Greenhouse Gas Emissions from Energy
April 2026 EDITION

Database documentation

International Energy Agency

INTERNATIONAL ENERGY AGENCY

The IEA examines the full spectrum of energy issues including oil, gas and coal supply and demand, renewable energy technologies, electricity markets, energy efficiency, access to energy, demand side management and much more. Through its work, the IEA advocates policies that will enhance the reliability, affordability and sustainability of energy in its 32 Member countries, 13 Association countries and beyond.

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Source: IEA.
International Energy Agency
Website: www.iea.org

In an effort to provide users with more timely information, with the April 2026 edition of the Greenhouse Gas Emissions from Energy database the IEA is releasing data for those countries of the IEA Family (including OECD, Association and Accession countries) and beyond, for which data up to 2024 have been already received and validated.

This document provides information regarding the April 2026 edition of the IEA Greenhouse gas emissions from energy database – which has replaced the IEA CO_2 emissions from fuel combustion database with expanded content as of 2021. This document can be found online at: https://www.iea.org/data-and-statistics/data-product/greenhouse-gas-emissions-from-energy. Selected data are available at: Greenhouse gas emissions from energy highlights

Please address your inquiries to emissions@iea.org.

Please note that all IEA data are subject to the following Terms and Conditions found on the IEA's website: https://www.iea.org/terms.

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Changes from last edition

Starting from this publication, bulk data are now made available in CSV format, fully aligned with the structure and content of the .Stat Data Explorer.

Geographical coverage

Romania became an IEA Accession country in April 2026. However, as the datasets for this edition had already been finalized, Romania is not included in the IEAFAMILY aggregate (comprising Member, Accession and Association countries). Romania will be integrated into the aggregate in subsequent editions.

Viet Nam became an IEA Association country in February 2026. However, because 2024 data was not yet available at time of publication, Viet Nam is not included in this edition and therefore not reflected in the IEAFAMILY aggregate. Viet Nam will be integrated into the aggregate in subsequent editions.

The countries, territories and economies included are:

OECD: Australia, Austria, Belgium, Canada, Chile, Colombia, Costa Rica, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Korea, Latvia, Lithuania, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Republic of Türkiye, United Kingdom, United States;

IEA Accession countries: Brazil, Chile, Colombia, Costa Rica, Israel, Romania;

IEA Association countries: Argentina, People's Republic of China, Egypt, India, Indonesia, Kenya, Morocco, Senegal, Singapore, South Africa, Thailand, Ukraine;

Other selected countries and economies: Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Georgia, Kosovo, Malta, Republic of Moldova, Montenegro, Republic of North Macedonia, Serbia;

For further details, please refer to the section on Geographical coverage.

Database description

The Greenhouse gas emissions from energy database includes annual data for:

- countries: 64 countries and 9 regional aggregates (see section *Geographical coverage*);
- years: 1960-2024 (OECD countries and regions);
  1971-2024 (non-OECD countries and regional aggregates);
  1990-2024 (indicators).

The database includes the following seven datasets:

IEAFAMBIGCO2	**CO_2 Emissions from fuel combustion (detailed estimates)** Detailed CO_2 emissions by subsector and by product. This data file includes four dimensions of “product”, “flow”, “time” and “country”.
IEAFAMGHG	**GHG Emissions from energy** Aggregated GHG emissions by sector and by product category. This data file includes five dimensions of “gas”, “product”, “flow”, “time” and “country”.
IEAFAMCO2INDIC	**CO_2 emissions indicators** Thirty-five emissions related, energy and socio-economic indicators. This data file includes three dimensions of “flow”, “time” and “country”.
IEAFAMCO2SECTOR	**Allocation of emissions from electricity and heat** CO_2 emissions after reallocation of emissions from electricity and heat generation to consuming sectors. This data file includes four dimensions of “flow”, “allocation”, “time” and “country”.

Definitions

Note: The short names included in this document correspond to the codes used in the .Stat Data Explorer. These may differ from the legacy short names in the IVT and TXT files, which were discontinued in January 2025.

Gas dimension

Gas

Gas	Short name	Definition
Carbon Dioxide	CO2	
Methane	CH4	The emissions figures are converted from gCH_4 to gCO_{2eq} using the 100-year Global Warming Potential (GWP). For the purpose of comparability with international data submission guidelines, the factors from the 5th Assessment of the IPCC are used. 1gCH4 = 28 gCO2eq
Nitrous Oxide	N2O	The emissions figures are converted from gN_2O to gCO_{2eq} using the 100-year Global Warming Potential (GWP). For the purpose of comparability with international data submission guidelines, the factors from the 5th Assessment of the IPCC are used. gN_2O = 265 gCO2eq
Total	TOTAL	Includes the total of all above three greenhouse gas emissions expressed in units of CO2eq.

Flow dimension

GHG emissions from fuel combustion (kt of CO_{2eq})

Flow	Short name	Definition
GHG emissions from fuel combustion	GHG_FUELCOMB	Includes total greenhouse gas emissions from fuel combustion including CO_2, CH_4 and N_2O. This includes GHG emissions from fuel combustion in IPCC Source/Sink Category 1 A Fuel Combustion Activities and those, which may be reallocated to IPCC Source/Sink Category 2 Industrial Processes and Product Use under the *2006 GLs*. GHG_FUELCOMB = MAINPROD + UNALLOC_AUTOPROD + OTHEN + TOTIND +

Flow	Short name	Definition
		TOTTRANS + RESIDENT + COMMPUB + AGRI_FOREST + FISHING + ONONSPEC. For the most recent year available, this value is estimated based on provisional data. Please refer to the section *Provisional year estimates* for more information on this methodology.
CO_2 from fuel combustion	CO2_FUELCOMB	Includes total CO_2 emissions from fuel combustion. This includes CO_2 emissions from fuel combustion in IPCC Source/Sink Category 1 A Fuel Combustion Activities and those, which may be reallocated to IPCC Source/Sink Category 2 Industrial Processes and Product Use under the *2006 GLs*. CO2_FUELCOMB = MAINPROD + UNALLOC_AUTOPROD + OTHEN + TOTIND + TOTTRANS + RESIDENT + COMMPUB + AGRI_FOREST + FISHING + ONONSPEC. For the most recent year available, this value is estimated based on provisional data. Please refer to the section *IEA Provisional year estimates* for more information on this methodology. In the file CO_2 emissions from fuel combustion starting in 1751, values for years starting in 1751 have been estimated following sources and methodology described in *Estimates for years starting 1751*
Main activity electricity and heat production	MAINPROD	Includes the sum of emissions from main activity producer electricity generation, combined heat and power generation and heat plants. Main activity producers are defined as those undertakings whose primary activity is to supply the public. They may be publicly or privately owned. Emissions from own on-site use of fuel are included. This corresponds to IPCC Source/Sink Category 1 A 1 a. *Note: This flow is included for CO_2 emissions from fuel combustion and excludes non-CO_2 greenhouse gases.*
Main activity producer electricity plants	MAINELEC	Refers to plants which are designed to produce electricity only. If one or more units of the plant is a CHP unit (and the inputs and outputs cannot be distinguished on a unit basis) then the whole plant is designated as a CHP plant. Main activity producers generate electricity for sale to third parties, as their primary activity. They may be privately or publicly owned. Note that the sale need not take place through the public grid. *Note: This flow is included for CO_2 emissions from fuel combustion and excludes non-CO_2 greenhouse gases.*
Main activity producer CHP plants	MAINCHP	Refers to plants which are designed to produce both heat and electricity (sometimes referred to as co-generation power stations). If possible, fuel inputs and electricity/heat outputs are on a unit basis rather than on

Flow	Short name	Definition
		a plant basis. However, if data are not available on a unit basis, the convention for defining a CHP plant noted above should be adopted. Main activity producers generate electricity and/or heat for sale to third parties, as their primary activity. They may be privately or publicly owned. Note that the sale need not take place through the public grid. *Note: This flow is included for CO_2 emissions from fuel combustion and excludes non-CO_2 greenhouse gases.*
Main activity producer heat plants	MAINHEAT	Refers to plants (including heat pumps and electric boilers) designed to produce heat only and who sell heat to a third party (e.g. residential, commercial or industrial consumers) under the provisions of a contract. Main activity producers generate heat for sale to third parties, as their primary activity. They may be privately or publicly owned. Note that the sale need not take place through the public grid. *Note: This flow is included for CO_2 emissions from fuel combustion and excludes non-CO_2 greenhouse gases.*
Electricity, CHP and heat plants (Own use)	EPOWERPLT	Emissions from own on-site use of fuel in electricity, CHP and heat plants. This includes CO_2 emissions from fuel combustion which may be reallocated to IPCC Source/Sink Category 2 Industrial Processes and Product Use under the *2006 IPCC Guidelines for GHG inventories*. *Note: This flow is included for CO_2 emissions from fuel combustion and excludes non-CO_2 greenhouse gases.*
Unallocated autoproducers	UNALLOC_AUTOPROD	Includes the emissions from the generation of electricity and/or heat by autoproducers. Autoproducers are defined as undertakings that generate electricity and/or heat, wholly or partly for their own use as an activity which supports their primary activity. They may be privately or publicly owned. In the *2006 IPCC Guidelines for GHG inventories*, these emissions would normally be distributed between industry, transport and "other" sectors. This includes CO_2 emissions from fuel combustion which may be reallocated to IPCC Source/Sink Category 2 Industrial Processes and Product Use under the *2006 IPCC Guidelines for GHG inventories*. *Note: This flow is included for CO_2 emissions from fuel combustion and excludes non-CO_2 greenhouse gases.*
Autoproducer electricity plants	AUTOELEC	Refers to plants which are designed to produce electricity only. If one or more units of the plant is a CHP unit (and the inputs and outputs cannot be distinguished on a unit basis) then the whole plant is designated as a CHP plant. Autoproducer undertakings generate electricity wholly or partly for their own use as an activity which supports their primary activity. They may be privately or publicly owned.

Flow	Short name	Definition
		This includes CO_2 emissions from fuel combustion which may be reallocated to IPCC Source/Sink Category 2 Industrial Processes and Product Use under the *2006 IPCC Guidelines for GHG inventories*. *Note: This flow is included for CO_2 emissions from fuel combustion and excludes non-CO_2 greenhouse gases.*
Autoproducer CHP plants	AUTOCHP	Refers to plants which are designed to produce both heat and electricity (sometimes referred to as co-generation power stations). If possible, fuel inputs and electricity/heat outputs are on a unit basis rather than on a plant basis. However, if data are not available on a unit basis, the convention for defining a CHP plant noted above should be adopted. Note that for autoproducer CHP plants, all fuel inputs to electricity production are taken into account, while only the part of fuel inputs to heat sold is shown. Fuel inputs for the production of heat consumed within the autoproducer's establishment are not included here but are included with figures for the final consumption of fuels in the appropriate consuming sector. Autoproducer undertakings generate electricity and/or heat, wholly or partly for their own use as an activity which supports their primary activity. They may be privately or publicly owned. This includes CO_2 emissions from fuel combustion which may be reallocated to IPCC Source/Sink Category 2 Industrial Processes and Product Use under the *2006 IPCC Guidelines for GHG inventories*. *Note: This flow is included for CO_2 emissions from fuel combustion and excludes non-CO_2 greenhouse gases.*
Autoproducer heat plants	AUTOHEAT	Refers to plants (including heat pumps and electric boilers) designed to produce heat only and who sell heat to a third party (*e.g.* residential, commercial or industrial consumers) under the provisions of a contract. Autoproducer undertakings generate heat, wholly or partly for their own use as an activity which supports their primary activity. They may be privately or publicly owned. This includes CO_2 emissions from fuel combustion which may be reallocated to IPCC Source/Sink Category 2 Industrial Processes and Product Use under the *2006 IPCC Guidelines for GHG inventories*. *Note: This flow is included for CO_2 emissions from fuel combustion and excludes non-CO_2 greenhouse gases.*
Other energy industry own use	OTHEN	Includes emissions from fuel combusted in oil refineries, for the manufacture of solid fuels, coal mining, oil and gas extraction and other energy-producing industries. This corresponds to the IPCC Source/Sink Categories 1 A 1 b and 1 A 1 c. This includes CO_2 emissions from fuel combustion which may be reallocated to IPCC Source/Sink Category 2 Industrial Processes and Product Use under the *2006 IPCC Guidelines for GHG inventories*.

Flow	Short name	Definition
Industry	TOTIND	Includes the emissions from combustion of fuels in industry. The IPCC Source/Sink Category 1 A 2 includes these emissions. However, in the *2006 GLs*, the IPCC category also includes emissions from industry autoproducers that generate electricity and/or heat. The IEA data are not collected in a way that allows the energy consumption to be split by specific end-use and therefore, autoproducers are shown as a separate item (*unallocated autoproducers*). This includes GHG emissions from fuel combustion which may be reallocated to IPCC Source/Sink Category 2 Industrial Processes and Product Use under the *2006 IPCC Guidelines for GHG inventories*.
Mining and Quarrying (excluding energy products)	MINING	[ISIC Rev. 4 Divisions 07 and 08 and Group 099] Mining (excluding fuels) and quarrying. *Note: This flow is included for CO_2 emissions from fuel combustion and excludes non-CO_2 greenhouse gases.*
Construction	CONSTRUC	[ISIC Rev. 4 Divisions 41 to 43] *Note: This flow is included for CO_2 emissions from fuel combustion and excludes non-CO_2 greenhouse gases.*
Manufacturing	MANUFACT	Manufacturing refers to the sum of the following industrial sub-sectors: • Iron and Steel • Chemical and petrochemical • Non-ferrous metals • Non-metallic minerals • Transport equipment • Machinery • Food and tobacco • Paper, pulp and printing • Wood and wood products • Textile and leather Definitions of the sub-sectors are below. *Note: This flow is included for CO_2 emissions from fuel combustion and excludes non-CO_2 greenhouse gases.*
Iron and steel	IRONSTL	[ISIC Rev. 4 Group 241 and Class 2431] This includes CO_2 emissions from fuel combustion which may be reallocated to IPCC Source/Sink Category 2 Industrial Processes and Product Use under the *2006 GLs*. *Note: This flow is included for CO_2 emissions from fuel combustion and excludes non-CO_2 greenhouse gases.*
Chemical and petrochemical	CHEMICAL	[ISIC Rev. 4 Divisions 20 and 21]

Flow	Short name	Definition
		Note: This flow is included for CO_2 emissions from fuel combustion and excludes non-CO_2 greenhouse gases.
Non-ferrous metals	NONFERR	[ISIC Rev. 4 Group 242 and Class 2432] Basic industries. This includes CO_2 emissions from fuel combustion which may be reallocated to IPCC Source/Sink Category 2 Industrial Processes and Product Use under the *2006 IPCC Guidelines for GHG inventories*. *Note: This flow is included for CO_2 emissions from fuel combustion and excludes non-CO_2 greenhouse gases.*
Non-metallic minerals	NONMET	[ISIC Rev. 4 Division 23] Such as glass, ceramic, cement, etc. *Note: This flow is included for CO_2 emissions from fuel combustion and excludes non-CO_2 greenhouse gases.*
Transport equipment	TRANSEQ	[ISIC Rev. 4 Divisions 29 and 30] *Note: This flow is included for CO_2 emissions from fuel combustion and excludes non-CO_2 greenhouse gases.*
Machinery	MACHINE	[ISIC Rev. 4 Divisions 25 to 28] Fabricated metal products, machinery and equipment other than transport equipment. *Note: This flow is included for CO_2 emissions from fuel combustion and excludes non-CO_2 greenhouse gases.*
Food and tobacco	FOODPRO	[ISIC Rev. 4 Divisions 10 to 12] *Note: This flow is included for CO_2 emissions from fuel combustion and excludes non-CO_2 greenhouse gases.*
Paper, pulp and printing	PAPERPRO	[ISIC Rev. 4 Divisions 17 and 18] *Note: This flow is included for CO_2 emissions from fuel combustion and excludes non-CO_2 greenhouse gases.*
Wood and wood Products	WOODPRO	[ISIC Rev. 4 Division 16] Wood and wood products other than pulp and paper. *Note: This flow is included for CO_2 emissions from fuel combustion and excludes non-CO_2 greenhouse gases.*
Textile and leather	TEXTILES	[ISIC Rev. 4 Divisions 13 to 15] *Note: This flow is included for CO_2 emissions from fuel combustion and excludes non-CO_2 greenhouse gases.*
Industry not elsewhere specified	INONSPEC	Including but not limited to: [ISIC Rev. 4 Divisions 22, 31 and 32] Any industry not included above. Note: Most countries have difficulties supplying an industrial breakdown for all fuels. In these cases, the non-specified industry row has been used. Regional aggregates of

Flow	Short name	Definition
		industrial consumption should therefore be used with caution. *Note: This flow is included for CO_2 emissions from fuel combustion and excludes non-CO_2 greenhouse gases.*
Transport	TOTTRANS	Includes emissions from the combustion of fuel for all transport activity, regardless of the sector, except for *international marine bunkers* and *international aviation bunkers*, which are not included in *transport* at a national or regional level (except for World transport emissions). This includes domestic aviation, domestic navigation, road, rail and pipeline transport, and corresponds to IPCC Source/Sink Category 1 A 3. The IEA data are not collected in a way that allows the autoproducer consumption to be split by specific end-use and therefore, this publication shows autoproducers as a separate item (*unallocated autoproducers*). Note: Starting in the 2006 edition, military consumption previously included in *domestic aviation* and in *road* should be in *non-specified other*.
Road	ROAD	Includes the emissions arising from fuel use in road vehicles, including the use of agricultural vehicles on highways. This corresponds to the IPCC Source/Sink Category 1 A 3 b. Excludes emissions from military consumption as well as motor gasoline used in stationary engines and diesel oil for use in tractors that are not for highway use.
Domestic aviation	DOMESAIR	Includes emissions from aviation fuels delivered to aircraft for domestic aviation – commercial, private, agriculture, etc. It includes use for purposes other than flying, e.g. bench testing of engines, but not airline use of fuel for road transport. The domestic/international split should be determined on the basis of departure and landing locations and not by the nationality of the airline. Note that this may include journeys of considerable length between two airports in a country (e.g San Francisco to Honolulu). For many countries this also incorrectly includes fuel used by domestically owned carriers for outbound international traffic. *Note: This flow is included for CO_2 emissions from fuel combustion and excludes non-CO_2 greenhouse gases.*
Rail	RAIL	Includes emissions from rail traffic, including industrial railways. *Note: This flow is included for CO_2 emissions from fuel combustion and excludes non-CO_2 greenhouse gases.*
Pipeline transport	PIPELINE	Includes emissions from fuels used in the support and operation of pipelines transporting gases, liquids, slurries and other commodities, including the energy used for pump stations and maintenance of the pipeline. Energy for the pipeline distribution of natural or coal gases, hot

