EIA-EPA Energy-Related CO2 Emissions Harmonization

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Introduction

Overview

The U.S. Energy Information Administration (EIA) and the U.S. Environmental Protection Agency (EPA) both publish estimates of energy-related carbon dioxide (CO_2) emissions. However, differences in the scope of emissions coverage, estimating methodologies, and definitions cause some of the emissions estimates to be misaligned between agencies.

This report was undertaken as part of the interagency response to Section 40419 of the Infrastructure Investment and Jobs Act (IIJA, 117th Congress of the United States 2021), which calls for the establishment of a system to harmonize estimates of greenhouse gases and other pollutant emissions published by EIA and EPA. The purpose of this report is to explain how and where these discrepancies exist, the extent of the discrepancies, and how users of EIA and EPA data can reconcile these differences. Although we aim to explain the differences, neither EIA nor EPA currently intends to change their respective emissions estimation methodologies as a result of the findings of this report.

This report focuses specifically on comparing estimates of annual U.S. energy-related fossil fuel combustion and non-energy use CO_2 emissions by economic sector. For EIA, the estimates for this comparison are from the July 2024 *Monthly Energy Review* (MER). For EPA, estimates are from the *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2022* (GHGI). Understanding the purpose of each product provides valuable context into why emissions estimates differ between the two products.

The MER is EIA's primary report of recent and historical U.S. energy statistics. In addition to estimates of CO_2 emissions, the MER also reports information on total energy production, consumption, stocks, trade, and energy prices; overviews of petroleum, natural gas, coal, electricity, nuclear energy, and renewable energy; and data unit conversions. The purpose of the MER is to provide Congress, federal and state agencies, energy analysts, and the general public with a comprehensive source of energy data and information.[1] In accordance with these objectives, the scope of CO_2 emissions estimates presented within the MER is limited to energy.

EIA considers *energy-related* CO_2 emissions to be those that occur from fossil fuel combustion and from the non-energy use (NEU, or also referred to as *non-fuel* or *non-combustion* use) of energy products. EIA's NEU emissions predominantly consist of usage of energy products in industrial applications, such as petrochemical feedstocks.

The annual EPA GHGI report provides a comprehensive accounting of total greenhouse gas emissions from all man-made sources in the United States, including CO_2 removal from the atmosphere by *sinks*, going back to 1990. The gases covered by the GHGI include CO_2, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, sulfur hexafluoride, and nitrogen trifluoride. The GHGI groups greenhouse gas (GHG) emission and sink estimates into five inventory reporting sectors: Energy; Industrial Processes and Product Use (IPPU); Agriculture; Land Use, Land-Use Change, and Forestry (LULUCF); and Waste.

[1] In accordance with Section 205(a)(2) of the Department of Energy Organization Act.

The emissions and removals presented in the GHGI report are organized by inventory reporting sector (as noted above) and within each sector calculated using internationally accepted methods for each source and sink category. The report presents estimates and underlying inputs using a common and consistent format that enables comparisons of emissions and/or removals of different GHG emissions across national inventories. As such, EPA's definition of *energy-related* is largely informed by the 2006 United Nations Intergovernmental Panel on Climate Change reporting guidelines, which include fossil fuel combustion and fugitive emissions (intentional or unintentional release of GHG during the extraction, process, or delivery of fossil fuels). However, due to national circumstances associated with data collection, EPA deviates slightly from these guidelines by considering some NEU emissions to be energy-related as well.[2]

This report only compares emissions estimates that are covered by both the EIA and EPA reports. Specifically, it covers CO_2 emissions from fossil fuel combustion (including the fossil component of municipal solid waste [MSW]) and CO_2 emissions associated with NEU. Geothermal energy-related CO_2 emissions are also included given their role in energy generation. Although not technically a fossil fuel, geothermal energy has associated non-condensable gases such as CO_2 in subterranean heated water.

Publication cycles and data relationship

The relationship between EIA's MER and EPA's GHGI report is intricate; both reports use some information from the other to estimate CO_2 emissions. In both instances, the data taken from one product to the other are exogenous and do not bias the estimates of the other, but they're worth mentioning to better understand the relationship between the two data products. This relationship is further complicated by differences in publication schedules, which lead to some data vintaging considerations mentioned further in this report.

EPA's GHGI has historically been published in April of each year, following international reporting guidelines. The GHGI publishes emissions estimates from 1990 to present, noting the latest year in the time series lags by around two years due to varying data availability across sectors.[3] The GHGI begins pulling in data for preliminary report drafts starting in the summer and continues to update and revise its estimates, including recalculating time series if underlying data or methods have changed, until data are frozen in March. The GHGI uses several data sources for its energy-related GHG estimates, with one primary source being the EIA MER's U.S. annual energy consumption estimates. Following this timeline, the GHGI typically uses each year's February edition of the MER for its finalized estimates.

EIA's MER is typically published during the last week of every month. Each release incorporates a new month of historical data (at approximately a three-month lag), as well as revisions to previous estimates. Data are revised for several potential reasons, such as updates to underlying data sources or changes to methodology. One such update with regards to CO_2 emissions has to do with emissions factors, which translate energy consumption into CO_2 emissions. The GHGI report releases an updated set of emissions

[2] The 2006 IPCC guidelines suggest that all industrial process emissions, regardless of whether or not these emissions are associated with energy products, are reported under the IPPU chapter of a country's emissions inventory.

