Energy Projections of IEA Countries – National Data 2025

Database documentation

International Energy Agency

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INTERNATIONAL ENERGY AGENCY

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This documentation provides support information for the Energy Projections of IEA Countries – National Data database.

This database includes: i) energy system projections to 2030, 2040 and 2050 based on national scenario modelling in the format of simplified balances, where available, for twenty-eight among IEA member countries, accession countries, and the European Union, as collected from national administrations; together with summary balances for historical years for all IEA member countries; ii) a set of transition indicators (e.g., greenhouse gas emission estimates, intensities, emissions factors, etc) developed based on the data collected from countries, consistent with the methodologies adopted by the IEA in the relevant historical databases.

This document can be found online at:

https://www.iea.org/data-and-statistics/data-product/energy-projections-of-iea-countries-national-data

Please address your inquiries to SLT@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

This section refers to changes of the database as compared to the 2024 edition of *Energy Projections of IEA Countries – with Extended Transitions Indicators* database.

Database name change

Following the discontinuation of the Projections: Energy Policies of IEA Countries database which was historically disseminated alongside this database, since 2024, the name of this publication has been revised from Energy Projections of IEA Countries – with Extended Transitions Indicators to Energy Projections of IEA Countries –National Data.

Database dissemination

In January 2025, the IEA has transitioned from its primary bulk data dissemination tool (Beyond2020 WDS web platform and IVT file format) to the open source .STAT SUITE platform, specifically the .Stat Data Explorer.

The .STAT SUITE Data Explorer has been selected because of its efficient and well-tuned navigation and search approach, the availability of appropriate data previews and contextual metadata, and the capacity to download data in standard formats. The decision to move platforms was also motivated by the widespread use of .STAT by IEA member government national statistical offices and by the role of the OECD Statistics and Development Directorate which oversees the management of the SIS-CC consortium and development of the .STAT platform.

*Following this transition, users will still be able to access Beyond2020 IVT files that they previously downloaded, but the IEA will no longer update or disseminate these files. Users will continue to have access to *.TXT files through their account on the IEA website. However, our objective is to discontinue disseminating data in *.TXT format over the course of 2025.*

The short names included in this document have been updated to improve harmonisation across IEA datasets. As of the 2025 release, the datasets in .Stat Data Explorer include different short names than the legacy IVT and TXT files.

Change of the Global Warming Potential values

At the Conference of the Parties (COP) 26 there was an agreement for the global community to report greenhouse gas emission inventories using the IPCC 5th Assessment Report (AR5) published GWP100 figures starting from year 2024 (Decision 18/CMA.1). This choice supersedes the original guidance (Decision 24/CP.19), based on which non-CO_2 emissions were to be reported using the GWP 100 figures published by AR4.

To keep aligned with the latest guidelines for national data submissions to UNFCCC, the non-CO_2 emission estimates included in this edition of the database are now developed based on the AR5 metrics, as detailed in table below. This decision impacts the estimates of non-CO_2 emissions comparing to the previous editions of this database.

Type of GHG	Previous metrics: AR4 GWP100	New metrics: AR5 GWP100
CH_4	25	28
N_2O	298	265

Data qualification

For the 2025 release, the IEA Secretariat only qualifies not available and estimated data.

New country additions

In February 2025, Latvia became the 32nd member of the IEA and, starting this year, projections data for Latvia are available.

Energy Projections of IEA Countries – National Data: Introduction

National projections have become more and more relevant within the evolving landscape of commitments taken by many countries globally. To accelerate energy transitions, long-term perspectives are essential in planning national energy systems and analysing their socio-economic and environmental impacts. Governments and other data users benefit from these projections for monitoring the progress towards national energy and climate targets, refining energy models and informing policy reviews and recommendations.

The IEA has historically collected information on energy balances projections from its members, with data up to the year 2050[1]. This data collection has supported the IEA In-depth reviews of energy policies, under the guidance of the Standing Group for Long-Term Cooperation (SLT) committee and has been the basis for the historically published annual Energy Policies of IEA Countries database.

To better support policy assessment in an evolving energy landscape, such data collection was upgraded over the last years through an extensive consultation of national administrations' data providers and other experts, and the feedback from the SLT committee. The main upgrades of the questionnaire were the definition of four categories of scenarios, with an associated request to countries to share multiple projections when available; and the addition of data for new and emerging technologies within the projections of energy balances. The Secretariat also improved the questionnaire functionalities and developed a broader set of transitions indicators with the objective of facilitating overall tracking to countries and data users alike.

In line with the recent revamp of the projections questionnaire, Energy Projections of IEA Countries – National Data is a newly designed IEA database comprising national projections of upgraded energy balances, and a new extended set of

[1] The SLT energy projections questionnaire and its associated *Questionnaire Compiler's Guide* are available at: https://www.iea.org/about/data-and-statistics/questionnaires.

transitions indicators developed by the Secretariat based on the projections of national energy balances.

Database structure

This database includes projections for energy balances, and a broad set of energy transitions indicators developed based on the data submitted by national administrations. The set of indicators, useful for monitoring energy transitions and climate objectives includes greenhouse gas (GHG) emissions by product and sector; various intensities [e.g., CO2/TES, CO2/GDP], various socio-economic indicators among other relevant indicators. This database includes annual data for:

- *countries: IEA member and Accession countries and European Union (see sections Data availability, Geographical coverage and Country notes for details on availability of projections by country);*
- *years: historical: 1960, 1970, 1980, 1990, 2000, 2010, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023 and projections: 2030, 2040 and 2050, unless otherwise specified. Note: data for historical years are available for all countries described above; data for projections are available for a smaller set.*
- *scenarios: up to five scenario categories, where available (see sections Data availability and Country notes for details on availability of scenarios by country);*

The database includes the following two databases:

Energy balances
Energy balances in matrix form (18 product categories; 25 flows) (Mtoe and TJ).

Transition Indicators
85 energy, economic and coupled indicators (various units).

Detailed definitions of each flow and product are presented in sections Flow dimension and Product dimension.

The historical energy balances data (up to year 2023) are derived from the IEA World energy balances (2025 edition) publication, while some of the historical transition indicators are derived from the IEA Greenhouse Gas Emissions from Energy (2025 edition) database. Projections based on national scenario modelling in the format of simplified balances, where available, are collected directly from the *member countries and are used to develop the corresponding transition indicators for the projection years.*

Qualifiers

Data published in the Energy Balances Database are what countries submit to the IEA Secretariat and can be partial. The IEA Secretariat only qualifies not available and estimated data, and does not qualify partial flows.

Definitions

Note: The short names included in this document have been updated to improve harmonisation across IEA datasets. This document, the datasets in the .Stat Data Explorer and the new TXT files may include different short names than previous releases.

Scenario dimension

The database includes projections data corresponding to multiple scenario categories, if available at national level, for example corresponding to different pathways (business as usual, more or less ambitious targets, etc).

The "scenario" dimension includes different scenario categories including: business as usual, stated policies, achieving national targets, achieving defined outcomes and other.

The "scenario" categories do not correspond to the included historical data. Hence, for all countries, the historical data have been disseminated under the scenario categories corresponding to the submitted projections data. If projections data are not submitted, the historical data have been disseminated under the "business as usual" category. Additionally, in a handful of cases, where the projections data submitted to the IEA doesn't correspond to the 2024/2025 submission cycle and due to the absence of information regarding the category of the underlying scenario, the figures are disseminated under the "business as usual" category.

If projections data corresponding to multiple scenarios have been collected from a country, while the country has classified more than one of the submitted scenarios under the same scenario cluster, one of the two scenarios has been disseminated under the "other" category to allow differentiation in between the two sets of data.

Please refer to the scenario categorisation section for additional details.

Scenario	Short name	Definition
Business as usual	BAU	The "business as usual" scenario category aims to capture scenarios that include only government policies which have been already adopted, and therefore project how the national energy landscape may evolve if the existing structures in energy supply and demand remain unchanged.
Stated policies	STEPS	The "stated policies" scenario category aims to capture scenarios that take into account national climate and/or energy-related policies and measures which have been already adopted by the government, together with pertinent policy proposals, announced commitments and plans which have been announced but are yet to be formally adopted.
Aspirational - achieving national targets	ASPTARGET	Scenarios within this category set an energy pathway consistent with specific target(s). By this means, they demonstrate what should be achieved across sectors and by various actors and by when, for the targets to be achieved. For example, a net zero scenario could set out a pathway for the national energy sector to achieve net zero emissions by a certain year. Or a Paris Agreement compliant scenario demonstrates a pathway consistent with the goal of limiting the global increase in temperature to 2 or 1.5°C (with a certain probability).
Aspirational - achieving defined outcomes	ASPOUTCOME	Scenarios within this category set an energy pathway consistent with particular desired outcome(s). By this means, they demonstrate what should be achieved across sectors and by various actors and by when, for the outcome(s) to be achieved. Examples include scenarios consistent with achieving affordability of energy sources or long/short-term energy security purposes. Some scenarios could have multiple desired outcomes.
Other	OTHER	Scenarios which do not fall under any of the above general categories can be reported under this option. Additionally, If projections data corresponding to multiple scenarios have been collected from a country, while the country has classified more than one of the submitted scenarios under the same scenario cluster, one of the two scenarios has been disseminated under the "other" category to allow differentiation in between the two sets of data.

Flow dimension

The flows corresponding to the energy balance file are detailed in the table below:

Energy balances

Flow	Short name	Definition
Indigenous production	INDPROD	Comprises the production of primary energy, i.e. hard coal, lignite, peat, crude oil, NGLs, natural gas, biofuels and waste, nuclear, hydro, geothermal, solar and the heat from heat pumps that is extracted from the ambient environment (only heat generated from heat pumps that is sold to third parties is included in the energy balance). Production is calculated after removal of impurities (e.g. sulphur from natural gas).
Imports	IMPORTS	Comprise amounts having crossed the national territorial boundaries of the country whether or not customs clearance has taken place. *For coal:* Imports comprise the amount of fuels obtained from other countries, whether or not there is an economic or customs union between the relevant countries. Coal in transit should not be included. *For oil and natural gas*: Quantities of crude oil and oil products imported under processing agreements (i.e. refining on account) are included. Quantities of oil in transit are excluded. Crude oil, NGL and natural gas are reported as coming from the country of origin; refinery feedstocks and oil products are reported as coming from the country of last consignment. Imported LNG which is exported to another country after regasification is considered both as an import and as an export of gas. *For electricity:* Amounts are considered as imported when they have crossed the national territorial boundaries of the country. If electricity is "wheeled" or transited through a country, the amount is shown as both an import and an export.
Exports	EXPORTS	Comprise amounts having crossed the national territorial boundaries of the country whether or not customs clearance has taken place. *For coal:* Exports comprise the amount of fuels supplied to other countries, whether or not there is an economic or customs union between the relevant countries. Coal in transit should not be included. *For oil and natural gas:* Quantities of crude oil and oil products exported under processing agreements (i.e. refining on account) are included. Re-exports of oil imported for processing within bonded areas are shown as an export of product from the processing country to the final destination. Imported LNG which is exported to another country after regasification is considered both as an import and as an export of gas.

Flow	Short name	Definition
		For electricity: Amounts are considered as exported when they have crossed the national territorial boundaries of the country. If electricity is "wheeled" or transited through a country, the amount is shown as both an import and an export.
International marine bunkers	BUNKERS_MARINE	Covers those quantities delivered to 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.
International aviation bunkers	BUNKERS_AVIATION	Includes deliveries of aviation fuels to 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. For many countries this incorrectly excludes fuel used by domestically owned carriers for their international departures.
Stock change (national territory)	STCHANAT	Reflects the difference between opening stock levels on the first day of the year and closing levels on the last day of the year of stocks on national territory held by producers, importers, energy transformation industries and large consumers. A stock build is shown as a negative number, and a stock draw as a positive number.
Total energy supply	TES	Total energy supply (TES) is made up of production + imports - exports - international marine bunkers - international aviation bunkers ± stock changes. Note, exports, bunkers and stock changes incorporate the algebraic sign directly in the number.
Transformation processes and own use	TRANENER	Shows the total of the energy transformation activities ("Electricity, CHP and heat plants" and "Other transformation processes") and energy used by energy-producing plants and losses ("Energy industry own use and distribution losses").
Electricity, CHP and heat plants	ELECHEAT	"Electricity, CHP and heat plants" should contain inputs of each fuel for the production of electricity and heat. This flow includes both main activity producers and autoproducer plants. However, for autoproducers 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. Notes: 1. Gross generation from hydro plants should not

Flow	Short name	Definition
		include that generated by pumped storage. The energy absorbed for pumped storage is accounted for under "Energy industry own use and distribution losses" (see "Hydropower" product definition). 2. If electricity is being used to produce heat in heat pumps or electric boilers, the electricity inputs are subtracted from the electricity production shown under the "Electricity" product.
Other transformation processes	TRANOTH	"Other transformation processes" includes conversion losses in gas manufacture, oil refineries, coke ovens and blast furnaces, liquefaction, and other non-specified transformation.
Energy industry own use and distribution losses	TOTENGY_LOSSES	"Energy industry own use and distribution losses" contains the primary and secondary energy consumed by transformation industries for heating, pumping, traction and lighting purposes. These are shown as negative numbers. Included here are, for example, coal mines' own use of energy, power plants' own consumption (which includes net electricity consumed for pumped storage) and energy used for oil and gas extraction. "Energy industry own use and distribution losses" also includes losses in gas distribution, electricity transmission and coal transport. Fuels used for pipeline transport are included in transport. Note that electricity generation losses appear in the electricity, CHP and heat plants.
Statistical differences	STATDIFF	Includes the sum of the unexplained statistical differences for individual fuels, as they appear in the basic energy statistics.
Total final consumption	TFC	Is the sum of the consumption in the end-use sectors and for non-energy use. Energy used for transformation processes and for own use of the energy producing industries is excluded. Final consumption reflects for the most part deliveries to consumers (see note on stock changes).
Industry	TOTIND	Energy used for transport by industry is not included here but is reported under transport. Non-energy use in industry is excluded from industry and reported separately.
Transport	TOTTRANS	Consumption in transport covers all transport activity (in mobile engines) regardless of the economic sector to which it is contributing (except for military fuel use). Non-energy use in transport is excluded from transport and reported separately.
Road	ROAD	Includes fuels used in road vehicles as well as agricultural and industrial highway use. Excludes military consumption as well as motor gasoline used in stationary engines and diesel oil for use in tractors that are not for highway use.