Flow	Short name	Definition
		water or steam (ISIC Rev. 4 Division 35) from the distributor to final users is excluded and should be reported in other energy industry own use, while the energy used for the final distribution of water (ISIC Rev. 4 Division 36) to household, industrial, commercial and other users should be included in commercial/public services. Losses occurring during the transport between distributor and final users should be reported as distribution losses. *Note: This flow is included for CO_2 emissions from fuel combustion and excludes non-CO_2 greenhouse gases.*
Domestic navigation	DOMESNAV	Includes emissions from fuels delivered to vessels of all flags not engaged in international navigation (see international marine bunkers). The domestic/international split should be determined on the basis of port of departure and port of arrival and not by the flag or nationality of the ship. Note that this may include journeys of considerable length between two ports in a country (*e.g.* San Francisco to Honolulu). Fuel used for ocean, coastal and inland fishing and military consumption are excluded. *Note: This flow is included for CO_2 emissions from fuel combustion and excludes non-CO_2 greenhouse gases.*
Transport - Not elsewhere specified	TRNONSPE	Includes all emissions from transport not elsewhere specified. Note: *International marine bunkers* and *international aviation bunkers* are not included in *transport* at a country or regional level (except for World transport emissions). *Note: This flow is included for CO_2 emissions from fuel combustion and excludes non-CO_2 greenhouse gases.*
Residential	RESIDENT	Includes all emissions from fuel combustion in households. This corresponds to IPCC Source/Sink Category 1 A 4 b.
Commercial and public services	COMMPUB	Includes emissions from all activities of ISIC Rev. 4 Divisions 33, 36-39, 45-47, 52, 53, 55-56, 58-66, 68-75, 77-82, 84 (excluding Class 8422), 85-88, 90-96 and 99.
Agriculture/forestry	AGRI_FOREST	Includes deliveries to users classified as agriculture, hunting and forestry by the ISIC, and therefore includes energy consumed by such users whether for traction (excluding agricultural highway use), power or heating (agricultural and domestic) [ISIC Rev. 4 Divisions 01 and 02].
Fishing	FISHING	Includes emissions from fuels used for inland, coastal and deep-sea fishing. Fishing covers fuels delivered to ships of all flags that have refuelled in the country (including international fishing) as well as energy used in the fishing industry [ISIC Rev.4 Division 03].

Flow	Short name	Definition
Final consumption - Other - Not elsewhere specified	ONONSPEC	Includes emissions from all fuel use not elsewhere specified as well as consumption in the above-designated categories for which separate figures have not been provided. Emissions from military fuel use for all mobile and stationary consumption are included here (*e.g.* ships, aircraft, road and energy used in living quarters) regardless of whether the fuel delivered is for the military of that country or for the military of another country.
International marine bunkers	BUNKERS_MARINE	Includes emissions from fuels burned by ships of all flags that are engaged in international navigation. The international navigation may take place at sea, on inland lakes and waterways, and in coastal waters. Consumption by ships engaged in domestic navigation is excluded. The domestic/international split is determined on the basis of port of departure and port of arrival, and not by the flag or nationality of the ship. Consumption by fishing vessels and by military forces is also excluded. Emissions from international marine bunkers should be excluded from the national totals. This corresponds to IPCC Source/Sink Category 1 A 3 d i.
International aviation bunkers	BUNKERS_AVIATION	Includes emissions from fuels used by aircraft for international aviation. Fuels used by airlines for their road vehicles are excluded. The domestic/international split should be determined on the basis of departure and landing locations and not by the nationality of the airline. Emissions from international aviation bunkers should be excluded from the national totals. This corresponds to IPCC Source/Sink Category 1 A 3 a i.
Total final consumption	TFC	Includes the emissions from the end-use sectors (industry, transport, commercial/institutional activities, residential, agriculture/forestry, fishing and other emissions not specified). Emissions related to the energy used for transformation processes and for own use of the energy producing industries are excluded. Final consumption emissions reflect for the most part emissions at the consumer level. Note that *international marine bunkers* and *international aviation bunkers* are not included at a national or regional level (except for World emissions). In the *2006 GLs*, the sub-categories also include emissions from autoproducers that generate electricity and/or heat. The IEA data are not collected in a way that allows the autoproducer consumption to be split by specific end-use and therefore, this publication shows autoproducers as a separate item (*unallocated autoproducers*).
Electricity and heat production	ELECHEAT_GROSS	Includes the sum of emissions from electricity production, combined heat and power plants and heat plants. It is the sum of main activity producers and autoproducers. Emissions from own on-site use of fuel are included. In the table *GHG Emissions from energy*, the name adopted is: *Electricity and heat generation*.

Flow	Short name	Definition
		For the most recent year available, this value is estimated based on provisional data. Please refer to the section Provisional year estimates for more information on this methodology.

Fugitive GHG emissions and energy-related GHG emissions

The following flows are expressed in thousand tonnes of CO_{2eq}, converted using the 100-year Global Warming Potential (GWP).

Flow	Short name	Definition
Fugitive GHG emissions	GHGFUGITI	Includes the fugitive CO_2 and CH_4 emissions from energy. This includes GHG emissions in IPCC Source/Sink Category 1 B under the *2006 GLs*.
Fugitive GHG emissions of which: Production	FUGPRODUC	It includes methane accidental emissions from upstream processes other than venting and flaring. This corresponds to IPCC Source/Sink Category 1 B 2 a iii 1, 1 B 2 a iii 2 (oil), 1B 2 b iii 1 and 1B 2 b iii 2 (natural gas).
Fugitive GHG emissions of which: Flared	FUGFLARED	It includes CO_2 from flaring or CH_4 emissions from incomplete combustion of flares. This corresponds to IPCC Source/Sink Category 1 B 2 a ii and 1 B 2 b ii (oil).
Fugitive GHG emissions of which: Vented	FUGVENTED	It includes methane emissions from venting. This corresponds to IPCC Source/Sink Category 1 B 1 a (coal), 1 B 2 a i (oil) and 1 B 2 b i (natural gas).
Fugitive GHG emissions of which: Transmission and distribution (Accidental)	FUGTRADIS	It includes methane accidental emissions from downstream processes. This corresponds to IPCC Source/Sink Category 1 B 2 a iii 3, 1 B 2 a.iii 4 and 1 B 2 a iii 5 (oil), 1 B 2 b iii 4 and 1 B 2 b iii 5 (natural gas).
Fugitive GHG emissions of which: Distribution losses (Deliberate)	FUGDISLOS	It includes methane deliberate emissions from downstream processes. This corresponds to IPCC Source/Sink Category 1 B 2 a iii 5 (oil) and 1 B 2 b iii 5 (natural gas).
GHG emissions from energy	GHG_ENERGY	*GHG emissions from energy* presents energy-related GHG emissions, including total GHG emissions from fuel combustion plus CO_2 and CH_4 fugitive emissions from energy, representing the bulk of the energy-related emissions, as in IPCC Source/Sink Category 1 with minor exceptions as detailed below: GHG_ENERGY = GHG_FUELCOMB + GHGFUGITI Exclusions from IPCC Source/Sink Category 1B:

		For fugitive emissions from *Oil and Gas:* o *N_2O emissions from waste gas flaring* o *CO_2 flared from Natural Gas industry* o *CO_2 vented* For fugitive emissions from *Coal:* o *Flared CH_4* o *All fugitive CO_2, including from flaring CH_4 and uncontrolled burning of coal dumps* Emissions from IPCC Source/Sink Category 1C - CO_2 capture and storage are not included.

Indicators

Flow	Short name	Notes
Total energy supply	TES	Total energy supply from the *IEA World Energy Balances* (converted to PJ). Total energy supply (TES) is made up of production + imports - exports - international marine bunkers - international aviation bunkers ± stock changes. The IPCC methodology does not assign any CO_2 emissions to fuel use of biofuels *per se*, only if it is used in an unsustainable way. This is evaluated in the Agriculture, Forestry and Other Land Use module of the *2006 GLs*. So although the inclusion of biomass in the IEA energy data does not alter its CO_2 emission estimates, it gives more insight into the CO_2 intensity of national energy use.
Total final consumption	TFC	Total final consumption from the *IEA World Energy Balances*. The IPCC methodology does not assign any CO_2 emissions to fuel use of biofuels *per se*, only if it is used in an unsustainable way. This is evaluated in the Agriculture, Forestry and Other Land Use module of the *2006 GLs*. So although the inclusion of biomass in the IEA energy data does not alter its CO_2 emission estimates, it gives more insight into the CO_2 intensity of national energy use.
Gross Domestic Product	GDP_R	GDP_R data are derived from three sources:

Flow	Short name	Notes
		- *International Monetary Fund. 2025. World Economic Outlook, April 2025:A Critical Juncture amid Policy Shifts. Washington, DC.* (IMF WEO) - *World Development Indicators. 2025. Washington, D.C. :The World Bank.* (WB WDI) - *CEPII – CHELEM database. 2025.* (CHELEM) Data from IMF WEO are used as a primary source for the period starting in 1980; if not available, data gaps are filled based on the other sources, based on data availability and the hierarchy described below: 1. Data from IMF WEO 2. WDI growth rates applied to IMF WEO data 3. Data from WB WDI for countries not included in IMF WEO for any year 4. CHELEM growth rates applied to IMF WEO data 5. Data from CHELEM Data in year *n* are rebased to 2015 using nominal GDP figures, GDP deflators and market exchange rates using following formula: $\mathbf{GDP_n} = \boldsymbol{GDP\ nominal\ USD_{base\_year}} * \mathbf{Real\_GDP\_growth_{\boldsymbol{n\ vs\ base\_year}}}$ Please note that the regional totals shown for OECD and other regions were calculated by summing individual countries' GDP data. This calculation yields slightly different results to the GDP totals published by primary sources.
Gross Domestic Product (PPP basis)	GDP_R_PPP	GDP_R_PPP figures are derived using same sources and methodology as for GDP USD. Data in year *n* are rebased to 2015 using nominal GDP figures, GDP deflators and PPP rates using following formula:

Flow	Short name	Notes
		$\mathbf{GDP_n}$ $= GDP\ nominal\ \boldsymbol{PPP}_{base\_year}$ $*\ \text{Real\_GDP\_growth}_{n\ vs\ base\_year}$ International price comparisons based on exchange rates may not reflect the relative purchasing power in each currency. PPPs are the rates of currency conversion that equalize the purchasing power of different currencies by eliminating the differences in price levels between countries. In their simplest form, PPPs are simply price relatives that show the ratio of the prices in national currencies of the same good or service in different countries.
Population	POP	**For OECD countries:** The main source of these series is the OECD *National Accounts Statistics* database. Missing data (especially for years 1960-1969) are estimated using growth rates from *World Development Indicators*, The World Bank, Washington D.C. database. **For non-OECD countries:** The main source of the population data is *World Development Indicators*, The World Bank, Washington D.C., 2025. Population data for Cyprus[1] are taken from the Eurostat online database.
CO_2 emissions from fuel combustion per unit of TES	CO2_TES	This ratio is expressed in tonnes of CO_2 per terajoule. It has been calculated using the total CO_2 fuel combustion emissions (CO2_FUELCOMB) and total energy supply (including biofuels and other non-fossil forms of energy).
CO_2 emissions from fuel combustion per unit of TFC	CO2_TFC	This ratio is expressed in tonnes of CO_2 per terajoule. It has been calculated using the total CO_2 fuel combustion emissions (CO2_FUELCOMB) and total final consumption (including biofuels and other non-fossil forms of energy).
CO_2 emissions from fuel combustion per unit of GDP	CO2_GDP	This ratio is expressed in kilogrammes of CO_2 per 2015 US dollar. It has been computed using the total CO_2 fuel

[1] Please refer to the section on Geographical coverage.

Flow	Short name	Notes
		combustion emissions (CO2_FUELCOMB) and GDP calculated using exchange rates.
Industry CO_2 emissions per unit of GDP	CO2_IND_GDP	This ratio is expressed in kilogrammes of CO_2 per 2015 US dollar. It has been computed using *Industry* CO_2 emissions (TOTIND) and total GDP calculated using exchange rates.
Transport CO_2 emissions per unit of GDP	CO2_TRANS_GDP	This ratio is expressed in kilogrammes of CO_2 per 2015 US dollar. It has been computed using *Transport* CO_2 emissions (TOTTRANS) and total GDP calculated using exchange rates.
Services CO_2 emissions per unit of GDP	CO2_SERV_GDP	This ratio is expressed in kilogrammes of CO_2 per 2015 US dollar. It has been computed using *Commercial and public services* CO_2 emissions (COMMPUB) and total GDP calculated using exchange rates.
Residential CO_2 emissions per unit of GDP	CO2_RES_GDP	This ratio is expressed in kilogrammes of CO_2 per 2015 US dollar. It has been computed using *Residential* CO_2 emissions (RESIDENT) and total GDP calculated using exchange rates.
CO_2 emissions from fuel combustion per unit of GDP (PPP basis)	CO2_GDPPPP	This ratio is expressed in kilogrammes of CO_2 per 2015 US dollar. It has been calculated using CO_2 Fuel Combustion emissions (CO2_FUELCOMB) and GDP calculated using purchasing power parities.
Industry CO_2 emissions per unit of GDP (PPP basis)	CO2_IND_GDPPPP	This ratio is expressed in kilogrammes of CO_2 per 2015 US dollar. It has been calculated using *Industry* CO_2 emissions (TOTIND) and total GDP calculated using purchasing power parities.
Transport CO_2 emissions per unit of GDP (PPP basis)	CO2_TRANS_GDPPPP	This ratio is expressed in kilogrammes of CO_2 per 2015US dollar. It has been calculated using *Transport* CO_2 emissions (TOTTRANS) and total GDP calculated using purchasing power parities.
Services CO_2 emissions per unit of GDP (PPP basis)	CO2_SERV_GDPPPP	This ratio is expressed in kilogrammes of CO_2 per 2015 US dollar. It has been calculated using the *Commercial and public services* CO_2 emissions

Flow	Short name	Notes
		(COMMPUB) and total GDP calculated using purchasing power parities.
Residential CO_2 emissions per unit of GDP (PPP basis)	CO2_RES_GDPPPP	This ratio is expressed in kilogrammes of CO_2 per 2015 US dollar. It has been calculated using *Residential* CO_2 emissions (RESIDENT) and total GDP calculated using purchasing power parities.
CO_2 emissions from fuel combustion per capita	CO2_POP	This ratio is expressed in tonnes of CO_2 per capita. It has been calculated using CO_2 fuel combustion emissions (CO2_FUELCOMB).
Industry CO_2 emissions per capita	CO2_IND_POP	This ratio is expressed in tonnes of CO_2 per capita. It has been calculated using *Industry* CO_2 emissions (TOTIND).
Transport CO_2 emissions per capita	CO2_TRANS_POP	This ratio is expressed in tonnes of CO_2 per capita. It has been calculated using the *Transport* CO_2 emissions (TOTTRANS).
Services CO_2 emissions per capita	CO2_SERV_POP	This ratio is expressed in tonnes of CO_2 per capita. It has been calculated using *Commercial and public services* CO_2 emissions (COMMPUB).
Residential CO_2 emissions per capita	CO2_RES_POP	This ratio is expressed in tonnes of CO_2 per capita. It has been calculated using *Residential* CO_2 emissions (RESIDENT).
CO_2 emissions index	CO2_INDEX	CO_2 fuel combustion emissions (CO2_FUELCOMB) expressed as an index, where the reference year = 100. Aside from the following exceptions, 2000 is used as the reference year: **Montenegro** (2005), **South Sudan** (2012)
Population index	POP_INDEX	Population expressed as an index, where the reference year = 100. Aside from the following exceptions, 2000 is used as the reference year: **Montenegro** (2005), **South Sudan** (2012) This index can be used as one of the constituents of the Kaya identity, for more information see the section *Understanding the IEA CO_2 emissions estimates*.
GDP per population index	GDP_POP_INDEX	GDP PPP / population expressed as an index, where the reference year = 100.

Flow	Short name	Notes
		Aside from the following exception, 2000 is used as the reference year: **Montenegro** (2005), **South Sudan** (2012) This index can be used as one of the constituents of the Kaya identity, for more information see the section *Understanding the IEA CO_2 emissions estimates.*
Energy intensity index	TES_GDP_INDEX	TES / GDP PPP expressed as an index, where the reference year = 100. Aside from the following exception, 2000 is used as the reference year: **Montenegro** (2005), **South Sudan** (2012) This index can be used as one of the constituents of the Kaya identity, for more information see the section *Understanding the IEA CO_2 emissions estimates*.
Carbon intensity index – CO_2/TES	CO2_TES_INDEX	CO_2 emissions / TES expressed as an index, where the reference year = 100. Calculated using CO_2 Fuel Combustion emissions (CO2_FUELCOMB). Aside from the following exception, 2000 is used as the reference year: **Montenegro** (2005), **South Sudan** (2012) This index can be used as one of the constituents of the Kaya identity, for more information see the section *Understanding the IEA CO_2 emissions estimates*.
GHG emissions from energy per unit of TES	GHG_TES	This ratio is expressed in tonnes of CO_{2eq} per terajoule. It has been calculated using the total GHG Energy emissions (GHG_ENERGY) and total energy supply (including biofuels and other non-fossil forms of energy).
GHG emissions from energy per unit of TFC	GHG_TFC	This ratio is expressed in tonnes of CO_{2eq} per terajoule. It has been calculated using the total GHG Energy emissions (GHG_ENERGY) and total final consumption (including biofuels and other non-fossil forms of energy).
GHG emissions from energy per unit of GDP	GHG_GDP	This ratio is expressed in kilogrammes of CO_{2eq} per 2015 US dollar. It has been computed using the total GHG Energy (GHG_ENERGY) emissions and GDP calculated using exchange rates.