[3] Availability of data inputs for estimating economy wide emissions and removals varies across the sectors. EPA has historically collaborated with EIA to include preliminary estimates for energy-related fossil fuel combustion estimates in its annual companion GHGI data highlights publication to preview more recent trends where data are available.

factors during its annual publication in April of each year. EIA then incorporates these new emissions factors into the MER emissions estimates, typically by around August or September that same year.

Although the EIA MER and EPA GHGI operate on different publication schedules, the mutual use of data between the reports does not bias either report's emissions estimates. The GHGI emission factors used by the MER are independent of the MER's energy consumption data, and the MER's energy consumption data are independent of the emissions factors provided in the EPA GHGI report. However, because the previous year's energy consumption estimates can be revised following the publication of the February MER, this revision can occasionally lead to some small differences in emissions estimates between the two products.

How different are EIA and EPA's energy-related CO_2 emissions?

The estimates of U.S. energy-related CO_2 emissions in EIA's MER and EPA's GHGI tend to be close, even prior to any adjustments. Over the last several years, estimates have differed by around 2%–3% (Table 1).

Table 1. Differences in EIA and EPA annual CO_2 emissions estimates from fossil fuel combustion and non-energy use, 2018–2022

million metric tons of carbon dioxide

Year	EIA estimate (MER)	EPA estimate (GHGI)	Difference (MER-GHGI)	Percentage difference
2018	5,278	5,120	158	3.1%
2019	5,147	4,972	175	3.5%
2020	4,584	4,452	131	3.0%
2021	4,906	4,778	127	2.7%
2022	4,939	4,816	123	2.6%

Data source: U.S. Energy Information Administration (EIA), *Monthly Energy Review* (MER), July 2024; U.S Environmental Protection Agency (EPA), *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2022* (GHGI), April 2024

There are five main causes for emissions differences.

1. Emissions accounting within the energy space

Nearly all CO_2 emissions represented in the MER can be categorized under fossil fuel combustion, with only low levels of NEU emissions. However, the GHGI represents some combustion emissions in other subcategories to better adhere with international reporting requirements. One example of this is municipal waste. Although combusted, waste is represented in its own category within the GHGI energy sector estimates (that is, waste incineration).

Accounting nuances can also occur between economic sectors. For instance, although EIA and EPA report nearly the same aggregate CO_2 emissions from motor gasoline and distillate fuel, EPA makes additional adjustments to split these values out between end-use sectors.

2. Geographic coverage

The energy use and CO_2 emissions in the EIA MER includes the 50 states and the District of Columbia. In addition to these areas, the EPA GHGI includes U.S. territories.[4]

In the GHGI, emissions from International Bunker Fuels (IBF) consumption are not included in national totals and are instead reported separately as a memo or information item,[5] consistent with internationally accepted methodological guidance and national inventory reporting requirements. Other international organizations, including the International Civil Aviation Organization and the International Maritime Organization, consider global action from international bunker fuel consumption. Therefore, the amount of each fuel type used for international bunkers is subtracted from fuel consumption data when determining fuel combustion emissions in the GHGI.

3. Distinctions between energy/Industrial Process and Product Use (IPPU)[6] and non-energy emissions

The distinction between energy and non-energy emissions is one of the larger sources of differences between EIA and EPA CO_2 emissions accounting. This difference is largely contained to the industrial sector, particularly with regards to NEU emissions. With some limited exceptions, EIA calculates NEU emissions across all industrial applications based on the information collected in EIA surveys, as well as from external data sources. Consistent with internationally accepted methodological guidance for national GHG inventories, the EPA GHGI treats some of these industrial emissions as energy-related and some as industrial process emissions, accounting for them in the IPPU chapter of the GHGI report.

4. Data vintages

Small discrepancies can arise between EIA and EPA emissions estimates due to differences in the publication schedule of both reports. The EPA 1990–2022 GHGI report used the February 2024 MER to construct its final emissions estimates. However, the statistics and estimates presented in the MER may vary between editions as new data are collected. Although the impact of these data revisions is often small and usually limited to the most recent years of data, it can occasionally affect CO_2 emissions estimates, resulting in some noticeable differences between agencies. If such revisions occur, data are reconciled in future annual publications of the GHGI. This particular discrepancy is discussed further in the previous Publication cycles and data relationship section of this report.

5. Sequestration rates and carbon emissions factors

Finally, differences in carbon emissions factors and sequestration rates between EIA and EPA cause some minor differences in emissions estimates. Carbon emissions factors refer to the amount of CO_2

[4] Note that the EPA GHGI territory emissions estimates are also based on EIA data for energy consumption by territory, published in EIA's International Energy Statistics.

