfills. To calculate methane emissions from landfills, SIT relies on a first order decay (FOD) model to estimate emissions. In the FOD model, the CH_4 emission rate is a function of the quantity of waste deposited in landfills (in short tons) over the previous 30 years. The national *Inventory* uses both the FOD method, as well as a back-calculation method that is based on directly measured amounts of recovered CH_4 from landfills and reported to GHGRP, which contributes to slight differences in emissions estimates between the *GHG Inventory by State* and SIT Industrial: SIT uses a percent of MSW emissions to estimate industrial landfill emissions (default is 7%). *Inventory by State* uses production volumes of pulp & paper, fruit & vegetables, and meat which is multiplied by a country and sector specific disposal factor and then used to calculate CH_4 emissions.	*

UN/IPCC Sector, Source and/or Sink category	Gas(es)	Included in SIT (Y/N/P)	Uses same data/ method (Y/N)	Key Differences	Plans to align SIT with *Inventory by State* data
Wastewater Treatment (domestic and industrial)	CH$_4$, N$_2$O	P	Y	Note: The national *Inventory* wastewater emissions are estimated using 2019 Refinement to the 2006 IPCC Guidelines, which includes refined methods and emission factors, but now includes not only CH$_4$ but also N$_2$O emissions from Industrial wastewater treatment. The national Inventory and *Inventory by State* also include many updated default values for domestic and industrial wastewater characteristics. SIT pulls emissions factors for the Wastewater module from the national *Inventory* where applicable. Some emission factors, like municipal wastewater, are no longer published by the national *Inventory.* Domestic: The *Inventory by State* downscales national *Inventory* estimates by state-level population or share of U.S. population and percent of population on septic systems. It also includes CH$_4$ and N$_2$O emissions from the discharge of wastewater effluent from centralized systems, which is not included in the SIT. Industrial: SIT default data is not available for all industrial sources. The *Inventory by State* allocates national emissions for each industry based on state share of national production (or wastewater flow for pulp and paper). The *Inventory by State* includes additional industrial wastewater sources, i.e., CH$_4$ emissions were also estimated for treating industrial wastewater from starch-based ethanol production, petroleum refining, and breweries; and N$_2$O emissions were also estimated for pulp and paper, red meat, and poultry processing, petroleum refining, and breweries.	*
Composting	CH$_4$, N$_2$O	N	NA	This source category is not included in SIT.	Δ
Anerobic Digestion at Biogas Facilities	CH$_4$	N	NA	This source category is not included in SIT.	Δ

Key for Table Notations and Formatting

Use of Italics indicates a subcategory.

P (Partial): Indicates a source is partially included in SIT, i.e., some but not all emissions within that source can be estimated by the tool and/or default activity data is missing or incomplete.

*: EPA is exploring potential to use *Inventory by State* estimates to improve default data. States using the tool can opt to use *Inventory by State* data or estimate using updated state-specific data if available.

Δ: EPA is evaluating adding this source to SIT. In the interim, we recommend states manually add totals from the *Inventory by State* to SIT as "other."

For more information, please visit the following:

- Inventory of U.S. Greenhouse Gas Emissions and Sinks by State: 1990-2022
  https://www.epa.gov/ghgemissions/state-ghg-emissions-and-removals

- State Inventory Tool (SIT)
  https://www.epa.gov/statelocalenergy/state-inventory-and-projection-tool