Flow	Short name	Notes
GHG emissions from energy per unit of GDP (PPP)	GHG_GDPPPP	This ratio is expressed in kilogrammes of CO_{2eq} per 2015 US dollar. It has been computed using the total GHG Energy (GHG_ENERGY) emissions and GDP calculated using purchasing power parities.
GHG emissions from energy per capita	GHG_POP	This ratio is expressed in tonnes of CO_{2eq} per capita. It has been computed using the total GHG Energy (GHG_ENERGY) emissions).

Allocation of CO_2 emissions from electricity/heat

Flow	Allocation	Definition
Emissions by sector	EMIS_SECT	Expressed in thousand tonnes of CO_2. This allocation type shows emissions for the same sectors which are present in the file CO_2 Emissions From Fuel Combustion. In particular, the emissions from electricity and heat production are shown separately and not reallocated.
Emissions with electricity and heat allocated to consuming sectors	EMIS_SECT_ALLOC	Expressed in thousand tonnes of CO_2. Emissions from electricity and heat generation have been allocated to final consuming sectors multiplying the amounts of electricity and heat consumed per electricity/heat country-specific carbon intensities. IEA data do not capture the autoproduction by sub-sector, but only the total. Therefore, caution is needed while using the sub-sectoral disaggregation of *Industry*.
Per capita emissions by sector	EMIS_SECT_POP	These ratios are expressed in kilogrammes of CO_2 per capita. This allocation type shows per capita emissions for the same sectors which are present in the file CO_2 Emissions From Fuel Combustion. In particular, the emissions from electricity and heat production are shown separately and not reallocated.
Per capita emissions with electricity and heat allocated to consuming sectors	EMIS_SECT_ALLOC_POP	These ratios are expressed in kilogrammes of CO_2 per capita. Emissions from electricity and heat generation have been allocated to final consuming sectors multiplying the amounts of electricity and heat consumed per electricity/heat country-specific carbon intensities. IEA data does not capture the autoproduction by sub-sector, but only the total. Therefore, caution is needed while using the sub-sectoral disaggregation of *Industry*.

Category dimension

Greenhouse gas emissions estimates matching the energy module of 2006 IPCC Guidelines

Note: The definition included in this table include mapping against ISIC Rev 3 categories to stay consistent with the definitions provide in the *2006 IPCC Guidelines*.

Category	Definition
1.Energy	This category includes all GHG emissions arising from combustion and fugitive releases of fuels. Emissions from the non-energy uses of fuels are generally not included here, but reported under Industrial Processes and Product Use Sector. ***Note:*** *The IEA estimates for fugitive emissions (GHGFUGITI) are not available for the entire geographical coverage of this database. For countries for which the IEA fugitive emissions are not available, this category corresponds to category 1.A. Fuel combustion activities.*
1.A. Fuel combustion activities	Emissions from the intentional oxidation of materials within an apparatus that is designed to raise heat and provide it either as heat or as mechanical work to a process or for use away from the apparatus.
1.A.1.Energy industries	Comprises emissions from fuels combusted by the fuel extraction or energy-producing industries.
1.A.1.a.Main activity electricity and heat production	Sum of emissions from main activity producers of electricity generation, combined heat and power generation, and heat plants. Main activity producers (formerly known as public utilities) are defined as those undertakings whose primary activity is to supply the public. They may be in public or private ownership. Emissions from own on-site use of fuel should be included. Emissions from autoproducers (undertakings which generate electricity/heat wholly or partly for their own use, as an activity that supports their primary activity) should be assigned to the sector where they were generated and not under 1 A 1 a. Autoproducers may be in public or private ownership.
1.A.1.a.i.Electricity generation	Comprises emissions from all fuel use for electricity generation from main activity producers except those from combined heat and power plants.
1.A.1.a.ii.Combined heat and power generation (CHP)	Emissions from production of both heat and electrical power from main activity producers for sale to the public, at a single CHP facility.
1.A.1.a.iii.Heat plants	*Production of heat from main activity producers for sale by pipe network.*
1.A.1.b.Petroleum refining	All combustion activities supporting the refining of petroleum products including on-site combustion for the generation of electricity and heat for own use. Does not include evaporative emissions occurring at the refinery. These emissions should be reported separately under 1 B 2 a.

1.A.1.c.Manufacture of solid fuels and other energy industries	Combustion emissions from fuel use during the manufacture of secondary and tertiary products from solid fuels including production of charcoal. Emissions from own on-site fuel use should be included. Also includes combustion for the generation of electricity and heat for own use in these industries.
1.A.1.c.i.Manufacture of solid fuels	Emissions arising from fuel combustion for the production of coke, brown coal briquettes and patent fuel.
1.A.1.c.ii.Other energy industries	Combustion emissions arising from the energy-producing industries own (on-site) energy use not mentioned above or for which separate data are not available. This includes the emissions from own-energy use for the production of charcoal, bagasse, saw dust, cotton stalks and carbonizing of biofuels as well as fuel used for coal mining, oil and gas extraction and the processing and upgrading of natural gas. This category also includes emissions from pre-combustion processing for CO2 capture and storage. Combustion emissions from pipeline transport should be reported under 1 A 3 e.
1.A.2.Manufacturing industries and construction	Emissions from combustion of fuels in industry. Also includes combustion for the generation of electricity and heat for own use in these industries. Emissions from fuel combustion in coke ovens within the iron and steel industry should be reported under 1 A 1 c and not within manufacturing industry. Emissions from the industry sector should be specified by sub-categories that correspond to the International Standard Industrial Classification of all Economic Activities (ISIC). Energy used for transport by industry should not be reported here but under Transport (1 A 3). Emissions arising from off-road and other mobile machinery in industry should, if possible, be broken out as a separate subcategory. For each country, the emissions from the largest fuel-consuming industrial categories ISIC should be reported, as well as those from significant emitters of pollutants. A suggested list of categories is outlined below.
1.A.2.a.Iron and steel	ISIC Group 271 and Class 2731.
1.A.2.b.Non-ferrous metals	ISIC Group 272 and Class 2732.
1.A.2.c.Chemicals	ISIC Division 24.
1.A.2.d.Pulp, paper and print	ISIC Divisions 21 and 22.
1.A.2.e.Food processing, beverages and tobacco	ISIC Divisions 15 and 16.
1.A.2.f.Non-metallic minerals	Includes products such as glass ceramic, cement, etc. ISIC Division 26.
1.A.2.g.Transport equipment	ISIC Divisions 34 and 35.
1.A.2.h.Machinery	Includes fabricated metal products, machinery and equipment other than transport equipment. ISIC Divisions 28, 29, 30, 31 and 32.
1.A.2.i.Mining (excluding fuels) and quarrying	ISIC Divisions 13 and 14.
1.A.2.j.Wood and wood products	ISIC Division 20.

1.A.2.k.Construction	ISIC Division 45.
1.A.2.l.Textile and leather	ISIC Divisions 17, 18 and 19.
1.A.2.m.Non-specified industry	Any manufacturing industry/construction not included above or for which separate data are not available. Includes, but is not limited to Includes ISIC Divisions 25, 33, 36 and 37.
1.A.3.Transport	Emissions from the combustion and evaporation of fuel for all transport activity (excluding military transport), regardless of the sector, specified by sub-categories below. Emissions from fuel sold to any air or marine vessel engaged in international transport (1 A 3 a i and 1 A 3 d i) should as far as possible be excluded from the totals and subtotals in this category and should be reported separately
1.A.3.a.Domestic aviation	Emissions from civil domestic passenger and freight traffic that departs and arrives in the same country (commercial, private, agriculture, etc.), including take-offs and landings for these flight stages. Note that this may include journeys of considerable length between two airports in a country (e.g. San Francisco to Honolulu). Exclude military, which should be reported under 1 A 5 b.
1.A.3.b.Road transportation	All combustion and evaporative emissions arising from fuel use in road vehicles, including the use of agricultural vehicles on paved roads.
1.A.3.c.Railways	Emissions from railway transport for both freight and passenger traffic routes.
1.A.3.d.Domestic navigation	Emissions from fuels used by vessels of all flags that depart and arrive in the same country (exclude fishing, which should be reported under 1 A 4 c iii, and military, which should be reported under 1 A 5 b). Note that this may include journeys of considerable length between two ports in a country (e.g. San Francisco to Honolulu)
1.A.3.e.Other transportation	Combustion emissions from all remaining transport activities including pipeline transportation, ground activities in airports and harbours, and off-road activities not otherwise reported under 1 A 4 c Agriculture or 1 A 2. Manufacturing Industries and Construction. Military transport should be reported under 1 A 5 (see 1 A 5 Nonspecified).
1.A.3.e.i.Pipeline transport	Combustion related emissions from the operation of pump stations and maintenance of pipelines. Transport via pipelines includes transport of gases, liquids, slurry and other commodities via pipelines. Distribution of natural or manufactured gas, water or steam from the distributor to final users is excluded and should be reported in 1 A 1 c ii or 1 A 4 a.
1.A.3.e.ii.Off-road	Combustion emissions from Other Transportation excluding Pipeline Transport.
1.A.4.Other sectors	Emissions from combustion activities as described below, including combustion for the generation of electricity and heat for own use in these sectors.
1.A.4.a.Commercial/ institutional	Emissions from fuel combustion in commercial and institutional buildings; all activities included in ISIC Divisions

	41,50, 51, 52, 55, 63-67, 70-75, 80, 85, 90-93 and 99.
1.A.4.b.Residential	All emissions from fuel combustion in households.
1.A.4.c.Agriculture/forestry/fishing/fish farms	Emissions from fuel combustion in agriculture, forestry, fishing and fishing industries such as fish farms. Activities included in ISIC Divisions 01, 02 and 05. Highway agricultural transportation is excluded.
1.A.5.Non-specified and unallocated autoproducers	All remaining emissions from fuel combustion that are not specified elsewhere. Include emissions from fuel delivered to the military in the country and delivered to the military of other countries that are not engaged in multilateral operations Emissions from fuel sold to any air or marine vessel engaged in multilateral operation pursuant to the Charter of the United Nations should be excluded from the totals and subtotals of the military transport, and should be reported separately. Note: For countries for which the allocation of fuel-use from autoproducers to the demand sectors is deemed to be not feasible due to the limitations corresponding to the methodology, the emissions associated with unallocated autorpoducers are included under this category. For additional details please refer to the section on *Allocating emissions from autoproducers to demand sectors*.
1.B. Fugitive emissions from fuels	Includes all intentional and unintentional emissions from the extraction, processing, storage and transport of fuel to the point of final use.
1.B.1.Solid fuels	Includes all intentional and unintentional emissions from the extraction, processing, storage and transport of fuel to the point of final use. ***Note**: The IEA fugitive emission estimates for solid fuels does not include the following categories:* *o Flared CH_4 from coal industry* *o All fugitive CO_2, including from flaring CH_4 and uncontrolled burning of coal dumps* o *Emissions from solid fuels transformation*
1.B.2.Oil and natural gas	Comprises fugitive emissions from all oil and natural gas activities. The primary sources of these emissions may include fugitive equipment leaks, evaporation losses, venting, flaring and accidental releases. ***Note**: The IEA fugitive emission estimates from oil and natural gas does not include the following categories:* *o N_2O emissions from waste gas flaring* *o CO_2 flared from Natural Gas industry* *o CO_2 vented*
1.B.2.a.Oil	Comprises emissions from venting, flaring and all other fugitive sources associated with the exploration, production, transmission, upgrading, and refining of crude oil and distribution of crude oil products.

1.B.2.a.i.Venting	Emissions from venting of associated gas and waste gas/vapour streams at oil facilities.
1.B.2.a.ii.Flaring	Emissions from flaring of natural gas and waste gas/vapour streams at oil facilities.
1.B.2.a.iii.All other	Fugitive emissions at oil facilities from equipment leaks, storage losses, pipeline breaks, well blowouts, land farms, gas migration to the surface around the outside of wellhead casing, surface casing vent bows, biogenic gas formation from tailings ponds and any other gas or vapour releases not specifically accounted for as venting or flaring.
1.B.2.b.Natural gas	Comprises emissions from venting, flaring and all other fugitive sources associated with the exploration, production, processing, transmission, storage and distribution of natural gas (including both associated and non-associated gas).
1.B.2.b.i.Venting	Emissions from venting of natural gas and waste gas/vapour streams at gas facilities.
1.B.2.b.ii.Flaring	Emissions from flaring of natural gas and waste gas/vapour streams at gas facilities.
1.B.2.b.iii.All other	Fugitive emissions at natural gas facilities from equipment leaks, storage losses, pipeline breaks, well blowouts, gas migration to the surface around the outside of wellhead casing, surface casing vent bows and any other gas or vapour releases not specifically accounted for as venting or flaring.
International aviation bunkers	Emissions from flights that depart in one country and arrive in a different country. Include take-offs and landings for these flight stages. Emissions from international military aviation can be included as a separate sub-category of international aviation provided that the same definitional distinction is applied and data are available to support the definition.
International marine bunkers	Emissions from fuels used by vessels of all flags that are engaged in international water-borne navigation. The international navigation may take place at sea, on inland lakes and waterways and in coastal waters. Includes emissions from journeys that depart in one country and arrive in a different country. Exclude consumption by fishing vessels (see Other Sector - Fishing). Emissions from international military water-borne navigation can be included as a separate sub-category of international waterborne navigation provided that the same definitional distinction is applied and data are available to support the definition.

Product dimension

Aggregated product categories

Product	Short name	Definition
Total	TOTAL	TOTAL = the total of all GHG emissions from fuel combustion from across products; for CO_2, TOTAL = COAL + OIL_TOTAL + NATURAL_GAS + WASTE_NONREN, for CH_4 and N_2O, TOTAL = COAL + OIL_TOTAL + NATURAL_GAS + WASTE_NONREN+ BIOPROD.
Coal and coal products	COAL	Includes all coal, both primary (hard coal, brown coal, anthracite, coking coal, other bituminous coal, sub-bituminous coal and lignite) and derived fuels (patent fuel, coke oven coke, gas coke, coal tar, BKB, gas works gas, coke oven gas, blast furnace gas and other recovered gases). Peat, peat products and oil shale are also aggregated in this category.
Oil and oil products	OIL_TOTAL	Includes crude oil, natural gas liquids, refinery feedstocks, additives/blending components, orimulsion, other hydrocarbons, refinery gas, ethane, LPG, motor gasoline excl. biofuels, aviation gasoline, gasoline type jet fuel, kerosene type jet fuel excl. biofuels, kerosene, gas/diesel oil excl. biofuels, fuel oil, naphtha, white spirit, lubricants, bitumen, paraffin waxes, petroleum coke and non-specified oil products.
Natural gas	NATURAL_GAS	Gas represents natural gas. It excludes natural gas liquids.
Total waste, non-renewable portion	WASTE_NONREN	Includes industrial waste and non-renewable municipal waste.
Biological products = biofuels and renewable wastes	RENEWABLE_FUELS	Includes biofuels (primary solid biofuels, biogases, biogasoline, biodiesels, bio jet kerosene and other liquid biofuels) and renewable wastes.

Coal

Product	Short name	Definition
Hard coal (no detail)	HARDCOAL_ND	This item is only used if the detailed breakdown is not available. It includes anthracite, coking coal, other bituminous coal.
Brown coal (no detail)	BROWNCOAL_ND	This item is only used if the detailed breakdown is not available. It includes lignite and sub-bituminous coal.
Anthracite	ANTHRACITE	Anthracite is a high rank coal used for industrial and residential applications. It is generally less than 10% volatile matter and a high carbon content (about 90% fixed carbon). Its gross calorific value is greater than 24 000 kJ/kg on an ash-free but moist basis.
Coking coal	COKING_COAL	Coking coal refers to bituminous coal with a quality that allows the production of a coke suitable to support a blast furnace charge. Its gross calorific value is equal to or greater than 24 000 kJ/kg on an ash-free but moist basis.
Other bituminous coal	OTH_BITCOAL	Other bituminous coal is used mainly for steam raising and space heating purposes and includes all bituminous coal that is not included under coking coal nor anthracite. It is usually more than 10% volatile matter and a relatively high carbon content (less than 90% fixed carbon). Its gross calorific value is greater than 24 000 kJ/kg on an ash-free but moist basis.
Sub-bituminous coal	SUB_BITCOAL	Non-agglomerating coals with a gross calorific value between 20 000 kJ/kg and 24 000 kJ/kg containing more than 31% volatile matter on a dry mineral matter free basis.
Lignite	LIGNITE	Lignite is a non-agglomerating coal with a gross calorific value of less than 20 000 kJ/kg, and greater than 31% volatile matter on a dry mineral matter free basis.
Patent fuel	PATENT_FUEL	Patent fuel is a composition fuel manufactured from hard coal fines with the addition of a binding agent. The amount of patent fuel produced may, therefore, be slightly higher than the actual amount of coal consumed in the transformation process. Consumption of patent fuels during the patent fuel manufacturing process is included under *energy industry own use*.
Coke oven cokes	COKE_OVEN_COKE_OTH	Coke oven coke is the solid product obtained from the carbonisation of coal, principally coking coal, at high temperature. It is low in moisture content and volatile matter. Coke oven coke is used mainly in the iron and steel industry, acting as energy source and chemical agent. Also included are semi-coke (a solid product obtained from the carbonisation of coal at a low temperature), lignite coke (a semi-coke made from lignite), coke breeze and foundry coke. The heading *energy industry own use* includes the consumption at the coking plants themselves. Consumption in the *iron and steel industry* does not include coke converted into blast furnace gas. To obtain the total emissions from coke oven coke in the iron and steel industry, the quantities converted into blast furnace gas have to be added (these

Product	Short name	Definition
		are aggregated under differences due to transformations and/or losses).
Gas coke	GAS_COKE	Gas coke is a by-product of hard coal used for the production of town gas in gas works. Gas coke is used for heating purposes. *Energy industry own use* includes the consumption of gas coke at gas works.
Coal tar	COAL_TAR	Coal tar is a result of the destructive distillation of bituminous coal. Coal tar is the liquid by-product of the distillation of coal to make coke in the coke oven process. Coal tar can be further distilled into different organic products (*e.g.* benzene, toluene, naphthalene), which normally would be reported as a feedstock to the petrochemical industry.
Brown coal briquettes (BKB)	BKB	Brown coal briquettes (braunkohlebriketts) are composition fuels manufactured from lignite, produced by briquetting under high pressure with or without the addition of a binding agent. The heading *energy industry own use* includes consumption by briquetting plants.
Gas works gas	GASWORKS_GAS	Gas works gas covers all types of gas produced in public utility or private plants, whose main purpose is the manufacture, transport and distribution of gas. It includes gas produced by carbonisation (including gas produced by coke ovens and transferred to gas works), by total gasification (with or without enrichment with oil products) and by reforming and simple mixing of gases and/or air.
Coke oven gas	COKE_OVEN_GAS	Coke oven gas is obtained as a by-product of the manufacture of coke oven coke for the production of iron and steel.
Blast furnace gas	BLAST_FURNACE_GAS	Blast furnace gas is produced during the combustion of coke in blast furnaces in the iron and steel industry. It is recovered and used as a fuel, partly within the plant and partly in other steel industry processes or in power stations equipped to burn it.
Other recovered gases	OTH_RECOVGASES	By-product of the production of steel in an oxygen furnace, recovered on leaving the furnace. The gases are also known as converter gas, LD gas or BOS gas. The quantity of recuperated fuel should be reported on a gross calorific value basis. Also covers non-specified manufactured gases not mentioned above, such as combustible gases of solid carbonaceous origin recovered from manufacturing and chemical processes not elsewhere defined.