Flow	Short name	Definition
Residential	RESIDENT	Includes consumption by households, excluding fuels used for transport. Includes households with employed persons, which is a small part of total residential consumption.
Commercial and public services	COMMPUB	Includes consumption corresponding to commercial and public services.
Non-energy use	NE_TOT	Covers those fuels that are used as raw materials in the different sectors and are not consumed as a fuel or transformed into another fuel. Non-energy use is shown separately in final consumption under the heading nonenergy use. Note that for biofuels, only the amounts 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
Non-energy use - chemical/petrochemical	NE_CHEM	Fuels used for chemical feedstocks and non–energy products in the petro-chemical industry, which includes cracking and reforming processes for the purpose of producing ethylene, propylene, butylene, synthesis gas, aromatics, butadene and other hydrocarbon-based raw materials in processes such as steam cracking, aromatics plants and steam reforming. Note: this flow was called “of which petrochemical feedstocks” in previous editions.
Electricity output	ELOUTPUT	"Electricity output” shows total quantities of gross electricity generated in TWh by all electricity and CHP plants (see the notes on "Electricity, CHP and heat plants"). Electricity generated from pumped storage should not be included.
Heat output	HEATOUT	"Heat output" shows quantities of heat produced in PJ for sale by CHP and heat plants. Heat produced in electric boilers is reported under the "Electricity" product and heat produced in heat pumps is reported under "Heat".
Installed electrical capacity	CAPACITY_ELEC	Represents the net maximum capacity which is the maximum active power that can be supplied, continuously, with all plants running, at the point of outlet (i.e. after taking the power supplies for the station auxiliaries and allowing for the losses in those transformers considered integral to the station).
Input to hydrogen and synthetic fuels production	INH2PROD	Includes the data corresponding to fuel/electricity inputs for hydrogen and synthetic fuels production.
Input to heat pumps	INHEATPUMP	Includes the data corresponding to electricity and/or recovered heat (non-ambient) inputs to all types of heat pumps including small-scale residential ones.

The flows corresponding to the Indicators file are detailed in the following table:

Transition indicators

Flow	Short name	Notes
Total energy supply	TES	Total energy supply, expressed in Mtoe or petajoules.
Total final consumption	TFC	Total final consumption, expressed in Mtoe or petajoules.
Gross Domestic Product	GDP	GDP data are derived from three sources: - International Monetary Fund. 2025. World Economic Outlook, April 2025: A Critical Juncture amid Policy Shifts. Washington, D.C. (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: $\mathrm{GDP_n} = GDP\ nominal\ USD_{base\_year} * \mathrm{Real\_GDP\_growth}_{n\ vs\ base\_year}$ 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	GDPPPP 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: $\mathrm{GDP_n} = GDP\ nominal\ PPP_{base\_year} * \mathrm{Real\_GDP\_growth}_{n\ vs\ base\_year}$ 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

Flow	Short name	Notes
		prices in national currencies of the same good or service in different countries.
Population	POP	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.
Energy intensity index - TES/GDP	TES_GDP	Expressed as toe or megajoules per thousand 2015 USD. Based on national GDP.
Energy intensity index - TES/GDP (PPP basis)	TES_GDPPPP	Expressed as toe or megajoules per thousand 2015 USD PPP.
Total energy supply per capita	TES_POP	Expressed as toe or gigajoules per capita
Total final consumption per capita	TFC_POP	Expressed as toe or gigajoules per capita
Total final consumption per unit of GDP	TFC_GDP	Expressed as toe or megajoules per thousand 2015 USD. Based on national GDP
Total final consumption per unit of GDP (PPP basis)	TFC_GDPPPP	Expressed as toe or megajoules per thousand 2015 USD PPP.
Total self-sufficiency	TOT_SELF	Production divided by TES expressed as a ratio.
Coal self-sufficiency	COAL_SELF	Production divided by TES expressed as a ratio. Includes coal, peat and oil shale.
Oil self-sufficiency	OIL_SELF	Production divided by TES expressed as a ratio.
Gas self-sufficiency	GAS_SELF	Production divided by TES expressed as a ratio.
Share of renewables in total energy supply	SHAREREN_TES	Renewable sources TES divided by total TES, expressed as a ratio. Renewable sources include hydro, geothermal, solar, wind, tide, wave, biofuels and the renewable fraction of municipal waste.
Share of renewables in total final energy	SHAREREN_TFC	Final energy consumption from all renewable sources divided by total final energy consumption. Renewable energy consumption is derived as the sum of direct final consumption of renewable sources plus the components of electricity and

Flow	Short name	Notes
consumption - SDG 7.2.1		heat consumption estimated to be derived from renewable sources based on generation shares. Renewable sources include hydro, geothermal, solar, wind, tide, wave, biofuels and the renewable fraction of municipal waste. *Note: This indicator is developed based on the same methodology used to derive the official SDG 7.2.1 indicator.*
Share of fossil fuels in total energy supply	SHAREFOSSIL_TES	Fossil fuel sources TES divided by total TES, expressed as a ratio. Fossil fuel sources include coal (including peat and oil shale), oil, natural gas, industrial waste and the non-renewable fraction of municipal waste.
Share of fossil fuels in total final consumption	SHAREFOSSIL_TFC	Final energy consumption from all fossil fuel sources divided by total final energy consumption. Fossil energy consumption is derived as the sum of direct final consumption of fossil sources plus the components of electricity and heat consumption estimated to be derived from fossil sources based on generation shares. Fossil fuel sources include coal (including peat and oil shale), oil, natural gas, industrial waste and the non-renewable fraction of municipal waste.
Share of renewables in electricity generation	SHAREREN_ELEOUT	Output of electricity produced from renewable sources divided by total output of electricity, expressed as a ratio. Renewable sources include electricity from hydro, geothermal, solar, wind, tide, wave, biofuels and the renewable fraction of municipal waste.
Share of low carbon sources in electricity generation	SHARELC_ELEOUT	Output of electricity produced from low carbon sources divided by total output of electricity, expressed as a ratio. Low carbon sources include electricity from hydro, geothermal, solar, wind, tide, wave, biofuels, the renewable fraction of municipal waste and nuclear.
Share of renewables in heat generation	SHAREREN_HEATOUT	Output of heat produced from renewable sources divided by total output of heat, expressed as a ratio. Renewable sources include heat from geothermal, solar thermal, biofuels and the renewable fraction of municipal waste.
Share of low carbon sources in heat generation	SHARELC_HEATOUT	Output of heat produced from low carbon sources divided by total output of heat, expressed as a ratio. Low carbon sources include heat from geothermal, solar thermal, biofuels, the renewable fraction of municipal waste and nuclear.
CO_2 from fuel combustion	CO2_FUELCOMB	Presents the 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 IPCC Guidelines. For the historical years, the CO_2 emissions are estimated according to the 2006 IPCC Guidelines (sectoral approach). For the projection years as well as the most recent year available (provisional year), this value is estimated based on projections or provisional data for TES by fuel category, and on their average carbon intensities for the latest three years, according to the following equation:

Flow	Short name	Notes
		$$CO2_y = \sum_i \left[\left(\frac{CO2_{y-1,i}}{TES_{y-1,i}} \right) + \left(\frac{CO2_{y-2,i}}{TES_{y-2,i}} \right) + \left(\frac{CO2_{y-3,i}}{TES_{y-3,i}} \right) \right] /3 \times TES_{y,i}$$ Where: y: projections or provisional year i: fuel category: coal, oil, natural gas, other (industrial waste+ non-renewable municipal waste) CO_{2y-1}, CO_{2y-2} and CO_{2y-3}: previous years CO_2 emissions from fuel combustion, calculated according to the 2006 IPCC Guidelines
CO_2 from fuel combustion - CCUS adjusted	CO2_FUELCOMB_CCUS	This indicator is derived by subtracting the total mass of CO_2 captured by CCUS from the total CO_2 emissions from fuel combustion: CO2_FUELCOMB_CCUS = CO2_FUELCOMB - CC_TOTAL
CO_2 emissions from fuel combustion of coal	CO2_FUELCOMB_COAL	Includes CO_2 emissions from coal combustion (including peat and oil shale).
CO_2 emissions from fuel combustion of oil	CO2_FUELCOMB_OIL	Includes CO_2 emissions from oil combustion
CO_2 emissions from fuel combustion of gas	CO2_FUELCOMB_GAS	Includes CO_2 emissions from natural gas combustion
CO_2 emissions from fuel combustion of other fuels	CO2_FUELCOMB_OTHER	Includes CO_2 emissions from industrial waste and non-renewable municipal waste combustion
GHG emissions from fuel combustion	GHG_FUELCOMB	Presents the total GHG 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 IPCC Guidelines. For the historical years, the GHG emissions are estimated according to the 2006 IPCC Guidelines (sectoral approach). For the projection years as well as the most recent year available (provisional year), this value is estimated based on projections or provisional data for TES by fuel category, and on their average carbon intensities for the latest three years, according to the following equation:

Flow	Short name	Notes
		$GHG_y = \sum_i \left[\left(\frac{GHG_{y-1,i}}{TES_{y-1,i}}\right) + \left(\frac{GHG_{y-2,i}}{TES_{y-2,i}}\right) + \left(\frac{GHG_{y-3,i}}{TES_{y-3,i}}\right)\right] / 3 \times TES_{y,i}$ Where: y: projections or provisional year i : fuel category: coal, oil, natural gas, other (industrial waste+ non-renewable municipal waste) and biofuels and renewable municipal waste (only for non-CO_2 emissions) GHG_{y-1}, GHG_{y-2} and GHG_{y-3}: previous years GHG emissions from fuel combustion, calculated according to the 2006 IPCC Guidelines
GHG emissions from fuel combustion - CCUS adjusted	GHG_FUELCOMB_CCUS	This indicator is derived by subtracting the total mass of CO_2 captured by CCUS from the total GHG emissions from fuel combustion: GHG_FUELCOMB_CCUS = GHG_FUELCOMB - CC_TOTAL
GHG emissions from fuel combustion of coal	GHG_FUELCOMB_COAL	Includes total greenhouse gas emissions from coal (including peat and oil shale) combustion including CO_2, CH_4 and N_2O.
GHG emissions from fuel combustion of oil	GHG_FUELCOMB_OIL	Includes total greenhouse gas emissions from oil combustion including CO_2, CH_4 and N_2O.
GHG emissions from fuel combustion of gas	GHG_FUELCOMB_GAS	Includes total greenhouse gas emissions from natural gas combustion including CO_2, CH_4 and N_2O.
GHG emissions from fuel combustion of other fuels	GHG_FUELCOMB_OTHER	Includes total greenhouse gas emissions from industrial waste and non-renewable municipal waste combustion including CO_2, CH_4 and N_2O.
Transport CO_2 emissions from fuel combustion	CO2_TRANS	This indicator contains CO_2 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. This includes domestic aviation, domestic navigation, road, rail and pipeline transport, and corresponds to IPCC Source/Sink Category 1 A 3.
Industry CO_2 emissions from fuel combustion	CO2_TOTIND	This indicator contains the CO_2 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

Flow	Short name	Notes
		generate electricity and/or heat. Additionally, this flow 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.
Residential CO_2 emissions from fuel combustion	CO2_RESIDENT	This indicator contains CO_2 emissions from fuel combustion in households. This corresponds to IPCC Source/Sink Category 1 A 4 b.
Commercial and public services CO2 emissions from fuel combustion	CO2_COMMPUB	This indicator includes CO_2 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.
Buildings CO_2 emissions from fuel combustion	CO2_BUILD	Includes the sum of "Residential " and "Commercial and public services" CO_2 emissions from fuel combustion.
Other final sectors CO_2 emissions from fuel combustion	CO2_OTHSECT	This indicator includes CO_2 emissions from 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). As well as emissions from fuels used for inland, coastal and deep-sea fishing. This 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. On top of the above emissions from final sectors not specified above are also included in this category, which includes emissions from military fuel use for all mobile and stationary consumption (e.g. ships, aircraft, road and energy used in living quarters).
International marine bunkers CO_2 emissions from fuel combustion	CO2_MARBUNK	CO_2 emissions from international marine bunkers in million tonnes of CO_2. These amounts are not included in the national totals.
International aviation bunkers CO_2 emissions from fuel combustion	CO2_AVBUNK	CO_2 emissions from international aviation bunkers in million tonnes of CO_2. These amounts are not included in the national totals.
Transport GHG emissions from fuel combustion	GHG_TRANS	This indicator contains GHG emissions from the combustion of fuel including CO_2, CH_4 and N_2O 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. This includes domestic aviation, domestic navigation, road, rail and pipeline transport, and corresponds to IPCC Source/Sink Category 1 A 3.

