Emission Factors

2026 edition

Database package documentation

International Energy Agency

INTERNATIONAL ENERGY AGENCY

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Acknowledgements

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This document contains a description of the 2026 edition of the IEA Emissions factors data package. The following table highlights its components and which parts are also available as standalone products:

Emissions Factors package			
Name of the dataset	**Emissions Factors**	**Monthly and Quarterly Emissions Factors**	**Life Cycle Upstream Emission Factors**
Type of data	CO_2, CH_4, N_2O emission factors for electricity (and heat – CO_2 only) generation, adjustment factors for trade and transmission and distribution losses, direct combustion emission factors for final consumption sectors	Monthly and quarterly CO_2 emission factors for electricity generation	Fuel-cycle greenhouse gas emissions per kwh of electricity, total upstream greenhouse gas emissions per kwh of electricity
Time granularity	Annual	Monthly and quarterly	Annual
Coverage	Global, up to 150 countries/region currently covered	Global, up to 52 countries currently covered	Global, up to 150 countries/region currently covered
Notes	Available as standalone product at Emissions Factors 2026 - Data product - IEA	Available only in the Emissions Factors Package	Available as standalone product at Life Cycle Upstream Emissions Factors 2026 - Data product - IEA
Regular frequency of update	Annually	Quarterly	Annually

Please address your inquiries to emissionfactors@iea.org.

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

A list of answers to frequently asked questions on this product and its uses is available at: FAQ.

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1. WHAT'S NEW

Geographical coverage

Romania became an IEA Accession country in April 2026. Accordingly, starting with the July 2026 edition, Romania is included in the IEA and Accession/Association countries.

Viet Nam became an IEA Association country in February 2026. Accordingly, starting with the July 2026 edition, Viet Nam is included in the IEA and Accession/Association countries.

Nigeria became an IEA Association country in July 2026. Accordingly, starting with the July 2026 publication, Nigeria is included in the IEA and Accession/Association countries.

Following the official announcement in May 2026 of the United Arab Emirates' withdrawal from the Organization of the Petroleum Exporting Countries (OPEC), the country has been excluded from the OPEC aggregate starting with the July 2026 edition.

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

Geographical coverage for the provisional year

In the 2026 edition, provisional 2025 data for selected non-OECD countries are added to those for OECD countries. Below is the list of the datapoints added, by country and type of indicator.

Flow	Countries
Emissions per kWh of electricity only (gCO_2eq per kWh) Sheet CO2 KWH ELE	Albania, Argentina, Armenia, Azerbaijan, Bangladesh, Bosnia and Herzegovina, Botswana, Brazil, Bulgaria, Cambodia, People's Republic of China, Croatia, Cyprus, Georgia, Ghana, India, Kazakhstan, Kosovo, Kyrgyzstan, Malta, Mauritius, Republic of Moldova, Mongolia, Montenegro, Namibia, Nigeria, Republic of North Macedonia, Peru, Romania, Serbia, Singapore, South Africa, Chinese Taipei, United Republic of Tanzania, Thailand, Ukraine, Uruguay, Viet Nam and Zambia.
Emissions per kWh of electricity and heat (gCO_2 per kWh) Sheet CO2 KWH ELE & HEAT	Albania, Argentina, Azerbaijan, Brazil, Bulgaria, Croatia, Cyprus, Georgia, Kosovo, Malta, Republic of Moldova, Republic of North Macedonia, Romania and Serbia.

2. COVERAGE

The factors described in this document are detailed below:

- **CO_2 emission factors for electricity and heat generation for world countries** (in CO_2 per kWh, 1990 to 2024). (Sheet CO2 KWH ELE & HEAT)
- **CO_2 emission factors for electricity only generation** (CHP electricity included) for world countries (in CO_2 per kWh, 1990 to 2024). (Sheet CO2KWH ELE)

  Provisional 2025 CO_2 emission factors for electricity and electricity/heat generation, based on provisional electricity generation data (for all OECD countries and selected non-OECD countries) are also available in sheets CO2 KWH ELE & HEAT and CO2KWH ELE.

  Note: the above emission factors are given for electricity and electricity/heat generation for: total electricity generation; generation from oil, coal, gas and from non-renewable waste, as well as from biofuels. (Sheets CO2 KWH ELE & HEAT and CO2KWH ELE)
- **CH_4 and N_2O emission factors for electricity generation** (based on default IPCC factors) (in CO_2eq per kWh, 1990 to 2024). (Sheets CH4 factors and N2O factors)
- **Adjustment factors for indirect emissions induced by electricity trade between countries** (for OECD countries, 1990 to 2024). (Sheet Trade adjustment)
- **Adjustment factors for emissions associated with transmission and distribution losses of electricity in the grid** (for countries with available data, 1990 to 2024). (Sheet T&D losses adjustment)
- **Emission factors by fuel from direct combustion in final consumption sectors, other than electricity and heat production** (1990 to 2024). (Sheet Direct combustion factors)
- **Total upstream emission factors** (in CO2eq per kWh) (sheet Total upstream factors)
- **Fuel-cycle emission factors** (in CO2eq per kWh) (sheet Fuel-cycle factors)

  Note that the fuel-cycle emission factors are a sub-component of total upstream emission factors.

  Life cycle adjustment factors for transmission and distribution losses (in CO2eq per kWh) (sheet Life cycle T&D factors)
  Note that these adjustment factors are not included in the above emission factors and can be added to the above to derive a closer intensity figure at the final consumption point.
- **Total emission factors** (in CO2eq per kWh) (sheet Total emission factors)
- **Monthly CO_2 emission factors for electricity only generation** (CHP electricity included) in CO_2 per kWh. (Sheet CO2KWH ELE - Monthly)
- **Quarterly CO_2 emission factors for electricity only generation** (CHP electricity included) in CO_2 per kWh. (Sheet CO2KWH ELE - Quarterly)

3. DEFINITIONS

Electricity and Heat Output and Emissions per kWh	
Flow	**Definition**
Emissions per kWh of electricity only (gCO_2eq per kWh)	This ratio is expressed in grammes of CO_{2eq} per kWh. Characteristics This ratio is based on total emissions from fossil fuels consumed for electricity generation, in both electricity-only and combined heat and power plants (CHP), divided by output of electricity generated from all fossil and non-fossil sources. Both main activity producers and autoproducers have been included in the calculation.
Emissions per kWh of electricity and heat (gCO_{2eq} per kWh)	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.
Trade adjustment (gCO2/kWh)	Part of the electricity consumed in one country may have been generated in another one. Similarly, part of the electricity generated in one country can be exported to other countries. Therefore, adjustments may be done to the emission factors calculated above to account for electricity trade. Such adjustments are based on the share of electricity that is imported or exported compared to the domestic supply. The data needed to calculate such adjustment are only available for OECD members and selected countries, depending on data availability. This adjustment can be positive or negative.
Transmission and distribution losses adjustment (gCO2/kWh)	As electricity is transmitted through a grid from the generation point to the consumption point, losses can occur for different reasons - they usually represent between 5 and 15% of the energy transmitted, mainly depending on the distance of the lines. Basically, for each kWh being consumed, a higher amount had to be generated.
Direct combustion factors ($kgCO_{2eq}/m^3$ or gCO_{2eq}/m^3 or $kgCO_{2eq}/kg$ or gCO_{2eq}/kg)	These factors are computed as weighted average of the consumption across all sectors excluding electricity generation. The included sectors comprise of energy industry own use, industry, transport, residential, commercial and public services, agriculture/forestry, fishing and other non-specified final consumption sector.
Total upstream emission factors (CO_{2eq}/kWh)	Correspond to the total upstream emissions intensity associated with the national electricity generation. The factors are computed using the overall life cycle footprint of the electricity generation technologies/fuels excluding direct emissions from combustion of the fuels at the generation point weighted by their respective shares in the generation mix. For the most recent year available, this value is estimated based on provisional data.

Electricity and Heat Output and Emissions per kWh	
Flow	**Definition**
Fuel-cycle emission factors (CO_{2eq}/kWh)	Correspond to the fuel-cycle emissions intensity associated with the national electricity generation. The factors are computed using the life cycle emissions intensity corresponding to fossil fuels, uranium and biofuels fuel-cycles weighted by the respective shares of all fuels/technologies in the generation mix. The non-fuel cycle life cycle emissions and the direct emissions from combustion of the fuels at the generation point are excluded. Note that the fuel-cycle emission factors are a sub-component of total upstream emission factors. For the most recent year available, this value is estimated based on provisional data.
Life cycle adjustment factors for transmission and distribution losses (CO_{2eq}/kWh)	Include the emission intensities associated with the transmission and distribution losses of electricity in the grid developed from a life cycle perspective. The factors are developed by multiplying the life cycle emission intensity of the electricity grid by the percentage of the T&D losses occurred. Note that these adjustment factors are not included in the above emission factors and can be added to the above to derive a closer intensity figure at the final consumption point.
Total greenhouse emissions per kwh of activity or electricity generated (gCO2eq/kWh)	Corresponds to the sum of emissions per kWh of electricity generation only for CO2, N2O and CH4, trade adjustment accounting for the emissions impact of electricity trade between countries (for OECD countries), total upstream emissions intensity associated with the national electricity generation and relevant adjustments associated with the transmission and distribution losses of electricity in the grid developed from a life cycle perspective. This is only included in the Emission Factors data package.

GHG		
GHG	**Short name**	**Definition**
CO2eq	CO2E	CO2 equivalent
CO2	CO2	CO2
CH4	CH4	The emission factors are converted from gCH_4 and gN_2O to gCO_{2eq} using the 100-year Global Warming Potential (GWP). To ensure alignment with the latest requirements from European Sustainability Reporting (ESRS) and other major disclosure standards, the factors from the 6th Assessment of the IPCC are used. $1gCH_4 = 27\ gCO_{2eq}$
N2O	N2O	The emission factors are converted from gCH_4 and gN_2O to gCO_{2eq} using the 100-year Global Warming Potential (GWP). To ensure alignment with the latest requirements from European Sustainability Reporting (ESRS) and other major disclosure standards, the factors from the 6th Assessment of the IPCC are used. $1gN_2O = 273\ gCO_{2eq}$

Aggregated product categories		
Flow	**Short name**	**Definition**
Total	TOTAL	TOTAL = the total of all CO_2 emissions from fuel combustion, *i.e.* COAL + OIL + NATGAS + OTHER.
Coal, peat and oil shale	COAL	Coal, peat and oil shale includes all coal, both primary (hard coal, brown coal, anthracite, coking coal, other bituminous coal, sub-bituminous coal and lignite) and derived fuels (patent fuel, coke oven coke, gas coke, coal tar, BKB, gas works gas, coke oven gas, blast furnace gas and other recovered gases). Peat, peat products and oil shale are also aggregated in this category.
Oil	OIL	Oil 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	NATGAS	Gas represents natural gas. It excludes natural gas liquids.
Non-renewables wastes	OTHER	Other includes industrial waste and non-renewable municipal waste.
Memo: Biofuels and renewable wastes	BIOPROD	Includes biofuels (primary solid biofuels, biogases, biogasoline, biodiesels, bio jet kerosene and other liquid biofuels) and renewable wastes.

4. GEOGRAPHICAL COVERAGE AND COUNTRY NOTES

Countries and regions

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For details regarding the country-specific monthly electricity statistics which have been used as basis for developing monthly and quarterly factors, please refer to the IEA Monthly Electricity Statistics documentation.

Country/Region	Short name	Definition
World	WORLD	Includes OECD Total; Africa; Non-OECD Asia Oceania (excluding China); China (P.R. of China and Hong Kong, China); Non-OECD Americas; Middle East; Non-OECD Europe and Eurasia; World aviation bunkers and World marine bunkers. It is also the sum of Africa (UN), Americas (UN), Asia (UN), Europe (UN), Oceania (UN), World aviation bunkers and World marine bunkers.
OECD Total	OECDTOT	Includes Australia; Austria; Belgium; Canada; Chile; Colombia; Costa Rica; the Czech Republic; Denmark; Estonia; Finland; France; Germany; Greece; Hungary; Iceland; Ireland; Israel; Italy; Japan; Korea; Latvia; Lithuania; Luxembourg; Mexico; the Netherlands; New Zealand; Norway; Poland; Portugal; the Slovak Republic; Slovenia; Spain; Sweden; Switzerland; the Republic of Türkiye; the United Kingdom and the United States.[1] Estonia, Latvia, Lithuania and Slovenia are included starting in 1990. Prior to 1990, data for Estonia, Latvia and Lithuania are included in Former Soviet Union and data for Slovenia in Former Yugoslavia.
OECD Americas	OECDAM	Includes Canada; Chile; Colombia; Costa Rica; Mexico and the United States.
OECD Asia Oceania	OECDAO	Includes Australia, Israel[2], Japan, Korea and New Zealand.