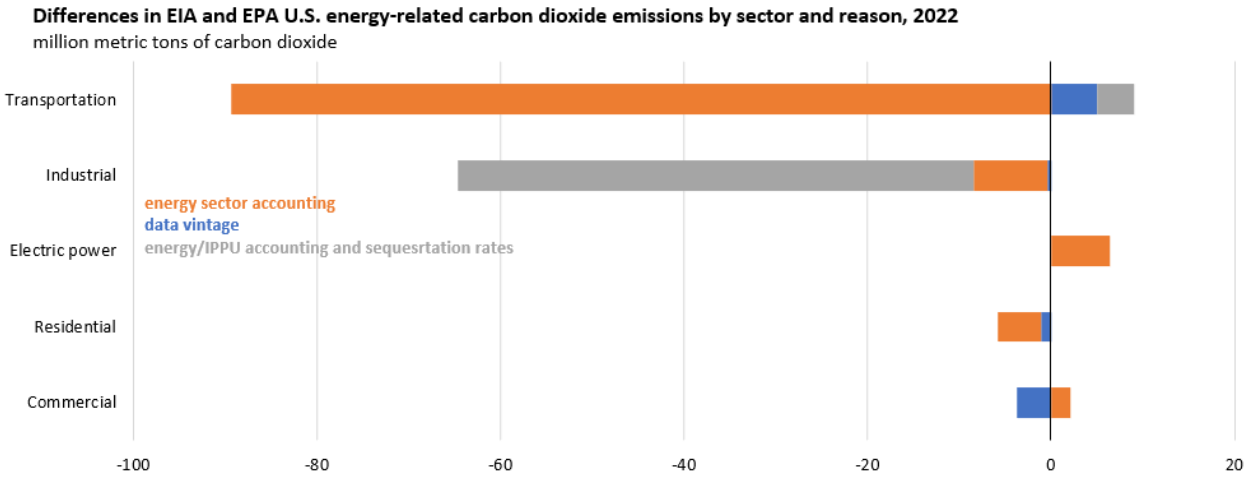
[5] Memo items are reported in the GHGI for informational purposes but are not counted toward energy-related total emissions.

[6] Industrial Processes and Product Use (IPPU) sector includes greenhouse gas emissions from industrial processes and from the use of greenhouse gases in products, and greenhouse gas emissions from industrial processes can occur in two different ways. First, they may be generated and emitted as the byproducts of various non-energy-related industrial activities (that is, CO_2 from producing clinker during manufacture of cement). Second, they may be emitted due to their use in manufacturing processes or by end-consumers (for example, residential and mobile air-conditioning use of fluorinated gases).

released when combusting a fuel. Sequestration rates refer to the amount of CO_2 that is captured within a finished product (for example, asphalt), as opposed to being released into the atmosphere.

Emissions factors used by EIA and EPA are typically well aligned, although not always identical. Emissions factors for the MER, and other EIA products, are updated on an annual basis to agree with the GHGI. Sequestration rates are primarily associated with NEU emissions and vary between agencies. Refer to the Appendix for further discussion on NEU emissions calculations.

Figure 1. Differences in EIA and EPA U.S. energy-related carbon dioxide emissions by sector and reason, 2022



Data source: U.S. Energy Information Administration (EIA), *Monthly Energy Review,* Tables 11.2–11.6; U.S. Environmental Protection Agency (EPA), *U.S. Inventory of Greenhouse Gas Emissions and Sinks: 1990–2022*, Tables A-5 and 3-1

Note: Differences are calculated as EPA minus EIA estimates. Differences in sequestration rates and emissions factors are included in energy/Industrial Process and Product Use (IPPU) accounting because these rates are influenced by respective accounting decisions. Geographic differences are not shown here because they cannot be measured at the sector level.

Absent any adjustment, total CO_2 energy-related emissions estimates from fossil fuel combustion and non-energy use of fuels are relatively close between agencies. For 2022, the difference in CO_2 emissions estimates between agencies in these categories was only 2.5% (123 million metric tons) (Table 2).

Table 2. Differences in EIA and EPA CO_2 emissions by sector from fossil fuel combustion and non-energy use, 2022

million metric tons of CO_2

Sector	EIA estimate (MER)	EPA estimate (GHGI)	Difference (MER-GHGI)	Percentage difference
Transportation	1,840	1,760	80	4.4%
Industrial	960	895	65	6.7%
Electric power	1,539	1,545	6	0.4%
Residential	340	334	6	1.7%
Commercial	260	259	1	0.6%
Territories	N/A	23	23	N/A
Total	**4,939**	**4,816**	**123**	**2.5%**

Data source: U.S. Energy Information Administration (EIA), *Monthly Energy Review* (MER), July 2024; U.S Environmental Protection Agency (EPA), *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2022* (GHGI), April 2024

After adjusting for known differences in emissions accounting and estimation methodology between agencies and products, we can reduce this emissions discrepancy to effectively zero.

Energy-related CO_2 emissions differences by sector

The remainder of this report provides additional details on energy-related CO_2 emissions across five economic sectors in order of largest to smallest differences in emissions estimates. The five economic sectors are transportation, industrial, electric power, residential, and commercial. For each sector we discuss the differences between EIA and EPA CO_2 emissions estimates, why they exist, and how best to reconcile them. The values shown in this analysis are the 2022 CO_2 emissions estimates from the July 2024 edition of EIA's *Monthly Energy Review* and EPA's *U.S. Inventory of Greenhouse Gases and Sinks: 1990–2022*. Although 2022 is used as the point of comparison in this report, a similar analysis can be applied more generally to other recent data years prior to 2022.

