



EMISSION FACTORS 2021

DATABASE DOCUMENTATION

This document contains a description of the electricity and heat emissions factors file distributed together with the 2021 edition of the Emission factors data package. This excel file includes 10 sheets with a set of carbon emission factors for electricity and electricity/heat generation. The factors are described below:

- CO₂ emission factors for electricity and heat generation for world countries (in CO₂ per kWh, 1990 to 2019). (Sheet CO2 KWH ELE & HEAT)
- CO₂ emission factors for electricity only generation (CHP electricity included) for world countries (in CO₂ per kWh, 1990 to 2019). (Sheet CO2KWH ELE)
- These emission factors are given for electricity and electricity/heat generation for the total electricity generation, and for generation from oil, coal, gas and from non-renewable wastes, as well as from biofuels. (Sheets CO2 KWH ELE & HEAT and CO2KWH ELE)
- CH₄ and N₂O emission factors for electricity generation (based on default IPCC factors) (in CO₂eq per kWh, 1990 to 2019). (Sheets CH4 factors and N2O factors)
- 2020 provisional emission factors for electricity and electricity/heat generation, based on provisional electricity generation data (for all OECD countries and selected non-OECD countries). (Sheets CO2 KWH ELE & HEAT and CO2KWH ELE)
- Adjustment factors to emission factors from electricity generation for indirect emissions induced by electricity trade between countries (for OECD countries, 1990 to 2019). (Sheet Trade adjustment)
- Adjustment factors to emission factors from electricity generation for emissions associated to transmission and distribution losses of electricity in the grid (for countries with available data, 1990 to 2019). (Sheet T&D losses adjustment)
- Emission factors by fuel from direct combustion of fuels in other sectors than electricity and heat production (1990 to 2019). (Sheet Implied emission factors)

Please address your inquiries to emissions@iea.org

Please note that all IEA data are subject to the following Terms and Conditions found on the IEA's website at: <http://www.iea.org/t&c/termsandconditions/>.

TABLE OF CONTENTS

1. WHAT'S NEW.....	5
2. DEFINITIONS	7
3. GEOGRAPHICAL COVERAGE AND COUNTRY NOTES.....	9
4. METHODOLOGY: CO ₂ /KWH EMISSION FACTORS.....	34
5. METHODOLOGY: OTHER FACTORS	37
6. UNITS AND CONVERSIONS.....	40
7. ABBREVIATIONS	42

1. WHAT'S NEW

Geographical coverage for the provisional year

In the 2021 edition, further to OECD countries, provisional 2020 data for selected non-OECD countries are available.

Below the list of the added countries and the respective flows.

Flow	Countries
Emissions per kWh of electricity only (gCO ₂ eq per kWh)	Benin, Botswana, Cote d'Ivoire, Equatorial Guinea, Ghana, Mauritius, Morocco, South Africa, Zambia, Argentina, Plurinational State of Bolivia, Brazil, Costa Rica, Ecuador, Guatemala, Paraguay, Peru, Uruguay, Hong Kong (China), India, Indonesia, Lao People's Democratic Republic, Singapore, Chinese Taipei, Thailand, People's Republic of China, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Georgia, Kosovo, Malta, Republic of Moldova, Republic of North Macedonia, Romania, Russian Federation, Serbia, Ukraine, Islamic Republic of Iran.
Emissions per kWh of electricity and heat (gCO ₂ per kWh)	Benin, Ghana, Mauritius, Morocco, Argentina, Brazil, Uruguay, Hong Kong (China), India, Indonesia, Chinese Taipei, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Georgia, Kosovo, Malta, Republic of Moldova, Republic of North Macedonia, Romania, Russian Federation, Serbia, Ukraine.

Geographical coverage

Chile, Colombia, and Israel are currently seeking accession to full IEA membership (Accession country), therefore they are included in the IEA and Accession/Association countries aggregate (IEA family), for data starting in 1971 and for the entire time series.

Lithuania 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 1990 and for the entire time series.