Flow	Short name	Notes
Industry GHG emissions from fuel combustion	GHG_TOTIND	This indicator contains the GHG emissions from the combustion of fuel including CO_2, CH_4 and N_2O 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. Additionally, this flow 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.
Residential GHG emissions from fuel combustion	GHG_RESIDENT	This indicator contains GHG emissions from the combustion of fuel including CO_2, CH_4 and N_2O in households. This corresponds to IPCC Source/Sink Category 1 A 4 b.
Commercial and public services GHG emissions from fuel combustion	GHG_COMMPUB	This indicator includes GHG emissions from the combustion of fuel including CO_2, CH_4 and N_2O 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.
Buildings GHG emissions from fuel combustion	GHG_BUILD	Includes the sum of "Residential " and "Commercial and public services" GHG emissions from the combustion of fuel including CO_2, CH_4 and N_2O.
Other final sectors GHG emissions from fuel combustion	GHG_OTHSECT	This indicator includes GHG emissions from the combustion of fuel including CO_2, CH_4 and N_2O from 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). As well as emissions from fuels used for inland, coastal and deep-sea fishing. This 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. On top of the above emissions from final sectors not specified above are also included in this category, which includes emissions from military fuel use for all mobile and stationary consumption (e.g. ships, aircraft, road and energy used in living quarters).
Total electricity and heat generation CO_2 emissions from fuel combustion	CO2_ELEHEAT	Represents the sum of fuel combustion CO_2 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.
Coal electricity and heat generation CO_2 emissions from fuel combustion	CO2_ELEHEAT_COAL	Represents the sum of coal (including peat and oil shale) combustion CO_2 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.
Oil electricity and heat	CO2_ELEHEAT_OIL	Represents the sum of oil combustion CO_2 emissions from electricity production, combined heat and power plants and heat

Flow	Short name	Notes
generation CO_2 emissions from fuel combustion		plants. It is the sum of main activity producers and autoproducers. Emissions from own on-site use of fuel are included.
Gas electricity and heat generation CO_2 emissions from fuel combustion	CO2_ELEHEAT_GAS	Represents the sum of natural gas combustion CO_2 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.
Other electricity and heat generation CO_2 emissions from fuel combustion	CO2_ELEHEAT_OTH	Represents the sum of industrial waste and non-renewable municipal waste combustion CO_2 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.
Total electricity and heat generation GHG emissions	GHG_ELEHEAT	Represents the sum of fuel combustion GHG emissions including CO_2, CH_4 and N_2O 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.
Coal electricity and heat generation GHG emissions	GHG_ELEHEAT_COAL	Represents the sum of coal (including peat and oil shale) combustion GHG emissions including CO_2, CH_4 and N_2O 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.
Oil electricity and heat generation GHG emissions	GHG_ELEHEAT_OIL	Represents the sum of oil combustion GHG emissions including CO_2, CH_4 and N_2O 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.
Gas electricity and heat generation GHG emissions	GHG_ELEHEAT_GAS	Represents the sum of natural gas combustion GHG emissions including CO_2, CH_4 and N_2O 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.
Other electricity and heat generation GHG emissions	GHG_ELEHEAT_OTH	Represents the sum of industrial waste and non-renewable municipal waste combustion GHG emissions including CO_2, CH_4 and N_2O 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.
CO_2 Intensity of electricity and heat generation	CO2INT_ELEHEAT	This ratio is based on CO_2 emissions from fossil fuels consumed for electricity and heat generation divided by the output of electricity and heat (in kWh) from all fossil and non-fossil sources. It includes electricity-only plants, combined heat and power plants, and heat-only plants. Both main activity producers and autoproducers have been included in the calculation. For

Flow	Short name	Notes
		the historical years the indicator has been calculated based on the following equation: $$\frac{\sum_{fuels}((Input_{Electricity\ plants} + Input_{CHP\ plants} + Input_{Heat\ plants} + Own\ use_{Plants}) \times EF_{fuel})}{Ele_{Inland} + Heat_{Inland}}$$ Where: • $\sum_{fuels}$: Sum over the fuels. • $Input_{plants}$: Fuel input into the plants (both main activity and autoproducer) expressed in energy unit. • EF_{fuel} : Default emission factors as provided in the *2006 IPCC Guidelines*. • $Ele_{Inland} + Heat_{Inland}$: electricity and heat generation from all sources (including non-emitting sources) Please refer to the IEA Emission Factors database documentation[2] file for the complete methodology. For the projection years, the figures are estimated by dividing the estimated emissions corresponding to electricity and heat generation by the total electricity and heat generation from all sources. The emissions corresponding to electricity and heat generation (the numerator) is calculated using the projections for input to the plants and 3-year average fuel specific emission factors as detailed in section on *Projections and provisional greenhouse gas emissions from fuel combustion.*
GHG Intensity of electricity and heat generation	GHGINT_ELEHEAT	This ratio is based on total GHG emissions from fossil fuels consumed for electricity and heat generation divided by the output of electricity and heat (in kWh) from all fossil and non-fossil sources. It includes electricity-only plants, combined heat and power plants, and heat-only plants. Both main activity producers and autoproducers have been included in the calculation. For the historical years the indicator has been calculated based on the following equation: $$\frac{\sum_{fuels,gases}((Input_{Electricity\ plants} + Input_{CHP\ plants} + Input_{Heat\ plants} + Own\ use_{Plants}) \times EF_{fuel,gas})}{Ele_{Inland} + Heat_{Inland}}$$ Where: • $\sum_{fuels,gases}$: Sum over the fuels and GHG gases (CO_2, CH_4, N_2O) • $Input_{plants}$: Fuel input into the plants (both main activity and autoproducer) expressed in energy unit. • EF_{fuel} : Default emission factors as provided in the *2006 IPCC Guidelines*. • $Ele_{Inland} + Heat_{Inland}$: electricity and heat generation from all sources (including non-emitting sources) Please refer to the IEA Emission Factors database documentation[2] file for the complete methodology

[2] The IEA Emission Factors database documentation can be accessed at: https://www.iea.org/data-and-statistics/data-product/emissions-factors-2025

Flow	Short name	Notes
		For the projection years, the figures are estimated by dividing the estimated emissions corresponding to electricity and heat generation by the total electricity and heat generation from all sources. The emissions corresponding to electricity and heat generation (the numerator) is calculated using the projections for input to the plants and 3-year average fuel specific emission factors as detailed in section on *Projections and provisional greenhouse gas emissions from fuel combustion*.
Total CO_2 captured by CCUS	CC_TOTAL	Represents the total emission savings through CCUS across the energy landscape.
CO_2 captured from electricity and heat generation by CCUS	CC_ELECHEAT	Represents the emission savings associated with CCUS in power generation.
CO_2 captured from hydrogen and synthetic fuel production by CCUS	CC_H2PROD	Represents the emission savings associated with CCUS in the production of blue hydrogen and other synthetic fuels.
CO_2 captured from manufacturing by CCUS	CC_MANUFACT	Represents the emission savings associated with CCUS across the manufacturing sectors, including ammonia production, Iron and steel and cement production.
CO_2 captured from natural gas processing by CCUS	CC_NGPROC	Represents the emission savings through CCUS at natural gas processing plants.
CO_2 captured from other sectors by CCUS	CC_OTHER	Represents the emission savings associated with CCUS in other areas of the energy supply, transformation and consumption not defined above.
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 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 combustion emissions (CO2_FUELCOMB) and 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.

Flow	Short name	Notes
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).
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_FUELCOMB) and total energy supply (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_FUELCOMB) emissions and GDP calculated using exchange rates.
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_FUELCOMB) 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_FUELCOMB) emissions).
CO_2 emissions index	CO2_INDEX	CO_2 fuel combustion emissions (CO2_FUELCOMB) expressed as an index, where the reference year = 100. Year 2000 is used as the reference year. This index can be used as one of the constituents of the Kaya identity, for more information refer to the section on Kaya identity.
Population index	POP_INDEX	Population expressed as an index, where the reference year = 100. Year 2000 is used as the reference year. This index can be used as one of the constituents of the Kaya identity, for more information refer to the section on Kaya identity.
GDP per population index	GDP_POP_INDEX	GDP PPP / population expressed as an index, where the reference year = 100. Year 2000 is used as the reference year. This index can be used as one of the constituents of the Kaya identity, for more information refer to the section on Kaya identity.
Energy intensity index – TES / GDP	TES_GDP_INDEX	TES / GDP PPP expressed as an index, where the reference year = 100. Year 2000 is used as the reference year. This index can be used as one of the constituents of the Kaya identity, for more information refer to the section on Kaya identity.

Flow	Short name	Notes
Carbon intensity index - CO_2 / TES	CO2_TES_INDEX	CO_2 emissions / TES expressed as an index, where the reference year = 100. Year 2000 is used as the reference year. Calculated using CO_2 fuel combustion emissions (CO2_FUELCOMB). This index can be used as one of the constituents of the Kaya identity, for more information refer to the section on Kaya identity.
CO_2 emissions from electricity and heat generation (including CHP) index	CO2_ELEHEAT_INDEX	Total electricity and heat generation CO_2 emissions (CO2_ELEHEAT) expressed as an index, where the reference year = 100. Year 2000 is used as the reference year. This index can be used as one of the constituents of the Kaya identity, for more information refer to the section on Kaya identity.
Electricity and heat output index	IND_ELEHEAT_OUTPUT	Electricity and heat output expressed as an index, where the reference year = 100. Year 2000 is used as the reference year. This index can be used as one of the constituents of the Kaya identity, for more information refer to the section on Kaya identity.
Share of electricity and heat output from fossil fuels index	SHAREFOSSIL_ELEHEAT_INDEX	Share of electricity and heat output from fossil fuels expressed as an index, where the reference year = 100. Year 2000 is used as the reference year. The share has been derived by dividing the electricity and heat output from fossil sources by the total electricity and heat output. This index can be used as one of the constituents of the Kaya identity, for more information refer to the section on Kaya identity.
CO_2 intensity of fossil fuel mix index	CO2INT_MIX_INDEX	CO_2 intensity of the fossil fuel mix expressed as an index, where the reference year = 100. Year 2000 is used as the reference year. The intensity has been derived by dividing the total CO_2 emissions from electricity and heat generation by the total input to electricity, heat and CHP plants. This index can be used as one of the constituents of the Kaya identity, for more information refer to the section on Kaya identity.
Thermal efficiency of electricity and heat plants including CHP index	THERMEFF_ELEHEAT_INDEX	Thermal efficiency of electricity and heat plants (including CHP), expressed as an index, where the reference year = 100. Year 2000 is used as the reference year. The efficiency has been derived by dividing the total electricity and heat output from fossil plants by the overall input to these generation plants. This index can be used as one of the constituents of the Kaya identity, for more information refer to the section on Kaya identity.

Product dimension

Energy balances table

Product	Short name	Definition
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) *Note: in this database, oil shale is aggregated with coal (however the secondary product shale oil is included under oil).*
Peat and peat products	PEAT_AND_PEAT_PRODUCTS	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 should not be included. Peat includes derived peat products.
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	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. Imports and exports of gaseous synthetic fuels including hydrogen are also reported under this product.
Nuclear	NUCLEAR	Energy released by nuclear fission or nuclear fusion.

Product	Short name	Definition
Hydropower	HYDRO	Hydro energy represents the potential and kinetic energy of water converted into electricity in hydroelectric plants The electricity losses associated with pumped storage electricity are included in the quantities given under "Electricity", "Energy industry own use and distribution losses".
Wind	WIND	Wind energy represents the kinetic energy of wind exploited for electricity generation in wind turbines
Geothermal	GEOTHERMAL	Geothermal energy is the energy available as heat emitted from within the earth's crust, usually in the form of hot water or steam. It is exploited at suitable sites: • for electricity generation using dry stream or high enthalpy brine after flashing • directly as heat for district heating, agriculture, etc.
Solar	SOLAR	Solar includes both solar photovoltaic electricity generation and solar thermal electricity and heat generation.
Tide, wave and ocean, and other energy sources	OCEAN_OTH_GEN	Tide, wave and ocean represents the mechanical energy derived from tidal movement, wave motion or ocean current and exploited for electricity generation. Other sources include production not included elsewhere such as fuel cells.
Biofuels and waste	BIOFUELS_RENWASTE	Includes primary solid biofuels, biogases, biogasoline, biodiesels, bio jet kerosene, other liquid biofuels, charcoal and the renewable fraction of municipal waste produced by households, industry, hospitals and the tertiary sector that are collected by local authorities for incineration at specific installations.
Total waste, non-renewable portion	WASTE_NONREN	Includes industrial waste of non-renewable origin consisting of solid and liquid products (e.g. tyres) combusted directly, usually in specialised plants, to produce heat and/or power and the non-renewable fraction of municipal waste produced by households, industry, hospitals and the tertiary sector that are collected by local authorities for incineration at specific installations.
Electricity	ELECTRICITY	Gross electricity production is measured at the terminals of all alternator sets in a station; it therefore includes the energy taken by station auxiliaries and losses in transformers that are considered integral parts of the station. The difference between gross and net production is generally estimated as 7% for conventional

Product	Short name	Definition
		thermal stations, 1% for hydro stations, and 6% for nuclear, geothermal and solar stations. If hydrogen or synthetic fuels are produced through power to gas processes by consumption of electricity, and due to the current absence of these products in the main structure of the energy balance, the final consumption of these fuels may be reported under electricity, while accounting for the conversion losses.
Heat	HEAT	Heat production includes all heat produced by main activity producer CHP and heat plants, as well as heat sold by autoproducer CHP and heat plants to third parties. Fuels used to produce quantities of heat for sale are reported as a transformation activity. The use of fuels for heat which is not sold is included under the sectors in which the fuel use occurs. The "Heat" product also permits the reporting of the heat extracted from ambient air and water by large-scale industrial heat pumps used for selling heat to third parties.
Total	TOTAL	Is the total of all energy sources.
Offshore wind	WIND_OFFSHORE	This product is a subcomponent of the “Wind” element. The primary energy value ascribed to electricity produced from wind is taken to be the physical energy content of the gross generation.
Hydrogen and synthetic fuels	HYDROGEN_SYNTHETIC_FUELS	This product includes data corresponding to hydrogen and synthetic fuels. Although quantities may be currently negligible, the potential prominent role of these fuels in the upcoming decades requires a clearer accounting framework. This item provides a mean to enhance the granularity for reporting supply and demand of these emerging energy carriers.
Heat pumps	HEAT_PUMPS	This product is for reporting of heat data corresponding to all types of heat pumps including small-scale residential ones. Note that the ambient heat data corresponding to industrial heat pumps who sell heat to third parties may also be reported under the already existing product “heat”. However, the ambient heat data corresponding to small-scale heat pumps mainly operated within the residential sector where heat is not sold are not reported under the product “heat”. Heat pumps are projected to be one of the key technologies for decarbonisation of end-use heating services, especially in the residential sector. This memo item allows the reporting of the combined impact of all types of heat pumps and not only the large-scale units used for selling heat.