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

Countries and regions

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For details regarding the country-specific monthly electricity statistics which have been used as basis for developing monthly and quarterly factors, please refer to the IEA Monthly Electricity Statistics documentation.

Country/Region	Short name	Definition
OECD Europe	OECDEUR	Includes Austria; Belgium; the Czech Republic; Denmark; Estonia; Finland; France; Germany; Greece; Hungary; Iceland; Ireland; Italy; Latvia; Lithuania; Luxembourg; the Netherlands; Norway; Poland; Portugal; the Slovak Republic; Slovenia; Spain; Sweden; Switzerland; the Republic of Türkiye and the United Kingdom. Estonia, Latvia, Lithuania and Slovenia are included starting in 1990. Prior to 1990, data for Estonia, Latvia and Lithuania are included in Former Soviet Union and data for Slovenia in Former Yugoslavia.
Africa	AFRICA	Includes Algeria; Angola; Benin; Botswana; Burkina Faso; Burundi; Cabo Verde; Cameroon; Central African Republic; Chad; Comoros; the Republic of the Congo (Congo); Côte d'Ivoire; the Democratic Republic of the Congo; Djibouti; Egypt; Equatorial Guinea; Eritrea; the Kingdom of Eswatini; Ethiopia; Gabon; Gambia; Ghana; Guinea; Guinea-Bissau; Kenya; Lesotho; Liberia; Libya; Madagascar; Malawi; Mali; Mauritania; Mauritius; Morocco; Mozambique; Namibia; Niger; Nigeria; Réunion (until 2010); Rwanda; Sao Tome and Principe; Senegal; the Seychelles; Sierra Leone; Somalia; South Africa; South Sudan (from 2012), Sudan; the United Republic of Tanzania (Tanzania); Togo; Tunisia; Uganda; Zambia; Zimbabwe.
Non-OECD Americas	LATAMER	Includes Argentina; Plurinational State of Bolivia (Bolivia); Brazil; Cuba; Curaçao [3]; Dominican Republic; Ecuador; El Salvador; Guatemala; Guyana; Haiti; Honduras; Jamaica; Nicaragua; Panama; Paraguay; Peru; Suriname (from 2000); Trinidad and Tobago; Uruguay; Bolivarian Republic of Venezuela (Venezuela) and Other non-OECD Americas.

[3] Netherlands Antilles was dissolved on 10 October 2010, resulting in two new constituent countries, Curaçao and Sint Maarten, with the remaining islands joining the Netherlands as special municipalities. From 2012 onwards, data now account for the energy statistics of Curaçao Island only. Prior to 2012, data remain unchanged and still cover the entire territory of the former Netherlands Antilles.

Countries and regions

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For details regarding the country-specific monthly electricity statistics which have been used as basis for developing monthly and quarterly factors, please refer to the IEA Monthly Electricity Statistics documentation.

Country/Region	Short name	Definition
Middle East	MIDEAST	Includes Bahrain, Islamic Republic of Iran, Iraq, Jordan, Kuwait, Lebanon, Oman, Qatar, Saudi Arabia, Syrian Arab Republic, United Arab Emirates and Yemen.
Non-OECD Europe and Eurasia	EURASIA	Includes Albania; Armenia; Azerbaijan; Belarus; Bosnia and Herzegovina; Bulgaria; Croatia; Cyprus[4]; Georgia; Gibraltar; Kazakhstan; Kosovo[5]; Kyrgyzstan; Malta; Republic of Moldova (Moldova); Montenegro; the Republic of North Macedonia (North Macedonia); Romania; Russian Federation; Serbia[6]; Tajikistan; Turkmenistan; Ukraine; Uzbekistan; Former Soviet Union (prior to 1990) and Former Yugoslavia (prior to 1990). Prior to 1990, data for Estonia, Latvia and Lithuania are included in Former Soviet Union and data for Slovenia in Former Yugoslavia.
Non-OECD Asia (excluding China)	ASIA	Includes Bangladesh, Brunei Darussalam, Cambodia (from 1995), DPR of Korea, India, Indonesia, Lao People's Democratic Republic (from 2000); Malaysia, Mongolia (from 1985), Myanmar, Nepal, Pakistan, Philippines, Singapore, Sri Lanka, Chinese Taipei, Thailand, Viet Nam and **Other non-OECD Asia**.
China (including Hong Kong, China)	CHINAREG	Includes the People's Republic of China and Hong Kong, China.
World Aviation Bunkers	WORLDAV	World aviation bunkers represents the sum of International Aviation Bunkers from all countries.
World Marine Bunkers	WORLDMAR	World marine bunkers represents the sum of International Marine Bunkers from all countries.

[4]. **Note byTurkey:**
The information in this document with reference to "Cyprus" relates to the southern part of the Island. There is no single authority representing both Turkish and Greek Cypriot people on the Island. Turkey recognises the Turkish Republic of Northern Cyprus (TRNC). Until a lasting and equitable solution is found within the context of the United Nations, Turkey shall preserve its position concerning the "Cyprus issue".
Note by all the European Union Member States of the OECD and the European Union:
The Republic of Cyprus is recognised by all members of the United Nations with the exception of Turkey. The information in this document relates to the area under the effective control of the Government of the Republic of Cyprus.
[5] This designation is without prejudice to positions on status, and is in line with United Nations Security Council Resolution 1244/99 and the Advisory Opinion of the International Court of Justice on Kosovo's declaration of independence.
[6]. Serbia includes Montenegro until 2004 and Kosovo until 1999.

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For details regarding the country-specific monthly electricity statistics which have been used as basis for developing monthly and quarterly factors, please refer to the IEA Monthly Electricity Statistics documentation.

Country/Region	Short name	Definition
Albania	ALBANIA	Data available for monthly and quarterly factors from 2018 onwards.
Algeria	ALGERIA	
Angola	ANGOLA	
Argentina	ARGENTINA	Argentina is an IEA Association country, therefore it is included in the IEA and Accession/Association countries aggregate (IEA Family). Data are also available for monthly and quarterly factors.
Armenia	ARMENIA	Data for Armenia are available starting in 1990. Prior to that, they are included in Former Soviet Union.
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. Data are also available for monthly and quarterly factors.
Austria	AUSTRIA	Data are also available for monthly and quarterly factors.
Azerbaijan	AZERBAIJAN	Data for Azerbaijan are available starting in 1990. Prior to that, they are included in Former Soviet Union.
Bahrain	BAHRAIN	
Bangladesh	BANGLADESH	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.
Belarus	BELARUS	Data for Belarus are available starting in 1990. Prior to that, they are included in Former Soviet Union.
Belgium	BELGIUM	Data are also available for monthly and quarterly factors.
Benin	BENIN	
Bolivia	BOLIVIA	

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For details regarding the country-specific monthly electricity statistics which have been used as basis for developing monthly and quarterly factors, please refer to the IEA Monthly Electricity Statistics documentation.

Country/Region	Short name	Definition
Bosnia and Herzegovina	BOSNIAHERZ	Data for Bosnia and Herzegovina are available starting in 1990. Prior to that, they are included in Former Yugoslavia. Data are also available for monthly and quarterly factors starting in 2019.
Botswana	BOTSWANA	
Brazil	BRAZIL	Brazil is an IEA Association country, therefore it is included in the IEA and Accession/Association countries aggregate (IEA Family). Data are also available for monthly and quarterly factors.
Brunei Darussalam	BRUNEI	
Bulgaria	BULGARIA	According to the provisions of Article 4.6 of the Convention and Decisions 9/CP.2 and 11/CP.4, Bulgaria is allowed to use 1988 as the base year. Data are also available for monthly and quarterly factors.
Cambodia	CAMBODIA	Data for Cambodia are available starting in 1995. Prior to that, they are included in Other non-OECD Asia.
Cameroon	CAMEROON	
Canada	CANADA	Data are also available for monthly and quarterly factors.
Chile	CHILE	Data start in 1971. Chile is currently seeking accession to full IEA membership (Accession country), therefore it is included in the IEA and Accession/Association countries aggregate (IEA Family). Data are also available for monthly and quarterly factors.

Countries and regions

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For details regarding the country-specific monthly electricity statistics which have been used as basis for developing monthly and quarterly factors, please refer to the IEA Monthly Electricity Statistics documentation.

Country/Region	Short name	Definition
People's Republic of China	CHINA	People's Republic of China is an IEA Association country, therefore it is included in the IEA and Accession/Association countries aggregate (IEA Family). Data are also available for monthly and quarterly factors.
Colombia	COLOMBIA	Colombia is currently seeking accession to full IEA membership (Accession country), therefore it is included in the IEA and Accession/Association countries aggregate (IEA Family), for data starting in 1971 and for the entire time series. Data are also available for monthly and quarterly factors.
Congo	CONGO	
Costa Rica	COSTARICA	Costa Rica joined the OECD in May 2021; data are now included in the applicable OECD aggregates. Costa Rica is currently seeking accession to full IEA membership (Accession country). Accordingly, Costa Rica is included in the IEA and Accession/Association countries aggregate for data starting in 1971. Data are also available for monthly and quarterly factors starting in 2021.
Côte d'Ivoire	COTEIVOIRE	
Croatia	CROATIA	Data for Croatia are available starting in 1990. Prior to that, they are included in Former Yugoslavia. Data are also available for monthly and quarterly factors.
Cuba	CUBA	

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For details regarding the country-specific monthly electricity statistics which have been used as basis for developing monthly and quarterly factors, please refer to the IEA Monthly Electricity Statistics documentation.

Country/Region	Short name	Definition
Curaçao	CURACAO	The Netherlands Antilles was dissolved on 10 October 2010, resulting in two new constituent countries, Curaçao and Sint Maarten, with the remaining islands joining the Netherlands as special municipalities. From 2012 onwards, data now account for the energy statistics of Curaçao Island only. Prior to 2012, data remain unchanged and still cover the entire territory of the former Netherlands Antilles.
Cyprus	CYPRUS	**Note by the Republic of Türkiye (Türkiye):** The information in the report with reference to "Cyprus" relates to the southern part of the Island. There is no single authority representing both Turkish and Greek Cypriot people on the Island. Türkiye recognises the Turkish Republic of Northern Cyprus (TRNC). Until a lasting and equitable solution is found within the context of the United Nations, Türkiye shall preserve its position concerning the "Cyprus" issue. **Note by all the European Union Member States of the OECD and the European Union:** The Republic of Cyprus is recognised by all members of the United Nations with the exception of Türkiye. The information in this report relates to the area under the effective control of the Government of the Republic of Cyprus. At its seventeenth session, the Conference of the Parties decided to amend Annex I to the Convention to include Cyprus (Decision 10/CP.17). The amendment entered into force on 9 January 2013. Data are also available for monthly and quarterly factors starting in 2018.
Czech Republic	CZECH	Data start in 1971. Data are also available for monthly and quarterly factors.
Democratic People's Republic of Korea	KOREADPR	

Countries and regions

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For details regarding the country-specific monthly electricity statistics which have been used as basis for developing monthly and quarterly factors, please refer to the IEA Monthly Electricity Statistics documentation.