The IEA continues to expand the coverage of its statistics reports and encourages more countries to collaborate on data exchange. As detailed data have become consistently available for Niger (before 2001) and for Guyana for the entire time series, the associated time series are now shown explicitly in the main list of countries, and have been removed from the Other Africa and Other non-OECD Americas regions, respectively. Additionally, detailed data have become available for Burkina Faso, Chad, Mauritania and Rwanda, which are now included as additional memo countries.

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

Old longname	New longname	Shortname	Old shortname (if changed)
Memo: Guyana	Guyana	GUYANA	
	Memo: Burkina Faso	MBURKINAF	
	Memo: Chad	MCHAD	
	Memo: Mauritania	MMAURITANI	
	Memo: Rwanda	MRWANDA	

With the objective to increase the geographical coverage of the statistical information provided, the IEA has included in the 2021 edition CO₂ emission factors for electricity and heat generation for a complementing set of over forty countries until 2018.

Flow	Countries
Emissions per kWh of electricity and heat (gCO ₂ per kWh)	Afghanistan, Anguilla, Antigua and Barbuda, Aruba, Bahamas, Barbados, Belize, Bhutan, Burundi, Cabo Verde, Central African Republic, Comoros, Cook Islands, Djibouti, Dominica, Kingdom of Eswatini, Fiji, Gambia, Grenada, Guinea, Guinea-Bissau, Kiribati, Lesotho, Liberia, Malawi, Maldives, Marshall Islands, Micronesia (Federated States of), Nauru, Niue, Palau, Papua New Guinea, Puerto Rico, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Samoa, Sao Tome and Principe, Seychelles, Sierra Leone, Solomon Islands, Somalia, Timor-Leste, Tonga, Tuvalu and Vanuatu.

2. DEFINITIONS

Electricity and Heat Output and Emissions per kWh		
Flow	Short name	Definition
Emissions per kWh of electricity only (gCO ₂ eq per kWh)	GHGKWHIN	<p>This ratio is expressed in grammes of CO₂ per kWh.</p> <p>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.</p> <p>The calculation methodology is available in part III.</p>
Emissions per kWh of electricity and heat (gCO ₂ per kWh)	GHGKWHHIN	<p>This ratio is based on total CO₂ 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.</p> <p>Both main activity producers and autoproducers have been included in the calculation.</p> <p>The calculation methodology is available in part III.</p>
Trade adjustment (gCO ₂ /kWh)	TRADECORREC	<p>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 countries. This adjustment can be positive or negative.</p> <p>The calculation methodology is available in part III.</p>
Transmission and distribution losses adjustment (gCO ₂ /kWh)	LOSSCORREC	<p>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.</p> <p>The calculation methodology is available in part III.</p>

GHG		
GHG	Short name	Definition
CO2	CO2	
CH4	CH4	The emission factors are converted from gCH ₄ and gN ₂ O to gCO ₂ eq using the 100-year Global Warming Potential (GWP). For the purpose of comparability with international data submission guidelines, the factors from the 4th Assessment of the IPCC are used. 1gCH ₄ = 25 gCO ₂ eq
N2O	N2O	The emission factors are converted from gCH ₄ and gN ₂ O to gCO ₂ eq using the 100-year Global Warming Potential (GWP). For the purpose of comparability with international data submission guidelines, the factors from the 4th Assessment of the IPCC are used. 1gN ₂ O = 298 gCO ₂ eq

Aggregated product categories		
Flow	Short name	Definition
Total	TOTAL	TOTAL = the total of all CO ₂ emissions from fuel combustion, <i>i.e.</i> 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.