Geographical coverage

Geographical coverage

Country/Region	Short name	Definition
Australia	AUSTRALI	Excludes the overseas territories. 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.
Austria	AUSTRIA	
Belgium	BELGIUM	
Canada	CANADA	
Colombia	COLOMBIA	Colombia is currently seeking accession to full IEA membership (Accession country).
Czech Republic	CZECH	Data start in 1980.
Denmark	DENMARK	Excludes Greenland and the Faroe Islands, except prior to 1990, where data on oil for Greenland were included with the Danish statistics.
Estonia	ESTONIA	Data start in 1990.
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.
Germany	GERMANY	Includes the new federal states of Germany from 1970 onwards.
Greece	GREECE	
Hungary	HUNGARY	Data start in 1970.
Ireland	IRELAND	
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.
Korea	KOREA	Data start in 1980.

Country/Region	Short name	Definition
Latvia	LATVIA	Data for Latvia are available starting in 1990. Latvia joined the IEA in February 2025.
Lithuania	LITHUANIA	Data for Lithuania are available starting in 1990.
Luxembourg	LUXEMBOU	
Mexico	MEXICO	Data start in 1980.
Netherlands	NETHLAND	Excludes Suriname, Aruba and the other former Netherland Antilles (Bonaire, Curaçao, Saba, Saint Eustatius and Sint Maarten).
New Zealand	NZ	
Norway	NORWAY	
Poland	POLAND	
Portugal	PORTUGAL	Includes the Azores and Madeira.
Slovak Republic	SLOVAKIA	Data start in 1980.
Spain	SPAIN	Includes the Canary Islands.
Sweden	SWEDEN	
Switzerland	SWITLAND	Includes Liechtenstein for the oil data. Data for other fuels do not include Liechtenstein.
Republic of Türkiye	TURKEY	
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 is excluded from the EU27 aggregate.
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 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.
European Union - 27	EU27	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 and Sweden. Please note that in the interest of having comparable data, all these countries are included since 1990 despite different entry dates into the European Union.

Methodological notes

Scenario categorisation

It is important to clearly communicate the purpose and context of the scenarios underlying the projections data to avoid misinterpretation. This section describes the general categories of scenarios which have been selected as the basis of the projections data included in this database. Understanding the category of the scenarios and their underlying methodology is of great value and facilitates the comparison and analysis of the projections data. Please refer to the Country notes section for detailed information corresponding to the country-specific scenarios.

Business as usual

The "business as usual" scenario category aims to capture scenarios that include only government policies which have been already adopted, and therefore project how the national energy landscape may evolve if the existing structures in energy supply and demand remain unchanged.

Scenarios with the "business as usual" category provide a baseline to compare alternative scenarios and a starting point for the understanding and analysis of the energy system by assuming a general continuation of historical trends into the future. The assumption is that the structure of the system remains unchanged or responds in pre-determined forms.

Examples include the European Commission's EU Reference Scenario 2020, the IEA Current Policies Scenario, the EIA's Annual Energy Outlook Reference Case and Canada's Energy Future Current Policies Scenario.

Stated policies

The "stated policies" scenario category aims to capture scenarios that take into account national climate and/or energy-related policies and measures which have been already adopted by the government, together with pertinent policy proposals, announced commitments and plans which have been announced but are yet to be formally adopted.

A cautious view of the extent and timing to which policy proposals are projected to be implemented and objectives achieved are key in defining this type of scenarios.

The aim of scenarios in this category is to provide a sense of where today's policy ambitions seem likely to drive the energy landscape.

In other words, this scenario type is a policy-based forecast, not a hypothetical scenario which is based on optimizing policy for a desired outcome.

It is typical to set out the gap in between the outcome of these types of scenario and targets such as efforts to limit global temperature increase to 1.5 Cº, or wider Paris Agreement objectives. Examples include the IEA Stated Policies Scenario (STEPS) and the EU's With Additional Measures (WAM) scenarios.

Beyond stated policies (aspirational)

Scenarios within this category set an energy pathway consistent with specific target(s) or other particular desired outcomes. By this means, they demonstrate what should be achieved across sectors and by various actors and by when, for the targets or outcomes to be achieved.

Examples include the European Commission's REG and MIX and the IEA Net Zero Emissions by 2050 (NZE) and Announced Pledges Scenario (APS) scenarios.

For the purpose of this publication, the "aspirational" scenarios have been divided into the following two sub-categories:

a. *Achieving national targets:*

This type of scenarios could set out a pathway for the national (or regional) energy sector to achieve a specific target. For example, a net zero scenario could set out a pathway for the national energy sector to achieve net zero emissions by a certain year. Or a Paris Agreement compliant scenario demonstrates a pathway consistent with the goal of limiting the global increase in temperature to 2 or 1.5°C (with a certain probability). Additionally, scenarios consistent with achieving certain sustainable development goals fall within this category.

b. *Achieving defined outcomes:*

This category of scenarios is consistent with defined outcomes rather than targets. Examples include scenarios consistent with achieving affordability of energy sources or long/short-term energy security purposes. Some scenarios could have multiple desired outcomes.

Other

Scenarios which do not fall under any of the above general categories have been reported under this option. You may refer to the Country notes section for detailed information corresponding to the methodology and model used and any underlying assumptions corresponding to scenarios identified under this category.

Note: If projections data corresponding to multiple scenarios have been collected from a country, while the country has classified more than one of the submitted scenarios under the same scenario cluster, one of the two scenarios has been disseminated under the "other" category to allow differentiation in between the two sets of data.

Energy balance: key concepts

Energy statistics expressed in physical units in the form of commodity balances, balances of supply and use of each energy commodity, are a simple way to assemble the main statistics so that key data are easily obtained, and that data completeness can be quickly assessed. However, because energy products are mainly bought for their heat-raising properties and can be converted into other energy products, presenting data in energy units is very powerful. The format adopted is called energy balance.

The energy balance takes the form of a matrix, where columns present all the different energy sources and rows represent all the different "flows", grouped in three main blocks: energy supply, transformation/energy use and final consumption.

To develop an energy balance from the set of energy commodity balances, the two main steps are: i) all the data are converted to a common energy unit – and also a "total" product is computed; and ii) some re-formatting is performed to avoid double counting when summing products together. For example, while the production of secondary products (e.g. motor gasoline) is shown in the production row in commodity balances, it is reported as an output of the relevant transformation (e.g. oil refineries) in an energy balance, where the production row only refers to production of primary products (e.g. crude oil).

The methodological assumptions underlying energy balances discussed in the next section are particularly important to understand differences across balances formulated by different organisations starting from the same energy commodity data.

IEA energy balances methodology

The unit adopted by the IEA is the mega joules (MJ). Conversion of the IEA energy balances to other energy units would be straightforward.

The main methodological choices underlying energy balances that can differentiate balances across organisations are: i) "net" versus "gross" energy content; ii) calorific values; and iii) primary energy conventions.

Net versus gross energy content

*The IEA energy balances are based on a "**net**" energy content, which excludes the energy lost to produce water vapour during combustion. All the elements of the energy balance are expressed on the same net basis to ensure comparability. Even elements (e.g. natural gas) that in commodity balances may be already in energy units but on a different basis (e.g. "gross") are converted (e.g. from "gross" to "net").*

The difference between the "net" and the "gross" calorific value for each fuel is the latent heat of vaporisation of the water produced during combustion of the fuel. For coal and oil, the net calorific value is about 5% less than gross, for most forms of natural and manufactured gas the difference is 9-10%, while for electricity and heat there is no difference as the concept has no meaning in this case.

Calorific values

Generally, the IEA adopts country-specific, time-varying, and for some products flow-dependent, net calorific values supplied by national administrations for most products; and regional default values (in conjunction with Eurostat for the European countries) for the oil products. More detailed explanations on the IEA conversion to energy units for the different energy sources are given in section 8 Units and Conversions.

Primary energy conventions

*A very important methodological choice is the definition of the "**primary energy equivalent**" for the electricity and heat produced from non-combustible sources, such as nuclear, geothermal, solar, hydro, wind. The information collected is generally the amount of electricity and heat produced, represented in the balance as an output of transformation. Conventions are needed to compute the most appropriate corresponding primary energy, input to the transformation, both in form and in amount.*

The principle adopted by the IEA is that the ***primary energy form*** *is the first energy form downstream in the production process for which multiple energy uses are practical. For example, the first energy form that can be used as energy in the case of nuclear is the nuclear heat of the reactor, most of which is then transformed into electricity. The application of this principle leads to the choice of the following primary energy forms:*

- **Electricity** for primary electricity (hydro, wind, tide/wave/ocean and solar photovoltaic).
- **Heat** for heat and secondary electricity (nuclear, geothermal and solar thermal).

Once the primary energy form is identified for all electricity and heat generated from non-combustible sources, the IEA adopts the ***physical energy content method*** *to compute the corresponding primary energy equivalent amounts: the primary energy equivalent is simply the physical energy content of the corresponding primary energy form.*

For primary electricity, such as hydro and solar PV, as electricity is identified as the primary energy form, the primary energy equivalent is simply the gross electricity generated in the plant.

For nuclear electricity, the primary energy equivalent is the quantity of heat generated in the reactors. In the absence of country-specific information, the IEA estimates the primary energy equivalent from the electricity generated by assuming an efficiency of 33%, derived as the average efficiency of nuclear power plants across Europe. Note that the principle of using the heat from nuclear reactors as the primary energy form for the energy statistics has an important effect on any indicators of energy supply dependence. Under the present convention, the primary nuclear heat appears as an indigenous resource. However, the majority of countries using nuclear power import their nuclear fuel, and if this fact could be taken into account, it would lead to an increase in the supply dependence on other countries.

For geothermal electricity, the primary energy equivalent is the quantity of heat and a similar back-calculation is used where the quantities of steam supplied to the plant are not measured, assuming a thermal efficiency of 10%. This figure is only approximate and reflects the fact that the steam from geothermal sources is generally of low quality. If data for the steam input to geothermal power plants are available, they are used directly as primary energy equivalent.

Similarly, for solar thermal plants the heat supply is back-calculated assuming a 33% efficiency of conversion of heat into electricity, reflecting relatively low working temperatures, although central receiver systems can reach higher temperatures and therefore higher efficiencies.

In summary, for geothermal and solar thermal, if no country-specific information is reported, the primary energy equivalent is calculated as follows:

- 10% for geothermal electricity;
- 50% for geothermal heat;
- 33% for solar thermal electricity;
- 100% for solar thermal heat.

*Alternative methods to the physical energy content method exist, such as the **partial substitution method**, used in the past by the IEA. In this case, the primary energy equivalent of the above sources of electricity generation would be computed as the hypothetical amount of energy necessary to generate an identical amount of electricity in conventional thermal power plants, considering an average generating efficiency. The principle was abandoned by the IEA and many other international organisations because it had little meaning for countries in which hydro electricity generation was a significant supply source, and because the actual substitution values were hard to establish as they depended on the marginal electricity production efficiencies. Partial substitution also had unreal effects on the energy balance as transformation losses appeared which had no physical basis.*

Since the two methods differ significantly in the treatment of electricity from solar, hydro, wind, etc., the share of renewables in total energy supply will appear to be very different depending on the method used. To interpret shares of various energy sources in total supply, it is important to understand the underlying conventions used to calculate the primary energy supply.

The IEA estimates of GHG emissions methodology

Historical CO_2 emissions from fuel combustion

The IEA uses the simplest (Tier 1) methodology to estimate historical CO_2 emissions from fuel combustion based on the 2006 IPCC Guidelines[3]*. The computation follows the concept of conservation of carbon. 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.

The IEA historical estimates of CO_2 emissions from fuel combustion are obtained following harmonised definitions and comparable methodologies across countries. However, 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. Please note that the IEA historical emissions estimations are only provided as benchmark estimate and do not replace official national submissions.

Please refer to the IEA https://iea.blob.core.windows.net/assets/2dc9ba1c-df9d-4008-9052-c71a95e2b4c6/WORLD_GHG_Documentation_2025_final.pdf for additional information.

[3] The 2006 IPCC Guidelines for National Greenhouse Gas Inventories is available at: https://www.ipcc-nggip.iges.or.jp/public/2006gl/vol2.html

Historical non-CO_2 greenhouse gas emissions from fuel combustion

Similar to the historical 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 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, shut downs 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.

Similarly, and 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). 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.

Please refer to the IEA Greenhouse Gas Emissions from Energy database documentation for additional information.

Projections and provisional greenhouse gas emissions from fuel combustion

For the projection years as well as the most recent year available (provisional year), the emissions estimates are based on projections or provisional energy data by fuel category, and on their average carbon intensities for the latest three years, according to the following equation:

$$GHG_y = \sum_i \left[\left(\frac{GHG_{y-1,i}}{E_{y-1,i}} \right) + \left(\frac{GHG_{y-2,i}}{E_{y-2,i}} \right) + \left(\frac{GHG_{y-3,i}}{E_{y-3,i}} \right) \right] / (3 \times E_{y,i})$$

Where:

y: projections or provisional year

i : fuel category: coal, oil, natural gas, other (industrial waste+ non-renewable municipal waste) and biofuels and renewable municipal waste (only for non-CO_2 emissions)

E: energy data. For total emissions this corresponds to total energy supply (TES), while for sectoral estimates this corresponds to the respective final consumption figures and for electricity and heat generation, these figures correspond to the inputs to the generation plants.

GHG_{y-1}, GHG_{y-2}, GHG_{y-3} : previous years GHG emissions from fuel combustion, calculated according to the 2006 IPCC Guidelines

Macroeconomic drivers of CO_2 emissions trends

The indicators include decomposition of CO_2 emissions into four driving factors (Kaya identity)[4], which is generally presented in the form below:

[4] Additional information available at: Yamaji, K., Matsuhashi, R., Nagata, Y. Kaya, Y., An integrated system for CO2/Energy/GNP analysis: case studies on economic measures for CO2 reduction in Japan. Workshop on CO2 reduction and removal: measures for the next century, March 19, 1991, International Institute for Applied Systems Analysis, Laxenburg, Austria.

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. (Py-Px)/Px, will not generally add up to the percentage change of CO_2 emissions (Cy-Cx)/Cx. However, relative changes of CO_2 emissions in time can be obtained from relative changes of the four factors as follows:

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/P	= GDP/population;
TES/GDP	= Total energy supply per GDP;
CO_2/TES	= CO_2 emissions per unit TES.