Transportation sector

Overview

Transportation sector CO_2 emissions estimates are notably different between the MER and GHGI but are generally easy to resolve. As published, direct-use CO_2 emissions estimates for 2022 differ by 4.4% (80.2 million metric tons) between the MER and GHGI.

Causes of discrepancy

There are four main causes for discrepancy between respective transportation sector totals. The largest difference in sectoral emissions estimates comes from treatment of fuels used for international aviation and maritime transport, also known as *international bunker fuels*. This application represents a significant share of jet fuel, distillate fuel oil, and residual fuel oil consumption. In the MER, consumption and associated emissions from these fuels are accounted for in the transportation sector. In the GHGI, in accordance with international reporting conventions, this fuel consumption and emissions are reported as a memo item outside of the transportation sector.

A second notable difference lies in varying methodologies for allocating gasoline and distillate fuel oil consumption to end-use sectors. EIA allocates distillate fuel oil and motor gasoline to end-use sectors based on their share of total consumption. For distillate fuel oil, these shares are reported in EIA's State Energy Data System (SEDS), and for motor gasoline, these shares are taken from the Federal Highway Administration's (FHWA) *Highway Statistics*. For the GHGI, data are needed on fuel use by vehicle type to determine emissions, so a bottom-up method is used to estimate transportation sector gasoline and diesel fuel use. The GHGI determines gasoline and diesel fuel use by vehicle type based on FHWA data and outputs from EPA's Motor Vehicle Emissions Simulator (MOVES) model. The GHGI then allocates the remaining fuel use to the remaining sectors based on the proportions in the EIA data. The differences in the EIA and GHGI gasoline and diesel fuel allocation approach across sectors are shown in the Appendix.

A third, albeit minor, difference comes from varying methodology in NEU emissions estimates. Although nearly all NEU activity takes place in the industrial sector, the sole exception to this is for petroleum-based lubricants, which are accounted for in both the industrial and transportation sectors.

The fourth and final cause for any remaining differences in sectoral emissions is discrepancy of data vintage between reports.

Harmonizing estimates

Some of the emissions discrepancies can be resolved by adjusting for data vintage and applying the same end-use sector shares for motor gasoline and distillate fuel oil consumption. Because the GHGI assumes a higher share of consumption from the transportation sector for these fuels, this difference can be addressed by adding the same amount of CO_2 emissions to the transportation sector to match adjustments made in the residential, commercial, and industrial sectors.

NEU CO_2 emissions from lubricants can be harmonized by calculating the difference in emissions estimates caused by disparate assumptions regarding sequestration rates.

Because the GHGI accounts for bunker fuel emissions in its own category, assumptions across the MER and GHGI can be aligned by subtracting bunker fuel emissions estimates from total transportation sector emissions.

Table 3. Harmonization adjustments for transportation sector CO_2 emissions, 2022

million metric tons of CO_2

Adjustment	Adjustment amount to MER	EPA estimate	Adjusted MER total	Remaining difference	Reason
Pre-adjustment	N/A	1,760	1,840	80	N/A
Data vintage	+5	1,760	1,845	85	July MER 2024 has updated fuel use
Distillate fuel oil and motor gasoline	+11	1,760	1,856	96	Align end-use shares with GHGI
Transportation lubricants NEU	+4	1,760	1,860	100	Match CO_2 sequestration assumptions with GHGI
Bunker fuels	-100	1,760	1,760	0	GHGI accounts for bunker fuels separately, outside the transportation sector

Data source: U.S. Energy Information Administration (EIA), *Monthly Energy Review* (MER), July 2024; U.S Environmental Protection Agency (EPA), *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2022* (GHGI), April 2024

Note: N/A=not applicable, NEU=non-energy use

Industrial sector

Overview

The industrial sector is also a large point of discrepancy between EIA and EPA's energy-related CO_2 emissions estimates. Industrial sector emissions from fossil fuel combustion and NEU differ by about 6.7% (64.7 million metric tons) between the MER and GHGI.

Causes of discrepancy

The differences in data vintage and allocation of motor gasoline and distillate fuel oil across end-use sectors creates some discrepancy between industrial sectoral emissions estimates, but the largest differences are a result of the following three reasons:

- Different distinctions between NEU and IPPU emissions
- Differences in underlying data sources
- Different adjustments for exports of energy products

The most significant difference is in the distinction between energy and non-energy CO_2 in the industrial sector. Within the GHGI, this decision effectively determines whether emissions are accounted for in the Energy or IPPU chapters of the report. Although some NEU energy consumption and CO_2 emissions are consistent between the MER and GHGI, EPA accounts for some emissions under the IPPU sector to better align with international greenhouse gas reporting conventions. One example of this is in CO_2

emissions from coking coal. The EPA GHGI accounts for coking coal used in iron and steel production under IPPU emissions, whereas the EIA MER treats all CO_2 emissions from coking coal use as energy related.