Country/Region	Short name	Definition
Democratic Republic of Congo	CONGOREP	
Denmark	DENMARK	Excludes Greenland and the Danish Faroes, except prior to 1990, where data on oil for Greenland were included with the Danish statistics. Data are also available for monthly and quarterly factors.
Dominican Republic	DOMINICANR	
Ecuador	ECUADOR	
Egypt	EGYPT	By convention, data for the fiscal year that starts on 1 July Y and ends on 30 June Y+1 are labelled as year Y. Egypt is an IEA Association country, therefore it is included in the IEA and Accession/Association countries aggregate (IEA Family).
El Salvador	ELSALVADOR	
Equatorial Guinea	EQGUINEA	Data start in 1981.
Eritrea	ERITREA	Data for Eritrea are available from 1992. Prior to that, they are included in Ethiopia.
Estonia	ESTONIA	Data start in 1990. Prior to that, they are included within Former Soviet Union. Data are also available for monthly and quarterly factors.
Ethiopia	ETHIOPIA	Data are reported on a fiscal year basis. By convention, data for the fiscal year that starts on 1 July Y and ends on 30 June Y+1 are labelled as year Y.
Kingdom of Eswatini	ESWATINI	
Finland	FINLAND	Data are also available for monthly and quarterly factors.

Countries and regions

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For details regarding the country-specific monthly electricity statistics which have been used as basis for developing monthly and quarterly factors, please refer to the IEA Monthly Electricity Statistics documentation.

Country/Region	Short name	Definition
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. Data are also available for monthly and quarterly factors.
Gabon	GABON	
Georgia	GEORGIA	Data for Georgia are available starting in 1990. Prior to that, they are included in Former Soviet Union. Data are also available for monthly and quarterly factors starting in 2018.
Germany	GERMANY	Includes the new federal states of Germany from 1970 onwards. Data are also available for monthly and quarterly factors.
Ghana	GHANA	
Gibraltar	GIBRALTAR	
Greece	GREECE	Data are also available for monthly and quarterly factors.
Guatemala	GUATEMALA	
Guyana	GUYANA	
Haiti	HAITI	
Honduras	HONDURAS	
Hong Kong, China	HONGKONG	

Countries and regions

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For details regarding the country-specific monthly electricity statistics which have been used as basis for developing monthly and quarterly factors, please refer to the IEA Monthly Electricity Statistics documentation.

Country/Region	Short name	Definition
Hungary	HUNGARY	Data starts in 1965. According to the provisions of Article 4.6 of the Convention and Decisions 9/CP.2 and 11/CP.4, Hungary is allowed to use average 1985-1987 as the base year. Data are also available for monthly and quarterly factors.
Iceland	ICELAND	Data are also available for monthly and quarterly factors.
India	INDIA	Data are reported on a fiscal year basis. By convention, data for the fiscal year that starts on 1 April Y and ends on 31 March Y+1 are labelled as year Y. This convention is different from the one used by Government of India, whereby fiscal year starts on 1 April Y and ends on 31 March Y+1 are labelled as year Y+1. India is an IEA Association country, therefore it is included in the IEA and Accession/Association countries aggregate (IEA Family). Data are also available for monthly and quarterly factors.
Indonesia	INDONESIA	Indonesia is an IEA Association country, therefore it is included in the IEA and Accession/Association countries aggregate (IEA Family).
Islamic Republic of Iran	IRAN	Data are reported on the Iranian fiscal year basis. Data for the fiscal year that starts on 20 March Y and ends on 19 March Y+1 are labelled as year Y.
Iraq	IRAQ	
Ireland	IRELAND	Data are also available for monthly and quarterly factors.

Countries and regions

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For details regarding the country-specific monthly electricity statistics which have been used as basis for developing monthly and quarterly factors, please refer to the IEA Monthly Electricity Statistics documentation.

Country/Region	Short name	Definition
Israel	ISRAEL	The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities. The use of such data by the OECD is without prejudice to the status of the Golan Heights, East Jerusalem and Israeli settlements in the West Bank under the terms of international law. Israel is currently seeking accession to full IEA membership (Accession country), therefore it is included in the IEA and Accession/Association countries aggregate (IEA Family).
Italy	ITALY	Includes San Marino and the Holy See. Data are also available for monthly and quarterly factors.
Jamaica	JAMAICA	
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. Data are also available for monthly and quarterly factors.
Jordan	JORDAN	
Kazakhstan	KAZAKHSTAN	Data for Kazakhstan are available starting in 1990. Prior to that they are included in Former Soviet Union.
Kenya	KENYA	Kenya joined the IEA as an Association country in June 2023. Accordingly, it is included in the IEA and Accession/Association countries aggregate (IEA Family)
Korea	KOREA	Data are also available for monthly and quarterly factors.

Countries and regions

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For details regarding the country-specific monthly electricity statistics which have been used as basis for developing monthly and quarterly factors, please refer to the IEA Monthly Electricity Statistics documentation.

Country/Region	Short name	Definition
Kosovo	KOSOVO	This designation is without prejudice to positions on status, and is in line with United Nations Security Council Resolution 1244/99 and the Advisory Opinion of the International Court of Justice on Kosovo's declaration of independence. Data for Kosovo are available starting in 2000. From 1990-1999, data for Kosovo are included in Serbia. Prior 1990 that, they are included in Former Yugoslavia.
Kuwait	KUWAIT	
Kyrgyzstan	KYRGYZSTAN	
Latvia	LATVIA	Data are also available for monthly and quarterly factors.
Lao People's Democratic Republic	LAO	Data start in 2000. Prior to that, they are included in the Other non-OECD Asia region.
Lebanon	LEBANON	
Libya	LIBYA	
Lithuania	LITHUANIA	Lithuania joined the IEA in February 2022; however, its data have not been included in the IEA member countries aggregate (IEA total) for this edition. They are included in the IEA and Accession/Association countries aggregate (IEA Family). Data are also available for monthly and quarterly factors.
Luxembourg	LUXEMBOU	Data are also available for monthly and quarterly factors.
Madagascar	MADAGASCAR	
Malaysia	MALAYSIA	
Malta	MALTA	At its fifteenth session, the Conference of the Parties decided to amend Annex I to the Convention to include Malta (Decision 3/CP.15). The amendment entered into force on 26 October 2010. Data are also available for monthly and quarterly factors starting in 2018.

Countries and regions

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For details regarding the country-specific monthly electricity statistics which have been used as basis for developing monthly and quarterly factors, please refer to the IEA Monthly Electricity Statistics documentation.

Country/Region	Short name	Definition
Mauritius	MAURITIUS	
Mexico	MEXICO	Data are also available for monthly and quarterly factors.
Republic of Moldova	MOLDOVA	
Mongolia	MONGOLIA	
Montenegro	MONTENEGRO	Data for Montenegro are available starting in 2005. From 1990 to 2004, data for Montenegro are included in Serbia. Prior to 1990, data are included in Former Yugoslavia.
Morocco	MOROCCO	Morocco is an IEA Association country, therefore it is included in the IEA and Accession/Association countries aggregate (IEA Family).
Mozambique	MOZAMBIQUE	
Myanmar	MYANMAR	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
Namibia	NAMIBIA	Electricity data are reported on a fiscal year basis. By convention data for the fiscal year that starts on 1 July Y and ends on 31 June Y+1 are labelled as year Y. Data for Namibia are available starting in 1991. Prior to that, they are included in Other Africa.
Nepal	NEPAL	Data are reported on a fiscal year basis. By convention data for the fiscal year that starts on 1 July Y and ends on 30 June Y+1 are labelled as year Y.
Netherlands	NETHLAND	Excludes Suriname, Aruba and the other former the Netherlands Antilles (Bonaire, Curaçao, Saba, Saint Eustatius and Sint Maarten). Data are also available for monthly and quarterly factors.
New Zealand	NZ	Data are also available for monthly and quarterly factors.

Countries and regions

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For details regarding the country-specific monthly electricity statistics which have been used as basis for developing monthly and quarterly factors, please refer to the IEA Monthly Electricity Statistics documentation.

Country/Region	Short name	Definition
Nicaragua	NICARAGUA	
Niger	NIGER	
Nigeria	NIGERIA	
Republic of North Macedonia	NORTHMACED	Data are also available for monthly and quarterly factors.
Norway	NORWAY	Discrepancies between Reference and Sectoral Approach estimates and the difference in the resulting growth rates arise from statistical differences between supply and consumption data for oil and natural gas. For Norway, supply of these fuels is the residual of two very large and opposite terms, production and exports. Data are also available for monthly and quarterly factors.
Oman	OMAN	
Pakistan	PAKISTAN	Data are reported on a fiscal year basis. By convention data for the fiscal year that starts on 1 July Y and ends on 30 June Y+1 are labelled as year Y.
Panama	PANAMA	
Paraguay	PARAGUAY	
Peru	PERU	Data are also available for monthly and quarterly factors.
Philippines	PHILIPPINES	
Poland	POLAND	According to the provisions of Article 4.6 of the Convention and Decisions 9/CP.2 and 11/CP.4, Poland is allowed to use 1988 as the base year. Data are also available for monthly and quarterly factors.
Portugal	PORTUGAL	Includes the Azores and Madeira. Data are also available for monthly and quarterly factors.
Qatar	QATAR	

Countries and regions

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For details regarding the country-specific monthly electricity statistics which have been used as basis for developing monthly and quarterly factors, please refer to the IEA Monthly Electricity Statistics documentation.

Country/Region	Short name	Definition
Romania	ROMANIA	According to the provisions of Article 4.6 of the Convention and Decisions 9/CP.2 and 11/CP.4, Romania is allowed to use 1989 as the base year. Data are also available for monthly and quarterly factors.
Russian Federation	RUSSIA	
Rwanda	RWANDA	
Saudi Arabia	SAUDIARABI	
Senegal	SENEGAL	Senegal joined the IEA as an Association country in June 2023. Accordingly, it is included in the IEA and Accession/Association countries aggregate (IEA Family)
Serbia	SERBIA	Serbia includes Kosovo from 1990 to 1999 and Montenegro from 1990 to 2004. Data are also available for monthly and quarterly factors.
Singapore	SINGAPORE	Singapore is currently an IEA Association country, therefore it is included in the IEA and Accession/Association countries aggregate (IEA Family).
Slovak Republic	SLOVAKIA	Data are also available for monthly and quarterly factors.
Slovenia	SLOVENIA	Data for Slovenia are available from 1990. Prior to that, they are included in Former Yugoslavia in the full publication. According to the provisions of Article 4.6 of the Convention and Decisions 9/CP.2 and 11/CP.4, Slovenia is allowed to use 1986 as the base year. Data are also available for monthly and quarterly factors.

Countries and regions

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For details regarding the country-specific monthly electricity statistics which have been used as basis for developing monthly and quarterly factors, please refer to the IEA Monthly Electricity Statistics documentation.

Country/Region	Short name	Definition
South Africa	SOUTHAFRIC	Nuclear data are reported on a fiscal year basis. By convention data for the fiscal year that starts on 1 April Y and ends on 31 March Y+1 are labelled as year Y. South Africa is currently an IEA Association country, therefore it is included in the IEA and Accession/Association countries aggregate (IEA Family).
South Sudan	SSUDAN	Data for South Sudan are available starting in 2012. Prior to that, they are included in Sudan.
Spain	SPAIN	Includes the Canary Islands. Data are also available for monthly and quarterly factors.
Sri Lanka	SRILANKA	
Sudan	SUDAN	South Sudan became an independent country on 9 July 2011. Data for South Sudan are available from 2012. Prior to 2012, they are included in Sudan.
Suriname	SURINAME	Data for Suriname are available from 2000. Prior to 2000, data for Suriname are presented in Other non-OECD Americas.
Sweden	SWEDEN	Data are also available for monthly and quarterly factors.
Switzerland	SWITLAND	Includes Liechtenstein for the oil data. Data for other fuels do not include Liechtenstein. Data are also available for monthly and quarterly factors.
Chinese Taipei	TAIPEI	
Tajikistan	TAJIKISTAN	
United Republic of Tanzania	TANZANIA	
Thailand	THAILAND	Thailand is an IEA Association country, therefore it is included in the IEA and Accession/Association countries aggregate (IEA Family).
Togo	TOGO	

Countries and regions

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For details regarding the country-specific monthly electricity statistics which have been used as basis for developing monthly and quarterly factors, please refer to the IEA Monthly Electricity Statistics documentation.