Peat

Product	Short name	Definition
Peat	PEAT	Peat is a combustible soft, porous or compressed, fossil sedimentary deposit of plant origin with high water content (up to 90% in the raw state), easily cut, of light to dark brown

		colour. Peat used for non-energy purposes is not included here. Milled peat is included here.
Peat products	PEAT_PRODUCTS	Products such as peat briquettes derived directly or indirectly from sod peat and milled peat.

Oil shale

product	Short name	Definition
Oil shale and oil sands	OIL_SHALE	Oil shale and oil sands are sedimentary rock which contains organic matter in the form of kerogen. Kerogen is a waxy hydrocarbon-rich material regarded as a precursor of petroleum. Oil shale may be burned directly or processed by heating to extract shale oil. Oil shale and tar sands used as inputs for other transformation processes are included here (this includes the portion consumed in the transformation process). Shale oil and other products derived from liquefaction are included in *other hydrocarbons*.

Oil

Product	Short name	Definition
Primary oil (no detail)	OIL_PRIM_PRODUCTS_ND	This item is only used if the detailed breakdown is not available. It includes crude oil, natural gas liquids, refinery feedstocks, additives/blending components and other hydrocarbons.
Crude oil	CRUDE_OIL	Crude oil is a mineral oil consisting of a mixture of hydrocarbons of natural origin and associated impurities, such as sulphur. It exists in the liquid phase under normal surface temperatures and pressure and its physical characteristics (density, viscosity, etc.) are highly variable. It includes field or lease condensates (separator liquids) which are recovered from associated and non-associated gas where it is commingled with the commercial crude oil stream.
Natural gas liquids	NGL	NGL are the liquid or liquefied hydrocarbons recovered from natural gas in separation facilities or gas processing plants. Natural gas liquids include ethane, propane, butane (normal and iso-), (iso) pentane and pentanes plus (sometimes referred to as natural gasoline or plant condensate).
Refinery feedstocks	REFINERY_FEEDSTOCKS	A refinery feedstock is a processed oil destined for further processing (e.g. straight run fuel oil or vacuum gas oil) other than blending in the refining industry. It is transformed into one or more components and/or finished products. With further processing, it will be transformed into one or more components and/or finished products. This definition also covers returns from the petrochemical industry to the refining industry (e.g. pyrolysis gasoline, C4 fractions, gasoil and fuel oil fractions).
Additives / blending components	ADDITIVES	Additives are non-hydrocarbon substances added to or blended with a product to modify its properties, for example, to improve its combustion characteristics. Alcohols and ethers (MTBE, methyl tertiary-butyl ether) and chemical alloys such as tetraethyl lead are included here. The biomass fractions of biogasoline, biodiesel and ethanol are not included here, but under liquid biofuels. This differs from the presentation of additives in the *Oil Information* publication.
Orimulsion	ORIMULSION	Emulsified oil made of water and natural bitumen.
Other hydrocarbons	HYDROCARBONS_OTHER	This category includes synthetic crude oil from tar sands, shale oil, etc., liquids from coal liquefaction, output of liquids from natural gas conversion into gasoline and hydrogen. Orimulsion and oil shale are presented separately and not included here.

Product	Short name	Definition
Refinery gas	REFINERY_GAS	Refinery gas is defined as non-condensable gas obtained during distillation of crude oil or treatment of oil products (*e.g.* cracking) in refineries. It consists mainly of hydrogen, methane, ethane and olefins. It also includes gases which are returned from the petrochemical industry.
Ethane	ETHANE	Ethane is a naturally gaseous straight-chain hydrocarbon (C_2H_6). It is a colourless paraffinic gas which is extracted from natural gas and refinery gas streams.
Liquefied petroleum gases	LPG	Liquefied petroleum gases are the light hydrocarbon fraction of the paraffin series, derived from refinery processes, crude oil stabilisation plants and natural gas processing plants, comprising propane (C_3H_8) and butane (C_4H_{10}) or a combination of the two. They could also include propylene, butylene, isobutene and isobutylene. LPG are normally liquefied under pressure for transportation and storage.
Motor gasoline excluding any biofuel component	MOTOR_GASOLINE_NONBIO	Motor gasoline is light hydrocarbon oil for use in internal combustion engines such as motor vehicles, excluding aircraft. Motor gasoline is distilled between 35ºC and 215ºC and is used as a fuel for land-based spark ignition engines. Motor gasoline may include additives, oxygenates and octane enhancers, including lead compounds such as TEL (tetraethyl lead) and TML (tetramethyl lead). Motor gasoline excluding biofuels does not include the liquid biofuel or ethanol blended with gasoline - see liquid biofuels.
Aviation gasoline	AVIATION_GASOLINE	Aviation gasoline is motor spirit prepared especially for aviation piston engines, with an octane number suited to the engine, a freezing point of -60ºC, and a distillation range usually within the limits of 30ºC and 180ºC.
Gasoline-type jet-fuel	GASOLINE_JET	Gasoline type jet fuel includes all light hydrocarbon oils for use in aviation turbine power units, which distil between 100ºC and 250ºC. This fuel is obtained by blending kerosenes and gasoline or naphthas in such a way that the aromatic content does not exceed 25% in volume, and the vapour pressure is between 13.7 kPa and 20.6 kPa. Additives can be included to improve fuel stability and combustibility.
Kerosene type jet fuel excl. biofuels	KEROSENE_JET_NONBIO	Kerosene type jet fuel is a medium distillate used for aviation turbine power units. It has the same distillation characteristics and flash point as kerosene (between 150ºC and 300ºC but not generally above 250ºC). In addition, it has particular specifications (such as freezing point) which are established by the International Air Transport Association (IATA). It includes kerosene blending components. Kerosene type jet fuel excluding biofuels does not include the liquid biofuels blended with jet kerosene.
Other kerosene	KEROSENE_OTHER	Kerosene (other than kerosene used for aircraft transport which is included with aviation fuels) comprises refined petroleum distillate intermediate in volatility between gasoline and gas/diesel oil. It is a medium oil distilling between 150ºC and 300ºC.
Gas/diesel oil excl. biofuels	GAS_DIESEL_OIL_NONBIO	Gas/diesel oil includes heavy gas oils. Gas oils are obtained from the lowest fraction from atmospheric distillation of crude oil, while heavy gas oils are obtained by vacuum redistillation of the residual from atmospheric distillation. Gas/diesel oil distils between 180ºC and 380ºC. Several grades are available depending on uses: diesel oil for diesel compression ignition (cars, trucks, marine, etc.), light heating oil for industrial and commercial uses, and other

Product	Short name	Definition
		gas oil including heavy gas oils which distil between 380°C and 540°C and which are used as petrochemical feedstocks. Gas/diesel oil excluding biofuels does not include the liquid biofuels blended with gas/diesel oil – see liquid biofuels.
Residual fuel oil	FUEL_OIL_RESIDUAL	Fuel oil defines oils that make up the distillation residue. It comprises all residual fuel oils, including those obtained by blending. Its kinematic viscosity is above 10 cSt at 80°C. The flash point is always above 50°C and the density is always higher than 0.90 kg/l.
Naphtha	NAPHTHA	Naphtha is a feedstock destined either for the petrochemical industry (e.g. ethylene manufacture or aromatics production) or for gasoline production by reforming or isomerisation within the refinery. Naphtha comprises material that distils between 30°C and 210°C.
White spirit & SBP	WHITE_SPIRIT	White spirit and SBP are refined distillate intermediates with a distillation in the naphtha/kerosene range. White Spirit has a flash point above 30°C and a distillation range of 135°C to 200°C. Industrial Spirit (SBP) comprises light oils distilling between 30°C and 200°C, with a temperature difference between 5% volume and 90% volume distillation points, including losses, of not more than 60°C. In other words, SBP is a light oil of narrower cut than motor spirit. There are seven or eight grades of industrial spirit, depending on the position of the cut in the distillation range defined above.
Lubricants	LUBRICANTS	Lubricants are hydrocarbons produced from distillate or residue; they are mainly used to reduce friction between bearing surfaces. This category includes all finished grades of lubricating oil, from spindle oil to cylinder oil, and those used in greases, including motor oils and all grades of lubricating oil base stocks.
Bitumen	BITUMEN	Bitumen is a solid, semi-solid or viscous hydrocarbon with a colloidal structure that is brown to black in colour. It is obtained by vacuum distillation of oil residues from atmospheric distillation of crude oil. Bitumen is often referred to as asphalt and is primarily used for surfacing of roads and for roofing material. This category includes fluidised and cut back bitumen.
Paraffin waxes	PARAFFIN_WAXES	Paraffin waxes are saturated aliphatic hydrocarbons. These waxes are residues extracted when dewaxing lubricant oils, and they have a crystalline structure which is more or less fine according to the grade. Their main characteristics are that they are colourless, odourless and translucent, with a melting point above 45°C.
Petroleum coke	PETROLEUM_COKE	Petroleum coke is defined as a black solid residue, obtained mainly by cracking and carbonising of petroleum derived feedstocks, vacuum bottoms, tar and pitches in processes such as delayed coking or fluid coking. It consists mainly of carbon (90 to 95%) and has a low ash content. It is used as a feedstock in coke ovens for the steel industry, for heating purposes, for electrode manufacture and for production of chemicals. The two most important qualities are "green coke" and "calcined coke". This category also includes "catalyst coke" deposited on the catalyst during refining processes: this coke is not recoverable and is usually burned as refinery fuel.
Other non-specified secondary oil products	OTH_SEC_OIL_PRODS_ND	Other oil products not classified above (e.g. tar, sulphur and grease) are included here. This category also includes aromatics (e.g. BTX or

Product	Short name	Definition
		benzene, toluene and xylene) and olefins (e.g. propylene) produced within refineries.

Gas

Product	Short name	Definition
Natural gas	NATURAL_GAS	Natural gas comprises gases, occurring in underground deposits, whether liquefied or gaseous, consisting mainly of methane. It includes both "non-associated" gas originating from fields producing only hydrocarbons in gaseous form, and "associated" gas produced in association with crude oil as well as methane recovered from coal mines (colliery gas) or from coal seams (coal seam gas). Production represents dry marketable production within national boundaries, including offshore production and is measured after purification and extraction of NGL and sulphur. It includes gas consumed by gas processing plants and gas transported by pipeline. Quantities of gas that are re-injected, vented or flared are excluded.

Other

Product	Short name	Definition
Industrial waste, non-renewable	WASTE_INDUSTRIAL_NONREN	Industrial waste of non-renewable origin consists of solid and liquid products (*e.g.* tyres) combusted directly, usually in specialised plants, to produce heat and/or power. Renewable industrial waste is not included here.
Municipal waste, non-renewable	WASTE_MUNICIPAL_NONREN	Municipal waste consists of products that are combusted directly to produce heat and/or power and comprises wastes produced by households, industry, hospitals and the tertiary sector that are collected by local authorities for incineration at specific installations. Renewable municipal waste is not included here.

Biofuels

Product	Short name	Definition
Primary solid biofuels	PRIMARY_SOLID_BIOFUEL	Primary solid biofuels is defined as any plant matter used directly as fuel or converted into other forms before combustion. This covers a multitude of woody materials generated by industrial process or provided directly by forestry and agriculture (firewood, wood chips, bark, sawdust, shavings, chips, sulphite lyes also known as black liquor, animal materials/wastes and other solid biofuels).

		Note that for biofuels, only the amounts of biomass specifically used for energy purposes (a small part of the total) are included in the energy statistics. Therefore, the non-energy use of biomass is not taken into consideration and the quantities are null by definition.
Biogases	BIOGASES	Biogases are gases arising from the anaerobic fermentation of biomass and the gasification of solid biomass (including biomass in wastes). The biogases from anaerobic fermentation are composed principally of methane and carbon dioxide and comprise landfill gas, sewage sludge gas and other biogases from anaerobic fermentation. Biogases can also be produced from thermal processes (by gasification or pyrolysis) of biomass and are mixtures containing hydrogen and carbon monoxide (usually known as syngas) along with other components. These gases may be further processed to modify their composition and can be further processed to produce substitute natural gas. Biogases are used mainly as a fuel but can be used as a chemical feedstock.
Biogasoline	BIOGASOLINE	Biogasoline includes bioethanol (ethanol produced from biomass and/or the biodegradable fraction of waste), biomethanol (methanol produced from biomass and/or the biodegradable fraction of waste), bioETBE (ethyl-tertio-butyl-ether produced on the basis of bioethanol; the percentage by volume of bioETBE that is calculated as biofuel is 47%) and bioMTBE (methyl-tertio-butyl-ether produced on the basis of biomethanol: the percentage by volume of bioMTBE that is calculated as biofuel is 36%). Biogasoline includes the amounts that are blended into the gasoline - it does not include the total volume of gasoline into which the biogasoline is blended.
Biodiesels	BIODIESEL	Biodiesels includes biodiesel (a methyl-ester produced from vegetable or animal oil, of diesel quality), biodimethylether (dimethylether produced from biomass), Fischer Tropsch (Fischer Tropsch produced from biomass), cold pressed bio-oil (oil produced from oil seed through mechanical processing only) and all other liquid biofuels which are added to, blended with or used straight as transport diesel. Biodiesels includes the amounts that are blended into the diesel - it does not include the total volume of diesel into which the biodiesel is blended.
Other liquid biofuels	LIQBIOFUEL_OTHER	Other liquid biofuels includes liquid biofuels not reported in either biogasoline or biodiesels.
Non-specified primary biofuels & waste	BIOFUEL_NONSPEC	This item is used when the detailed breakdown for primary biofuels and waste is not available.

Charcoal	CHARCOAL	It covers the solid residue of the destructive distillation and pyrolysis of wood and other vegetal material.

Geographical coverage and country notes

Countries and regions

This document is without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries and to the name of any territory, city or area. In this publication, 'country' refers to country or territory, as case may be. Data start in 1960 for OECD countries and regions, and in 1971 for non-OECD countries and regions, unless otherwise specified.