Differences in underlying data sources also contribute to discrepancies in NEU and, more broadly, industrial sector emissions between the MER and GHGI. EIA's NEU energy consumption and CO_2 emissions estimates are sourced from a mix of EIA surveys as well as external data.[7] Most notable among these sources is Section 3 of EIA's *Manufacturing Energy Consumption Survey* (MECS).

NEU estimates in the GHGI incorporate information from additional data sources, which can lead to further adjustments. Most notable among these data sources is the EPA Greenhouse Gas Reporting Program (GHGRP). These adjustments can lead to differences in NEU energy consumption and emissions estimates between the MER and GHGI. For example, the GHGI uses data from both the MER and GHGRP to estimate emissions associated with natural gas used as a feedstock in ammonia production.

For some fuels, the GHGI also adjusts energy consumption estimates to account for export of secondary energy products outside of the United States. This adjustment lowers NEU consumption estimates and emissions in the GHGI relative to those in the MER.

Harmonizing estimates

One adjustment that needs to be made is for emissions from motor gasoline and distillate fuel oil, as mentioned previously. Differences in industrial combustion emissions estimates for both of these fuels can be reconciled by aligning sector-level fuel allocation between the MER and GHGI.

In addition, emissions that are attributed to the IPPU chapter of the GHGI need to be harmonized. To do this, start with EIA's total industrial sector emissions and calculate how much of this total is attributed to the IPPU chapter of the GHGI. Because the MER considers all of these emissions to be energy-related by default, subtract this same IPPU adjustment from the MER emissions total.

Lastly, differences in NEU emissions need to be accounted for. Many of the differences in NEU emissions are the result of inconsistencies in NEU energy consumption and sequestration rates. The difference in changes to NEU emissions between EIA and EPA resulting from energy usage adjustments and sequestration rates needs to be calculated and added to the total emissions from the MER to mimic the CO_2 emissions adjustments made in the GHGI.

[7] Data sources will vary by time period and fuel. Refer to Note 3 of the MER Section 1 Notes for additional information.

Table 4. Harmonization adjustments for industrial sector CO_2 emissions, 2022

million metric tons of CO_2

Adjustment	Adjustment amount to MER	EPA estimate	Adjusted MER total	Remaining difference	Reason
Pre-adjustment	N/A	895	960	65	N/A
Data vintage	-1	895	959	64	July MER 2024 has updated fuel use
Distillate fuel oil and motor gasoline	-8	895	951	56	Align end-use shares with GHGI
Subtract non-energy industrial process emissions	-64	895	887	-8	GHGI does not consider these emissions to be energy-related
Match NEU energy and sequestration adjustments	+8	895	895	0	Align MER NEU emissions adjustments with GHGI

Data source: U.S. Energy Information Administration (EIA), *Monthly Energy Review* (MER), July 2024; U.S Environmental Protection Agency (EPA), *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2022* (GHGI), April 2024

Note: N/A=not applicable, NEU=non-energy use

Electric power sector

Overview

Differences in electric power sector CO_2 emissions are typically very close between EPA and EIA. For 2022, total emissions from the sector differed by only 0.4% (6.4 million metric tons) between the MER and GHGI.

Causes of discrepancy

The only significant discrepancy between electric power sector emissions accounting between the two reports is with CO_2 emissions associated with the combustion of municipal solid waste (MSW). EIA accounts for CO_2 from the combustion of non-biogenic municipal solid waste in the *other* fuels category within the electric power sector.[8] Although the EPA GHGI estimates comparable emissions from waste incineration, they account for these emissions separately from the rest of the electric power sector in accordance with international reporting conventions. Differences in total (biogenic plus non-biogenic) MSW emissions between the MER and GHGI were identified during this harmonization exercise, and research into this discrepancy is ongoing.

[8] Which also includes CO_2 emissions released during geothermal electricity generation

Harmonizing estimates

Electric power sectoral CO_2 emissions estimates can be aligned by identifying the difference in the non-biogenic municipal solid waste emissions estimates between the GHGI and MER and adding that difference to the MER's sector total.

Table 5. Harmonization adjustments for electric power sector CO_2 emissions, 2022

million metric tons of CO_2

Adjustment	Adjustment amount to MER	EPA estimate	Adjusted MER total	Remaining difference	Reason
Pre-adjustment	N/A	1,545	1,539	-6	N/A
(Non-biogenic) municipal solid waste	+6	1,545	1,545	0	GHGI accounts for waste incineration separately from the rest of electric power

Data source: U.S. Energy Information Administration (EIA), *Monthly Energy Review* (MER), July 2024; U.S Environmental Protection Agency (EPA), *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2022*, April 2024

Note: N/A=not applicable

Residential sector

Overview

Residential sector CO_2 emissions are often closely aligned between the MER and the GHGI. Direct-use CO_2 emissions estimates (excluding emissions attributed to the sector from electricity use) differed only by 1.7% (5.8 million metric tons of CO_2) between the MER and GHGI in 2022.

Causes of discrepancy

Much of the discrepancy between MER and GHGI residential sector emissions estimates comes from different methodologies for allocating motor gasoline and distillate fuel oil consumption across end-use sectors, as mentioned previously. Any residual discrepancies aside from fuel allocation are a result of differences in data vintage.