Country/Region	Short name	Definition
Trinidad and Tobago	TRINIDAD	
Tunisia	TUNISIA	
Republic of Türkiye	TURKEY	Data are also available for monthly and quarterly factors.
Turkmenistan	TURKMENIST	
Ukraine	UKRAINE	Ukraine is currently an IEA Association country, therefore it is included in the IEA and Accession/Association countries aggregate (IEA Family).
United Arab Emirates	UAE	
Uganda	UGANDA	
United Kingdom	UK	Shipments of coal and oil to the Channel Islands and the Isle of Man from the United Kingdom are not classed as exports. Supplies of coal and oil to these islands are, therefore, included as part of UK supply. Exports of natural gas to the Isle of Man are included with the exports to Ireland. As of the 1st of February 2020, the United Kingdom (UK) is no longer part of the European Union (EU) and was into a transition period until 31 December 2020. The UK is excluded from the EU27 2020 aggregate, but still included in the EU28 aggregate for reference. Data are also available for monthly and quarterly factors.

Countries and regions

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For details regarding the country-specific monthly electricity statistics which have been used as basis for developing monthly and quarterly factors, please refer to the IEA Monthly Electricity Statistics documentation.

Country/Region	Short name	Definition
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[7] 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. Data are also available for monthly and quarterly factors.
Uruguay	URUGUAY	
Uzbekistan	UZBEKISTAN	
Venezuela	VENEZUELA	
Viet Nam	VIETNAM	
Yemen	YEMEN	
Zambia	ZAMBIA	
Zimbabwe	ZIMBABWE	
Former Soviet Union (if no detail)	FSUND	Before 1990, includes Armenia, Azerbaijan, Belarus, Estonia, Georgia, Kazakhstan, Kyrgyzstan, Latvia, Lithuania, Republic of Moldova, Russian Federation, Tajikistan, Turkmenistan, Ukraine and Uzbekistan.
Former Yugoslavia (if no detail)	YUGOND	
Other Africa	OTHERAFRIC	Includes Burkina Faso; Burundi; Cape Verde; Central African Republic; Chad; Comoros; Djibouti; Gambia; Guinea; Guinea-Bissau; Lesotho; Liberia; Malawi; Mali; Mauritania; Namibia (until 1990); Réunion (until 2010); Sao Tome and Principe; Seychelles; Sierra Leone and Somalia.

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

Countries and regions

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For details regarding the country-specific monthly electricity statistics which have been used as basis for developing monthly and quarterly factors, please refer to the IEA Monthly Electricity Statistics documentation.

Country/Region	Short name	Definition
Other non-OECD Americas	OTHERLATIN	Includes Anguilla, Antigua and Barbuda; Aruba; the Bahamas; Barbados; Belize; Bermuda; Bonaire (from 2012); the British Virgin Islands; the Cayman Islands; Dominica; the Falkland Islands (Malvinas); French Guiana (until 2010); Grenada; Guadeloupe (until 2010); Martinique (until 2010); Montserrat; Puerto Rico (for natural gas and – up to 2016 data - electricity)11; Saba (from 2012); Saint Eustatius (from 2012); Saint Kitts and Nevis; Saint Lucia; Saint Pierre and Miquelon; Saint Vincent and the Grenadines; Sint Maarten (from 2012); Suriname (until 1999); the Turks and Caicos Islands.
Other non-OECD Asia	OTHERASIA	Includes Afghanistan; Bhutan; Cambodia (until 1994); Cook Islands; Fiji; French Polynesia; Kiribati; Lao People's Democratic Republic (until 1999); Macau, China; Maldives; Mongolia (until 1984); New Caledonia; Palau (from 1994); Papua New Guinea; Samoa; Solomon Islands; Timor Leste; Tonga and Vanuatu.
Burkina Faso*	MBURKINFA	Burkina Faso data are also included in the Other Africa region.
Chad*	MCHAD	Chad data are also included in the Other Africa region.
Greenland*	MGREENLAND	Data starts in 2004. Prior to 1990, data on oil for Greenland were included with the Danish statistics, within the OECD region. They are not included in any region after 1990.
Mauritania*	MAURITANIA	
Mali*	MALI	
Palestinian Authority*	MPALESTINE	
Memo: ASEAN	MASEAN	Data starts in 2000. Includes: Brunei; Cambodia; Indonesia; Lao People's Democratic Republic; Malaysia; Myanmar; Philippines; Singapore; Thailand; and Viet Nam.

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For details regarding the country-specific monthly electricity statistics which have been used as basis for developing monthly and quarterly factors, please refer to the IEA Monthly Electricity Statistics documentation.

Country/Region	Short name	Definition
Memo: Africa (UN)	UNAFRICA	Includes Algeria; Angola; Benin; Botswana; Burkina Faso; Burundi; Cabo Verde; Cameroon; Central African Republic; Chad; Comoros; the Republic of the Congo (Congo); Côte d'Ivoire; the Democratic Republic of the Congo; Djibouti; Egypt; Equatorial Guinea; Eritrea; the Kingdom of Eswatini; Ethiopia; Gabon; Gambia; Ghana; Guinea; Guinea-Bissau; Kenya; Lesotho; Liberia; Libya; Madagascar; Malawi; Mali; Mauritania; Mauritius; Morocco; Mozambique; Namibia; Niger; Nigeria; Réunion (until 2010); Rwanda; Sao Tome and Principe; Senegal; the Seychelles; Sierra Leone; Somalia; South Africa; South Sudan (from 2012), Sudan; the United Republic of Tanzania (Tanzania); Togo; Tunisia; Uganda; Zambia; Zimbabwe. Note that Memo: Africa (UN) is identical to Africa.
Memo: Americas (UN)	UNAMERICAS	Includes Antigua and Barbuda; Argentina; Aruba; the Bahamas; Barbados; Belize; Bermuda; the Plurinational State of Bolivia (Bolivia); Bonaire (from 2012); the British Virgin Islands; Brazil; Canada; the Cayman Islands; Chile; Colombia; Costa Rica; Cuba; Curaçao[8]; Dominica; the Dominican Republic; Ecuador; El Salvador; the Falkland Islands (Malvinas); Guatemala; French Guiana (until 2010); Grenada; Guadeloupe (until 2010); Guyana; Haiti; Honduras; Jamaica; Martinique (until 2010); Mexico; Montserrat; Nicaragua; Panama; Paraguay; Peru; Puerto Rico (for natural gas) [9]; Saba (from 2012); Saint Kitts and Nevis; Saint Lucia; Saint Pierre and Miquelon; Saint Vincent and the Grenadines; Sint Eustatius (from 2012); Sint Maarten (from 2012); Suriname; Trinidad and Tobago; the Turks and Caicos Islands; the United States; Uruguay; the Bolivarian Republic of Venezuela (Venezuela).

[8]. The Netherlands Antilles was dissolved on 10 October 2010 resulting in two new 'constituent countries' (Curaçao and Sint Maarten) with the other islands joining The Netherlands as "special municipalities'. However, due to lack of detailed data the IEA Secretariat's data and estimates under the "Netherlands Antilles" still refer to the whole territory of the Netherlands Antilles as it was known prior to 10 October 2010 up to the end of 2011. Data refer only to the island of Curaçao from 2012. The other islands of the former Netherlands Antilles are added to Other non-OECD Americas from 2012.
[9]. Oil statistics as well as coal trade statistics for Puerto Rico are included under the United States.

Countries and regions

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For details regarding the country-specific monthly electricity statistics which have been used as basis for developing monthly and quarterly factors, please refer to the IEA Monthly Electricity Statistics documentation.

Country/Region	Short name	Definition
Memo: Asia (UN)	UNASIATOT	Data for Asia (UN) are available from 1990. Includes Afghanistan; Armenia; Azerbaijan; Bahrain; Bangladesh; Bhutan; Brunei Darussalam; Cambodia; the People's Republic of China; Cyprus[10]; Georgia; Hong Kong, China; India; Indonesia; the Islamic Republic of Iran; Iraq; Israel[11]; Japan; Jordan; the Democratic People's Republic of Korea; Korea; Kazakhstan; Kuwait; Kyrgyzstan; Lao People's Democratic Republic; Lebanon; Macau, China; Malaysia; the Maldives; Mongolia; Myanmar; Nepal; Oman; Pakistan; the Philippines; Qatar; Saudi Arabia; Singapore; Sri Lanka; the Syrian Arab Republic; Tajikistan; Chinese Taipei; Thailand; Timor-Leste; Turkey; Turkmenistan; the United Arab Emirates; Uzbekistan; Viet Nam; and Yemen.
Memo: Europe (UN)	UNEUROPE	Data for Europe (UN) are available from 1990. Includes Albania; Austria; Belarus; Belgium; Bosnia and Herzegovina; Bulgaria; Croatia; the Czech Republic; Denmark; Estonia; Finland; the Republic of North Macedonia (North Macedonia); France; Germany; Gibraltar; Greece; Hungary; Iceland; Ireland; Italy; Kosovo[12]; Latvia; Lithuania; Luxembourg; Malta; the Republic of Moldova (Moldova); Montenegro; the Netherlands; Norway; Poland; Portugal; Romania; the Russian Federation; Serbia[13]; the Slovak Republic; Slovenia; Spain; Sweden; Switzerland; Ukraine; the United Kingdom.
Memo: Oceania (UN)	UNOCEANIA	Includes Australia; New Zealand; Cook Islands; Fiji; French Polynesia; Kiribati; New Caledonia; Palau; Papua New Guinea; Samoa; the Solomon Islands; Tonga; Vanuatu.

[10]. Refer to the country note for Cyprus earlier in this section.
[11]. The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities. The use of such data by the OECD is without prejudice to the status of the Golan Heights, East Jerusalem and Israeli settlements in the West Bank under the terms of international law.
[12]. This designation is without prejudice to positions on status, and is in line with United Nations Security Council Resolution 1244/99 and the Advisory Opinion of the International Court of Justice on Kosovo's declaration of independence.
[13]. Serbia includes Montenegro until 2004 and Kosovo until 1999.

Countries and regions

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For details regarding the country-specific monthly electricity statistics which have been used as basis for developing monthly and quarterly factors, please refer to the IEA Monthly Electricity Statistics documentation.

Country/Region	Short name	Definition
Memo: non-OECD total	NOECDTOT	Includes Africa; Non OECD Asia (excluding China); China (P.R. of China and Hong Kong, China); Non-OECD Americas; Middle East and Non-OECD Europe and Eurasia.
Memo: IEA Total	IEATOT	Includes Australia; Austria; Belgium; Canada; the Czech Republic; Denmark; Estonia; Finland; France; Germany; Greece; Hungary; Ireland; Italy; Japan; Korea; Latvia; Lithuania; Luxembourg; Mexico[14]; the Netherlands; New Zealand; Norway; Poland; Portugal; the Slovak Republic; Spain; Sweden; Switzerland; the Republic of Türkiye; the United Kingdom and the United States. Estonia is included starting in 1990. Prior to 1990, data for Estonia are included in Former Soviet Union.
Memo: IEA and Accession/Association countries	IEAFAMILY	Includes: IEA member countries: Australia, Austria, Belgium, Canada, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, Korea, Latvia, Lithuania, Luxembourg, Mexico, the Netherlands, New Zealand, Norway, Poland, Portugal, the Slovak Republic, Spain, Sweden, Switzerland, the Republic of Türkiye, the United Kingdom and the United States; Accession countries: Brazil, Chile, Colombia, Costa Rica, Israel, and Romania; Association countries: Argentina, the People's Republic of China, Egypt, India, Indonesia, Kenya, Morocco, Nigeria, Singapore, Senegal, South Africa, Thailand, Ukraine and Viet Nam. Estonia, Latvia, Lithuania and Slovenia are included starting in 1990. Prior to 1990, data for Estonia, Latvia and Lithuania are included in Former Soviet Union and data for Slovenia in Former Yugoslavia.

Countries and regions

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For details regarding the country-specific monthly electricity statistics which have been used as basis for developing monthly and quarterly factors, please refer to the IEA Monthly Electricity Statistics documentation.