3. GEOGRAPHICAL COVERAGE AND COUNTRY NOTES

Countries and regions

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

Country/Region	Short name	Definition
World	WORLD	<p>Includes OECD Total; Africa; non-OECD Asia (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.</p> <p>It is also the sum of Africa, Americas, Asia, Europe, Oceania, World aviation bunkers and World marine bunkers.</p>
Memo: OECD Total	OECDTOT	<p>Includes Australia; Austria; Belgium; Canada; Chile; Colombia; 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; Turkey; the United Kingdom and the United States.</p> <p>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.</p>

Countries and regions

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

Country/Region	Short name	Definition
OECD Americas	OECDAM	Includes Canada, Chile, Colombia, Mexico and the United States. Costa Rica joined the OECD in May 2021, however its data have not been included in the OECD aggregates for this edition.
OECD Asia Oceania	OECDAO	Includes Australia, Israel ¹ , Japan, Korea and New Zealand.
OECD Europe	OECDEUR	Includes Austria; Belgium; the Czech Republic; Denmark; Estonia; Finland; France; Germany; Greece; Hungary; Iceland; Ireland; Italy; Latvia; Lithuania; Luxembourg; the Netherlands; Norway; Poland; Portugal; the Slovak Republic; Slovenia; Spain; Sweden; Switzerland; Turkey 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, Cameroon, Republic of Congo (Congo) ² , Côte d'Ivoire, Democratic Republic of Congo (from 1981), Egypt, Equatorial Guinea, Eritrea, Ethiopia, Gabon, Ghana, Kenya, Libya, Mauritius, Morocco, Mozambique, Namibia (from 1991), Niger, Nigeria, Senegal, South Africa, South Sudan (from 2012), Sudan, United Republic of Tanzania, Togo, Tunisia, Zambia, Zimbabwe and Other Africa. Includes Algeria, Angola, Benin, Botswana (from 1981), Cameroon, Republic of Congo (Congo), Côte d'Ivoire, Democratic Republic of Congo (from 1981), Equatorial Guinea, Egypt, Eritrea, Ethiopia, Gabon, Ghana, Kenya, Libya, Mauritius, Morocco, Mozambique, Namibia (from 1991), Niger, Nigeria, Senegal, South Africa, South Sudan (from 2012), Sudan, United Republic of Tanzania, Togo, Tunisia, Zambia, Zimbabwe and Other Africa . Note that Africa is identical to Memo: Africa (UN).

¹ 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.

² Country short names are included in parentheses.

Countries and regions

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

Country/Region	Short name	Definition
Non-OECD Americas	LATAMER	Includes Argentina; Plurinational State of Bolivia (Bolivia); Brazil; Colombia ³ ; Costa Rica; Cuba; Curaçao ⁴ ; 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 .
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 ⁵ ; Georgia; Gibraltar; Kazakhstan; Kosovo ⁶ ; Kyrgyzstan; Malta; Republic of Moldova (Moldova); Montenegro; the Republic of North Macedonia (North Macedonia); Romania; Russian Federation; Serbia ⁷ ; 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.

³ Data for Colombia, that joined the OECD in April 2020, are not included in the OECD aggregate for this edition.

⁴ 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.

⁵ **Note by Turkey:**

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.

⁶ 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.

⁷ Serbia includes Montenegro until 2004 and Kosovo until 1999.

Countries and regions

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

Country/Region	Short name	Definition
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.
Albania	ALBANIA	
Algeria	ALGERIA	
Angola	ANGOLA	
Argentina	ARGENTINA	
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.
Austria	AUSTRIA	
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	
Benin	BENIN	
Bolivia	BOLIVIA	
Bosnia and Herzegovina	BOSNIAHERZ	Data for Bosnia and Herzegovina are available starting in 1990. Prior to that, they are included in Former Yugoslavia.
Botswana	BOTSWANA	
Brazil	BRAZIL	
Brunei Darussalam	BRUNEI	

Countries and regions

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

Country/Region	Short name	Definition
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.
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	
Chile	CHILE	Data start in 1971.
People’s Republic of China	CHINA	
Colombia	COLOMBIA	Colombia joined the OECD in April 2020, its data is now included in the OECD aggregates. 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.
Congo	CONGO	
Costa Rica	COSTARICA	Data for Costa Rica, that joined the OECD in May 2021, are not included in the OECD aggregate for this edition and have thus been included in Non-OECD Americas.
Côte d’Ivoire	COTEIVOIRE	
Croatia	CROATIA	Data for Croatia are available starting in 1990. Prior to that, they are included in Former Yugoslavia.
Cuba	CUBA	
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.