Harmonizing estimates

By adjusting for data vintage and aligning MER's sector-level shares with the GHGI, this approach shifts some CO_2 emissions from the residential, commercial, and industrial sectors back to the transportation sector and resolves the discrepancy in residential sector emissions estimates.

Table 6. Harmonization adjustments for residential sector CO_2 emissions, 2022

million metric tons of CO_2

Adjustment	Adjustment amount to MER	EPA estimate	Adjusted MER total	Remaining difference	Reason
Pre-adjustment	N/A	334	340	6	N/A
Data vintage	-1	334	339	5	July MER 2024 has updated fuel use
Distillate fuel oil and motor gasoline	-5	334	334	0	Align end-use shares with GHGI

Data source: U.S. Energy Information Administration (EIA), *Monthly Energy Review* (MER), July 2024; U.S Environmental Protection Agency (EPA), *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2022* (GHGI), April 2024

Note: N/A=not applicable

Commercial sector

Overview

Commercial sector CO_2 emissions are often very close between the MER and GHGI. Direct-use CO_2 emissions estimates for 2022 differed only by 0.6% (1.5 million metric tons) between the MER and GHGI.

Causes of discrepancy

Similar to the residential sector, the primary reason for this discrepancy is due to differences in data vintage and allocating distillate fuel oil and motor gasoline usage between different end-use sectors.

Harmonizing estimates

Aligning our sector-level allocation of these fuels between the MER and GHGI allows us to reconcile this small discrepancy.

Table 7. Harmonization adjustments for commercial sector CO_2 emissions, 2022

million metric tons of CO_2

Adjustment	Adjustment amount to MER	EPA estimate	Adjusted MER total	Remaining difference	Reason
Pre-adjustment	N/A	259	260	1	N/A
Data vintage	-4	259	256	-3	July MER 2024 has updated fuel use
Distillate fuel oil and motor gasoline	+3	259	259	0	Align end-use shares with GHGI

Data source: U.S. Energy Information Administration (EIA), *Monthly Energy Review* (MER), July 2024; U.S Environmental Protection Agency (EPA), *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2022* (GHGI), April 2024

Note: N/A=not applicable

U.S. territories

Overview

As noted earlier in this report, the GHGI includes emissions from U.S. territories in its national emissions total, whereas the MER does not. For 2022, the GHGI estimated total emissions from U.S. territories to be about 0.5% of the MER's U.S. total emissions estimate (23 million metric tons).

Causes of discrepancy

The MER includes energy use and emissions associated with all 50 states, including Hawaii and Alaska, and the District of Columbia. U.S. emissions estimates reported in the GHGI includes these regions, as well as emissions from U.S. territories[9] to the extent they are known to occur. Due to data limitations, the GHGI does not apportion territory emissions by sector but reports them on aggregate as their own category.[10]

Harmonizing estimates

Because the GHGI inventory accounts for U.S. territory emissions, the MER and GHGI estimates can be aligned by adding the U.S. territories emissions to the MER's U.S. emissions total.

Conclusion

Both EIA and EPA provide estimates of energy-related CO_2 emissions. Two main sources of this information from the two agencies are EIA's *Monthly Energy Review* and EPA's *U.S. Inventory of Greenhouse Gas Emissions and Sinks*. However, total CO_2 emissions estimates between these two products are often different, creating confusion for stakeholders using both EIA and EPA data. Fortunately, many of these differences are well understood and can be mitigated by users of EIA and EPA data with only a few adjustments.

This report uses 2022 energy-related CO_2 emissions estimates from EIA's MER and EPA's GHGI report to illustrate common differences in each product's reported CO_2 emissions by economic sector and discusses the extent of differences in emissions estimates between agencies, the causes of these discrepancies, and what adjustments can be made to better harmonize estimates. After adjusting for known differences in emissions accounting, data users can reduce the discrepancy in reported energy-related CO_2 emissions to effectively zero.

[9] Includes American Samoa, Guam, Puerto Rico, U.S. Virgin Islands, Wake Island, the Commonwealth of Northern Mariana Islands, and other outlying U.S. Pacific Islands