For the purpose of this publication, the terms are represented as indices (2000 = 100)

The Kaya identity can be used to discuss the primary driving forces of CO_2 emissions. 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 neither as fundamental driving forces in themselves, nor as generally independent from each other.

Drivers of electricity and heat generation emissions trends

The indicators included in this dataset also include the change in CO_2 emissions from electricity and heat generation over time decomposed into the respective changes of four driving factors:

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

where:

C = CO_2 emissions;

E = fossil fuel inputs to thermal generation;

ELF = electricity and heat output from fossil fuels;

EL = total electricity and heat output;

This can be rewritten as:

CO_2 emissions from electricity and heat 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 and heat generation efficiency;

EFS = share of electricity and heat from fossil fuels;

EL = total electricity and heat output.

This decomposition expresses, for a given time, CO_2 emissions from electricity and heat 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 and heat from fossil fuels (EFS) and total electricity and heat 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. (CFy-CFx)/CFx may not perfectly match the percentage change of total CO_2 emissions (Cy-Cx)/Cx. To avoid this, a more complex decomposition method is required. In this case, the logarithmic mean divisia (LMDI) method proposed by Ang (2004)[5] has been used.

Using this method, the change in total CO_2 emissions from electricity and heat generation 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:

ΔC = ΔCF + ΔEI+ΔEFS +ΔEL

where:

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

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

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

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

[5] B.W Ang, Decomposition analysis for policymaking in energy: which is the preferred method?, Energy Policy, Volume 32, Issue 9, 2004

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. 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 and heat generation would affect both the CO_2 intensity of the generation mix and the thermal efficiency of generation.

Data availability

Table below represents the details of availability of data corresponding to the main structure of the energy balances for each year, the number of scenarios as well as the date of the latest submission to IEA.

Projections availability for energy balances data

Country	2030	2040	2050	Number of scenarios	Latest submission to the IEA
Australia	p	p	..	1	2024/2025
Austria	✓	✓	✓	1	2022/2023
Belgium	p	p	p	1	2024/2025
Canada	✓	✓	✓	3	2024/2025
Colombia	✓	✓	✓	1	2021/2022
Czech Republic	✓	✓	✓	1	2017/2018
Denmark	✓	✓	✓	1	2024/2025
Estonia	✓	✓	✓	1	2024/2025
Finland	✓	✓	✓	1	2024/2025
France	✓	✓	✓	2	2022/2023
Germany	✓	✓	✓	1	2023/2024
Greece	..	..	..	N/A	N/A
Hungary	p	p	p	1	2023/2024
Ireland	✓	✓	✓	4	2024/2025
Italy	✓	✓	..	1	2024/2025
Japan	p	p	..	1	2024/2025
Korea	✓	✓	✓	1	2024/2025
Latvia	✓	✓	✓	1	2024/2025
Lithuania	p	p	..	1	2023/2024
Luxembourg	..	..	..	N/A	N/A

Country	2030	2040	2050	Number of scenarios	Latest submission to the IEA
Mexico	..	..	..	N/A	N/A
Netherlands	✓	✓	..	2	2024/2025
New Zealand	✓	✓	✓	1	2024/2025
Norway	..	..	..	N/A	N/A
Poland	✓	..	..	1	2016/2017
Portugal	✓	✓	..	1	2024/2025
Slovak Republic	✓	✓	✓	2	2024/2025
Spain	✓	..	..	1	2024/2025
Sweden	✓	✓	✓	1	2024/2025
Switzerland	✓	✓	✓	1	2024/2025
Republic of Türkiye	..	..	..	N/A	N/A
United Kingdom	p	p	p	1	2024/2025
United States	✓	✓	✓	2	2022/2023
European Union - 27	..	..	..	N/A	N/A

Note: ✓ indicates that the projections data are available; **p** indicates that the projections data are partially available; **..** indicates that projections are not available.

The table below presents the details of availability of the recently introduced granular data corresponding to the emerging fuels and technologies which are expected to have a prominent role in the upcoming decades.

Projections availability for emerging fuels and technologies

Country	CCUS	Hydrogen and synthetic fuels	Heat pumps
Australia	..	..	..
Austria	..	..	..
Belgium	✓	p	..
Canada	✓	✓	p

Country	CCUS	Hydrogen and synthetic fuels	Heat pumps
Colombia	..	..	..
Czech Republic	..	..	..
Denmark	✓	✓	..
Estonia	✓	..	..
Finland	..	✓	✓
France	✓	✓	✓
Germany	✓	✓	✓
Greece	..	..	..
Hungary	✓	p	p
Ireland	..	✓	✓
Italy	✓	✓	✓
Japan	..	p	..
Korea	✓	..	..
Latvia	..	p	✓
Lithuania	..	p	p
Luxembourg	..	..	..
Mexico	..	..	..
Netherlands	✓	..	✓
New Zealand	..	..	..
Norway	..	..	..
Poland	..	..	..
Portugal	..	✓	✓
Slovak Republic	✓	✓	..
Spain	..	..	..
Sweden	..	✓	..
Switzerland	✓	✓	✓
Republic of Türkiye	..	..	..
United Kingdom	..	..	..

Country	CCUS	Hydrogen and synthetic fuels	Heat pumps
United States	✓	..	..
European Union - 27	..	..	..

Note: ✓ indicates that the projections data are available; **p** indicates that the projections data are partially available; **..** indicates that projections are not available.

Country notes

This section includes the country notes corresponding to the included projections data in the database. Please refer to the IEA World Energy Balances, documentation for the country notes related to the included historical data.

The source is the institution that has provided IEA with the projections data and the collaborating institution is the institution that does the modelling for the projections.

Australia

Source(s)

Department of Industry, Science, Energy and Resources.

Collaborating institution: The Department of Climate Change, Energy, the Environment and Water (DCCEEW). The DCCEEW published the projections of Australia's primary energy consumption by sector as a special topic in the December 2024 Quarterly Update of the National Greenhouse Gas Inventory.

Scenario(s)

Business as usual

General notes

All projections data are based on the 2024/25 submission to the IEA.

Projections for 2050 are not available. The projections are updated on an annual basis.

All data except GDP and population data refer to the fiscal year July to June (e.g. 2030 implies 1 July 2029 to 30 June 2030).

Country does not currently develop official long term energy projections up to 2050. Electricity generation and capacity data, as well as sectoral energy consumption (excludes electricity demand figures), GDP growth rate and population figure for 2030 and 2040 are based on the Australian government's 2024 *Australian Emissions Projections assumptions* data, available at: Australia's emissions projections 2024

GDP growth rates and population data for years 2040 and 2050 are sourced from the *2023 Intergenerational Report* published by the Australian Government Treasury, available at: https://treasury.gov.au/publication/2023-intergenerational-report

Austria

Source(s)

Republic of Austria - Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology

Scenario(s)

Business as usual

General notes

All projections data are based on the 2022/23 submission to the IEA.

Frequency of the projection updates are expected to be biannually.

The projections have been developed in relation to the development of the National Energy and Climate Plan (NECP) which has been submitted to the European Commission in December 2019. The corresponding reports are available at:

https://www.umweltbundesamt.at/energie/energieszenarien/

https://www.umweltbundesamt.at/studien-reports/publikationsdetail?pub_id=2380&cHash=ea613d8c56d727831c1418f84f84d345

In year 2023 there has been updates to the country's climate targets (e.g., achieving climate neutrality by 2040), due to the newly defined and planned policies and measures. The updated report of scenarios can be found at the European Union's web platform.

Belgium

Source(s)

FPS Economy (DG Energy), Bruxelles Environnement, Vlaams Energie- en Klimaatagentschap, Service Public de Wallonie and Federal Planning Bureau

Scenario(s)

Stated policies

General notes

All projections data are based on the 2024/25 submission to the IEA, which have not been updated.

For the projection years, heat generation data are not available.

Frequency of the projection updates are expected to be once every three years.

For the "Stated policies" scenario, international energy prices are taken from IEA World Energy Outlook (WEO) 2022 and the national policies are based on European Commission's National energy and climate plans 2023.

Main assumptions for EU policies include fit for 55 legislation (as defined in June 2023), ETS-1 price path (IEA-WEO 2022) and ETS-2 price of 45 euros. More information on the underlying methodology is available at: https://www.plan.be/publications/publication-2488-nl-energievooruitzichten_van_belgie_bij_aangekondigd_beleid

Canada

Source(s)

Natural Resources Canada, Ottawa

Collaborating institution: Canada Energy Regulator (CER)

Scenario(s)

Business as usual

Aspirational – achieving national targets

Other

*Note: The country has submitted two different scenarios both corresponding to the "aspirational - achieving national targets" category as defined in this database. Hence, for the purpose of this publication one of the two scenarios has been disseminated under the "other" category to allow differentiation in between the two sets of data. The "*Canada Net-zero Scenario*" scenario has been included under the "aspirational - achieving national targets" category, while the "*Global Net-zero Scenario*" scenario has been included under the "other category". Additional information regarding the differences in between the two scenario is listed in the general notes section below.*

General notes

All projections data are based on the 2024/25 submission to the IEA.

The projections are updated on an annual basis.

In the 2025 edition, under the aspirational - achieving national targets scenario, the IEA Secretariat estimated the stock changes for coal in 2040 and 2050.

The projections are based on forecasts provided by the Canada Energy Regulator (CER) and are featured in the annual CER publication, *Canada's Energy Future 2023: Energy Supply and Demand Projections to 2050 ("EF2023")*, available at:

https://www.cer-rec.gc.ca/en/data-analysis/canada-energy-future/2023/

Natural Resources Canada (NRCan) accesses this information through the CER's Open Data, Annexes and other including provision of unpublished aggregates. These projections are then used in combination with energy balance figures previously reported to the IEA by NRCan through the annual questionnaire submissions.

The projections reported in this questionnaire are obtained by applying the percentage growth rates forecast in the CER's EF2023 to baseline IEA energy balance submissions for Canada. When there is no clear concordance between a specific flow/product from the IEA Projections questionnaire with the CER's publication, best efforts are made to identify the most appropriate donor.

Projections are based upon three core scenarios modelled by the CER: the "Canada Net-zero Scenario" (CNZ), the "Global Net-zero Scenario" (GNZ) and the "Current Measures Scenario" (CM). The central premise to these scenarios is based on the level of future climate action, both globally and domestically (which are briefly elaborated upon below).

For the purposes of the publication, the CER projections from the Current Measures Scenario have been matched to the "business as usual" Scenario. Both the CNZ and GNZ scenarios are matched to the Aspirational – achieving national targets Scenario. This approach was taken as both scenarios assume the realization of Canada's goal of net-zero GHG emissions by 2050, with CER back casting the necessary transformations across the energy system to reach this target.

This approach involves extrapolating past specific policy frameworks to incorporate assumptions about significant advancements in, and deployment of, low-carbon technologies like hydrogen, electric vehicles, and carbon capture, utilization, and storage, along with their economic impacts and technological maturation timelines. The Global Net-zero (GNZ) scenario assumes rapid global and Canadian action towards reducing greenhouse gas (GHG) emissions, consistent with global efforts to limit warming to 1.5°C. Under this scenario, there is a significant shift towards electrification and renewable energy, with extensive deployment of technologies like carbon capture, utilization, and storage. The reduced global demand for oil and natural gas leads to lower international prices for these commodities, influencing Canadian production.

Under the Canada Net-zero (CNZ) scenario, Canada achieves net-zero emissions by 2050, independent of slower global efforts to reduce GHGs. While similar domestic transitions as in the GNZ are presumed, the slower pace of global action is both insufficient to limit warming to 1.5°C and has a more moderate impact on Canadian energy markets and prices. Meanwhile, the Current Measures (CM) scenario is predicated on the continuation of climate and energy policies in place at publication of EF2023 and assumes no further domestic action in addition to limited future global action. There is higher domestic and global demand for fossil fuels and less adoption of renewable and low-carbon technologies, leading to a more carbon-intensive energy system, with higher GHG emissions. There is no presumption that Canada achieves net-zero emissions.

Additional details are available at: https://www.cer-rec.gc.ca/en/data-analysis/canada-energy-future/2023/

Colombia

Source(s)

Unidad de Planeación Minero Energética

Collaborating institutions: MME, MADS, Minhacienda, IEA, Irena, gsnova, E&Y, ANM, ANH, BM, DANE, DNP, Woodmac, Promigas, SSPD, Universidad Nacional, Mintransporte

Scenario(s)

Stated policies

General notes

All projections data are based on the 2021/22 submission to the IEA.

Frequency of the projection updates are biannual.

The projections data are based on the “Modernization scenario”, which brings together the initiatives that would imply a technological leap in demand and an energy change giving greater importance to fuel gases, as a transitory path towards country’s decarbonization. For this scenario, an expected GDP growth of 3.1% is assumed in the long term. This scenario is distinguished by the adoption of technologies with the best energy yields in the world in 2050 and a greater degree of ambition in mitigating climate change, leveraged mainly by the use of fuel gases. Regarding the energy supply, the “Modernization scenario” contemplates Colombia's position as a net importer of liquid fuels and natural gas, the increase in blends in biofuels, a higher percentage of participation of wind and solar generation, the entry of other renewables such as offshore wind power and biogas. Similarly, greater penetration of distributed generation and improvement in energy efficiency in thermal generation are considered. Additional information is available at: https://www1.upme.gov.co/DemandayEficiencia/Paginas/PEN.aspx

Some additional detailed assumption corresponding o the scenario are also listed below:

- **Historical energy consumption:** The historical consumption information used in the simulation model corresponds to what is recorded in the Colombian Energy Balance - BECO for the period between 2010 and 2019 (UPME, 2020).
- **Service coverage Assumption:** In all scenarios, a coverage level of 100% of electricity is assumed in 2030. Full adoption of the most efficient technology available in Colombia or internationally in a given year is assumed.
- **Residential Assumptions:**

    a. Reduction of firewood consumption and substitution for LPG in rural areas.

    b. Replacement of inefficient luminaires with LED

c. Electrification of urban homes

d. Replacement of inefficient lighting with LED and low-pressure sodium technologies

- **Transportation Assumptions:**

a. Total fleet projection of 29 million fleet by 2050.

b. Full adoption of the most efficient technology available in Colombia or internationally in a given year.

c. Gradual entry of zero and low emission vehicles in the light fleet.

d. Gradual entry of zero and low emission vehicles in the passenger fleet

and penetration of natural gas (compressed and liquefied) and LPG in cargo transportation.