Country/Region	Short name	Definition
OECD Americas	OECDAM	Includes Canada; Chile; Colombia; Costa Rica; Mexico and the United States.
OECD Asia Oceania	OECDAO	Includes Australia; Israel[2]; Japan; Korea and New Zealand.
OECD Europe	OECDEUR	Includes Austria; Belgium; the Czech Republic; Denmark; Estonia; Finland; France; Germany; Greece; Hungary; Iceland; Ireland; Italy; Latvia; Lithuania; Luxembourg; the Netherlands; Norway; Poland; Portugal; the Slovak Republic; Slovenia; Spain; Sweden; Switzerland; the Republic of Türkiye and the United Kingdom. Estonia, Latvia, Lithuania and Slovenia are included starting in 1990. Prior to 1990, data for Estonia, Latvia and Lithuania are included in Former Soviet Union and data for Slovenia in Former Yugoslavia.
Albania	ALBANIA	
Argentina	ARGENTINA	Argentina is an IEA Association country, therefore it is included in the IEA and Accession/Association countries aggregate (IEA Family), for data starting in 1971 and for the entire time series.
Australia	AUSTRALIA	Excludes the overseas territories. Data are reported on a fiscal year basis. By convention data for the fiscal year that

[2]. The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities. The use of such data by the OECD is without prejudice to the status of the Golan Heights, East Jerusalem and Israeli settlements in the West Bank under the terms of international law.

		starts on 1 July Y-1 and ends on 30 June Y are labelled as year Y.
Austria	AUSTRIA	
Belgium	BELGIUM	
Bosnia and Herzegovina	BOSNIAHERZ	Data for Bosnia and Herzegovina are available starting in 1990. Prior to that, they are included in Former Yugoslavia.
Brazil	BRAZIL	Brazil is currently seeking accession to full IEA membership (Accession country), therefore it is included in the IEA and Accession/Association countries aggregate (IEA Family), for data starting in 1971 and for the entire time series.
Bulgaria	BULGARIA	According to the provisions of Article 4.6 of the Convention and Decisions 9/CP.2 and 11/CP.4, Bulgaria is allowed to use 1988 as the base year.
Canada	CANADA	
Chile	CHILE	Data start in 1971. Chile is currently seeking accession to full IEA membership (Accession country), therefore it is included in the IEA and Accession/Association countries aggregate (IEA Family), for data starting in 1971 and for the entire time series.
China, People's Republic of	CHINA	People's Republic of China is an IEA Association country, therefore it is included in the IEA and Accession/Association countries aggregate (IEA Family), for data starting in 1971 and for the entire time series.
Colombia	COLOMBIA	Colombia is currently seeking accession to full IEA membership (Accession country), therefore it is included in the IEA and Accession/Association countries aggregate (IEA Family), for data starting in 1971 and for the entire time series.
Costa Rica	COSTARICA	Costa Rica joined the OECD in May 2021; data are now included in the applicable OECD aggregates. Costa Rica is currently seeking accession to full IEA membership (Accession country). Accordingly, Costa Rica is included in the IEA and Accession/Association countries aggregate for data starting in 1971.
Croatia	CROATIA	Data for Croatia are available starting in 1990. Prior to that, they are included in Former Yugoslavia.
Cyprus	CYPRUS	**Note by the Republic of Türkiye (Türkiye):**

		The information in the report with reference to “Cyprus” relates to the southern part of the Island. There is no single authority representing both Turkish and Greek Cypriot people on the Island. Türkiye recognises the Turkish Republic of Northern Cyprus (TRNC). Until a lasting and equitable solution is found within the context of the United Nations, Türkiye shall preserve its position concerning the “Cyprus” issue. **Note by all the European Union Member States of the OECD and the European Union:** The Republic of Cyprus is recognised by all members of the United Nations with the exception of Türkiye. The information in this report relates to the area under the effective control of the Government of the Republic of Cyprus. At its seventeenth session, the Conference of the Parties decided to amend Annex I to the Convention to include Cyprus (Decision 10/CP.17). The amendment entered into force on 9 January 2013.
Czech Republic	CZECH	Data start in 1971.
Denmark	DENMARK	Excludes Greenland and the Danish Faroes, except prior to 1990, where data on oil for Greenland were included with the Danish statistics.
Egypt	EGYPT	Data for Egypt are reported on a fiscal year basis. By convention, data for the fiscal year that starts on 1 July Y and ends on 30 June Y+1 are labelled as year Y. Egypt is an IEA Association country, therefore it is included in the IEA and Accession/Association countries aggregate (IEA Family), for data starting in 1971 and for the entire time series.
Estonia	ESTONIA	Data start in 1990. Prior to that, they are included within Former Soviet Union.
Finland	FINLAND	
France	FRANCE	Includes Monaco and excludes the overseas collectivities: New Caledonia; French Polynesia; Saint Barthélemy; Saint Martin; Saint Pierre and Miquelon; and Wallis and Futuna. Energy data for the following overseas departments: Guadeloupe; French Guiana; Martinique; Mayotte; and Réunion are included for the years from 2011 onwards, and excluded for earlier years.

Georgia	GEORGIA	Data for Georgia are available starting in 1990. Prior to that, they are included in Former Soviet Union.
Germany	GERMANY	Includes the new federal states of Germany from 1970 onwards.
Greece	GREECE	
Hungary	HUNGARY	Data start in 1965. According to the provisions of Article 4.6 of the Convention and Decisions 9/CP.2 and 11/CP.4, Hungary is allowed to use average 1985-1987 as the base year.
Iceland	ICELAND	
India	INDIA	Data are reported on a fiscal year basis. By convention, data for the fiscal year that starts on 1 April Y and ends on 31 March Y+1 are labelled as year Y. This convention is different from the one used by Government of India, whereby fiscal year starts on 1 April Y and ends on 31 March Y+1 are labelled as year Y+1. India is an IEA Association country, therefore it is included in the IEA and Accession/Association countries aggregate (IEA Family), for data starting in 1971 and for the entire time series.
Indonesia	INDONESIA	Indonesia is an IEA Association country, therefore it is included in the IEA and Accession/Association countries aggregate (IEA Family), for data starting in 1971 and for the entire time series.
Ireland	IRELAND	
Israel	ISRAEL	The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities. The use of such data by the OECD is without prejudice to the status of the Golan Heights, East Jerusalem and Israeli settlements in the West Bank under the terms of international law. Data start in 1971. Israel is currently seeking accession to full IEA membership (Accession country), therefore it is included in the IEA and Accession/Association countries aggregate (IEA Family), for data starting in 1971 and for the entire time series.
Italy	ITALY	Includes San Marino and the Holy See.
Japan	JAPAN	Includes Okinawa. Starting 1990, data are reported on a fiscal year basis. By convention data for the fiscal year that starts on 1 April Y and ends on 31 March Y+1 are labelled as year Y.

Kenya	KENYA	Kenya joined the IEA as an Association country in June 2023. Accordingly, it is included in the IEA and Accession/Association countries aggregate (IEA Family), for data starting in 1971 and for the entire time series.
Korea	KOREA	Data start in 1971.
Kosovo	KOSOVO	This designation is without prejudice to positions on status, and is in line with United Nations Security Council Resolution 1244/99 and the Advisory Opinion of the International Court of Justice on Kosovo's declaration of independence. Data for Kosovo are available starting in 2000. From 1990-1999, data for Kosovo are included in Serbia. Prior 1990 that, they are included in Former Yugoslavia.
Latvia	LATVIA	Latvia joined the IEA as a full member in February 2025. Accordingly, it is included in the IEA member countries aggregate (IEA Total) for data starting in 1990. Data for Latvia are available starting in 1990. Prior to that, they are included in Former Soviet Union.
Lithuania	LITHUANIA	Lithuania joined the IEA in February 2022; Accordingly, Lithuania is included in the IEA member countries aggregate (IEA Total) for data starting in 1990. Data for Lithuania are available starting in 1990. Prior to that, they are included in Former Soviet Union.
Luxembourg	LUXEMBOURG	
Malta	MALTA	At its fifteenth session, the Conference of the Parties decided to amend Annex I to the Convention to include Malta (Decision 3/CP.15). The amendment entered into force on 26 October 2010.
Mexico	MEXICO	Data start in 1971.
Republic of Moldova	MOLDOVA	Data for the Republic of Moldova are available starting in 1990. Prior to that, they are included in Former Soviet Union.
Montenegro	MONTENEGRO	Data for Montenegro are available starting in 2005. From 1990 to 2004, data for Montenegro are included in Serbia. Prior to 1990, data are included in Former Yugoslavia.
Morocco	MOROCCO	Morocco is an IEA Association country, therefore it is included in the IEA and Accession/Association countries

		aggregate (IEA Family), for data starting in 1971 and for the entire time series. The statistical data for Morocco are supplied by and under the responsibility of the relevant Moroccan authorities. The use of such data by the IEA are without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries and to the name of any territory, city or area.
Netherlands	NETHERLANDS	Excludes Suriname, Aruba and the other former the Netherlands Antilles (Bonaire, Curaçao, Saba, Saint Eustatius and Sint Maarten).
New Zealand	NEWZEALAND	
Republic of North Macedonia	NORTHMACED	Data for the Republic of North Macedonia (North Macedonia) are available starting in 1990. Prior to that, they are included in Former Yugoslavia.
Norway	NORWAY	Discrepancies between Reference and Sectoral Approach estimates and the difference in the resulting growth rates arise from statistical differences between supply and consumption data for oil and natural gas. For Norway, supply of these fuels is the residual of two very large and opposite terms, production and exports.
Poland	POLAND	According to the provisions of Article 4.6 of the Convention and Decisions 9/CP.2 and 11/CP.4, Poland is allowed to use 1988 as the base year.
Portugal	PORTUGAL	Includes the Azores and Madeira.
Romania	ROMANIA	According to the provisions of Article 4.6 of the Convention and Decisions 9/CP.2 and 11/CP.4, Romania is allowed to use 1989 as the base year. Romania became an Accession country in April 2026.
Senegal	SENEGAL	Senegal joined the IEA as an Association country in June 2023. Accordingly, it is included in the IEA and Accession/Association countries aggregate (IEA Family), for data starting in 1971 and for the entire time series.
Serbia	SERBIA	Data for Serbia are available starting in 1990. Prior to that, they are included in Former Yugoslavia. Serbia includes Kosovo from 1990 to 1999 and Montenegro from 1990 to 2004.
Singapore	SINGAPORE	Due to Singapore large trade volume in comparison to its final consumption, a slight misalignment of trade figures can

		have a significant impact on the Energy balance of Singapore. As a result, large discrepancies between the Reference and Sectoral Approach estimates arise from statistical differences between supply and consumption of oil and oil products. The IEA secretariat, the Energy Market Authority and the National Climate Change Secretariat (NCCS) are working closely together on improving data quality for Singapore. Singapore is currently an IEA Association country, therefore it is included in the IEA and Accession/Association countries aggregate (IEA Family), for data starting in 1971 and for the entire time series.
Slovak Republic	SLOVAKIA	Data start in 1971.
Slovenia	SLOVENIA	Data for Slovenia are available from 1990. Prior to that, they are included in Former Yugoslavia in the full publication. According to the provisions of Article 4.6 of the Convention and Decisions 9/CP.2 and 11/CP.4, Slovenia is allowed to use 1986 as the base year.
South Africa	SOUTHAFRICA	Nuclear data are reported on a fiscal year basis. By convention data for the fiscal year that starts on 1 April Y and ends on 31 March Y+1 are labelled as year Y. Large differences between the Reference and Sectoral Approach estimates are due to losses associated with coal-to-liquid and to a lesser extent gas-to-liquid transformation. South Africa is currently an IEA Association country, therefore it is included in the IEA and Accession/Association countries aggregate (IEA Family), for data starting in 1971 and for the entire time series.
Spain	SPAIN	Includes the Canary Islands.
Sweden	SWEDEN	
Switzerland	SWITZERLAND	Includes Liechtenstein for the oil data. Data for other fuels do not include Liechtenstein.
Thailand	THAILAND	Thailand is an IEA Association country, therefore it is included in the IEA and Accession/Association countries aggregate (IEA Family), for data starting in 1971 and for the entire time series.
Republic of Türkiye	TURKIYE	
Ukraine	UKRAINE	Data for Ukraine are available starting in 1990. Prior to that, they are included in Former Soviet Union. Ukraine is currently an IEA Association country, therefore it is

		included in the IEA and Accession/Association countries aggregate (IEA Family), for data starting in 1990 and for the entire time series.
United Kingdom	UK	Shipments of coal and oil to the Channel Islands and the Isle of Man from the United Kingdom are not classed as exports. Supplies of coal and oil to these islands are, therefore, included as part of UK supply. Exports of natural gas to the Isle of Man are included with the exports to Ireland. As of the 1st of February 2020, the United Kingdom (UK) is no longer part of the European Union (EU) and was into a transition period until 31 December 2020. The UK is excluded from the EU27 2020 aggregate, but still included in the EU28 aggregate for reference.
United States	USA	Includes the 50 states and the District of Columbia but generally excludes all territories, and all trade between the U.S. and its territories. Oil statistics include Guam, Puerto Rico[3] and the United States Virgin Islands; trade statistics for coal include international trade to and from Puerto Rico and the United States Virgin Islands. Starting with 2017 data, inputs to and outputs from electricity and heat generation include Puerto Rico.
OECD Total	OECDTOT	Includes Australia; Austria; Belgium; Canada; Chile; Colombia; Costa Rica; the Czech Republic; Denmark; Estonia; Finland; France; Germany; Greece; Hungary; Iceland; Ireland; Israel; Italy; Japan; Korea; Latvia; Lithuania; Luxembourg; Mexico; the Netherlands; New Zealand; Norway; Poland; Portugal; the Slovak Republic; Slovenia; Spain; Sweden; Switzerland; the Republic of Türkiye; the United Kingdom and the United States.[4] Estonia, Latvia, Lithuania and Slovenia are included starting in 1990. Prior to 1990, data for Estonia, Latvia and Lithuania are included in Former Soviet Union and data for Slovenia in Former Yugoslavia. Pre-1971 values have been estimated in accordance with the methodology described in the section *Estimates for years starting in 1751*.
Total IEA	IEATOT	Includes Australia; Austria; Belgium; Canada; the Czech Republic; Denmark;

[3]. Inputs to and outputs from electricity and heat generation up to 2016, and natural gas data for the entire time series for Puerto Rico are included under Other non-OECD Americas.

		Estonia; Finland; France; Germany; Greece; Hungary; Ireland; Italy; Japan; Korea; Latvia, Lithuania; Luxembourg; Mexico; the Netherlands; New Zealand; Norway; Poland; Portugal; the Slovak Republic; Spain; Sweden; Switzerland; the Republic of Türkiye; the United Kingdom and the United States. Estonia is included starting in 1990. Prior to 1990, data for Estonia are included in Former Soviet Union.
IEA and Accession/Association countries	IEAFAMILY	Includes: IEA member countries: Australia, Austria, Belgium, Canada, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, Korea, Latvia, Lithuania, Luxembourg, Mexico, the Netherlands, New Zealand, Norway, Poland, Portugal, the Slovak Republic, Spain, Sweden, Switzerland, the Republic of Türkiye, the United Kingdom and the United States; Accession countries: Brazil, Chile, Colombia, Costa Rica and Israel Association countries: Argentina, the People's Republic of China, Egypt, India, Indonesia, Morocco, Singapore, South Africa, Thailand, Ukraine, Kenya and Senegal. Romania became an IEA Accession country in April 2026. However, as the datasets for this edition had already been finalized, Romania is not included in the IEAFAMILY aggregate (comprising Member, Accession and Association countries). Romania will be integrated into the aggregate in subsequent editions. Viet Nam became an IEA Association country in February 2026. However, because 2024 data was not yet available at time of publication, Viet Nam is not included in this edition and therefore not reflected in the IEAFAMILY aggregate. Viet Nam will be integrated into the aggregate in subsequent editions. Pre-1971 values have been estimated in accordance with the methodology described in *Estimates for years starting 1751*.
European Union (27)	EU27	Includes Austria, Belgium, Bulgaria, Croatia, Cyprus[5], the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Poland, Portugal, Romania, the Slovak Republic, Slovenia, Spain, and Sweden. Please note that in the interest of having comparable data, all of these countries

[5]. Refer to the country note for Cyprus earlier in this section.

		are included since 1990 despite different entry dates into the European Union.
European Union (28)	EU28	Refers to the EU27 with the addition of the United Kingdom[6]. Includes Austria; Belgium; Bulgaria; Croatia; Cyprus; the Czech Republic; Denmark; Estonia; Finland; France; Germany; Greece; Hungary; Ireland; Italy; Latvia; Lithuania; Luxembourg; Malta; the Netherlands; Poland; Portugal; Romania; the Slovak Republic; Slovenia; Spain, Sweden, and the United Kingdom. Please note that in the interest of having comparable data, all of these countries are included since 1990 despite different entry dates into the European Union.
G7	G7	Includes Canada, France, Germany, Italy, Japan, the United Kingdom and the United States. Pre-1960 values have been estimated in accordance with the methodology described in *Estimates for years starting 1751*

[6]. As of the 1st of February 2020, the United Kingdom (UK) is no longer part of the European Union (EU) and has entered into a transition period until 31 December 2020.

Fiscal year

This table lists the countries for which data are reported on a fiscal year basis. More information on beginning and end of fiscal years by country is reported in the column 'Definition'. This document is without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries and to the name of any territory, city or area. In this publication, 'country' refers to country, economy or territory, as case may be. Data start in 1960 for OECD countries and regions, and in 1971 for non-OECD countries and regions, unless otherwise specified.

Country/Region	Short name	Definition
Australia	AUSTRALIA	Data are reported on a fiscal year basis. By convention, data for the fiscal year that starts on 1 July Y-1 and ends on 30 June Y are labelled as year Y.
Egypt	EGYPT	Data are reported on a fiscal year basis. By convention, data for the fiscal year that starts on 1 July Y and ends on 30 June Y+1 are labelled as year Y.
India	INDIA	Data are reported on a fiscal year basis. By convention, data for the fiscal year that starts on 1 April Y and ends on 31 March Y+1 are labelled as year Y. This convention is different from the one used by Government of India, whereby fiscal year starts on 1 April Y and ends on 31 March Y+1 are labelled as year Y+1.
Japan	JAPAN	Starting 1990, data are reported on a fiscal year basis. By convention, data for the fiscal year that starts on 1 April Y and ends on 31 March Y+1 are labelled as year Y.
South Africa	SOUTHAFRICA	Nuclear data are reported on a fiscal year basis. By convention data for the fiscal year that starts on 1 April Y and ends on 31 March Y+1 are labelled as year Y.

Understanding the IEA estimates of CO_2 emissions from fuel combustion

The importance of estimating emissions

The ultimate objective of the UNFCCC (the Convention) is the stabilisation of GHG concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. The Convention also calls for all Parties to commit themselves to the following objectives:

- to develop, update periodically, publish and make available to the Conference of the Parties (COP) their national inventories of anthropogenic emissions by sources and removals by sinks, of all greenhouse gases not controlled by the Montreal Protocol.
- to use comparable methodologies for inventories of GHG emissions and removals, to be agreed upon by the COP.

As a response to the objectives of the UNFCCC, the IEA Secretariat, together with the IPCC, the OECD and numerous international experts, has helped to develop and refine an internationally-agreed methodology for the calculation and reporting of national GHG emissions from fuel combustion. This methodology was published in 1995 in the IPCC Guidelines for National Greenhouse Gas Inventories. After the initial dissemination of the methodology, revisions were added to several chapters and published as the Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories (1996 GLs). In April 2006, the IPCC approved the 2006 Guidelines at the 25th session of the IPCC in Mauritius. Until 2015, most Parties, as well as the IEA, still calculated their inventories using the 1996 GLs. In December 2011 in Durban, Parties adopted Decision 15/CP.17 to update their reporting tables so as to implement the 2006 GLs. The new reporting tables have been mandatory since 15 April 2015.

The IEA estimates of CO_2 emissions from fuel combustion

Energy is at the core of the greenhouse gas estimation. It is estimated that for Annex I Parties energy accounts for over 80%[7] of total GHG emissions, while for the world the share is around three quarters, although shares vary greatly by country. Within energy, CO_2 from fuel combustion accounts for the largest fraction, 92% for Annex I countries, once again varying depending on the economic structure of the country.