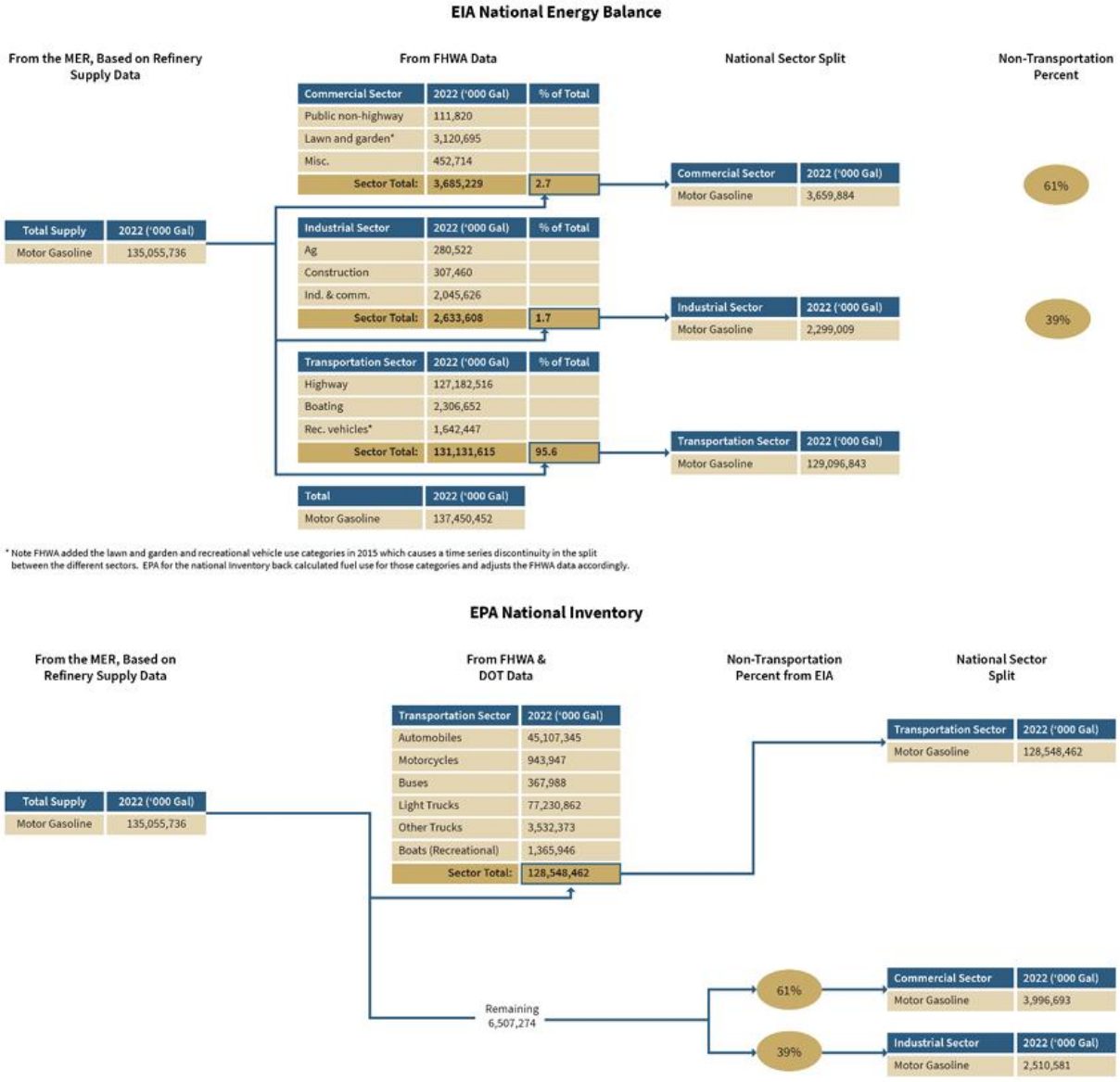
[10] Note that the EPA GHGI territory emissions estimates are also based on EIA data for energy consumption by territory, published in EIA's International Energy Statistics.