F. Electrification of the motorcycle fleet

g. LPG penetration in river navigation

h. Increase in air travel.

i. Entry of new electric mass transport trains (metros, commuter trains).

j. According to economic and population projections, by 2050, country's GDP per capita will be between 10,000 and 20,000 USD (similar to the current Chilean), so the number of vehicles per thousand inhabitants could be up to 250.

k. Achieve the maximum efficiencies postulated in the Useful Energy Balance study - BEU (UPME, 2019).

l. A gradual inclusion of zero and low emission vehicles in the light fleet (cars, campers, taxis and vans).

- **Oil and derivatives Assumptions:**

a. Medium and low oil production scenarios according to current official information (UPME, 2020).

b. Refining capacity and composition of the refinery diet remain at the same levels as in the base years.

c. Mixture of biofuels in accordance with current regulations and assumptions of increase

d. Increased efficiency in refineries e. supply of liquid fuels subject to increases in efficiency and/or technological substitution in sectors of final consumption, particularly transport.

- **Electricity assumptions:**

  a. FNCER installed capacity according to the scenario

  b. Installation of new technology capacity for the Colombian context (geothermal, nuclear, etc.)

  c. Progressive development between resource scenarios distributed according to the area available for installation

  d. Impact modelling of Smart Grids and microgrids through the demand curve.

Czech Republic

Source(s)

Ministry of Industry and Trade of the Czech Republic.

Scenario(s)

Not applicable.

General notes

There has been no submission of projections data to the IEA for the past three years. All projections data are based on the 2017/18 submission to the IEA.

Denmark

Source(s)

Danish Energy Agency.

Collaborating institution: Danish Ministry of Climate, Energy and Utilities.

Scenario(s)

Business as usual

General notes

All projections data are based on the 2024/25 submission to the IEA. The projections are updated on an annual basis.

In the 2025 edition, for geothermal, the IEA Secretariat estimated the production, as well as electricity, CHP, and heat plant input in 2030, 2040 and 2050.

The projections are based on existing policy measures. Several models including Ramses, IntERACT and FREM have been used for the purpose of the modelling. More information on the underlying methodology can be accessed at the following links:

Final report: https://www.kefm.dk/klima/klimastatus-og-fremskrivning/klimastatus-og-fremskrivning-2024

IntERACT model: https://ens.dk/service/fremskrivninger-analyser-modeller/forbrugsmodellen-interact

Other used models: https://ens.dk/service/fremskrivninger-analyser-modeller/oevrige-modeller

Ambient heat from heat pumps reported under product ‘heat”, may contain production from residential units which is typically not accounted for within the main structure of the IEA balance.

Estonia

Source(s)

Ministry of Climate

Collaborating institution: Estonian Environmental Research Centre

Scenario(s)

Stated policies

General notes

All projections data are based on the 2024/25 submission to the IEA.

Frequency of the projection updates are biannual.

The projections are based on data from Estonian Environment Research Centre's annual publication.

The main assumption for the projection was that step-by-step, the use of oil shale shall decrease for the production of electricity and increase for the production of shale oil. The retort gas that occurs as a side product during the production of shale oil is used for electricity production. The projected future usage of fuel based on the model was applied while using the emission calculations of the 2006 IPCC Guidelines. Oil shale is included under Coal and shale oil under Oil.

Projection figures for electricity and heat demand and non-energy use are not available.

The greenhouse gas emission projections are undergoing an update in relation to preparation of new Climate Law, hence data are not up to date and revisions are expected.

Due to the high production of oil shales and the special treatment of this product within the energy balance, which results in a high uncertainty of supply-based emissions estimate, GHG emissions as well as the corresponding indicators have not been developed for the projection years.

Finland

Source(s)

Ministry of Economic Affairs and Employment

Collaborating institutions: VTT Technical Research Centre, Finnish Environment Institute, Natural Resources Institute Finland and Finnish Institute for Health and Welfare)

Scenario(s)

Stated policies

General notes

All projections data are based on the 2024/25 submission to the IEA.

Minor updates to the projections are on an annual basis, when new policy measures are adopted, sectoral models or scenarios are updated and new statistical data are available. Major updates are scheduled once every four years, when new energy and climate plans and strategies are published.

The Ministry of Economic Affairs and Employment compiles the scenario data and forms the energy balances. The scenario describes the development of the energy system with energy and climate policy measures implemented or adopted by June 2024. The submission does not represent any official final projection.

The scenario is modelled and used in the preparation of the Government's energy and climate strategy (the strategy is scheduled to be published in mid-2025 and it will include decisions and plans on new policies and measures). The original time horizon of current projections is mid-term and targeted to the years 2030-2035, the projection figures for 2040-2050 are approximate.

Some power plants located at the industrial sites are owned by energy companies, while other are owned by the industry. Due to the absence of the granular data providing this differentiation, the sold heat vs own heat production is roughly estimated. Additionally, the division of fuels for heat production is indicatively shared between the transformation sector and final consumption of the industry sector.

The data reported under the product “Memo: heat pump”, include data corresponding to small-scale heat pumps used in the residential and commercial public services sectors. Data corresponding to large-scale heat pumps has been excluded, as the models do not include the granular data corresponding to the ambient heat input to these large-scale heat pumps.

The memo row electrical capacities do not have any data corresponding to combustible fuels as such scenario projections are not yet available. Furthermore, the heat break-down by fuel is not available as most boilers are multifuel boilers. Projections for granular data corresponding to offshore wind are not available. The scenario includes no CCUS, as its future is less sure than last year.

A report describing the modelling assumptions and scenarios that are prepared for the energy and climate strategy will be published in appr. June 2025 by the research consortium led by VTT Technical Research Centre.

Additional information can be accessed through the following links:

Carbon neutral Finland 2035 – national climate and energy strategy, http://urn.fi/URN:ISBN:978-952-327-843-1

Finland's 8th National Communication to the UNFCCC: https://unfccc.int/NC8

France

Source(s)

Ministry of Energy Transition, General Directorate for Energy and Climate in collaboration with other ministries including finance, agriculture, housing and transport.

Scenario(s)

Stated policies

Aspirational – achieving national targets

General notes

All projections data are based on the 2022/23 submission to the IEA.

The “With existing measures (WEM)” scenario, takes into account all the policies and measures adopted until end of year 2021. This corresponds to the STEPS scenario in this database.

The "With additional measures (WAM)" scenario aims for GHG emission targets which are compatible with the 55 EU package for year 2030, and for climate neutrality in 2050. It also aims at reaching additional policy targets such as re-industrialisation, public health, biodiversity protection, etc.

For the WEM scenario additional information is available at: https://www.ecologie.gouv.fr/scenarios-prospectifs-energie-climat-air

There are ongoing updates to the WAM scenario and no public documentation corresponding to this scenario is available yet.

The frequency of the projections update is once every five years for the WAM and once every two years for the WEM scenarios respectively.

For the projections, different sectoral models have been used to describe the physical transformation across sectors and also project energy consumption levels. Following that, the results have been aggregated to develop energy balances as well as the projected GHG inventories.

Germany

Source(s)

Öko-Institut (lead), Fraunhofer ISI, IREES

Scenario(s)

Stated policies

General notes

All projections data are based on the 2023/24 submission to the IEA.

The projections are updated on an annual basis.

Projections are based on bottom-up modelling with sectoral models and include policies and measures implemented until end of July 2023.

The aim of the scenario modelling is not to develop a complete energy balance, but rather aims at projecting GHG emissions estimates under the impact of adopted and announced policies and measures. Hence, there are certain limitations for completing the full energy balance as detailed below:

- The imports and exports projections are net figures and therefore stock changes are not available for the projection years.
- The modelling of non-energy consumption contains a share coming from unspecified fossil fuels. In the absence of a product called 'other fuel' in the IEA balances format, this figure has been allocated to the coal/oil shale product.

Additional information are available at (in German language): https://www.umweltbundesamt.de/themen/klima-energie/klimaschutz-energiepolitik-in-deutschland/szenarien-fuer-die-klimaschutz-energiepolitik/integrierte-energie-treibhausgasprojektionen#Berichterstattung

Greece

Source(s)

Ministry for Environment & Energy

Scenario(s)

Not applicable.

General notes

Projections are not available.

Hungary

Source(s)

Ministry for Innovation and Technology, Regional Centre for Energy Policy Research (REKK), Global Green Growth Institute (GGGI)

Scenario(s)

Business as usual

General notes

All projections data are based on the 2023/24 submission to the IEA.

Projections are based on the With Existing Measures (WEM) scenario from the TIMES-HU model of the Regional Centre for Energy Policy Research (REKK). The emission trajectory of the scenario follows current trends, assuming that all existing sectoral policy strategies and measures remain in effect, and that there will be no new interventions.

The modeling has been done in reference to the update of the National Energy and Climate Plan (NECP). However, as the updated NECP is not yet finalised, projections corresponding to scenarios besides BaU have not been included.

Supply and transformation data corresponding to fossil fuels, biofuels & waste, and non-renewable waste are not available as the disaggregated figures for these flows are not available from the scenario modelings. Hence, the corresponding flows in the balance and the related indicators are not available for the projections.

Ireland

Source(s)

Sustainable Energy Authority of Ireland (SEAI)

Collaborating institutions: Economic and Social Research Institute (ESRI), Environmental Protection Agency (EPA), Department of Transport, National Transport Authority (NTA)

Scenario(s)

Business as usual

Stated policies

Aspirational – achieving national targets

Aspirational – achieving defined outcomes

Other

Note: The country has submitted two different scenarios both corresponding to the "business as usual" category as defined in this database. Hence, for the purpose of this publication one of the two scenarios has been disseminated under the "other" category to allow differentiation in between the two sets of data. The "High_WEM" scenario has been included under the "business as usual" category, while the "Low_WEM" scenario has been included under the "other" category. Additional information regarding the differences in between the two scenario is listed in the general notes section below.

Note: Similar to above, the country has submitted two different scenarios both corresponding to the "aspirational - achieving national targets" category as defined in this database. Hence, for the purpose of this publication one of the two scenarios has been disseminated under the "aspirational – achieving defined outcomes" category to allow differentiation in between the two sets of data. The "High_WAM_CAP24" scenario has been included under the "aspirational - achieving national targets" category, while the "Low_WAM_CAP24" scenario has been included under the "aspirational – achieving defined outcomes" category. Additional information regarding the differences in between the two scenario is listed in the general notes section below.

General notes

All projections data are based on the 2024/25 submission to the IEA.

The projections are updated on an annual basis.

SEAI's National Energy Modelling Framework (NEMF) is a full national energy-economy model that assesses the impacts of packages of energy policies and measures (PaMs) on energy supply and demand. It combines several SEAI sectoral models with data from the ESRI's Ireland Environment, Energy and

Economy (I3E) macroeconomic model to produce policy-rich outlooks for the whole energy system.

The NEMF contains data on 650 individual heat demand archetypes, which provide a detailed description of demand in residential, services and industry sectors, as well as agricultural energy use. The electricity module simulates the scheduling of resources (generation, storage, interconnection and demand side management) to meet electricity demand at an hourly resolution. The transport module estimates the fuel demand of different modes of transport based on projections of the total activity demand (including the impact of demand management measures), the fleet composition (including EV uptake), and other PaMs such as biofuel blending. Additional information are available at: https://www.seai.ie/publications/Annex-Model-Description.pdf

https://www.seai.ie/data-and-insights/seai-statistics/energy-data/

https://www.seai.ie/publications/National-Energy-Projections-2023.pdf

The three submitted scenarios are based on the following main assumptions:

a.
    1) Implemented and adopted policies by end of year 2023 for the “High_WEM” and “Low_WEM” scenarios which correspond to the “business as usual” and “other” scenario categories in this database
    2) Implemented, adopted and planned policies from the Climate Action Plan 2024, including partial achievement of demand reduction target in Transport sector for the “High_WAM” scenario which corresponds to “stated policies” scenario in this database
    3) Implemented, adopted and planned policies from the Climate Action Plan 2024, including full achievement of demand reduction target in Transport sector for the “High_WAM_CAP24” and “Low_WAM_CAP24” scenarios which corresponds to “aspirational – achieving national targets” and “aspirational – achieving defined outcomes” scenarios in this database.

b. A varying carbon tax that increases by €7.50 per annum and reaches €100 per tonne by 2030.
c. Emissions Trading Scheme (ETS) price trajectory used is the European Commission "Recommended parameters for reporting on GHG projections in 2025" WEM trajectory.
d. Fossil fuel price trajectories used are the European Commission "Recommended parameters for reporting on GHG projections in 2025" central price trajectories for the “High_WEM”, “High_WAM” and

"High_WAM_CAP24" scenarios. On the other hand, for the "Low_WEM" and "Low_WAM_CAP24" scenarios, these price trajectories are informed by the IEA "World Energy Outlook 2023" Announced Pledges scenario.

Projection figures for non-energy use are not available.

Italy

Source(s)

Ministry of Economic Development, Ricerca Sistema Energetico (RSE)

Collaborating institutions: MASE (Ministry of Environment and Energy Security), GSE (Gestore dei Servizi Energetici), ISPRA (Italian Institute for Environmental Protection and Research)

Scenario(s)

Aspirational - achieving national targets

General note

All projections data are based on the 2024/25 submission to the IEA.

Projections for year 2050 are not available as the data are related to the NECP Policy Scenario.

The projections are updated on an annual basis.

For the scenario projections, the TIMES-RSE model, an energy model of the Markal TIMES family has been used. The scenario is based on the assumption of meeting renewable power targets (REPowerEU) by 2030 and achieve net zero target by 2050.

Additional information on the NECP are available at: https://commission.europa.eu/energy-climate-change-environment/implementation-eu-countries/energy-and-climate-governance-and-reporting/national-energy-and-climate-plans_en

The technical report (in Italian) is available on the RSE website: https://www.rse-web.it/rapporti/.