Country/Region	Short name	Definition
Memo: European Union – 28	EU28	Refers to the EU27 with the addition of the United Kingdom . Includes Austria; Belgium; Bulgaria; Croatia; Cyprus; the Czech Republic; Denmark; Estonia; Finland; France; Germany; Greece; Hungary; Ireland; Italy; Latvia; Lithuania; Luxembourg; Malta; the Netherlands; Poland; Portugal; Romania; the Slovak Republic; Slovenia; Spain, Sweden, and the United Kingdom. Please note that in the interest of having comparable data, all of these countries are included since 1990 despite different entry dates into the European Union.
Memo: 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 of these countries are included since 1990 despite different entry dates into the European Union.
Memo: Former Yugoslavia	MYUGO	Includes Former Yugoslavia (if no detail); Bosnia and Herzegovina; Croatia; the Republic of North Macedonia (North Macedonia); Kosovo; Montenegro; Slovenia and Serbia
Memo: Former Soviet Union	MFSU15	Includes the Former Soviet Union with all 15 countries for all years.
Memo: OPEC	OPEC	Includes Algeria; Republic of the Congo; Equatorial Guinea; Gabon; the Islamic Republic of Iran; Iraq; Kuwait; Libya; Nigeria; Saudi Arabia; the Bolivarian Republic of Venezuela (Venezuela).
Memo: G7	MG7	Includes Canada, France, Germany, Italy, Japan, the United Kingdom and the United States.
Memo: G8	MG8	Includes Canada, France, Germany, Italy, Japan, Russian Federation, the United Kingdom and the United States.

Countries and regions

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For details regarding the country-specific monthly electricity statistics which have been used as basis for developing monthly and quarterly factors, please refer to the IEA Monthly Electricity Statistics documentation.

Country/Region	Short name	Definition
Memo: G20	MG20	Includes Argentina, Australia, Brazil, Canada, China (including Hong Kong, China), India, Indonesia, Japan, Korea, Mexico, Russian Federation, Saudi Arabia, South Africa, the Republic of Türkiye, the United Kingdom, the United States, the European Union – 27 and the African Union.
Memo: Annex I Parties	ANNEX1	Includes Australia, Austria, Belarus, Belgium, Bulgaria, Canada, Croatia, Cyprus[15], the Czech Republic[16,17], Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Latvia, Liechtenstein (not available in this publication)[18], Lithuania, Luxembourg, Malta, Monaco (included with France), the Netherlands, New Zealand, Norway, Poland, Portugal, Romania, the Russian Federation, the Slovak Republic[19], Slovenia, Spain, Sweden, Switzerland, the Republic of Türkiye, Ukraine, the United Kingdom and the United States.[20] *The countries that are listed above are included in Annex I of the United Nations Framework Convention on Climate Change as amended on 11 December 1997 by the 12th Plenary meeting of the Third Conference of the Parties in Decision 4/CP.3. This includes the countries that were members of the OECD at the time of the signing of the Convention, the EEC, and fourteen countries in Central and Eastern Europe and the Former Soviet Union that were undergoing the process of transition to market economies. During subsequent sessions, the Conference of the Parties agreed to amend Annex I to the Convention to include Malta (Decision 3/CP.15, effective from 26 October 2010) and Cyprus (Decision 10/CP.17, effective from 9 January 2013).*

[15]. Refer to the country note for Cyprus earlier in this section.
[16]. Czechia in official UN documents.
17. Czechoslovakia was in the original list of Annex I countries.
[18]. Oil data for Liechtenstein are included under Switzerland.
[19]. Slovakia in official UN documents.
[20]. The European Union is also an Annex I Party in its own right. The EU was assigned an overall reduction target under the Kyoto Protocol, which by agreement, was used to determine the individual targets of the fifteen states that were EU members in 1997 when the Kyoto Protocol was adopted.

Countries and regions

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For details regarding the country-specific monthly electricity statistics which have been used as basis for developing monthly and quarterly factors, please refer to the IEA Monthly Electricity Statistics documentation.

Country/Region	Short name	Definition
Memo: Annex II Parties	ANNEX2	Includes Australia, Austria, Belgium, Canada, Denmark, Finland, France[21], Germany, Greece, Iceland, Ireland, Italy, Japan, Luxembourg, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland[22], the United Kingdom and the United States. *According to Decision 26/CP.7 in document FCCC/CP/2001/13/ Add.4,* the Republic of Türkiye *has been deleted from the list of Annex II countries to the Convention. This amendment entered into force on 28 June 2002.*
Memo: Annex II North America	ANNEX2NA	Includes Canada and the United States.
Memo: Annex II Europe	ANNEX2EU	Includes Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.
Memo: Annex II Asia Oceania	ANNEX2AO	Includes Australia, Japan and New Zealand.
Memo: Annex I Economies in Transition	ANNEX1EIT	Annex I: Economies in Transition (EITs) are those countries in Annex I that are undergoing the process of transition to a market economy. This includes Belarus, Bulgaria, Croatia, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Russian Federation, the Slovak Republic, Slovenia and Ukraine.
Memo: Non-Annex I Parties	NONANNEX1	

[21]. In IEA data, France also includes Monaco, which is not in the list of Annex II Parties.
[22]. In IEA data, Switzerland includes Oil data for Liechtenstein, which is not in the list of Annex II Parties.

Countries and regions

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For details regarding the country-specific monthly electricity statistics which have been used as basis for developing monthly and quarterly factors, please refer to the IEA Monthly Electricity Statistics documentation.

Country/Region	Short name	Definition
Memo: Annex B Kyoto Parties	ANNEXB	Includes Australia, Austria, Belgium, Belarus, Bulgaria, Croatia, Cyprus[23], the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Kazakhstan, Latvia, Liechtenstein (not available in this publication), Lithuania, Luxembourg, Malta, Monaco (included with France), the Netherlands, Norway, Poland, Portugal, Romania, the Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Ukraine and the United Kingdom.[24] *Refers to countries with emission targets under the second commitment period (CP) of the Kyoto Protocol (2013-2020) as per the Doha Amendment. This differs from the list of countries with targets under the first CP (2008-2012). Please note that the Doha Amendment has not yet entered into force. Membership of Annex B in the second CP of the Kyoto Protocol differs from that in Annex I. In particular, Annex B excludes, or does not contain targets for Canada, Japan, New Zealand, the Russian Federation,* the Republic of Türkiye *and the United States (all Annex I member states), but includes Kazakhstan (a non-Annex I Party under the Convention, but an Annex I Party under the Kyoto Protocol (as per decision 9/CMP.8).*

Please note that the following countries have not been considered:

- **Non-OECD Europe and Eurasia**: Andorra; Faroe Islands (after 1990); Liechtenstein (except for oil data); Svalbard; Jan Mayen Islands;
- **Africa:** British Indian Ocean Territory; French Southern and Antarctic Lands; Mayotte; Saint Helena; Western Sahara;
- **Non-OECD Americas**: Bouvet Island; Saint Barthélemy; Greenland (after 1990); Saint Martin (French Part); South Georgia and the South Sandwich Islands;
- Antarctica;
- **Non-OECD Asia (excluding China):** American Samoa; Cocos (Keeling) Islands; Christmas Island; Heard Island and McDonald Islands; Marshall Islands; Micronesia (Federated States of); Nauru; Niue; Norfolk Island; Northern Mariana Islands; Pitcairn; Tokelau; Tuvalu; United States Minor Outlying Islands; Wallis and Futuna Islands.

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

[24]. The European Union is also an Annex I Party in its own right. The EU was assigned an overall reduction target under the Kyoto Protocol, which by agreement, was used to determine the individual targets of the fifteen states that were EU members in 1997 when the Kyoto Protocol was adopted.

Supplementary countries

With the objective to increase the geographical coverage of the information provided, the IEA has estimated emission factors for electricity and heat generation for over sixty supplementary countries[25] not covered explicitly in the *IEA World energy balances*, using a simplified approach based on more aggregated[26] energy data from the United Nations Statistics Division (UNSD) *2022 Energy Balances* publication (https://unstats.un.org/unsd/energystats/pubs/balance). For these set of countries, emissions estimates are available starting with 1990.

As for the other countries covered in the database, such estimations are based on the Tier 1 methodology of the *2006 IPCC Guidelines for National Greenhouse Gas Inventories,* using weighted average emission factors for the aggregated product categories of the energy data which reflect for each country the mix of the relevant region in the IEA *World energy balances* database (Other non-OECD America, Other Africa or Other non-OECD Asia).

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Country/Region	Short name	Definition
Afghanistan*	MAFGHANIST	
Anguilla*	MANGUILLA	
Antigua and Barbuda*	MANTIGUABA	
Aruba*	MARUBA	
Bahamas*	MBAHAMAS	
Barbados*	MBARBADOS	
Belize*	MBELIZE	
Bhutan*	MBHUTAN	
Burundi*	MBURUNDI	
Cabo Verde*	MCABOVERDE	
Central African Republic*	MCENTRAFRI	
Comoros*	MCOMOROS	
Cook Islands*	MCOOKISLA	
Djibouti*	MDJIBOUTI	
Dominica*	MDOMINICA	

[25] Please consider that the data for such countries (based on UNSD energy data), may not add up to the respective regional totals based on IEA energy data (Other Africa, Other non-OECD America and Other non-OECD Asia), as they are independently treated.

[26] Such data are available for the following list of aggregated product categories (primary coal, secondary coal, oil products and crude/NGL/feedstocks)..

Supplementary countries

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As for the other countries covered in the database, such estimations are based on the Tier 1 methodology of the *2006 IPCC Guidelines for National Greenhouse Gas Inventories,* using weighted average emission factors for the aggregated product categories of the energy data which reflect for each country the mix of the relevant region in the IEA *World energy balances* database (Other non-OECD America, Other Africa or Other non-OECD Asia).

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Country/Region	Short name	Definition
Fiji*	MFIJI	
Gambia*	MGAMBIA	
Grenada*	MGRENADA	
Guinea *	MGUINEA	
Guinea-Bissau *	MGUINEABIS	
Kiribati*	MKIRIBATI	
Lesotho*	MLESOTHO	
Liberia*	MLIBERIA	
Malawi*	MMALAWI	
Maldives*	MMALDIVES	
Marshall Islands*	MMARSHALL	
Micronesia (Federated States of)*	MMICRONES	
Nauru*	MNAURU	
Niue*	MNIUE	
Palau*	MPALAU	
Papua New Guinea*	MPAPUANG	

Supplementary countries

With the objective to increase the geographical coverage of the information provided, the IEA has estimated emission factors for electricity and heat generation for over sixty supplementary countries[25] not covered explicitly in the *IEA World energy balances*, using a simplified approach based on more aggregated[26] energy data from the United Nations Statistics Division (UNSD) *2022 Energy Balances* publication (https://unstats.un.org/unsd/energystats/pubs/balance). For these set of countries, emissions estimates are available starting with 1990.

As for the other countries covered in the database, such estimations are based on the Tier 1 methodology of the *2006 IPCC Guidelines for National Greenhouse Gas Inventories,* using weighted average emission factors for the aggregated product categories of the energy data which reflect for each country the mix of the relevant region in the IEA *World energy balances* database (Other non-OECD America, Other Africa or Other non-OECD Asia).

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Country/Region	Short name	Definition
Puerto Rico*	MPUERTORIC	
Saint Kitts and Nevis*	MSTKITTSNE	
Saint Lucia*	MSTLUCIA	
Saint Vincent and the Grenadines*	MSTVINCENT	
Samoa*	MSAMOA	
Sao Tome and Principe*	MSAOTOME	
Seychelles*	MSEYCHELLE	
Sierra Leone*	MSIERRALEO	
Solomon Islands*	MSOLOMONIS	
Somalia*	MSOMALIA	
Timor-Leste*	MTIMORLES	
Tonga*	MTONGA	
Tuvalu*	MTUVALU	
Vanuatu*	MVANUATU	

Fiscal year

This table lists the countries for which data are reported on a fiscal year basis. More information on beginning and end of fiscal years by country is reported in the column 'Definition'.