Countries and regions

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

Country/Region	Short name	Definition
Cyprus	CYPRUS	<p>Note by Turkey:</p> <p>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. 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.</p> <p>Note by all the European Union Member States of the OECD and the European Union:</p> <p>The Republic of Cyprus is recognised by all members of the United Nations with the exception of Turkey. The information in this report relates to the area under the effective control of the Government of the Republic of Cyprus.</p> <p>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.</p>
Czech Republic	CZECH	Data start in 1971.
Democratic People's Republic of Korea	KOREADPR	
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.
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.
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.

Countries and regions

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

Country/Region	Short name	Definition
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.
Finland	FINLAND	
France	FRANCE	Includes Monaco and excludes the overseas collectivities: New Caledonia; French Polynesia; Saint Barthélemy; Saint Martin; Saint Pierre and Miquelon; and Wallis and Futuna. Energy data for the following overseas departments: Guadeloupe; French Guiana; Martinique; Mayotte; and Réunion are included for the years from 2011 onwards, and excluded for earlier years.
Gabon	GABON	
Georgia	GEORGIA	Data for Georgia are available starting in 1990. Prior to that, they are included in Former Soviet Union.
Germany	GERMANY	Includes the new federal states of Germany from 1970 onwards.
Ghana	GHANA	
Gibraltar	GIBRALTAR	
Greece	GREECE	
Guatemala	GUATEMALA	
Guyana	GUYANA	
Haiti	HAITI	
Honduras	HONDURAS	
Hong Kong, China	HONGKONG	
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.
Iceland	ICELAND	
India	INDIA	Data are reported on a fiscal year basis. By convention, data for the fiscal year that starts on 1 April Y and ends on 31 March Y+1 are labelled as year Y. This convention is different from the one used by Government of India, whereby fiscal year starts on 1 April Y and ends on 31 March Y+1 are labelled as year Y+1.
Indonesia	INDONESIA	

Countries and regions

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

Country/Region	Short name	Definition
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	
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.
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.
Jordan	JORDAN	
Kazakhstan	KAZAKHSTAN	Data for Kazakhstan are available starting in 1990. Prior to that they are included in Former Soviet Union.
Kenya	KENYA	Electricity data are reported on a fiscal year basis, beginning on the 1 July Y and ending on the 30 June of Y+1.
Korea	KOREA	Data starts in 1971.
Kosovo	KOSOVO	This designation is without prejudice to positions on status, and is in line with United Nations Security Council Resolution 1244/99 and the Advisory Opinion of the International Court of Justice on Kosovo's declaration of independence. Data for Kosovo are available starting in 2000. From 1990-1999, data for Kosovo are included in Serbia. Prior 1990 that, they are included in Former Yugoslavia.
Kuwait	KUWAIT	
Kyrgyzstan	KYRGYZSTAN	Data for Kyrgyzstan are available starting in 1990. Prior to that, they are included in Former Soviet Union.

Countries and regions

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

Country/Region	Short name	Definition
Latvia	LATVIA	Data for Latvia are available starting in 1990. Prior to that, they are included in Former Soviet Union.
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 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 1990 and for the entire time series. Data for Lithuania are available starting in 1990. Prior to that, they are included in Former Soviet Union.
Luxembourg	LUXEMBOU	
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.
Mauritius	MAURITIUS	
Mexico	MEXICO	Data start in 1971.
Republic of Moldova	MOLDOVA	Data for the Republic of Moldova are available starting in 1990. Prior to that, they are included in Former Soviet Union.
Mongolia	MONGOLIA	Data for Mongolia are available starting in 1985. Prior to that, they are included in Other Asia.
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	
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

Countries and regions

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

Country/Region	Short name	Definition
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).
New Zealand	NZ	
Nicaragua	NICARAGUA	
Niger	NIGER	
Nigeria	NIGERIA	
Republic of North Macedonia	NORTHMACED	Data for the Republic of North Macedonia (North Macedonia) are available starting in 1990. Prior to that, they are included in Former Yugoslavia.
Norway	NORWAY	Discrepancies between Reference and Sectoral Approach estimates and the difference in the resulting growth rates arise from statistical differences between supply and consumption data for oil and natural gas. For Norway, supply of these fuels is the residual of two very large and opposite terms, production and exports.
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	
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.
Portugal	PORTUGAL	Includes the Azores and Madeira.