Japan

Source(s)

The Institute of Energy Economics, Japan

Collaborating institutions: Agency of National Resources and Energy, Ministry of Economy, Trade and Industry, Japan

Scenario(s)

Aspirational - achieving national targets

General notes

All projections data are based on the 2024/25 submission to the IEA.

Projections for the year 2050 are not available.

The frequency of updated to the projections are typically once every three years.

For 2030 and 2040, partial information on primary energy supply and electricity generation by product, electricity generation capacities and final consumption of heat and total final consumption by sector is available. Hence, the rest of the flows in the energy balance as well as all relevant indicators are not available for this country.

For 2030, the projections are based on an econometrics method, which estimates energy demand from macroeconomic indicators. For 2040, the projections are based on a scenario analysis using bottom-up optimisation models. The underlying assumption are consistent with Japan's Nationally Determined Contribution (NDC) of 46% reduction in GHG emissions from the 2013 levels by 2030, 60% reduction by 2035, 73% reduction by 2040 and net zero by 2050.

Additional information is available at:

Energy supply and demand outlook for 2030, Agency for Natural Resources and Energy, Ministry of Economy, Trade and Industry, Japan (in Japanese): https://www.enecho.meti.go.jp/category/others/basic_plan/pdf/20211022_03.pdf

Supplemental information for the 6th Strategic Energy Plan. (in English):https://www.enecho.meti.go.jp/category/others/basic_plan/pdf/strategic_energy_plan.pdf

Supplemental information for the 7th Strategic Energy Plan. (in English): https://www.meti.go.jp/english/press/2025/0218_001.html

Energy supply and demand outlook for 2040, Agency for Natural Resources and Energy, Ministry of Economy, Trade and Industry, Japan (in Japanese): https://www.enecho.meti.go.jp/category/others/basic_plan/pdf/20250218_03.pdf

Korea

Source(s)

Korea Energy Economics Institute (KEEI)

Collaborating institutions: Statistics Korea, Korea Meteorological Administration, Korea Development Institute, Korea Institute for Industrial Economics Trade

Scenario(s)

Business as usual

General notes

All projections data are based on the 2024/25 submission to the IEA. The projections are updated on an annual basis.

In the 2025 edition, for oil, the IEA Secretariat estimated the heat generated in 2030, 2040, and 2050.

The Korea Energy Economics Institute's STEM model is an integrated outlook system for analysing the impact of changes in climate and energy policies and energy technologies on future energy supply and demand, greenhouse gas emissions in the energy sector, and the economy.

This system consists of economic, energy, and environmental models. The economic model is an equilibrium model that combines a small-scale macroeconomic model and an input-output model, the energy model is a bottom-up model composed of modules by sector, and the environmental model is combined with the energy model to calculate greenhouse gas emissions.

The 'Long-term Energy Outlook' of the Korea Energy Economics Institute assumes that the current climate change and energy policy keynotes will continue the trend without significant changes until 2050. This is the long-term change path of energy consumption and supply expected when given external assumptions about our country's population, economic growth, industrial structure, energy prices, and temperature, and when energy technology is steadily developed at a similar level to the past and current or confirmed policies and regulations are maintained.

It serves as the baseline for assessing the direction and degree of change in energy supply and greenhouse gas emissions when domestic climate change and energy policy and technology change.

Similar to IEA's STEPS scenario, it presents the general direction of change in the energy system based on current policies and does not reflect the country's declared goals in the outlook.

Latvia

Source(s)

Institute of Physical Energy Collaborating institutions: Ministry of Climate and Energy, The Ministry of Economic Affairs

Scenario(s)

Business as Usual

General notes

All projections data are based on the 2024/25 submission to the IEA.

The projections are updated once every two years.

For the purpose of this publication, the “With Existing Measures” (WEM) scenario submitted by Latvia is classified as Business as Usual (BAU), because it does not include all the targets defined in the EU Directives (such as the EED and RES Directives) for 2030.

The scenario analysis was carried out with the TIMES-Latvia model — a bottom-up, partial-equilibrium, linear programming optimisation model based on the internationally recognised TIMES framework. Since 2022, the Institute of Physical Energetics has customised this model to capture Latvia’s specific energy and economic conditions. Before that, the MARKAL-Latvia model (also part of the MARKAL/TIMES family) was applied for GHG emission projections in the energy sector.

TIMES-Latvia represents the full energy supply and demand system of Latvia, covering five key sectors: industry, residential, agriculture, commercial & services, and transport. Each sector is further disaggregated by energy end-use. The model is demand-driven and projects the long-term development of Latvia's energy system for the period 2024–2060, using macroeconomic forecasts and sectoral drivers such as GDP, population, household numbers, floor area, and transport mileage.

The optimisation determines the least-cost investment pathway and the optimal deployment of technologies over time to satisfy energy service demands. It minimises the total system cost—or equivalently, maximises the combined consumer–producer surplus—while accounting for investment, operating, and fuel costs, as well as emissions constraints. The model incorporates a broad portfolio of current and future technologies, tracking emissions by fuel type, sector, and technology.

Key inputs include: Useful energy demand (e.g., lighting, heating, transport mileage); Price projections for imported energy resources (oil, gas, coal), based on European Commission recommendations and adjusted to Latvian conditions; Domestic fuel price projections, differentiated by geography and availability (e.g., solid biomass is modelled in four price categories); Historical energy system data for 2000–2022, used to calibrate the model to real-world conditions as well as descriptions for existing and future technologies.

Electricity and district heating consumption are calculated endogenously within the model. Energy taxes are incorporated exogenously, following the core price projections. Carbon pricing is aligned with the European Commission's harmonised trajectory for the EU ETS and the planned ETS II system. Demographic projections indicate a continued decline in Latvia's population in both the medium and long term. Forecasts for households, dwellings, and residential floor area are based on demographic trends and sector-specific parameters, such as average household size and dwelling area.

In the medium term (2024–2030), the baseline scenario assumes an average annual GDP growth of 2.6%, driven by gains in competitiveness through technology, efficiency, and innovation. In the long term (2031–2050), economic growth is expected to slow to 1.2%–2.2% annually.

Energy price projections for imported fuels (oil, gas, coal) are based on the European Commission's guidance ("Recommended parameters for reporting on GHG projections in 2025") and adjusted to reflect Latvia's market conditions and fuel price correlations. Carbon pricing follows the EC's harmonised trajectory for the current ETS and planned ETS II.

Energy sector development is shaped by GHG reduction measures focused on improving energy efficiency and increasing the share of renewables. These changes impact both energy supply and demand, driven by policy implementation, technological progress, and evolving energy markets.

The scenario incorporates all adopted policies as of June 30, 2024. Over the next seven years, energy efficiency programs will prioritise renovation of multi-apartment buildings and public infrastructure, alongside initiatives to replace fossil fuels with renewables across all sectors.

Additional information is available at:

https://videscentrs.lvgmc.lv/files/Klimats/SEG_emisiju_un_ETS_monitorings/Zinojums_par_klimatu/SEG_prognozu_pilnie_zinojumi/2025/LV_Report%20_Projections%20and%20PaMs_2025.pdf

Lithuania

Source(s)

Lithuanian Energy Agency

Collaborating institutions: Ministry of Environment of the Republic of Lithuania, Ministry of Energy of the Republic of Lithuania, Environmental Protection Agency

Scenario(s)

Stated policies

General notes

All projections data are based on the 2023/24 submission to the IEA.

Projections for year 2050 are not available.

The projections are updated once every two years.

The model is based on statistical data, reflecting the factual energy consumption and its long-term trends, considering specific assumptions of the expansion of energy generation capacity, technological improvements, future energy needs and the estimated impact of energy policy measures.

The model is based on the following main assumptions:

Main targets in electricity generation:

- Installed capacity of onshore wind farms, GW: 4.5 (2030);
- Installed capacity of offshore wind, GW: 1.4 (2030);
- Installed capacity of solar photovoltaic power plants, GW: 4.1 (2030);
- Installed capacity of hydrogen production (electrolysis), GW: 1.3 (2030).

Main targets for the share of renewables:

- Share of renewables in gross consumption of electricity: 100% (2030);
- Share of renewables in final consumption of energy in transport (with multiplicators for biofuels) : 29% (2030);
- Share of renewables in final consumption of energy for heating and cooling: 80% (2030);
- Share of renewables in gross final consumption of energy: 55% (2030).

Main energy consumption and energy savings targets:

- Final energy consumption without green hydrogen production and environmental energy, ktoe: 4430 (2030);
- Primary energy consumption, ktoe: 5440 (2030);
- Final energy consumption, ktoe: 4384 (2030);
- Cumulative final energy savings, TWh: 39.3.
- Main GHG emissions targets:
- GHG emission reduction target for EU ETS (emission trading system) sectors compared to 2005 levels: -62% (2030);
- GHG reduction targets for sectors not participating in the EU ETS scheme compared to 2005 levels: -21% (2030).

Main greenhouse gas (GHG) emissions targets:

- GHG emission reduction target for EU ETS (emission trading system) sectors compared to 2005 levels: -62% (2030);
- GHG reduction targets for sectors not participating in the EU ETS scheme compared to 2005 levels: -21% (2030).

Projections are partially available for demand and electricity generation for year 2030. Hence, the rest of the flows in the energy balance as well as all relevant indicators are not available for this country. Additionally, GDP-based projections are not available.

Additional information is available at:

https://www.e-tar.lt/portal/legalAct.html?documentId=TAR.E151BC09AE62

https://www.ena.lt/nn2-nens/

Luxembourg

Source(s)

STATEC, Institut national de la statistique et des études économiques du Grand-Duché du Luxembourg.

Scenario(s)

Not applicable.

General notes

Projections are not available.

Mexico

Source(s)

Secretaría de Energía

Scenario(s)

Not applicable.

General notes

Projections are not available.

Netherlands

Source(s)

Netherlands Enterprise Agency (RVO), Department of Sustainable Industry & Monitoring

Collaborating institutions: Netherlands Environmental Assessment Agency (Dutch: 'Planbureau voor de Leefomgeving' (PBL), TNO Energy Transition, Statistics Netherlands (CBS) and the National Institute for Public Health and the Environment (RIVM), Wageningen University and Research (WUR)

Scenario(s)

Business as usual

Stated policies

General notes

All projections data are based on the 2024/25 submission to the IEA.

Projections for year 2050 are not available.

The projections are updated on an annual basis.

Updated projections are reported annually in the Climate and Energy Outlook (KEV), as required by the national climate act since 2019. The KEV-report describes policies and measures in place or planned and which are included in the projections with regard to energy savings, renewable energy and greenhouse gas emission reductions in the Netherlands as a whole, as well as for various sectors. The KEV includes the policy variants 'with existing measures' (WEM) and 'with additional measures' (WAM), matching the IEA categories of, respectively, the "business as usual" and "stated policies" scenarios. Please note that the WEM scenario (submitted as BAU) is not static and incorporates impacts of policies once these are formally adopted. The KEV published in 2024 includes a projection horizon up to 2040.

These projections are developed by the Netherlands Environmental Assessment Agency (PBL) which is an independent governmental agency, in cooperation with Statistics Netherlands (CBS), TNO Energy Transition, the National Institute for Public Health and the Environment (RIVM) and the Netherlands Enterprise Agency (RVO). PBL has overall responsibility for the KEV and for the projections and the evaluative aspects in the report in specific (including the final editing of the report). This fits with their role in the Netherlands as independent planning agencies and guarantees an independent evaluative view. CBS provides various statistics such as related to economic development and energy balances.

As described above, the KEV published in 2024 includes a projection horizon up to 2040 (not 2050). These projections are developed by PBL, which is an independent governmental agency. In the KEV 2024 it is acknowledged that the ambitions of European and national energy and climate policy up to and including

2050, and the necessary policy preparations resulting from this, increasingly require insights into Dutch energy and emission developments after 2030. In order to get a better picture thereof, it is considered that these developments would best be outlined within the context of different scenarios. However, the KEV methodology is characterized by the use of only one reference path for the expected developments for exogenous factors (such as developments in demographics, macroeconomics and energy prices). This method is therefore less suitable for describing the broader range of possible distant future developments up to 2050. Consequently, it should be noted that the requested information on the year 2050 could not be supplied for this questionnaire. Likewise, the hydrogen memo items could not be filled out at this point in time as hydrogen has only relatively recently been included in the KEV and is as yet considered incomplete; but it could possibly be included in future submissions. In addition, for the sake of clarity a separate Annex is attached which contains the relevant projections within the Eurostat energy balance format which form the basis for this submission.

Projections of energy consumption and production levels in the KEV are, in general, calculated with a suite of sectoral models using parameters on economic (volume) development of sectors and prices of energy commodities and technologies. These parameters are selected by the experts at PBL using the best available official data at that time. The models are interlinked ensuring consistency and enabling supply and demand interactions. These models are developed over many years and are described in the background reports of the KEV.Additional information is available at:

The English summary of the Climate and Energy Outlook 2024 (Dutch: 'Klimaat en Energieverkenning (KEV)) is available on the PBL website: https://www.pbl.nl/en/publications/climate-and-energy-outlook-of-the-netherlands-2024

The complete KEV (in Dutch) and relevant background reports (including methods applied and assumptions used) are available on the PBL website: https://www.pbl.nl/kev

New Zealand

Source(s)

Ministry of Business, Innovation and Employment

Scenario(s)

Other

General notes

All projections data are based on the 2024/25 submission to the IEA.

The projections are updated on an annual basis.

The model uses econometric, financial, and optimisation models to consider different future scenarios and sensitivities for the energy sector. The submitted scenario corresponds to a “business as usual” scenario complimented with a carbon price reaching NZD $250 per tonne by 2050, hence identified under the “other” scenario category. Additional information are available at: https://www.mbie.govt.nz/assets/739f0bf5df/energy-modelling-technical-guide-august-2016.pdf

Norway

Source(s)

Ministry of Petroleum and Energy

Scenario(s)

Not applicable.

General Notes

Projections are not available.

Poland

Source(s)

Ministry of Economy

Scenario(s)

Not applicable.

General notes

There has been no submission of projections data to the IEA for the past five years. All projections data are based on the 2016/17 submission.

Projections are not available for years 2040 and 2050.