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Country/Region	Short name	Definition
Australia	AUSTRALI	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.
Bangladesh	BANGLADESH	Data are reported on a fiscal year basis. By convention data for the fiscal year that starts on 1 July Y-1 and ends on 30 June Y are labelled as year Y.
Egypt	EGYPT	Data are reported on a fiscal year basis. By convention, data for the fiscal year that starts on 1 July Y and ends on 30 June Y+1 are labelled as year Y.
Ethiopia	ETHIOPIA	Data are reported on a fiscal year basis. By convention, data for the fiscal year that starts on 1 July Y and ends on 30 June Y+1 are labelled as year Y.
India	INDIA	Data are reported on a fiscal year basis. By convention, data for the fiscal year that starts on 1 April Y and ends on 31 March Y+1 are labelled as year Y. This convention is different from the one used by Government of India, whereby fiscal year starts on 1 April Y and ends on 31 March Y+1 are labelled as year Y+1.
Islamic Republic of Iran	IRAN	Data are reported according to the Iranian calendar year. By convention data for the year that starts on 20 March Y and ends on 19 March Y+1 are labelled as year Y.
Japan	JAPAN	Starting 1990, data are reported on a fiscal year basis. By convention, data for the fiscal year that starts on 1 April Y and ends on 31 March Y+1 are labelled as year Y.
Myanmar	MYANMAR	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.
Namibia	NAMIBIA	Electricity data are reported on a fiscal year basis. By convention data for the fiscal year that starts on 1 July Y and ends on 31 June Y+1 are labelled as year Y.
Nepal	NEPAL	Data are reported on a fiscal year basis. By convention data for the fiscal year that starts on 1 July Y and ends on 30 June Y+1 are labelled as year Y.
Pakistan	PAKISTAN	Data are reported on a fiscal year basis. By convention fiscal year Y/Y+1 is labelled as year Y.

Fiscal year

This table lists the countries for which data are reported on a fiscal year basis. More information on beginning and end of fiscal years by country is reported in the column 'Definition'.

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Country/Region	Short name	Definition
South Africa	SOUTHAFRIC	Nuclear data are reported on a fiscal year basis. By convention data for the fiscal year that starts on 1 April Y and ends on 31 March Y+1 are labelled as year Y.

5. METHODOLOGY: GHG/KWH EMISSION FACTORS

Data source

The estimates of GHG emissions in this publication are based on the *2006 IPCC Guidelines* and the IEA *World Energy Balances* data; they represent the total emissions from fuel combustion.

For OECD Member countries, these figures are derived based on information provided in the five annual OECD questionnaires completed by the national administrations. For the member countries of the Economic Commission for Europe of the United Nations (UNECE) and a few others, the data shown are mostly based on information provided by the national administrations through the same annual questionnaires. The commodity balances for all other countries are based on national energy data of heterogeneous nature, converted and adapted to fit the IEA format and methodology.

Considerable effort has been made to ensure that the data presented adhere to the IEA definitions reported in the section on Methodological notes in the general documentation[27]. These definitions, based on the *United Nations International Recommendations on Energy Statistics*[28], are used by most of the international organisations that collect energy statistics.

Nevertheless, energy statistics at the national level are often collected using criteria and definitions which differ, sometimes considerably, from those of international organisations. This is especially true for non-OECD countries, which are submitting data to the IEA on a voluntary basis. The IEA secretariat has identified most of these differences and, where possible, adjusted the data to meet international definitions.

The indicator: definition

In the **total CO_2** emissions per kWh, for electricity or for electricity and heat generation, the numerator presents the **CO_2** emissions from fossil fuels consumed for electricity generation, while the denominator presents the total electricity generated, coming from fossil fuels, but also from nuclear, hydro, geothermal, solar, biofuels, etc. As a result, the emissions per kWh vary a lot across countries and from year to year, depending on the generation mix.

The above factors reflect annual average intensities of the national grid and can be used for the estimation of location-based Scope 2 emissions corresponding to consumption of purchased electricity under the GHG protocol.

In the **CO_2** emissions per kWh **by fuel** the numerator and denominator only refer to the electricity generation from a given fuel:

- Coal includes primary and secondary coal, and coal gases. Peat and oil shale have also been aggregated with coal, where applicable.
- Oil includes oil products (and crude oil for some countries).
- Gas represents natural gas.
- Non-renewable wastes includes industrial waste and non-renewable municipal waste.
- Biofuels includes both biofuels and renewable wastes. Note that these emission factors, for the CO_2 gas, are not accounted for in the total CO_2 emissions of the energy sector according to the IPCC guidelines.

27. https://www.iea.org/data-and-statistics/data-product/greenhouse-gas-emissions-from-energy#documentation
28. http://unstats.un.org/unsd/energy/ires/IRES_Whitecover.pdf.

Electricity-only carbon emission factors: allocation of emissions from CHP plants

Calculating emission factors for electricity-only generation from the IEA energy balances require specific assumptions, as for combined heat and power (CHP) plants only data for a combined input are available.
The IEA adopts the **fixed-heat-efficiency approach,** which consist in fixing the efficiency of heat generation to compute the input to heat, and calculating the input to electricity as a residual from the total input. The standard heat efficiency was set to that of a typical heat boiler, 90%.

The **proportionality approach** would conversely allocate inputs based on the proportion of electricity and heat in the output. This is equivalent to fixing the efficiency of electricity and heat to be equal. With the advantage of simplicity and transparency, the proportionality approach however tends to overstate electricity efficiency and to understate heat efficiency. For example, for CHP generation in OECD countries, total efficiency is around 60%. However, total electricity-only plant efficiency is around 41% in OECD countries. Similarly, 60% is quite low for heat generation (given typical heat-only plant efficiencies of 80-95%).

In general, the fixed-heat-efficiency approach attributes larger emissions to electricity than the proportionality approach, with values much closer to those of electricity-only plants. While the fixed-heat-efficiency approach has proven to provide sensible results in most cases, implementation problems arise in two cases:

i) When the observed efficiency is over 100% (i.e. there are problems in data quality).
ii) When the observed efficiency is between 90% and 100% (the total efficiency may be correct or it may be overstated).

In both cases, it is not possible to use the fixed-heat-efficiency approach and, by default, the proportionality approach is used to allocate the inputs based on the output shares.

Calculation of the carbon emission factor

CO_2kWh for electricity and heat generation =

$$\frac{\sum_{fuels} \langle (Input_{Electricity\ plants} + Input_{CHP\ plants} + Input_{Heat\ plants} + Own\ use_{Plants}) \times EF_{fuel} \rangle}{Ele_{Inland} + Heat_{Inland}}$$

Where:

- CO_2kWh : Carbon factors (in CO_2/kWh) calculated at the generation point
- $\sum_{fuels}$: 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*.
- $Ele_{Inland} + Heat_{Inland}$:
  - For the total emission factor: includes the generation from all sources (i.e. as well the non-emitting sources).
  - For the emission factors by fuel (oil, coal, gas, non-renewable waste and Memo: biofuels): includes only the electricity generated by the corresponding fuel.

CO_2kWh for electricity generation =

$$= \frac{\sum_{fuels} \langle (Input_{Electricity\ plants} + Input_{CHP\ plants/Ele} + Own\ use_{Plants/Ele}) \times EF_{fuel} \rangle}{Ele_{Inland}}$$

Where:

- CO_2kWh : Carbon factors (in CO_2/kWh) calculated at the generation point
- $\sum_{fuels}$: Sum over the fuels.
- $Input_{plants}$: Fuel input into the plants (both main activity and autoproducer) expressed in energy unit.
- $Input_{CHP\ plants/Ele} = Input_{CHP\ plants} - \frac{Heat\ output}{\eta_{heat}}$
- η_{heat} efficiency of heat generation - assumed to be 0.9 (*i.e.* 90%) except when the observed efficiency of CHP generation is higher than 90%, in which case emissions are allocated using the proportionality approach ($EFF_{HEAT} = EFF_{ELEC} = EFF_{CHP}$).
- $Own\ use_{Plants/Ele} = Own\ use_{Plants} \times \frac{Total\ electricity\ output}{Total\ electricity\ output + Total\ heat\ output}$
- EF_{fuel} : default emission factors as provided in the *2006 IPCC Guidelines*.
- Ele_{Inland} :
  - For the total emission factor: includes the generation from all sources (i.e. as well the non-emitting sources).
  - For the emission factors by fuel (oil, coal, gas, non-renewable waste and Memo: biofuels): includes only the electricity generated by the corresponding fuel.

Note that in some cases, when the output of electricity is very small for a given fuel, rounding effects can cause the corresponding emission factor to appear very high. It is advised to disregard these emission factors which are clearly out of the range.

Provisional carbon emission factors

While the methodology previously described refers to time series up to the year Y-1, the factors for the latest year (Y) provided for OECD countries and selected non-OECD countries are based on a simplified methodology. The available data for the year Y only include the breakdown of electricity generated by fuel, but not the fuel input to plant. The assumption used is that there was no change in the efficiency of plants and in the energy content of the input products compared to the year Y-1.

With these assumptions, the factor was derived as follows:

$$CO_2kWh\,(Y) = \frac{\sum_{fuels} \left(CO_2kWh_{fuel}(Y-1) \times Ele_{Inland\,fuel}\,(Y) \right)}{Ele_{Inland}\,(Y)}$$

Please note that data for the provisional year may be subject to revisions more often as better information become available in further editions of the product.

For the provisional year, only the total carbon emission factor is included.

CH_4 and N_2O emissions for electricity generation

If CO_2 represent a large majority in term of greenhouse gas emissions from fuel combustion, it is not the only one.

Emission factors for CH_4 and N_2O were calculated using the same methodology as for the CO_2 per kWh, using the Tier 1 methodology and the default emission factors of the *2006 IPCC Guidelines*, including also emissions from biofuels in this case (as opposed to CO_2 only emissions). The emission factors are converted from gCH_4 and gN_2O to gCO_2eq using the 100-year Global Warming Potential (GWP) given below. To ensure alignment with the latest

requirements from European Sustainability Reporting (ESRS) and other major disclosure standards, the factors from the 6th Assessment of the IPCC (AR6) are used.

Designation or Name	**Chemical formula**	**100-Year GWP**
Carbon dioxide	CO_2	1
Methane	CH_4	27
Nitrous oxide	N_2O	273

Note that the uncertainty associated with CH_4 and N_2O emissions factors is very large, therefore these emission factors are provided as an indication when no better information is available. Please see the *2006 IPCC guidelines*[29] for more information about the uncertainty associated to emission factors.

29. http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_2_Ch2_Stationary_Combustion.pdf

6. METHODOLOGY: OTHER FACTORS

Correction factor for electricity trade

Part of the electricity consumed in one country may have been generated in another one. Similarly, part of the electricity generated in one country can be exported to other countries. Therefore, adjustments may be done to the emission factors calculated above to account for electricity trade. Such adjustments are based on the share of electricity that is imported or exported compared to the domestic supply. The data needed to calculate such adjustment (i.e. the breakdown of electricity import by trade partner) are only available for OECD members and selected countries, depending on data availability. This adjustment can be positive or negative, and is calculated as follows:

$$\mathrm{CO_2kWh}_{trade} = \frac{C_{Indigenous} + C_{Imported} - C_{Exported}}{Net\ electricity} - CO_2kWh$$

With

$$C_{Indigenous} = Ele_{Inland} * CO_2kWh$$

And

$$C_{Imported} = \sum_{partner} Ele_{Imports_{partner}} * CO_2kWh_{partner}$$

And

$$C_{Exported} = Ele_{Exports} * \frac{C_{Indigenous} + C_{Imported}}{Ele_{Inland} + Ele_{Imports}}$$

Where

- $\mathrm{CO_2kWh}_{trade}$: Adjustment of the carbon factor (in CO_2/kWh) for emissions induced by the trade of electricity with partner countries.
- $\mathrm{CO_2kWh}_{partner}$: Carbon emission factor for electricity generation of the partner country.
- $Net\ electricity : Ele_{Inland} + Ele_{Imports} - Ele_{Exports}$

Note that for a given country, trade data are those reported by the country for which the factor is calculated, which in some cases can differ from those reported from trade partners. Also, since the emission factors from trading partners are used, the quality of this adjustment depends not only on the quality of the data reported by the country, but also on the quality of the data reported by the trading partners. Moreover, in some cases, country report imports from non-specified countries. In such cases, assumptions were made based on transmission grid and data reported by potential partners.