Given its extensive work in global energy data collection and compilation, the IEA is able to produce comparable estimates of CO_2 emissions from fuel combustion across countries and region, providing a reference database for countries with more and less advanced national systems.

The estimates of CO_2 emissions from fuel combustion presented in this publication are calculated using the IEA energy data[8] and the default methods and emission factors from the 2006 IPCC Guidelines for National Greenhouse Gas Inventories (2006 GLs)[9].

Prior to the 2015 edition of this publication, the IEA used methods and emission factors of the Revised 1996 IPCC Guidelines, in line with UNFCCC recommendations for the reporting under the Kyoto Protocol. The IEA implementation of the 2006 GLs in this edition follows the decision of UNFCCC Parties to update their reporting tables and to implement the 2006 GLs starting on 15 April 2015.

The implications of changes in methods and emissions factors on the IEA emissions estimates for this edition are discussed in the section IEA estimates: Changes under the 2006 IPCC Guidelines.

Data in this publication and its corresponding database may have been revised with respect to previous editions also because the IEA reviews its energy databases each year. In the light of new assessments, revisions may be made to the energy data time series for any individual country.

7. Based on data reported to the UNFCCC, excluding land-use, land-use change and forestry (LULUCF).
8. Published in World Energy Statistics and World Energy Balances, IEA, Paris.
9. See: http://www.ipcc-nggip.iges.or.jp/public/2006gl/vol2.html.

CO_2 emissions from fuel combustion: key concepts

The IEA uses the simplest (Tier 1) methodology to estimate CO_2 emissions from fuel combustion based on the 2006 GLs. The computation follows the concept of conservation of carbon, from the fuel combusted into CO_2. While for the complete methodology the reader should refer to the full IPCC documents, a basic description follows.

Generally, the Tier 1 estimation of CO_2 emissions from fuel combustion for a given fuel can be summarised as follows:

CO_2 emissions from fuel combustion
CO_2 = Fuel consumption * Emission factor

where:

Fuel consumption = amount of fuel combusted;

Emission factor = default emission factor

Emissions are then summed across all fuels and all sectors of consumption to obtain national totals. A more detailed explanation of the step by step calculation is presented in the section IEA estimates: Changes under the 2006 IPCC Guidelines.

IEA estimates vs. UNFCCC submissions

Based on the IEA globally collected energy data, the IEA estimates of CO_2 emissions from fuel combustion are a global database obtained following harmonised definitions and comparable methodologies across countries. They do not represent an official source for national submissions, as national administrations should use the best available country-specific information to complete their emissions reporting.

The IEA CO_2 estimates can be compared with those reported by countries to the UNFCCC Secretariat to highlight possible problems in methods, input data or emission factors. Still, care should be used in interpreting the results of any comparison since the IEA estimates may differ from a country's official submission for many reasons.

For most Annex II countries, the two calculations are expected to be within 5-10%, depending on the coverage of the fuel combustion sector in the national inventory. For some EIT and non-Annex I countries, differences may be larger. If the underlying energy data are different, more work is needed on the collecting and reporting of energy statistics.

In case of systematic biases in the energy data or emission factors, emission trends will usually be more reliable than the absolute emission levels. By comparing trends in the IEA estimates with trends in emissions as reported to the UNFCCC, it should be possible to identify definition problems or methodological differences.

Some of the reasons for these differences are:

- **The IEA uses a Tier 1 method to compute emissions estimates.**

For the calculation of CO_2 emissions from fuel combustion, the IEA uses a Tier 1 method. Countries may be using a more sophisticated Tier 2 or Tier 3 method that takes into account more detailed country-specific information available (e.g. on different technologies or processes).

- **Energy activity data based on IEA energy balances may differ from those used for the UNFCCC calculations.**

Countries often have several “official” data sources such as a Ministry, a Central Bureau of Statistics, a nationalised electricity company, etc. Data can also be collected from the energy suppliers, the energy consumers or customs statistics. The IEA Secretariat tries to collect the most accurate data, but does not necessarily have access to the complete data set that may be available to national experts calculating emission inventories for the UNFCCC. In addition to different sources, the methodology used by the national bodies providing the data to the IEA and to the UNFCCC may differ. For example, general surveys, specific surveys, questionnaires, estimations, combined methods and classifications of data used in national statistics and in their subsequent reclassification according to international standards may result in different series.

- **The IEA uses average net calorific values for oil products.**

To transform fuel consumption data from physical units to energy units, the IEA uses an average net calorific value (NCV) for each secondary oil product. These NCVs are region-specific and constant over time. Country-specific NCVs that can vary over time are used for NGL, refinery feedstocks and additives. Crude oil NCVs are further split into production, imports, exports and average. Different coal types have specific NCVs for production, imports, exports, inputs to main activity power plants and coal used in coke ovens, blast furnaces and industry, and can vary over time for each country.

Country experts may have more detailed data on calorific values available when calculating the energy content of the fuels. This in turn could produce different values than those of the IEA.

- **The IEA uses average carbon content values.**

The IEA uses the default carbon content values given in the 2006 GLs. Country experts may have better information available, allowing them to use country-specific values.

- **The IEA cannot allocate emissions from autoproducers into the end-use sectors.**

The 2006 GLs recommend that emissions from autoproduction should be included with emissions from other fuel use by end-consumers. At the same time, the emissions from the autoproduction of electricity and heat should be excluded from the energy transformation source category to avoid double counting. The IEA is not able to allocate the fuel use from autoproducers between industry and other. Therefore, this publication shows a category called “Unallocated autoproducers”. However, this should not affect the total emissions for a country.

- **Military emissions may be treated differently.**

According to the 2006 GLs, military emissions should be reported in Source/Sink Category 1 A 5, Non-Specified. Previously, the IEA questionnaires requested that warships be included in international marine bunkers and that the military use of aviation fuels be included in domestic air. All other military use should have been reported in non-specified other.

At the IEA/Eurostat/UNECE Energy Statistics Working Group meeting (Paris, November 2004), participants decided to harmonise the definitions used to collect energy data on the joint IEA/Eurostat/UNECE questionnaires with those used by the IPCC to report GHG inventories. As a result, starting in the 2006 edition of this publication, all military consumption should be reported in non-specified other. Sea-going versus coastal is no longer a criterion for splitting international and domestic navigation.

However, it is not clear whether countries are reporting on the new basis, and if they are, whether they will be able to revise their historical data. The IEA has found that in practice most countries consider information on military consumption as confidential and therefore either combine it with other information or do not include it at all.

The IEA estimates include all CO_2 emissions from fuel combustion. Countries may have included parts of these emissions in the IPCC category industrial processes and product use.

Although emissions totals would not differ, the allocation to the various sub-totals of a national inventory could. National GHG inventories submitted to the UNFCCC divide emissions according to source categories. Two of these IPCC Source/Sink Categories are energy, and industrial processes and product use. Care must be taken not to double count emissions from fuel combustion that occur within certain industrial processes (e.g. iron and steel). The IEA estimates in this publication include all the CO_2 emissions from fuel

combustion, while countries are asked to report some of them within the industrial processes and product use category under the 2006 GLs. See a more detailed discussion in the section IEA Estimates: Changes under the 2006 IPCC Guidelines.

- **The units may be different.**

The 2006 GLs ask that CO_2 emissions be reported in Gg of CO_2 (1 Gg = 1 kilotonne). A million tonnes of CO_2 is equal to 1 000 Gg of CO_2, so to compare the numbers in this publication with national inventories expressed in Gg, the IEA emissions must be multiplied by 1 000.

Macroeconomic drivers of CO_2 emissions trends

Tables and graphs presented online and in the overview for drivers refer to the decomposition of CO_2 emissions into four driving factors (Kaya identity)[10], which is generally presented in the form:

Kaya identity
$C = P\ (G/P)\ (E/G)\ (C/E)$

where:

C = CO_2 emissions;

P = population;

G = GDP;

E = primary energy consumption.

The identity expresses, for a given time, CO_2 emissions as the product of population, per capita economic output (G/P), energy intensity of the economy (E/G) and carbon intensity of the energy mix (C/E). Because of possible non-linear interactions between terms, the sum of the percentage changes of the four factors, e.g. $(P_y\text{-}P_x)/P_x$, will not generally add up to the percentage change of CO_2 emissions $(C_y\text{-}C_x)/C_x$. However, relative changes of CO_2 emissions in time can be obtained from relative changes of the four factors as follows:

[10]. Yamaji, K., Matsuhashi, R., Nagata, Y. Kaya, Y., *An integrated system for CO_2/Energy/GNP analysis: case studies on economic measures for CO_2 reduction in Japan*. Workshop on CO_2 reduction and removal: measures for the next century, March 19, 1991, International Institute for Applied Systems Analysis, Laxenburg, Austria.

Kaya identity: relative changes in time

$$C_y/C_x = P_y/P_x\ (G/P)_y/(G/P)_x\ (E/G)_y/(E/G)_x\ (C/E)_y/(C/E)_x$$

where x and y represent for example two different years.

In this publication, the Kaya decomposition is presented as:

CO_2 emissions and drivers

$$CO_2 = P\ (GDP/P)\ (TES/GDP)\ (CO_2/TES)$$

where:

CO_2 = CO_2 emissions;

P = population;

GDP[11]/P = GDP/population;

TES/GDP[11] = Total energy supply per GDP;

CO_2/TES = CO_2 emissions per unit TES.

Indices of all terms (2000 = 100 unless otherwise specified) are shown for each country and regional aggregate in Part II of the full publication, both in the Summary tables and in the individual country/region pages (Table 1, Key indicators, and Figure 6, CO_2 emissions and drivers). Note that in its index form, CO_2/TES corresponds to the Energy Sector Carbon Intensity Index (ESCII)[12].

The Kaya identity can be used to discuss the primary driving forces of CO_2 emissions. For example, it shows that, globally, increases in population and GDP per capita have been driving upwards trends in CO_2 emissions, more than offsetting the reduction in energy intensity. In fact, the carbon intensity of the energy mix is almost unchanged, due to the continued dominance of fossil fuels - particularly coal - in the energy mix, and to the slow uptake of low-carbon technologies.

However, it should be noted that there are important caveats in the use of the Kaya identity. Most important, the four terms on the right-hand side of equation should be considered

[11]. GDP based on purchasing power parities (PPP).
[12]. See the IEA publication Tracking Clean Energy Progress 2023.

neither as fundamental driving forces in themselves, nor as generally independent from each other.

Drivers of electricity generation emissions trends

Graphs present also the change in CO_2 emissions from electricity generation over time decomposed into the respective changes of four driving factors[13]:

CO_2 emissions from electricity generation
C = (C/E) (E/ELF) (ELF/EL) (EL)

where:

C = CO_2 emissions;

E = fossil fuel inputs to thermal generation;

ELF = electricity output from fossil fuels;

EL = total electricity output;

This can be rewritten as:

CO_2 emissions from electricity generation
C = (CF) (EI) (EFS) (EL)

where:

C = CO_2 emissions;

CF = carbon intensity of the fossil fuel mix;

EI = the reciprocal of fossil fuel based electricity generation efficiency;

EFS = share of electricity from fossil fuels;

EL = total electricity output.

[13]. M. Zhang, X. Liu, W. Wang, M. Zhou. *Decomposition analysis of CO_2 emissions from electricity generation in China.* Energy Policy, 52 (2013), pp. 159–165.

This decomposition expresses, for a given time, CO_2 emissions from electricity generation as the product of the carbon intensity of the fossil fuel mix (CF), the reciprocal of fossil fuel based thermal electricity generation efficiency (1/EF), the share of electricity from fossil fuels (EFS) and total electricity output (EL).

However, due to non-linear interactions between terms, if a simple decomposition is used, the sum of the percentage changes of the four factors, e.g. $(CF_y\text{-}CF_x)/CF_x$ may not perfectly match the percentage change of total CO_2 emissions $(C_y\text{-}C_x)/C_x$. To avoid this, a more complex decomposition method is required. In this case, the logarithmic mean divisia (LMDI) method proposed by Ang (2004)[14] has been used.

Using this method, the change in total CO_2 emissions from electricity generation (ΔC) between year t and a base year 0, can be computed as the sum of the changes in each of the individual factors as follows:

$$\Delta C = \Delta CF + \Delta EI + \Delta EFS + \Delta EL$$

where:

$$\Delta CF = L(C^t, C^0) ln\left(\frac{CF^t}{CF^0}\right)$$

$$\Delta EI = L(C^t, C^0) ln\left(\frac{EI^t}{EI^0}\right)$$

$$\Delta EFS = L(C^t, C^0) ln\left(\frac{EFS^t}{EFS^0}\right)$$

$$\Delta EL = L(C^t, C^0) ln\left(\frac{EL^t}{EL^0}\right)$$

and:

$$L(x, y) = (y - x)/(ln\, y - ln\, x)$$

This decomposition can be useful when analysing the trends in CO_2 emissions from electricity generation. For instance, it shows that globally, since 1990, the main driver of increased CO_2 emissions from electricity generation has been increased electricity output, with improvements in the overall thermal efficiency, and the CO_2 intensity of the electricity

[14]. B. W. Ang, Decomposition analysis for policymaking in energy: which is the preferred method?, Energy Policy, 32 (9) (2004), pp. 1131–1139.

generation mix being offset by an increase in the share of electricity derived from fossil fuel sources.

However, as is the case with the Kaya decomposition, it should be noted that the four terms on the right-hand side of equation should be considered neither as fundamental driving forces in themselves, nor as generally independent from each other. For instance, substituting coal with gas as a source of electricity generation would affect both the CO_2 intensity of the electricity generation mix and the thermal efficiency of generation.

Allocating indirect emissions

Indirect emissions are emissions deriving from the generation of electricity and heat which then are consumed by end use sectors. IEA includes all the emissions related to electricity and heat production into the transformation sector. In order to reallocate emissions of the transformation to end-use sectors the IEA has developed an internal methodology making use of the available data, which consisted in allocating emissions based on the total amount of electricity and heat consumed by each end use sector.

Starting with the 2020 edition, the IEA has adopted a new methodology which relies on multiplying electricity and heat consumption by electricity and heat specific emission factors. The new approach resolves some drawbacks existing in the previous methodology. In particular this new methodology allows assigning different emission factors to electricity and heat.

Specific emission factors are calculated by dividing the carbon dioxide emissions produced by the generation of electricity or heat by the electricity or heat consumed across all sectors, excluding transmission and distribution losses:

$$EF_{o,c,t} = \frac{\sum_{f,p}(I_{o,c,t,f,p} \cdot CC_{f})}{\left(\sum_{i} E_{i,o,c,t}\right)}$$

where:

EF = emission factor per unit of electricity or heat consumed, expressed in gCO_2/kWh

I: energy inputs to generate electricity or heat. Note that the IEA energy balances include only the data for combined input to CHP plants. Thus, the IEA adopts the fixed-heat-efficiency approach, which is based on fixing the efficiency of heat generation to compute the input to heat, and calculating the input to electricity as a residual from the total input. Please refer to the documentation file of the IEA 'Emission factors 2020 edition', section 4 for more details.

CC: default carbon content in tons of CO_2 per unit of energy (please refer to section 'CO_2 emissions from fuel combustion: key concepts' for more details)

E: electricity and heat used by end use sector i across final consumption and energy producing sectors

o: electricity or heat

i: end use sector, e.g. industry, transport, residential…

c: country

t: time

f: fuel type

p: represents the plant types in the IEA statistics (Main Activity Electricity Plant, Autoproducer Electricity Plant, Main Activity CHP plant, Autoproducer CHP plant, Main Activity Heat Plant and Autoproducer Heat Plant)

Then, the indirect emissions are calculated as:

$$IE_{i,c,t} = \sum_{o} EF_{o,c,t} \cdot E_{i,o,c,t}$$

where:

E: electricity and heat used by, country c, year t and end use sector I across final consumption and energy producing sectors

And the total emissions are calculated as:

$$TE_{i,c,t} = DE_{i,c,t} + : IE_{i,c,t}$$

Provisional year estimates

With the objective of increasing the timeliness of IEA greenhouse gas emission estimates, the IEA publishes provisional year estimates for total emissions from fuel combustion and emissions from electricity and heat production, based on a simplified methodology relying on provisional data for supply, as demand side data is not generally available for the most recent year.

Values are calculated based on provisional data for total energy supply (TES) by fuel category, and on their average carbon intensities for the latest two years, according to the following equation:

Provisional year GHG emissions from fuel combustion

$$GHG_y = \sum_i \left[\left(\frac{GHG_{y-1,i}}{TES_{y-1,i}} \right) + \left(\frac{GHG_{y-2,i}}{TES_{y-2,i}} \right) \right] / 2 \cdot TES_{y,i}$$

Where:

y: Provisional year

i: fuel category: coal, oil, natural gas, other (industrial waste + non-renewable municipal waste)

GHG_{y-1} *and* GHG_{y-2} : Previous years emissions from fuel combustion, calculated according to the 2006 GLs (sectoral approach).

Note: In the case of availability of full balance data, the provisional year estimates are developed based on a demand-side estimate in accordance with the estimates for historical years. For this edition of the database Brazil, Kenya and Argentina are the only three countries falling under this category.

For electricity and heat emissions, the data for the year Y includes for selected countries the breakdown of electricity generation by fuel type, but not the associated fuel inputs. The assumption used is that generation efficiency is constant compared to the year Y-1, as in the following equation:

Provisional year electricity and heat production emissions

$$ELECHEAT_{i,y} = (ELOUTPUT_{i,y} + HEATOUT_{i,y}) \times \mathbf{CO_2kWh}_{i,y-1}$$

Where:

CO2kWh: Carbon emission factors (in CO_2/kWh) for electricity and heat combined, for y-1**;**

$\boldsymbol{ELOUTPUT + HEATOUT}$**:** total electricity plus heat output (GWh);

$\boldsymbol{i}$**:** fuel type, e.g. anthracite, diesel, natural gas.