Portugal

Source(s)

Directorate General for Energy and Geology (DGEG)

Scenario(s)

Aspirational - achieving national targets

General notes

All projections data are based on the 2024/25 submission to the IEA.

Projections for the year 2050 are not available.

The projections are updated on a regular basis, as they are supporting the decisions regarding the National Energy and Climate Plan (NECP 2030). Projections are updated outside this timeframe if any substantial reason justify, such as the development of national strategies or policies affecting significantly the energy system.

DGEG has prepared several scenarios to base the decisions by the Government regarding strategy, targets, and measures, for the Portuguese NECP 2030. The scenarios have been developed with the national model JANUS, which is implemented over a LEAP platform. For the purpose of this publication, the "With Additional Measures" (WAM) scenario, which is aligned with the “Beyond Stated Policies (Aspirational)” category has been selected.

The WAM scenario reflects all policies and measures adopted or planned after 30 June 2022 for the energy sector and the forestry sector. In the Waste and Wastewater and Agriculture sectors, all policies and measures adopted or planned by the end of 2023 were considered in this scenario.

NECP targets are policy decisions and not directly the outcomes of the energy modelling. In general, targets are more conservative than the modelling, as they take into account other information and concerns (e.g., security of supply). The projections were developed with backcasting techniques and awareness of policy trends, stakeholder perceptions, and recent R&D results; not forward-looking and finding cost-optimal paths considering cost and efficiency curves of technology, fuels and emissions as it is done for instance by the Carbon Neutrality Roadmap 2050.

Additional information is available at:

https://www.dgeg.gov.pt/media/vedhi5t1/pnec-pt_template-final-vers%C3%A3o-final_30_06_2023.pdf

The projections are updated on a regular basis, as they are supporting the decisions regarding NECP 2030. As it is defined in the Regulation (EU) 2018/1999 of the European Parliament and Council on the Governance of the Energy Union and Climate Action, a draft proposal of the updated NECP was submitted by June 2023 (final version until the end of June 2024). The work is in progress, so is not fully integrated in this document.

Slovak Republic

Source(s)

Ministry of Economy of the Slovak Republic

Collaborating institutions: Ministry of Environment of the Slovak Republic, Ministry of Economy of the Slovak Republic

Scenario(s)

Stated policies

Aspirational – achieving national targets

General notes

All projections data are based on the 2024/25 submission to the IEA.

As needed, recalibration is done at least every 3 years, scenario updates can be done multiple times a year.

To derive the projections, the model used is Compact Primes Slovakia, developed by E3-Modelling - developed in the General Algebraic Modelling System (GAMS) , is a fully-fledged energy demand and supply model, designed as a single-country compact tool. A substantial part of the mathematics of CPS are derived from the well-known PRIMES model, a largescale modular system of sub-models, covering multiple countries. The model is actor and market oriented, and so it represents individual actors' decisions in supply and demand of energy and the balancing of their decisions in simultaneous markets cleared by prices.

The WEM scenario (With Existing Measures) is a reference scenario. The scenario contains measures and policies that have been adopted by 2021. This scenario includes currently (2023) valid sectoral legislative regulations. The calibration year of the scenario was 2019.

Modelling only includes a summary category of biomass & waste, distinction between renewable and non-renewable waste is therefore not possible. Values for biomass and waste includes non-renewable waste as well

In the Final consumption in the industry sector the model does not calculate with heat, but steam. In the cells of final consumption of heat in industry, the values for steam were used.

Energy consumption of heat pumps was not specifically modelled; values are therefore 0.

Electricity & generation from natural gas includes in the 2040 and 2050 electricity generated from all gasses, not only natural gas and can include clean gas.

International aviation bunkers, stock changes were not calculated within the model.

Model calculates only net imports, if positive the number was written in the imports, if negative the value was written in the exports.

Installed capacity of power plants using oil not distinguishable from natural gas plants and added to installed capacity of natural gas plants.

Distinction between non-energy and non-energy chemical and petrochemical is not possible.

Additional information is available at: https://www.mhsr.sk/uploads/files/A65vdZIY.pdf?csrt=11227970159270649411

Spain

Source(s)

Ministry for the Ecological Transition and the Demographic Challenge

Scenario(s)

Aspirational - achieving national targets

General notes

All projections data are based on the 2024/25 submission to the IEA. For 2040 and 2050, partial data are available for total final consumption (TFC) but are not published.

These figures are Spain's only long-term scenario public data for 2040 and 2050 and are available here: https://ec.europa.eu/clima/sites/lts/lts_es_summary_en.pdf

Additionally, macroeconomic data are also available.

The projections are based on Spain's Long-term low greenhouse gas emission development strategies (LT-LEDS). Additional information is available at: https://www.miteco.gob.es/es/prensa/anexoelp2050_tcm30-516147.pdf

Sweden

Source(s)

Swedish Energy Agency in collaboration with other governmental institutions.

Scenario(s)

Stated policies

General notes

All projections data are based on the 2024/25 submission to the IEA.

The projections are updated once every two years.

The projections are based on the reference scenario used for calculating projections of greenhouse gas emissions according to Regulation (EU) No 525/2013 - European Union Greenhouse gas Monitoring Mechanism Regulation (MMR). Hence, the "stated policies" scenario category has been selected. Additional information is available at: https://energimyndigheten.a-w2m.se/Home.mvc?ResourceId=213739

For the projections all production of solar power is allocated to the energy industry (and not in part to other sectors).

There are no forecasts for the import/export of oil products, hence oil imports should be interpreted as "net imports of crude oil and oil products".

Non-renewable waste includes other non-renewable fuels. Furthermore, the statistical difference between total energy supply, transformation, and total final consumption for biofuels and renewable waste is due to the use of biofuels for non-energy purposes/feedstocks.

The calculated efficiency of products is generally high due to widespread use of flue gas condensation.

Switzerland

Source(s)

Swiss Federal Office of Energy

Collaborating institutions: Prognos AG, TEP Energy GmbH, Infras AG

Scenario(s)

Aspirational - achieving national targets

General notes

All projections data are based on the 2024/25 submission to the IEA.

Projections are updated unregularly, typically once every five to ten years.

The projections are based the main scenario used for the Swiss long-term climate strategy to 2050 and for the submission of the strategy to the UN Climate Change Secretariat. The target scenario is based on net-zero emissions in 2050; nuclear phase out by 2034 and the annual electricity balance in 2050.

Additional information is available at:

https://www.bfe.admin.ch/bfe/de/home/politik/energieperspektiven-2050-plus.html

The balances do not include statistical differences.

Projections of imports are net imports and are not available for exports.

Data reported under the “biofuels and renewable waste” product includes power-to-X and Power-to-hydrogen figures from renewable sources and biogenic fuels.

The “electricity” figures reported under the “Energy industry own use and distribution losses” flow include electricity consumption by electrolysers and carbon capture and storage (CCS). The “heat” figures reported under the “Energy industry own use and distribution losses” flow, include the heat consumption by CCS.

Republic of Türkiye

Source(s)

Ministry of Energy and Natural Resources.

Scenario(s)

Not applicable.

General notes

Projections are not available.

United Kingdom

Source(s)

Department for Business, Energy and Industrial Strategy (BEIS).

Collaborating institution: Department of Energy Security and Net Zero (DESNZ)

Scenario(s)

Business as usual.

General notes

All projections data are based on the 2024/25 submission to the IEA.

Projections are updated annually.

The Energy and Emissions Projections publication provides projections of energy, emissions and electricity generation. These projections include policies that have been implemented and those that are planned - where the level of funding has been agreed and the design of the policy is near final.

Partial projections are available for 2030, 2040 and 2050 for coal, oil, natural gas and electricity.

Additional information is available at: https://assets.publishing.service.gov.uk/media/675c0ca798302e574b915336/eep-report-2023-2050.pdf

https://www.gov.uk/government/publications/energy-and-emissions-projections-2023-to-2050

United States

Source(s)

U.S. Energy Information Administration (EIA)

Scenario(s)

Business as usual

Other

General notes

All projections data are based on the 2022/23 submission to the IEA.

Projections are updated on an annual basis.

The National Energy Modelling System (NEMS) has been used to generate the projections in the Annual Energy Outlook 2023 (AEO 2023). This included general features of the model structure, assumptions concerning energy markets, and the key input data and parameters that were critical to formulating the model results. The EIA develops projections in NEMS by using a market-based approach, subject to regulations and standards. For each fuel and consuming sector, NEMS balances energy supply and demand, accounting for economic competition across the various energy fuels and sources. The projection period in NEMS currently extends to 2050. Additional information is available at: https://www.eia.gov/outlooks/aeo/

https://www.eia.gov/outlooks/aeo/tables_ref.php https://www.eia.gov/outlooks/aeo/nems/documentation/

https://www.eia.gov/analysis/

For the purpose of this publication, data corresponding to two scenarios are included. The “reference” case is based on already adopted regulations and standards (as of mid-November 2022) and is in alignment with the “business as usual” scenario category. The “high economic growth” scenario, is one of the few scenarios developed to reflect the uncertainty in projections of economic growth. In this scenario, real GDP grows at an average annual rate of 2.3 percent from 2022 to 2050. This scenario has been identified under the “other” category for the purpose of this publication.

Heat generation and consumption data is not included for forecast years, as a resulted the corresponding energy balances flows and respective indicators are not available.

European Union

Source(s)

European Commission

Scenario(s)

No information is available.

General notes

Projections are available but can not be publicly disseminated by the IEA.

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)

Energy content

Coal

Coal has separate net calorific values for production, imports, exports, inputs to electricity/heat generation and coal used in coke ovens, blast furnaces and industry.

For electricity/heat generation, coal inputs to each type of plant (i.e. main activity electricity plant, autoproducer electricity plant, main activity CHP plant, autoproducer CHP plant, main activity heat plant, autoproducer heat plant) are converted to energy units using average factors calculated from the Annual Electricity Questionnaire. All other flows are converted using an average net calorific value.

Crude oil

Country-specific net calorific values (NCV) for production, imports and exports by country are used to calculate the balances. The average value is used to convert all the other flows to heat values.

Gases

World Energy Statistics expresses the following gases in terajoules, using their gross calorific value.

To calculate the net heat content of a gas from its gross heat content, multiply the gross heat content by the appropriate following factor.

Gas	Ratio NCV to GCV
Natural gas	0.9
Gas works gas	0.9
Coke oven gas	0.9
Blast furnace gas	1.0
Other recovered gases	1.0

Biofuels and waste

The heat content of primary solid biofuels, biogases, municipal waste and industrial waste, expressed in terajoules on a net calorific value basis, is presented in World Energy Statistics. The Secretariat does not receive information on volumes and other characteristics of these fuels.

Data for charcoal are converted from tonnes using the average net calorific values given in the electronic tables.

Unless country-specific information has been provided, data for biogasoline are converted from tonnes using 26 800 kJ/kg. Biodiesels and other liquid biofuels are assumed to have a net calorific value of 36 700 kJ/kg unless otherwise specified.

Oil products

For oil products, the IEA applies regional net calorific values (in conjunction with Eurostat for the European countries), except for the individual countries listed in the table at the end of this section.

Electricity

Figures for electricity production, trade, and final consumption are calculated using the energy content of the electricity. Electricity is converted as follows: Data in TWh x 3600 = data in TJ.

Hydro-electricity production (excluding pumped storage) and electricity produced by other non-thermal means (wind, tide/wave/ocean, solar PV, etc.) are accounted for similarly. Gross electricity generation in TWh x 3600= primary energy equivalent in TJ.

The primary energy equivalent of nuclear electricity is calculated from the gross generation by assuming a 33% conversion efficiency. The calculation to be carried *out is the following: gross electricity generation in TWh x 3600 ⁄ 0.33 = primary energy equivalent in TJ.*

In the case of electricity produced from geothermal heat, if the actual geothermal efficiency is not known, then the primary equivalent is calculated assuming an efficiency of 10%. The calculation to be carried out is the following: gross electricity generation in TWh x 3600/0.10 = primary energy equivalent in TJ.

For electricity produced from solar thermal heat, the primary equivalent is calculated assuming an efficiency of 33% unless the actual efficiency is known. The calculation to be carried out is the following: gross electricity generation in TWh x 3600/0.33 = primary energy equivalent in TJ.

Heat

In the case of heat produced in a geothermal plant, if the actual geothermal efficiency is not known, then the primary equivalent is calculated assuming an efficiency of 50%. The calculation to be carried out is the following: Heat production in TJ / 0.50 = primary energy equivalent in TJ.

For heat produced in a solar thermal plant, the primary equivalent is equal to the heat consumed.

For direct use of geothermal and solar thermal heat, all the heat consumed is accounted for in production and consumption.

Examples

The following examples indicate how to calculate the net calorific content (in ktoe) of the quantities expressed in original units in World Energy Statistics.

From original units	To Mtoe (on a NCV basis)
Coking coal production (Poland) for 2018 in thousand tonnes	divide by 41 868 and then multiply by 29.646
Natural gas in terajoules (gross)	multiply by 2.38846×10^{-5} and then multiply by 0.9
Motor gasoline (Poland) in thousand tonnes	divide by 41 868 and then multiply by 44.000
Heat in terajoules (net)	multiply by 2.38846×10^{-5}

Abbreviations

Btu:	British thermal unit
GWh:	gigawatt hou
kcal:	kilocalorie
kg:	kilogramme
kJ:	kilojoule
Mt:	million tonnes
m^3:	cubic metre
t:	metric ton = tonne = 1,000 kg
TJ:	terajoule
toe:	tonne of oil equivalent = 10^7 kcal
CHP:	combined heat and power
GCV:	gross calorific value
GDP:	gross domestic product
HHV:	higher heating value = GCV
LHV:	lower heating value = NCV
NCV:	net calorific value
PPP:	purchasing power parity
TES:	total energy supply
EU:	European Union
SLT:	Standing Group for Long-Term Cooperation
IEA:	International Energy Agency
IPCC:	Intergovernmental Panel on Climate Change
ISIC:	International Standard Industrial Classification
OECD:	Organisation for Economic Co-Operation and Development
OLADE:	Organización Latinoamericana de Energía
UN:	United Nations
UNIPEDE:	International Union of Producers and Distributors of Electrical Energy
c	confidential
..	not available
x	not applicable

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