This adjustment does not take into account geographically localized connections between countries. For example, Luxembourg reports trade from Germany, which is mostly related to electricity from the Vianden hydro plant; however the trade adjustment would be calculated using the nationally averaged carbon emission factor for Germany. As this case was known, the figure was set as “not available”. But other similar issue may occur.

Correction factor for electricity T&D losses

As electricity is transmitted through a grid from the generation point to the consumption point, losses can occur for different reasons - they usually represent between 5 and 15% of the energy transmitted, mainly depending on the distance of the lines. Basically, for each kWh being consumed, a higher amount had to be generated.

The adjustment due to losses was calculated as follows:

$$\mathrm{CO_2kWh}_{loss} = CO_2kWh \times loss\ factor$$

Where

- CO_2kWh_{loss} : Adjustment (in CO_2/kWh) for emission induced by the losses of electricity in transmission and distribution.
- $loss\ factor = \frac{Losses}{Total\ grid}$

  Where
  - $Losses$: Total transmission and distribution losses in the grid.
  - $Total\ grid$: Total amount of electricity transiting through the country electricity grid, calculated as gross electricity generation – own use in plant + imports.

Note that data quality for electricity transmission and distribution losses may be very variable across countries.

Use of the adjustment indicators

In order to allow more flexibility for the users depending on their reporting needs, the CO_2 emission factors are presented in a disaggregated manner. Since the CO_2 emission per kWh represents the emissions at the generation point, this factor can be completed by adding the transmission and distribution losses factor, and the correction for electricity trade. By adding these figures one can obtain a closer figure to the CO_2 per kWh at the final user point. These factors can be applied for location-based Scope 2 emissions reporting under the GHG protocol. The factors can also be completed with the CH_4 and N_2O figures to obtain more complete greenhouse gas per kWh indicators. As stipulated above, these figures are to be taken with caution due to the uncertainty associated with the corresponding IPCC emission factors. The CH_4 and N_2O adjustment for trade and losses are not provided here due to the negligible impact compared to the uncertainty associated with the figure.

Please note that for reporting Scope 3 emissions associated with the consumption of purchased electricity, the life cycle upstream and T&D emission factors are recommended. These factors are available in the IEA Emission Factors package and as an independent database, called the IEA Life Cycle Upstream Emission Factors.

Direct combustion factors for individual fuels

In most cases fuels are combusted directly for other purposes than electricity generation, within all sectors of final consumption. The Direct combustion factors vary according to the fuel used, and are computed as weighted average of the consumption across all final consumption sectors for a given country. These factors can be applied for reporting Scope 1 emissions associated with direct combustion of fuels under the GHG protocol and are computed as follows:

$$DCF = \frac{E_{Industry} + E_{Transport} + E_{Others}}{FC_{Industry} + FC_{Transport} + FC_{Others}}$$

Where:

- DCF : Direct combustion factors for fuel combustion other than for electricity and heat generation, in mass CO_{2eq} / kg of fuel and mass CO_{2eq} / m^3 for natural gas (the mass of CO_{2eq} is in units of kilograms for the CO_2 factors and in units of grams for the included non-CO_2 factors).
- $E_{Industry}$: Total CO_{2eq} emissions from fuel combustion in the *Industry* sector plus emission in the *Energy* sector except electricity and CHP plants in kg CO_{2eq}.
- $E_{Transport}$: Total CO_{2eq} emissions from fuel combustion in the *Transport* sector in kg CO_{2eq}.
- E_{Others} : Total CO_{2eq} emissions from fuel combustion in the *Residential*, *Commercial and Public services, Agriculture/Forestry*, *Fishing* and *Other non-specified* sectors in kg CO_{2eq}.
- FC_{sector} : Total fuel consumption in the respective sector, expressed in kg.

Which is equivalent to:

$$DCF = \frac{\left(FC_{Industry} \times NCV_{Industry} + FC_{Transport} \times NCV_{Transport} + FC_{Others} \times NCV_{Others}\right) \times EF_{fuel}}{FC_{Industry} + FC_{Transport} + FC_{Others}}$$

Where:

- NCV_{Sector}: Net Calorific Value, which is product-, country-, sector- and time-specific.

These emission factors are presented for individual and for some average fuels described below:

- For coal: individual primary products (anthracite, coking coal, other bituminous coal, sub-bituminous coal and lignite); as well as the weighted average coal mix;
- For oil: individual secondary products (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, bitumen, petroleum coke and non-specified oil products); as well as the weighted average oil product mix.
- For natural gas

When no data is reported for a fuel and year, the data is marked as X: Not applicable.

Similar to the emission factors corresponding to electricity generation, the non-CO_2 direct combustion emission factors are converted from gCH_4 and gN_2O to gCO_{2eq} using the 100-year GWP from AR6.

7. METHODOLOGY: MONTHLY AND QUARTERLY FACTORS

This section details the methodology corresponding to the development of monthly and quarterly grid emission factors based on monthly electricity data.

Within the package, the quarterly update of monthly and quarterly emission factors complements the data published in the current editions of the IEA Emission Factors database. The data is included for:

- countries: 52 countries (see section *Geographical coverage and country notes*);
- years: 2015 to quarter prior to latest publication (e.g. 2025Q3 publication will cover data up to 2025Q2).

The IEA Monthly Electricity Statistics exhibits monthly data on electricity generation for over 50 countries. The IEA Electricity Information includes granular product-specific yearly data corresponding to both gross and net electricity output. By merging data from these two databases, it is possible to estimate gross monthly generation data per product scaled to match the yearly statistics.

On the other hand, the IEA World Energy Balances contains yearly energy balances for over 150 countries. The database includes granular fuel/technology specific input and output data to electricity generation plants. This enables estimating fuel-specific electricity generation CO_2 intensities at country-level. Merging the derived intensities with the monthly scaled generation data enables developing estimates of the CO_2 intensities associated with the electricity grids with monthly and quarterly resolutions.

Once annual fuel-specific CO_2 intensities corresponding to electricity generation have been calculated as described in chapter 5, the methodology to derive monthly and quarterly factors includes two further steps as detailed below.

Scaling the monthly electricity generation data based on annual statistics

This step involves scaling the monthly electricity generation data per product to match the yearly electricity statistics.

Firstly, the yearly gross and net generation data for aggregated products are used to derive product-specific net to gross ratios. These ratios are applied to the granular gross yearly generation data to develop the product-specific annual net generation figures as per the following formula:

$$NetEle_{j,y,w} = \frac{NetEle_{i,y,w}}{GrossEle_{i,y,w}} \; x \; GrossEle_{j,y,w}$$

$NetEle_{j,y,w}$: *net electricity generation for fuel j and country w in year y*

$GrossEle_{i,y,w}$: *gross electricity generation for fuel category i and country w in year y*

$NetEle_{i,y,w}$: *net electricity generation for fuel category i and country w in year y*

$GrossEle_{j,y,w}$: *gross electricity generation for fuel j and country w in year y*

Note: *The product-specific annual net electricity generation data are available at an aggregated fuel level. Hence, the above computed gross to net ratios do not always match the granularity of gross generation included in the yearly statistics. Thus, it is assumed that the ratio is consistent among the sub-products of each aggregated fuel category.*

Following the above, the fuel-specific net monthly data are aggregated (accounting for fiscal year if applicable) to derive the raw annualized net generation data for the year y, as per the following:

$$AnnualizedNetEle_{j,y,w} = \sum_{m} NetEle_{j,m,w}$$

$AnnualizedNetEle_{j,y,w}$: *annualized net electricity generation for fuel j and country w in year y based on monthly data*

$NetEle_{j,m,w}$: *net monthly electricity generation for fuel j and country w in month m*

The product-specific scaling factors are computed by deriving the ratio between the above calculated annualized net electricity generation and the annual net electricity output as per the following formula:

$$SF_{j,y,w} = \frac{AnnualizedNetEle_{j,y,w}}{NetEle_{j,y,w}}$$

$SF_{j,y,w}$: *monthly to annual scaling factor for fuel j and country w in year y*

$NetEle_{j,y,w}$: *net electricity generation for fuel j and country w in year y*

$AnnualizedNetEle_{j,y,w}$: *annualized net electricity generation for fuel j and country w in year y based on monthly data*

Finally, the scaling factors are multiplied by the monthly generation data to compute the scaled net monthly generation data as per the following formula:

$$NetEleScaled_{j,m,w} = NetEle_{j,m,w} \; x \; SF_{j,y,w}$$

$NetEleScaled_{j,m,w}$: *scaled net monthly electricity generation for fuel j and country w in month m*

$NetEle_{j,m,w}$: *net monthly electricity generation for fuel j and country w in month m*

$SF_{j,y,w}$: *monthly to annual scaling factor for fuel j and country w in year y*

Note: *The yearly electricity data are available with a time lag of two years. This means that in the present year Y, the global coverage of the IEA Electricity Information database is up to year Y-2. Hence, the scaling factors corresponding to the most recent years (Y and Y-1) are assumed to be equal to the latest available year (Y-2).*

Note: *In some cases, monthly electricity generation data may be incomplete or significantly differ from the annual statistics. In such cases, scaling is not viable and monthly data is estimated based on available yearly data.*

Developing monthly and quarterly grid emission factors

To develop monthly and quarterly grid emission factors, the scaled net monthly generation data derived in Step 2 are converted to monthly gross generation figures. Therefore, product-specific gross to net ratios are developed and multiplied by the scaled net monthly data as per the following formula:

$$GrossEle_{i,m,w} = \sum_{j} \left(\frac{GrossEle_{j,y,w}}{NetEle_{j,y,w}} \; x \; NetEleScaled_{j,m,w}\right)$$

$GrossEle_{i,m,w}$: *gross electricity generation for fuel category i and country w in month m*

$GrossEle_{j,y,w}$: *gross electricity generation for fuel j and country w in year y*

$NetEle_{j,y,w}$: *net electricity generation for fuel j and country w in year y*

$NetEleScaled_{j,m,w}$: *scaled net monthly electricity generation for fuel j and country w in month m*

Note: *The IEA monthly electricity statistics does not include gross generation. Therefore, the gross to net ratio applied in the above formula is derived based on annual data, assuming that the ratio is constant throughout the year.*

Following the above, monthly grid emission factors are computed as follows:

$$CO_2\ intensity_{m,w}\left(\frac{gCO_2}{kWh}\right) = \frac{\sum_i (CO_2\ intensity_{i,y,w} \times GrossEle_{i,m,w})}{\sum_i GrossEle_{i,m,w}}$$

$CO_2\ intensity_{m,w}\left(\frac{gCO_2}{kWh}\right)$: *CO_2 intensity of electricity generation for country w in month m, expressed in gCO_2/kWh.*

$CO_2\ intensity_{i,y,w}\left(\frac{gCO_2}{kWh}\right)$: *CO_2 intensity of electricity generation for fuel category i and country w in year y, expressed in gCO_2/kWh.*

$GrossEle_{i,m,w}$: *gross electricity generation for fuel category i and country w in month m, expressed in kWh*

Note: *As the yearly electricity data are available with a time lag of two years, for the present year Y, the global coverage of the IEA World Energy Balances database is up to year Y-2. Hence, the yearly fuel-specific emissions intensities corresponding to the most recent years (Y and Y-1) are assumed to be equal to those of the latest available year (Y-2). This approach assumes that there are no changes in the efficiency of the generation plants, the quality (calorific value) of the fuel inputs to plants and the fuel shares in the respective aggregated product categories comparing to year Y-2.*

Following the development of monthly emission factors, the quarterly emission factors are derived as per the following formula:

$$CO_2\ intensity_{Q,w}\left(\frac{gCO_2}{kWh}\right) = \frac{\sum_m (CO_2\ intensity_{m,w} \times\ GrossEle_{\ m,w})}{\sum_m GrossEle_{\ m,w}}$$

$CO_2\ intensity_{Q,w}\left(\frac{gCO_2}{kWh}\right)$: *CO_2 intensity of electricity generation for country w in quarter Q expressed in gCO_2/kWh.*

$CO_2\ intensity_{m,w}\left(\frac{gCO_2}{kWh}\right)$: *CO_2 intensity of electricity generation for country w in month m expressed in gCO_2/kWh.*

$GrossEle_{\ m,w}$: *total gross electricity generation for country w in month m*

8. METHODOLOGY: ELECTRICITY GRID EMISSION FACTORS

The following two sections details the methodology corresponding to development of the total upstream and fuel-cycle emission factors corresponding to national grids as well as the life cycle adjustment factors for T&D losses and a proxy for a total emission factor.