The table below includes the list of countries for which total and/or power generation provisional year estimates have been published in the 2025 edition:

Table 3. Geographical coverage for the provisional year

Flow	Countries
GHG Emissions from fuel combustion	All OECD member countries; Morocco, Albania, Armenia, Azerbaijan, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Georgia, Kazakhstan, Kosovo, Malta, Republic of Moldova, Montenegro, Republic of North Macedonia, Romania, Serbia.
Electricity and heat production emissions	All OECD member countries; Morocco, Albania, Armenia, Azerbaijan, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Georgia, Kazakhstan, Kosovo, Malta, Republic of Moldova, Montenegro, Republic of North Macedonia, Romania, Serbia.

IEA estimates: changes under the 2006 IPCC guidelines

The 2006 IPCC Guidelines methodology: key concepts

This section briefly presents the Tier 1 methodology to estimate CO_2 emissions from fuel combustion based on the 2006 GLs, outlining the main differences with the 1996 GLs - used for previous editions of this publication. The focus is on the key points relevant to the IEA estimation. For the complete methodology, the reader should refer to the full IPCC documents.[15]

Generally, the Tier 1 estimation of CO_2 emissions from fuel combustion for a given fuel can be summarised as follows:

CO_2 emissions from fuel combustion

$CO_2 = AD * NCV * CC * COF$

where:

CO_2 = CO_2 emissions from fuel combustion;

AD = Activity data;

NCV = Net calorific value;

CC = Carbon content;

COF = Carbon oxidation factor.

Emissions are then summed over all fuels.

While the basic concept of the calculation - the conservation of carbon - is unchanged, the 2006 GLs differ from the 1996 GLs in the:

[15]. Both the *1996 GLs* and the *2006 GLs* are available from the IPCC Greenhouse Gas Inventories Programme (*www.ipcc-nggip.iges.or.jp*).

- default net calorific values by product;
- default carbon content by product;
- default carbon oxidation factors;
- treatment of fuels used for **non-energy** purposes;
- **allocation** of fuel combustion emissions across the Energy and IPPU categories.

2006 Guidelines: overview of changes

This section describes the key methodological changes 2006 GLs for a Tier 1 estimation of CO_2 emissions from fuel combustion, with a short assessment of their impact on results.

Net calorific values

Net calorific values (NCVs) are used to convert the activity data for all the different fuels from "physical" units (e.g. tonnes) to "energy" units (e.g. Joules).

In the 1996 GLs, country-specific net calorific values were given for primary oil (crude oil and NGL), for primary coal and for a few secondary coal products. These NCVs were based on the average 1990 values of the 1993 edition of the IEA Energy Balances.

In the 2006 GLs, those country-specific NCVs were removed, and one default is provided for each fuel (with upper and lower limits, as done for the carbon content). Large differences were therefore observed for products whose quality varies a lot from country to country, such as primary oil and coal products. Replacing country-specific values with one default value would significantly affect emissions calculations if the default values were used.

The IEA CO_2 emissions from fuel combustion estimates are based on the IEA energy balances, computed using time-varying country-specific NCVs. Therefore, they are not affected by changes to the default net calorific values of the 2006 GLs.

Carbon content

Carbon content is the quantity of carbon per unit of energy of a given fuel. Some of the fuel-specific default values for carbon content, called “carbon emission factors” in the 1996 GLs, were revised in the 2006 GLs. In addition, values were added for some fuels not directly mentioned in the 1996 GLs.

As the carbon content may vary considerably for some fuels, the 2006 GLs introduced ranges of values, i.e. providing for each fuel a default value with lower and upper limits. The IEA CO_2 emissions are calculated using the IPCC default values.

A summary of the default carbon content values in the two set of guidelines is shown in Table 4. Relative changes between the 2006 GLs and the 1996 GLs range between -13.7% (refinery gas) and + 7.3% (blast furnace gas), although for many fuels the variation is minimal, or zero. Such systematic changes are reflected in Tier 1 CO_2 emissions estimates.

Carbon oxidation factors

A small fraction of the carbon contained in fuels entering the combustion process (typically less than 1-2%) is not oxidised. Under the 1996 GLs, this amount was subtracted from emissions in the calculations by multiplying the calculated carbon content of a fuel by a "fraction of carbon oxidised". The fraction of carbon oxidised had a value of less than 1.0, which had the effect of reducing the emissions estimate. However, in most instances, emissions inventory compilers had no "real" information as to whether this correction was actually applicable.

Therefore, in the 2006 GLs, it was decided that all carbon is assumed to be emitted by default, unless more specific information is available. Therefore, under the 2006 GLs, the default carbon oxidation factor is equal to 1 for all fuels.

A summary of the default carbon oxidation factors in the two set of guidelines is shown in Table 5. Relative changes from the 1996 GLs and the 2006 GLs are +0.5% for natural gas; +1% for oil, oil products and peat; and +2% for coal. Such changes are reflected in systematic increases in Tier 1 CO_2 emissions estimates.

Table 4. Comparison of default carbon content values*

Kilogrammes / gigajoule

Fuel Type	*1996 Guidelines*	*2006 Guidelines***	Percent Change
Anthracite	26.8	26.8	0.0%
Coking Coal	25.8	25.8	0.0%
Other Bituminous Coal	25.8	25.8	0.0%
Sub-Bituminous Coal	26.2	26.2	0.0%
Lignite	27.6	27.6	0.0%
Patent Fuel	25.8	26.6	+3.1%
Coke oven coke	29.5	29.2	-1.0%
Gas Coke	29.5	29.2	-1.0%
Coal Tar	..	22.0	x

Fuel Type	*1996 Guidelines*	*2006 Guidelines***	Percent Change
BKB	25.8	26.6	+3.1%
Gas Works Gas	..	12.1	x
Coke Oven Gas	13.0	12.1	-6.9%
Blast Furnace Gas	66.0	70.8	+7.3%
Other recovered gases	..	49.6	x
Peat	28.9	28.9	0.0%
Oil shale	29.1	29.1	0.0%
Natural Gas	15.3	15.3	0.0%
Crude Oil	20.0	20.0	0.0%
Natural Gas Liquids	17.2	17.5	+1.7%
Refinery Feedstocks	20.0	20.0	0.0%
Orimulsion	22.0	21.0	-4.5%
Refinery Gas	18.2	15.7	-13.7%
Ethane	16.8	16.8	0.0%
Liquefied petroleum gases (LPG)	17.2	17.2	0.0%
Motor Gasoline excl. biofuels	18.9	18.9	0.0%
Aviation Gasoline	18.9	19.1	+1.1%
Gasoline type jet fuel	18.9	19.1	+1.1%
Kerosene type jet fuel excl. bio	19.5	19.5	0.0%
Other Kerosene	19.6	19.6	0.0%
Gas/Diesel Oil excl. biofuels	20.2	20.2	0.0%
Fuel Oil	21.1	21.1	0.0%
Naphtha	20.0	20.0	0.0%
Lubricants	20.0	20.0	0.0%
Bitumen	22.0	22.0	0.0%
Petroleum Coke	27.5	26.6	-3.3%
Non-specified oil products	20.0	20.0	0.0%
Other hydrocarbons	20.0	20.0	0.0%
White Spirit & SBP	20.0	20.0	0.0%
Paraffin Waxes	20.0	20.0	0.0%

Fuel Type	*1996 Guidelines*	*2006 Guidelines***	Percent Change
Industrial Waste	..	39.0	x
Municipal Waste (non-renewable)	..	25.0	x

* "Carbon content" was referred to as the "carbon emission factor" in the *1996 GLs*.
** The *2006 GLs* also give the lower and upper limits of the 95 percent confidence intervals, assuming lognormal distributions.

Table 5. Comparison of default carbon oxidation factors*

Fuel Type	*1996 Guidelines*	*2006 Guidelines***	Percent Change
Coal	0.980	1.00	+2.0%
Oil and oil products	0.990	1.00	+1.0%
Natural gas	0.995	1.00	+0.5%
Peat **	0.990	1.00	+1.0%

* "Carbon oxidation factor" was referred to as "fraction of carbon oxidised" in the *1996 GLs*.
** The *1996 GLs* specified a carbon oxidation factor for peat used for electricity generation only.

Treatment of fuels used for non-energy purposes

Many hydrocarbons are used for non-energy purposes e.g. petrochemical feedstocks, lubricants, solvents, and bitumen. In some of these cases, the carbon in the fuel is quickly oxidised to CO_2, in other cases, it is stored (or sequestered) in the product, sometimes for as long as centuries.

In the 1996 IPCC GLs, Tier 1 Sectoral Approach emissions included emissions from fuels used for non-energy purposes. The share of carbon assumed to be stored (not emitted) was estimated based on default "fractions of carbon stored" (shown for reference in Table 6).

Table 6. Fraction of Carbon Stored in the *1996 GLs*

Fuel Type	*1996 Guidelines*
Naphtha*	0.8
Lubricants	0.5
Bitumen	1.0
Coal Oils and Tars (from coking coal)	0.75
Natural Gas*	0.33
Gas/Diesel Oil*	0.5
LPG*	0.8
Ethane*	0.8
Other fuels for non-energy use	To be specified

* When used as feedstocks.

Note: this table is included only for reference. CO_2 emissions from fuel combustion in this publication do not include emissions from non-energy use of fuels.

In the 2006 GLs, all deliveries for non-energy purposes are excluded. Numerically, excluding all non-energy use of fuel from energy sector emissions calculations is equivalent to applying a fraction of carbon stored equal to 1 to all quantities delivered for non-energy purposes.

In the case of a complete greenhouse gas inventory covering all IPCC Source/Sink categories, any emissions associated with non-energy use of fuels would be accounted in another Source/Sink category. However, as this publication only deals with CO_2 emissions from fuel combustion, emissions associated with non-energy use of fuels are no longer included in the IEA CO_2 emissions estimates.

Within the IEA estimates, the effect of this change is mainly noticeable for countries whose petrochemical sectors are large in comparison to the size of their economies, e.g. the Netherlands.

Assessing the overall impact of methodological changes on IEA estimates

Table 7 shows a comparison of IEA estimates of total CO_2 emissions from fuel combustion for the 2014 data (from the 2016 edition). Emissions are calculated using: i) the 1996 GLs Sectoral Approach, methodology as in previous publications, and ii) the 2006 GLs[16] - which correspond to the data published in this edition.

[16]. Including the emissions which may be reallocated from Energy to IPPU under the *2006 GLs*.

The overall impact of the change in methodology on the IEA estimates of CO_2 emissions from fuel combustion varies from country to country, mainly depending on the underlying fuel mix and on the relative importance of non-energy use of fuels in the total.

Most countries show a decrease in CO_2 emissions levels under the new methodology, as the reductions due to the removal of non-energy use emissions are generally larger than the systematic increase due to changes in the oxidation factor.

For the year 2014, reductions of 1% or greater are observed for sixty-five countries, with thirteen showing a decrease of 5% or more. The largest relative decreases are observed in countries with high non-energy use of fuels (mainly oil products and natural gas) relative to their total energy consumption: Trinidad and Tobago (-39%), Gibraltar (-17%), Lithuania (-14%), and Singapore (-13%), the Netherlands, Belarus and Brunei Darussalam (all 11%). As emissions from non-energy use of fuels are not included in energy sector emissions under the 2006 GLs, emissions previously attributed to non-energy use of oil products and natural gas are no longer included in IEA CO_2 emissions from fuel combustion estimates for these countries. One country, Curaçao presented a large increase (27%) in 2014. This was due to the inclusion of emissions from reported energy use of bitumen, which had been excluded (considered carbon stored / non-energy use) under the 1996 GLs.

Within the IEA databases, these changes will also be reflected in all indicators derived from CO_2 emissions totals (e.g. CO_2/TES, CO_2/GDP). Impacts on trends should be visible when the relative weight of the non-energy use of fuels changes in time.

However, as mentioned, most of the methodological changes would not have significant impact in the case of a complete inventory covering all IPCC source/sink categories; in particular, the reallocation of emissions between categories would not affect total emissions estimates, nor the overall trends.

Table 7. Comparison of IEA CO_2 emissions estimates for non-OECD Countries (2014 data, 2016 edition)

$MtCO_2$

Country	*1996 GLs CO_2 Sectoral Approach*	*2006 GLs CO_2 Fuel Combustion*[16]	Percent Change
World	**32903.3**	**32381.0**	**-1.6%**
Annex I Parties	**12852.2**	**12628.4**	**-2%**
Non-annex I Parties	**18932.1**	**18622.2**	**-2%**
OECD			

Country	*1996 GLs CO_2 Sectoral Approach*	*2006 GLs CO_2 Fuel Combustion*[16]	Percent Change
Australia	375.2	373.8	-0.4%
Austria	60.8	60.8	0.0%
Belgium	95.0	87.4	-8.0%
Canada	574.6	554.8	-3.4%
Chile	76.4	75.8	-0.8%
Czech Republic	98.4	96.6	-1.8%
Denmark	34.7	34.5	-0.6%
Estonia	17.5	17.5	0.0%
Finland	46.4	45.3	-2.4%
France	295.8	285.7	-3.4%
Germany	734.6	723.3	-1.5%
Greece	66.4	65.9	-0.8%
Hungary	41.3	40.3	-2.4%
Iceland	2.0	2.0	0.0%
Ireland	33.7	33.9	0.6%
Israel	66.3	64.7	-2.4%
Italy	325.7	319.7	-1.8%
Japan	1193.3	1188.6	-0.4%
Korea	589.5	567.8	-3.7%
Luxembourg	9.2	9.2	0.0%
Mexico	432.1	430.9	-0.3%
Netherlands	166.6	148.3	-11.0%
New Zealand	33.2	31.2	-6.0%
Norway	36.9	35.3	-4.3%
Poland	281.3	279.0	-0.8%
Portugal	43.2	42.8	-0.9%
Slovak Republic	29.9	29.3	-2.0%
Slovenia	12.6	12.8	1.6%
Spain	234.8	232.0	-1.2%
Sweden	38.7	37.4	-3.4%

Country	*1996 GLs CO_2 Sectoral Approach*	*2006 GLs CO_2 Fuel Combustion*[16]	Percent Change
Switzerland	37.7	37.7	0.0%
The Republic of Türkiye	304.8	307.1	0.8%
United Kingdom	409.0	407.8	-0.3%
United States	5235.9	5176.2	-1.1%
OECD Total	**12033.5**	**11855.6**	**-1.5%**

Country	*1996 GLs CO_2 Sectoral Approach*	*2006 GLs CO_2 Fuel Combustion*[16]	Percent Change
Non-OECD Europe and Eurasia			
Albania	4.3	4.1	-4.7%
Armenia	5.2	5.2	0.0%
Azerbaijan	31.3	30.8	-1.6%
Belarus	64.3	57.4	-10.7%
Bosnia and Herzegovina	21.2	21.6	1.9%
Albania	42.2	42.1	-0.2%
Croatia	15.8	15.1	-4.4%
Cyprus [17]	5.7	5.8	1.8%
Georgia	8.0	7.7	-3.8%
Gibraltar	0.6	0.5	-16.7%
Kazakhstan	220.3	223.7	1.5%
Kosovo	7.3	7.4	1.4%
Kyrgyzstan	8.3	8.4	1.2%
Latvia	6.7	6.7	0.0%
Lithuania	12.0	10.3	-14.2%
FYR of Macedonia	7.3	7.4	1.4%
Malta	2.3	2.3	0.0%
Republic of Moldova	7.2	7.2	0.0%
Montenegro	2.2	2.2	0.0%
Romania	69.0	68.2	-1.2%
Russian Federation	1525.3	1467.6	-3.8%
Serbia	37.9	38.1	0.5%
Tajikistan	4.6	4.7	2.2%
Turkmenistan	66.6	67.0	0.6%
Ukraine	239.6	236.5	-1.3%
Uzbekistan	101.0	97.9	-3.1%

[17]. Please refer to the section Geographical coverage and country notes.