Countries and regions

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

Country/Region	Short name	Definition
Qatar	QATAR	
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.
Russian Federation	RUSSIA	Data for Russian Federation are available starting in 1990. Prior to that, they are included in Former Soviet Union.
Saudi Arabia	SAUDIARABI	
Senegal	SENEGAL	
Serbia	SERBIA	Data for Serbia are available starting in 1990. Prior to that, they are included in Former Yugoslavia. Serbia includes Kosovo from 1990 to 1999 and Montenegro from 1990 to 2004.
Singapore	SINGAPORE	
Slovak Republic	SLOVAKIA	
Slovenia	SLOVENIA	Data for Slovenia are available from 1990. Prior to that, they are included in Former Yugoslavia in the full publication. According to the provisions of Article 4.6 of the Convention and Decisions 9/CP.2 and 11/CP.4, Slovenia is allowed to use 1986 as the base year.
South Africa	SOUTHAFRIC	Nuclear 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.
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.
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	
Switzerland	SWITLAND	Includes Liechtenstein for the oil data. Data for other fuels do not include Liechtenstein.
Chinese Taipei	TAIPEI	

Countries and regions

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

Country/Region	Short name	Definition
Tajikistan	TAJIKISTAN	Data for Tajikistan are available starting in 1990. Prior to that, they are included in Former Soviet Union.
United Republic of Tanzania	TANZANIA	Oil data are reported on a fiscal year basis, beginning on the 1 July Y and ending on the 30 June Y+1.
Thailand	THAILAND	
Togo	TOGO	
Trinidad and Tobago	TRINIDAD	
Tunisia	TUNISIA	
Turkey	TURKEY	
Turkmenistan	TURKMENIST	Data for Turkmenistan are available starting in 1990. Prior to that, they are included in Former Soviet Union.
Ukraine	UKRAINE	Data for Ukraine are available starting in 1990. Prior to that, they are included in Former Soviet Union.
United Arab Emirates	UAE	
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. In this publication with data up to 2019, the UK is still included in the EU28 aggregate. However, it is excluded from the EU27 2020 aggregate.
United States	USA	Includes the 50 states and the District of Columbia but generally excludes all territories, and all trade between the U.S. and its territories. Oil statistics include Guam, Puerto Rico ⁸ 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.

⁸. 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

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

Country/Region	Short name	Definition
Uruguay	URUGUAY	
Uzbekistan	UZBEKISTAN	Data for Uzbekistan are available starting in 1990. Prior to that, data are included in Former Soviet Union.
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	Before 1990, includes Bosnia and Herzegovina; Croatia; Kosovo; Montenegro; Republic of North Macedonia (North Macedonia); Slovenia and Serbia.
Other Africa	OTHERAFRIC	Includes Burkina Faso; Burundi; Cape Verde; Central African Republic; Chad; Comoros; Djibouti; the Kingdom of Eswatini; Gambia; Guinea; Guinea-Bissau; Lesotho; Liberia; Madagascar; Malawi; Mali; Mauritania; Namibia (until 1990); Réunion (until 2010); Rwanda; Sao Tome and Principe; Seychelles; Sierra Leone; Somalia; and Uganda.
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

Countries and regions

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

Country/Region	Short name	Definition
Memo: Burkina Faso	MBURKINFA	Burkina Faso data are also included in the Other Africa region.
Memo: Chad	MCHAD	Chad data are also included in the Other Africa region.
Memo: 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.
Memo: Madagascar	MMADAGASCA	Madagascar data are also included in the Other Africa region.
Memo: Mali	MMALI	Data start in 2000. Mali data are also included in the Other Africa region.
Memo: Mauritania	MMAURITANI	Mauritania data are also included in the Other Africa region.
Memo: Palestinian Authority	MPALESTINE	Data starts in 2001.
Memo: Rwanda	MRWANDA	Rwanda data are also included in the Other Africa region.
Memo: Uganda	MUGANDA	Uganda data are also included in the Other Africa region.
Memo: Uganda	MUGANDA	Uganda data are also included in the Other Africa region.
Memo: ASEAN	MASEAN	Data starts in 2000. Includes: Brunei; Cambodia; Indonesia; Lao People's Democratic Republic; Malaysia; Myanmar; Philippines; Singapore; Thailand; and Viet Nam.
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.