Total upstream and fuel-cycle grid emission factors

The overall methodology for developing country-specific fuel-cycle and upstream emission factors corresponding to electricity grids, includes the following listed steps:

1. Developing country-specific fuel-cycle and upstream emission factors for all the fuels and technologies used for electricity generation globally.

   Note: As it will be detailed in the following sections, depending on the fuel/technology and the source of the compiled data, the factors correspond to either the generation output (mass of CO_{2eq}/kWh electricity generation) or the unit of energy inputs to the generation plant (mass of CO_{2eq}/kWh fuel input to the generation plant).

2. Computing the fuel-cycle emission factors corresponding to electricity grid by multiplying the fuel specific factors developed in Step 1 with the corresponding activity data for each fuel and dividing by the total electricity generation as expressed by the equation below:

$$EF_{Fuel-cycle\ grid\ emission\ factor} = \frac{\sum_i (EF_{i,t} \times activity_{i,t})}{Total\ electricity\ output_t}$$

$EF_{i,t}$: fuel-cycle emission factor per kWh output or unit of energy input to the plant for each fuel i in year t expressed in gCO_{2eq}/kWh

activity i,t: electricity output or fuel input to the plant for fuel i in year t

Total electricity output: total electricity generation from all fuels and technologies (kWh) in year t

Note that the fuel-cycle emission factors are a sub-component of total upstream emission factors which are detailed below.

3. Computing the total upstream emission factors corresponding to electricity grid by multiplying the fuel/technology-specific factors derived in Step 1 with the corresponding activity data for each fuel/technology and dividing by the total electricity generation as expressed by the equation below:

$$EF_{Total\ upstream\ grid\ emission\ factor} = \frac{\sum_i (EF_{i,t} \times activity_{i,t})}{Total\ electricity\ output_t}$$

EF i,t: upstream emission factor per kWh output or unit of energy input to the plant for each fuel/technology i in year t expressed in gCO_{2eq}/kWh

activity i,t: electricity output or fuel input to the plant for fuel or technology i in year t

Total electricity output t: total electricity generation from all fuels and technologies (kWh) in year t

The factors published for the provisional year (year 2024 in this edition) are based on a simplified methodology. The available data for the latest year only include the breakdown of electricity generated by fuel, but not the fuel input to the plants. Hence, it is not possible to use the emission factors per unit of energy input to the plants which were applied in the above equations for a subset of the fuels. Considering this limitation, the assumption is that there has been no change in the efficiency of these plants and in the energy content of the input products compared to the

previous year. Following these assumptions, both the fuel-cycle and total upstream factors are derived as expressed by the following equation:

$$EF_Y = \frac{\sum_i (EF_{i,y-1} \times electricity\ ouput_{\ i,y})}{Total\ electricity\ output_{\ y}}$$

EF y: total grid Upstream or grid fuel-cycle emission factor per kWh output in provisional year Y expressed in gCO_{2eq}/kWh

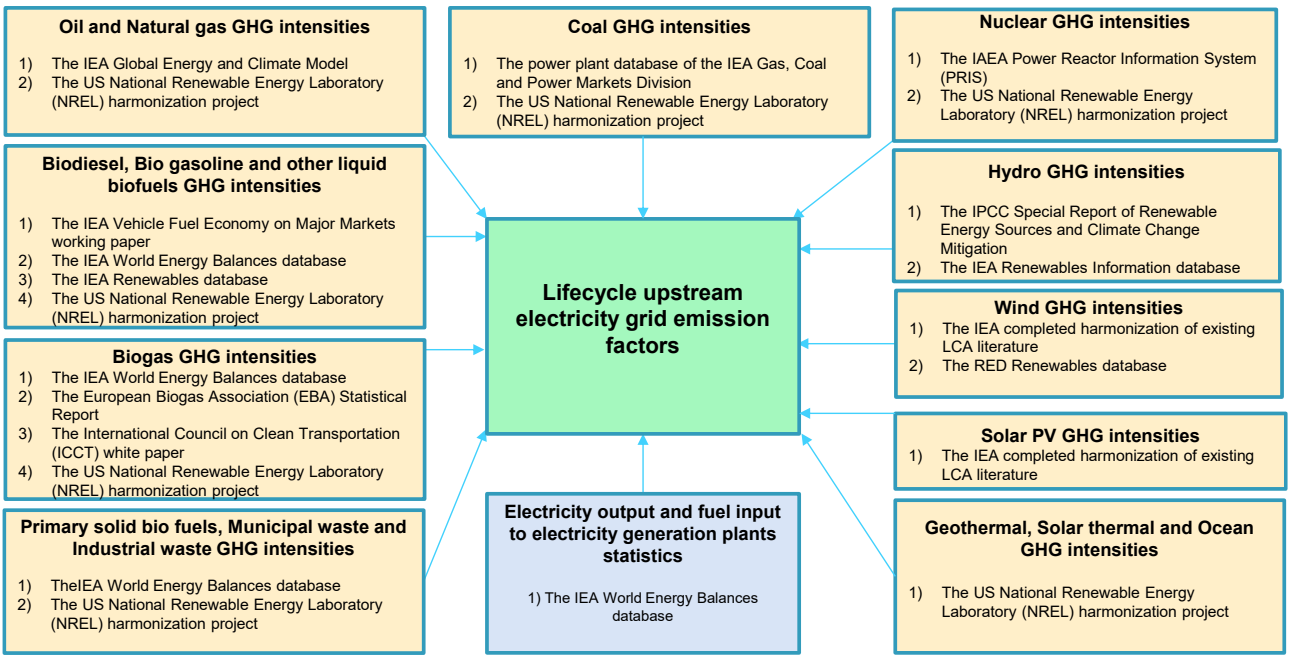
EF i,y-1: total upstream or fuel-cycle emission factor for each fuel/technology i per kWh output in year Y-1 expressed in gCO_{2eq}/kWh

electricity output i,y: electricity output (kWh) from each fuel or technology i in provisional year Y

Total electricity output t: total electricity generation from all fuels and technologies (kWh) in provisional year Y

The relative weights of the intensities corresponding to each fuel/technology in determining the overall life cycle grid emission factor is dissimilar. The statistical significance of each fuel/technology on determining the overall grid intensity, depends on the respective share in the electricity generation mix as well as the magnitude of each fuel/technology-specific emission factors. On a global level, coal and, to a lesser extent, natural gas correspond to high upstream intensities and at the same time are major contributors to the global electricity mix, hence their relative weight in determining the overall global life cycle grid intensity is significant. On the other hand, the relative importance of technologies such as wave/tidal and fuels like biogas are minor.

The simplified schematic below provides an overview of the various components required for developing these emission factors and the corresponding source(s) used for each constituent. The source for the energy data used for the above is the IEA World Energy Balances database. The fuel/technology-specific emission intensities have been derived based on data from multiple sources as shown in the figure and detailed in the following sections. Each of the following fuel/technology specific sections is comprised of two sub-sections including fuel-cycle and total upstream emission factors.



Life cycle adjustment factor for T&D losses

As electricity is transmitted through a grid from the generation plant to the final consumption point, losses can occur along the way for different reasons. The occurred T&D losses typically represent between 5 and 15% of the energy transmitted, mainly depending on the distance and quality of the lines. This means that for each unit of electricity consumed, a higher amount had to be generated.

In order to account for the emission intensity induced due to the T&D losses from a life cycle perspective, the overall life cycle emission intensity of the electricity grid is multiplied by the percentage of the T&D losses occurred as detailed by the following equation. The factors include all greenhouse gases including CO_2, CH_4 and N_2O.

$$T\&D_{life\ cycle} = (EF_{Total\ upstream} + EF_{Direct})\ x\ Loss\ factor$$

$T\&D_{Life\ cycle}$: emission intensities associated with the transmission and distribution losses of electricity in the grid developed from a life cycle perspective expressed in gCO_{2eq}/kWh.

$EF_{Total\ upstream}$: total upstream emissions intensity associated with the national electricity grid expressed in gCO_{2eq}/kWh

EF_{Direct}: direct emissions intensity associated with the national electricity grid expressed in gCO_{2eq}/kWh. This is the total emissions at the point of generation from fossil fuels consumed for electricity generation, divided by output of electricity generated from all fossil and non-fossil sources.

$$Loss\ factor = \frac{T\&D\ losses}{Grid\ electricity\ throughput}$$

Where:

- $T\&D\ Losses$ *: total transmission and distribution losses in the grid.*
- $Grid\ electricity\ throughput$ *: total amount of electricity flowing through the national electricity grid, computed as gross electricity generation – own use of electricity in generation plants + imports.*

Note that these adjustment factors are not included in the above detailed total upstream and fuel-cycle emission factors and can be added to the above to derive a closer intensity figure at the final consumption point.

The data quality for electricity transmission and distribution losses may be very variable across countries.

Total emission factor

In order to account for a proxy of a global emission factor related to electricity-only generation from national grids, including life cycle factors and transmission and distribution adjustments the current database accommodates the following indicator in the Emission Factors package:

$$EF_{Total} = EF_{Total\ upstream} + CO_2kWh + N_2O\ kWh + CH_4\ kWh + T\&D\ Life\ cycle + CO_2kWh_{trade}$$

EF_{Total}: Total greenhouse emissions per kwh of activity or electricity generated expressed in gCO2eq/kWh.

$EF_{Total\ upstream}$: total upstream emissions intensity associated with the national electricity grid expressed in gCO_{2eq}/kWh

CO_2kWh: Carbon factors calculated at the generation point for electricity only expressed in gCO_{2eq}/kWh

N_2O *kWh: Nitrous oxide factors calculated at the generation point for electricity only expressed in gCO_{2eq}/kWh, subject to data availability*

CH_4kWh: *Methane factors calculated at the generation point for electricity only expressed in gCO_{2eq}/kWh, subject to data availability*

T&D $_{Life\ cycle}$: emission intensities associated with the transmission and distribution losses of electricity in the grid developed from a life cycle perspective expressed in gCO_{2eq}/kWh, subject to data availability

CO_2kWh_{trade}: *Adjustment of the carbon factor (in CO_2/kWh) for indirect emissions induced by electricity trade between countries (for OECD countries) in gCO2eq/kWh*

9. UNITS AND CONVERSIONS

General conversion factors for energy

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

Conversion factors for mass

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

Conversion factors for volume

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

Decimal prefixes

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

Tonne of CO_2

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

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

10. ABBREVIATIONS

CO_2	carbon dioxide
Btu	British thermal unit
BKB	Brown coal briquettes (braunkohlebriketts)
Gg	gigagramme
GJ	gigajoule
GWh	gigawatt hour
J	joule
kcal	kilocalorie
kg	kilogramme
kt	thousand tonnes
ktoe	thousand tonnes of oil equivalent
kWh	kilowatt hour
MJ	megajoule
Mt	million tonnes
Mtoe	million tonnes of oil equivalent
$MtCO_2$	million tonnes of carbon dioxide
m^3	cubic metre
PJ	petajoule
t	metric ton = tonne = 1 000 kg
tC	tonne of carbon
TJ	terajoule
toe	tonne of oil equivalent = 10^7 kcal
CC	carbon content
CEF	carbon emission factor
COF	carbon oxidation factor
CHP	combined heat and power
GCV	gross calorific value
GDP	gross domestic product
GWP	global warming potential
NCV	net calorific value
TES	total energy supply
Convention	United Nations Framework Convention on Climate Change
COP	Conference of the Parties to the Convention
G20	Group of Twenty (See the section *Geographical coverage and country notes*)
IEA	International Energy Agency
IPCC	Intergovernmental Panel on Climate Change
OECD	Organisation for Economic Co-Operation and Development
UN	United Nations
UNFCCC	United Nations Framework Convention on Climate Change
..	not available
x	not applicable
c	confidential