Non-OECD Europe and Eurasia	**2516.4**	**2446.1**	**-2.8%**

Table 7. Comparison of IEA CO_2 emissions estimates for Non-OECD Countries (2014 data, 2016 edition)

$MtCO_2$

Country	*1996 GLs CO_2 Sectoral Approach*	*2006 GLs CO_2 Fuel Combustion*[16]	Percent Change
Non-OECD Africa			
Algeria	126.4	122.9	-2.8%
Angola	19.5	19.3	-1.0%
Benin	5.7	5.7	0.0%
Botswana	6.8	6.9	1.5%
Cameroon	6.0	6.0	0.0%
Congo	2.7	2.6	-3.7%
Cote d'Ivoire	4.6	4.7	2.2%
Dem. Rep. of Congo	9.3	9.4	1.1%
Egypt	181.1	173.3	-4.3%
Eritrea	0.6	0.6	0.0%
Ethiopia	9.2	9.1	-1.1%
Gabon	3.5	3.5	0.0%
Ghana	13.3	13.1	-1.5%
Kenya	12.3	12.4	0.8%
Libya	48.1	47.9	-0.4%
Mauritius	3.9	4.0	2.6%
Morocco	53.0	53.1	0.2%
Mozambique	3.8	3.9	2.6%
Namibia	3.6	3.6	0.0%
Niger	2.0	2.0	0.0%
Nigeria	61.9	60.2	-2.7%
Senegal	6.4	6.3	-1.6%
South Africa	442.3	437.4	-1.1%
South Sudan	13.9	13.3	-4.3%
Sudan	1.5	1.5	0.0%

Country	*1996 GLs CO_2 Sectoral Approach*	*2006 GLs CO_2 Fuel Combustion*[16]	Percent Change
United Rep. of Tanzania	10.4	10.4	0.0%
Togo	1.7	1.7	0.0%
Tunisia	25.0	25.0	0.0%
Zambia	3.3	3.2	-3.0%
Zimbabwe	11.4	11.5	0.9%
Other non-OECD Africa	32.3	31.0	-4.0%
Non-OECD Africa	**1125.6**	**1105.3**	**-1.8%**
Non-OECD Asia Oceania (excl. China)			
Bangladesh	63.9	62.3	-2.5%
Brunei Darussalam	7.5	6.7	-10.7%
Cambodia	6.0	6.1	1.7%
DPR of Korea	37.0	37.8	2.2%
India	2038.9	2019.7	-0.9%
Indonesia	442.3	436.5	-1.3%
Malaysia	227.5	220.5	-3.1%
Mongolia	17.8	18.2	2.2%
Myanmar	19.6	19.6	0.0%
Nepal	5.8	5.9	1.7%
Pakistan	141.0	137.4	-2.6%
Philippines	94.5	95.7	1.3%
Singapore	50.9	45.3	-11.0%
Sri Lanka	16.5	16.7	1.2%
Chinese Taipei	260.9	249.7	-4.3%
Thailand	263.1	243.5	-7.4%

Country	*1996 GLs CO_2 Sectoral Approach*	*2006 GLs CO_2 Fuel Combustion*[16]	Percent Change
Vietnam	143.7	143.3	-0.3%
Other non-OECD Asia Oceania	41.7	42.1	1.0%
Non-OECD Asia Oceania (excl. China)	**3878.8**	**3807.0**	**-1.9%**
China			
People's Republic of China	9199.1	9087.0	-1.2%
Hong Kong (China)	47.3	47.9	1.3%
China (incl. Hong Kong)	**9246.4**	**9134.9**	**-1.2%**
Non-OECD Americas			
Argentina	195.3	192.4	-1.5%
Plurinational State of Bolivia	18.2	18.3	0.5%
Brazil	492.6	476.0	-3.4%
Cuba	29.6	29.4	-0.7%
Curaçao	3.7	4.7	27.0%
Dominican Republic	19.5	19.3	-1.0%
Ecuador	38.7	38.7	0.0%
El Salvador	5.9	5.9	0.0%
Guatemala	16.1	16.1	0.0%
Haiti	2.7	2.8	3.7%
Honduras	8.7	8.7	0.0%
Jamaica	7.1	7.2	1.4%
Nicaragua	4.5	4.5	0.0%

Country	*1996 GLs CO_2 Sectoral Approach*	*2006 GLs CO_2 Fuel Combustion*[16]	Percent Change
Panama	10.6	10.6	0.0%
Paraguay	5.2	5.2	0.0%
Peru	48.4	47.8	-1.2%
Suriname	2.0	2.0	0.0%
Trinidad and Tobago	38.0	23.2	-38.9%
Uruguay	6.5	6.3	-3.1%
Bolivarian Republic of Venezuela	155.5	155.0	-0.3%
Other non-OECD Americas	19.9	20.1	1.0%
Non-OECD Americas	**1209.0**	**1173.9**	**-2.9%**
Non-OECD Middle East			
Bahrain	31.8	29.7	-6.6%
Islamic Republic of Iran	576.1	556.1	-3.5%
Iraq	140.2	141.0	0.6%
Jordan	23.9	24.1	0.8%
Kuwait	88.4	86.1	-2.6%
Lebanon	22.1	22.4	1.4%
Oman	63.1	59.9	-5.1%
Qatar	82.7	77.6	-6.2%
Saudi Arabia	521.4	506.6	-2.8%
Syrian Arab Republic	28.1	27.6	-1.8%
United Arab Emirates	175.8	175.4	-0.2%
Yemen	21.1	21.3	0.9%
Non-OECD Middle East	**1774.7**	**1727.8**	**-2.6%**

Non-CO_2 greenhouse gas emissions from fuel combustion

With the objective to increase the scope of greenhouse gas emissions reported, the IEA has included estimates for non-CO_2 greenhouse gases from fuel combustion starting the 2021 edition of this publication.

Similar to the estimates for the CO_2 emissions from fuel combustion and considering the type and level of disaggregation of activity data available at country level, the Tier 1 methodology from the 2006 IPCC Guidelines for GHG inventories have been adopted for the purpose of these estimates.

Unlike CO_2, the non-CO_2 greenhouse gas emissions from fuel combustion are strongly dependent on the technology used. Since the set of technologies, applied in each sector vary considerably, the guidelines do not provide default emission factors for these gases on the basis of fuels only. However, sector-specific Tier 1 default emission factors can provide a reasonable estimate for these emissions.

For estimating the emissions corresponding to stationary combustion, the default Tier 1 non-CO_2 emission factors provided in the 2006 GLs, assume effective combustion in high temperature. As such, the factors are good representation for steady and optimal conditions and do not take into account the impact of start-ups, shutdowns or combustion with partial loads. The emission factors provided for CH_4 and N_2O in the 2006 GLs, are based on the 1996 IPCC Guidelines and have been established by a large group of inventory experts. However, due to the absence of sufficient measurements and since the concept of conservation of carbon does not apply in the case of non-CO_2 gases, the uncertainty range associated with these estimates are set at a factor of three.

When compared to the latest published scientific research, the default IPCC published emission factor corresponding to combustion of solid biomass is deemed to be underestimating methane emissions from traditional cook stoves. In the absence of granular data corresponding to cooking in the IEA World Energy Balances database, the consumption of primary solid biomass in the residential sector in non–OECD countries excluding Eurasia has been considered as traditional. This convention is largely in alignment with the methodology used for estimating the Sustainable Development Goal 7, indicator 7.2.1. For the above selected set of countries, the upper range of IPCC emission factor for residential consumption of solid biomass has replaced the default value. This methodology reflects the impact of higher levels of incomplete combustion in

traditional stoves and is consistent with the estimates published in the World Energy Outlook Special Report on Clean Cooking. Please refer to section on *Non-CO_2 greenhouse gas emissions from fuel combustion* for additional details.

Similarly, for mobile combustion, the non-CO_2 emission factors are more difficult to estimate accurately than those for CO_2, as they will depend on vehicle technology, fuel and operating characteristics. The distance-based activity data (i.e vehicle-kilometres travelled) and information corresponding to disaggregated fuel combustion are typically less accurate. Moreover, the CH_4 and N_2O emission rates are largely dependent on the combustion and emission control system of the vehicles. As a result, default fuel-based emission factors are highly uncertain. However, the Tier 1 method does allow using fuel-based emission factors if it is not possible to estimate fuel consumption by vehicle type.

The emissions figures are converted from gCH_4 and gN_2O to gCO_{2eq} using the 100-year Global warming potential (GWP). The GWP is a metric which allows comparisons of the global warming impacts of different gases. Specifically, it is a measure of how much energy the emissions of 1 ton of a gas will absorb over a given period of time, relative to the emissions of 1 ton of carbon dioxide. The larger the GWP, the more that a given gas warms the earth compared to CO_2 over that time period. For the purpose of comparability with international data submission guidelines and based on *Decision 18/CMA.1* from UNFCCC's Measurement, Reporting and Verification (MRV) framework, the factors from the 5th Assessment of the IPCC are used.

Table 8. AR5 GWP100 factors

Type of GHG	AR5 GWP100	AR6 GWP100
CH_4	28	27
N_2O	265	273

Table 8 below summarizes the non-CO_2 Tier 1 emission factors used by IEA for the purpose of these estimates. Users can refer to chapters 2 and 3 of the 2006 GLs for the complete methodology and underlying assumptions.

Table 9. Sources of non-CO_2 emission factors for the IEA estimates

Sector	Chapter	Table	Notes
Energy Industries (including electricity and heat production)	Chapter 2 – Stationary Combustion	Table 2.2	Default sector-specific emission factors

Sector	Chapter	Table	Notes
Industry	Chapter 2 – Stationary Combustion	Table 2.3	Default sector-specific emission factors
Commercial and public services	Chapter 2 – Stationary Combustion	Table 2.4	Default sector-specific emission factors
Residential	Chapter 2 – Stationary Combustion	Table 2.5	Default sector-specific emission factors*
Agriculture/forestry	Chapter 2 – Stationary Combustion	Table 2.5	Default sector-specific emission factors
Fishing	Chapter 2 – Stationary Combustion	Table 2.5	Default sector-specific emission factors
Final consumption - Other - Not elsewhere specified	Chapter 2 – Stationary Combustion	N/A	Estimated based on the global weighted average of final sectors and the respective default sector-specific emission factors
Road	Chapter 3 – Mobile Combustion	Table 3.2.2	Default sector-specific emission factors**
Rail	Chapter 3 – Mobile Combustion	Table 3.4.1	Default sector-specific emission factors***
Internal navigation	Chapter 3 – Mobile Combustion	Table 3.5.3	Default sector-specific emission factors
Domestic aviation	Chapter 3 – Mobile Combustion	Table 3.6.5	Default sector-specific emission factors
Transport - Not elsewhere specified	Chapter 3 – Mobile Combustion	N/A	Estimated based on the global weighted average of transport modes and the respective default sector-specific emission factors
International marine bunkers	Chapter 3 – Mobile Combustion	Table 3.5.3	Default sector-specific emission factors
International aviation bunkers	Chapter 3 – Mobile Combustion	Table 3.6.5	Default sector-specific emission factors

* As discussed, for residential consumption of primary solid biomass in non-OECD countries excluding Eurasia, the upper limit of the methane emission factor has been selected. This methodology reflects the impact of higher levels of incomplete combustion in traditional stoves.

** Based on the following assumptions: 1) A 50% split between the uncontrolled and oxidation catalyst combustion for the motor gasoline fleet. 2) Similar emission factors as diesel for kerosene, white spirit, lubricants and bitumen. 3) For biodiesel and biogasoline, the EPA emission factors for light duty vehicles and the fuel economy figures provided in the 2006 IPCC Guidelines are used to estimate the emission factors.

*** Based on the following assumptions: 1) Similar emission factor as other bituminous coal for all coal products 2) Similar emission facto as diesel for all oil products 3) Similar emission factor as Commercial and public services for solid bio fuels.

Fugitive emissions

With the objective to increase the scope of greenhouse gas emissions reported, the IEA has included estimates for carbon dioxide and methane emissions for the category 1.B of the 2006 IPCC Guidelines for GHG inventories, for recent years. Data were derived from the ongoing IEA work on methane emissions[18]. For detailed information on methodologies and definitions, please consult the 2025 IEA Global Methane Tracker documentation[19].The approach adopted to estimating methane and carbon dioxide emissions from global coal, oil and gas operations is bottom-up: country-specific and production type-specific emission intensities are applied to production and consumption data. For the case of oil and gas related fugitive emissions, the starting points were emission intensities for upstream and downstream oil and gas in the United States, based on the 2024 greenhouse gas inventory of the United States along with a range of other data sources, including an IEA survey of companies and countries. The United States intensities were then scaled to obtain intensities for all other countries, based upon a range of auxiliary country-specific data and information. Scaling factors were finally applied to production (for upstream emissions) or consumption (for downstream emissions) of oil and gas within each country.

For the case of coal related fugitive emissions, the US Environmental Protection Agency's Greenhouse Gas Reporting Program and separate data sources providing disaggregated estimates for China, India and Australia were used as starting points. The mine-level estimates generated are then aggregated, verified and calibrated against the country-based estimates taken from satellites and atmospheric readings. From there, additional criteria including coal quality, mine depth and regulatory oversight were used as key factors to estimate emission intensities for mine in other countries for which there are no reliable direct measurements.

Additionally, the IEA Methane Tracker integrates results from publicly-reported, credible sources where data has become available including emissions detected by satellites and comprehensive measurement studies. Changes in the atmospheric concentration of methane can be used to estimate the rate of emissions from a source that would have caused such a change. This is done based on data processing by Kayrros, an earth observation firm, to convert readings of concentrations to identify large sources of emissions from oil and gas operations. Reported emissions encompass individual methane sources above 5 tonnes per hour as well as clusters of smaller sources in dense areas (e.g. shale plays). Estimates are

[18]. Accessible at: https://www.iea.org/reports/global-methane-tracker-2025

[19] Available at: https://iea.blob.core.windows.net/assets/451af9a0-8736-40dc-b843-69275d6fdb07/GlobalMethaneTracker2025Documentation.pdf

also provided using “basin-level inversions”, which use satellite readings to assess methane emissions across a wider oil and gas production region; the same approach is also used to measure the methane footprint of coal basins. More information is available on the IEA Global Methane Tracker documentation[45].

The emissions figures are converted from gCH_4 using the 100-year Global warming potential (GWP). For the purpose of comparability with international data submission guidelines and based on Decision 18/CMA.1 from UNFCCC’s Measurement, Reporting and Verification (MRV) framework, the factors from the 5th Assessment of the IPCC are used.

Fugitive emissions estimates are available for 98 countries covering the large majority of the World’s fugitive emissions. The IEA also provides estimates for 18 regional aggregates, including World. A detailed list covering geographical availability can be found down below.

Table 10. Geographical availability for fugitive emissions

Country/Region
Countries: Australia, Canada, Colombia, Denmark, Estonia, France, Germany, Israel, Italy, Japan, Korea, Mexico, Netherlands, New Zealand, Norway, Poland, Slovenia, Sweden, United Kingdom, United States, Egypt, Kenya, Morocco, Senegal, South Africa, Argentina, Brazil, India, Indonesia, Thailand, People's Republic of China, Romania, Ukraine. **Regions**: OECD Total, OECD Americas, OECD Asia Oceania, OECD Europe, European Union (27), European Union (28), G7

Units and conversions

General conversion factors for energy

To	TJ	Gcal	Mtoe	MBtu	GWh
From:	multiply by:				
terajoule (TJ)	1	2.388×10^{2}	2.388×10^{-5}	9.478×10^{2}	2.778×10^{-1}
gigacalorie (Gcal)	4.187×10^{-3}	1	1.000×10^{-7}	3.968	1.163×10^{-3}
million tonnes of oil equivalent (Mtoe)	4.187×10^{4}	1.000×10^{7}	1	3.968×10^{7}	1.163×10^{4}
million British thermal units (MBtu)	1.055×10^{-3}	2.520×10^{-1}	2.520×10^{-8}	1	2.931×10^{-4}
gigawatt hour (GWh)	3.600	8.598×10^{2}	8.598×10^{-5}	3.412×10^{3}	1

Conversion factors for mass

To	kg	t	lt	st	lb
From:	multiply by:				
kilogramme (kg)	1	1.000×10^{-3}	9.842×10^{-4}	1.102×10^{-3}	2.205
tonne (t)	1.000×10^{3}	1	9.842×10^{-1}	1.102	2.205×10^{3}
long ton (lt)	1.016×10^{3}	1.016	1	1.120	2.240×10^{3}
short ton (st)	9.072×10^{2}	9.072×10^{-1}	8.929×10^{-1}	1	2.000×10^{3}
pound (lb)	4.536×10^{-1}	4.536×10^{-4}	4.464×10^{-4}	5.000×10^{-4}	1

Conversion factors for volume

To	gal U.S.	gal U.K.	bbl	ft^3	l	m^3
From:	multiply by:					
U.S. gallon (gal U.S.)	1	8.327×10^{-1}	2.381×10^{-2}	1.337×10^{-1}	3.785	3.785×10^{-3}
U.K. gallon (gal U.K.)	1.201	1	2.859×10^{-2}	1.605×10^{-1}	4.546	4.546×10^{-3}
barrel (bbl)	4.200×10^{1}	3.497×10^{1}	1	5.615	1.590×10^{2}	1.590×10^{-1}
cubic foot (ft^3)	7.481	6.229	1.781×10^{-1}	1	2.832×10^{1}	2.832×10^{-2}
litre (l)	2.642×10^{-1}	2.200×10^{-1}	6.290×10^{-3}	3.531×10^{-2}	1	1.000×10^{-3}
cubic metre (m^3)	2.642×10^{2}	2.200×10^{2}	6.290	3.531×10^{1}	1.000×10^{3}	1

Decimal prefixes

10^{1}	deca (da)	10^{-1}	deci (d)
10^{2}	hecto (h)	10^{-2}	centi (c)
10^{3}	kilo (k)	10^{-3}	milli (m)
10^{6}	mega (M)	10^{-6}	micro (μ)
10^{9}	giga (G)	10^{-9}	nano (n)
10^{12}	tera (T)	10^{-12}	pico (p)
10^{15}	peta (P)	10^{-15}	femto (f)
10^{18}	exa (E)	10^{-18}	atto (a)

Tonne of CO_2

The 2006 GLs and the UNFCCC Reporting Guidelines on Annual Inventories both ask that CO_2 emissions and removals be reported in Gg (gigagrammes) of CO_2. A million tonnes of CO_2 is equal to 1 000 Gg of CO_2, so to compare the numbers in this publication with national inventories expressed in Gg, multiply the IEA emissions by 1 000.

Other organisations may present CO_2 emissions in tonnes of carbon instead of tonnes of CO_2. To convert from tonnes of carbon, multiply by 44/12, which is the molecular weight ratio of CO_2 to C.

Abbreviations

CO_2	carbon dioxide
CH_4	Methane
N_2O	Nitrous oxide
CO_{2eq}	Carbon dioxide equivalent
Btu	British thermal unit
BKB	Brown coal briquettes (braunkohlebriketts)
Gg	gigagramme
GJ	gigajoule
GWh	gigawatt hour
J	joule
kcal	kilocalorie
kg	kilogramme
kt	thousand tonnes
ktoe	thousand tonnes of oil equivalent
kWh	kilowatt hour
MJ	megajoule
Mt	million tonnes
Mtoe	million tonnes of oil equivalent
$MtCO_2$	million tonnes of carbon dioxide
m^3	cubic metre
PJ	petajoule
t	metric ton = tonne = 1 000 kg
tC	tonne of carbon
TJ	terajoule
toe	tonne of oil equivalent = 10^7 kcal
CC	carbon content
CEF	carbon emission factor
COF	carbon oxidation factor
CHP	combined heat and power
GCV	gross calorific value
GDP	gross domestic product
GWP	global warming potential
NCV	net calorific value
PPP	purchasing power parity
TES	total energy supply
Convention	United Nations Framework Convention on Climate Change
COP	Conference of the Parties to the Convention
G20	Group of Twenty (See the section *Geographical coverage and country notes*)
IEA	International Energy Agency
IPCC	Intergovernmental Panel on Climate Change
IPPU	Industrial Processes and Product Use

OECD	Organisation for Economic Co-Operation and Development
UN	United Nations
UNFCCC	United Nations Framework Convention on Climate Change
..	not available
x	not applicable

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