Appendix

Calculating sector shares of motor gasoline and distillate fuel oil

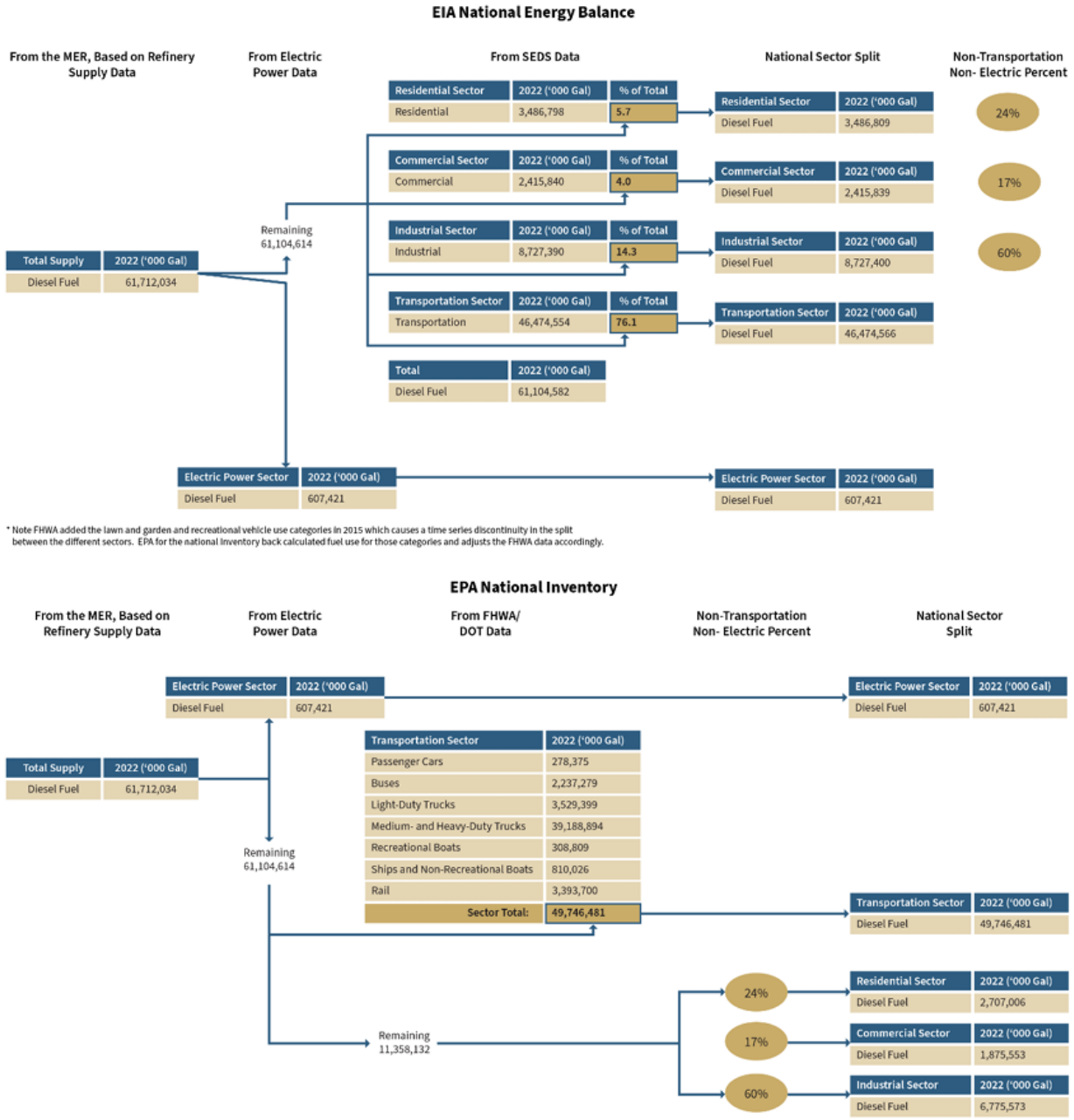
The GHGI uses a slightly different approach to allocating total gasoline and diesel fuel use across the different sectors compared with the EIA data. The differences in the EIA and GHGI gasoline and diesel fuel allocation approach across sectors are shown in Figures 2 and 3 below, including information on the categories of use included in each sector and data for 2022 as an example.[11]

Figure 2. Comparison of gasoline sector allocation



[11] Source: *Methodology Report: Inventory of U.S. Greenhouse Gas Emissions and Sinks by State: 1990–2022*, Chapter 2: Energy (https://www.epa.gov/system/files/documents/2024-09/method-report_ghgibystate-chapter-2-508.pdf)

Figure 3. Comparison of diesel fuel sector allocation



Non-energy use assumptions and calculations

Because differences in non-energy use (NEU) emissions assumptions are both the most complex and most significant differences between EIA and EPA CO_2 emissions accounting, disentangling and understanding these differences warrants further explanation and analysis.

Both EIA and EPA use a bottom-up approach to CO_2 emissions accounting. In other words, CO_2 emissions are estimated by taking total energy consumption for a fossil fuel and applying an emissions factor,

which represents the amount of CO_2 released from that fuel when combusted. Mathematically, the amount of CO_2 released can be represented as:

$$CO2_{s,f,y} = energy\ consumed_{s,f,y} \cdot emissions\ rate_{s,f,y}$$

Where s represents an economic sector, f represents a fossil fuel, and y represents the year. For most sectors and fuels, both EIA and EPA assume that fuels are released via combustion and that the fuel is completely combusted during the process.

This calculation is slightly modified for NEU applications of fuels. During NEU applications of fuels, sometimes not all the CO_2 is released into the atmosphere, but rather some is sequestered (stored) in finished products. In these cases, emissions calculations are modified to account for the amount of CO_2 sequestered during these NEU processes. Namely:

$$CO2_{s,f,y} = energy\ consumed_{s,f,y} \cdot emissions\ rate_{s,f,y} \cdot (1 - sequestration\ rate_{s,f,y})$$

Where the sequestration rate represents the amount of CO_2 that is captured in finished products. With this formulation in mind, differences in NEU emissions accounting between EIA and EPA emissions accounting can be broken down into each of these three distinct pieces:

- NEU energy consumption
- CO_2 emissions factor
- Sequestration rates

Differences in overall energy consumed for NEU purposes is the largest source of differences between EIA and EPA NEU CO_2 emissions estimates. The cause of these differences is largely from either energy export assumptions or instances where the GHGI accounts for specific industrial activities in the IPPU sector (while the MER accounts for them in total energy-related CO_2 emissions).

Assumptions regarding the amount of CO_2 sequestered during NEU activities is also a notable source of differences in emissions estimates between the MER and GHGI. Several potential reasons explain these differences. First and foremost is the consideration of which activities are, or are not, considered as energy related. In addition to this assumption influencing overall energy consumption, differences in the scope of activities considered under NEU can also affect how much CO_2 is sequestered during NEU activities for various fuels. Mitigating this difference is an area of ongoing research between the two agencies.

Assumptions with regards to emissions factors are typically a minor source of discrepancy between the MER and GHGI because of the relatively static nature of the emissions factors themselves (they tend not to change substantially from year to year) and the MER aligning its emissions factors with the latest GHGI report in the fall of each year.