Countries and regions

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

Country/Region	Short name	Definition
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 ⁹ ; 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) ¹⁰ ; 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).
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 ¹¹ ; Georgia; Hong Kong, China; India; Indonesia; the Islamic Republic of Iran; Iraq; Israel ¹² ; 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.

⁹. 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.

¹⁰. Oil statistics as well as coal trade statistics for Puerto Rico are included under the United States.

¹¹. Refer to the country note for Cyprus earlier in this section.

¹². 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

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

Country/Region	Short name	Definition
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 ¹³ ; Latvia; Lithuania; Luxembourg; Malta; the Republic of Moldova (Moldova); Montenegro; the Netherlands; Norway; Poland; Portugal; Romania; the Russian Federation; Serbia ¹⁴ ; 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.
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; Luxembourg; Mexico ¹⁵ ; the Netherlands; New Zealand; Norway; Poland; Portugal; the Slovak Republic; Spain; Sweden; Switzerland; Turkey; 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, Luxembourg, Mexico, the Netherlands, New Zealand, Norway, Poland, Portugal, the Slovak Republic, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the United States; Accession countries: Chile, Colombia, Israel and Lithuania; Association countries: Brazil; the People’s Republic of China; India; Indonesia; Morocco; Singapore; South Africa; Thailand.

¹³. 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.

¹⁴. Serbia includes Montenegro until 2004 and Kosovo until 1999.

¹⁵. Mexico became the 30th IEA Member country in February 2018. Accordingly, starting with the 2018 preliminary edition, Mexico now appears in the list of IEA Members and is included in the IEA zone aggregate for the entire time series.

Countries and regions

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

Country/Region	Short name	Definition
Memo: European Union – 28	EU28	Includes Austria, Belgium, Bulgaria, Croatia, Cyprus ¹⁶ , 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 ¹⁷ . 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	Refers to the EU28 with the exclusion of the United Kingdom. Namely includes Austria; Belgium; Bulgaria; Croatia; Cyprus ¹¹ ; the Czech Republic; Denmark; Estonia; Finland; France; Germany; Greece; Hungary; Ireland; Italy; Latvia; Lithuania; Luxembourg; Malta; the Netherlands; Poland; Portugal; Romania; the Slovak Republic; Slovenia; Spain and Sweden. Please note that in the interest of having comparable data, all these countries are included since 1990 despite different entry dates into the European Union.
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; Angola; Republic of the Congo; Equatorial Guinea; Gabon; the Islamic Republic of Iran; Iraq; Kuwait; Libya; Nigeria; Saudi Arabia; the United Arab Emirates; 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.
Memo: G20	MG20	Includes Argentina, Australia, Brazil, Canada, China (including Hong Kong, China), India, Indonesia, Japan, Korea, Mexico, Russian Federation, Saudi Arabia, South Africa, Turkey, the United States and the European Union – 28.

¹⁶ Refer to the country note for Cyprus earlier in this section.

¹⁷ As of the 1st of February 2020, the United Kingdom (UK) is no longer part of the European Union (EU) and has entered into a transition period until 31 December 2020.

In this publication with data up to 2019, the UK is still included in the EU28 aggregate.

Countries and regions

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

Country/Region	Short name	Definition
Memo: Annex I Parties	ANNEX1	<p>Includes Australia, Austria, Belarus, Belgium, Bulgaria, Canada, Croatia, Cyprus¹⁸, the Czech Republic^{19,20}, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Latvia, Liechtenstein (not available in this publication)²¹, Lithuania, Luxembourg, Malta, Monaco (included with France), the Netherlands, New Zealand, Norway, Poland, Portugal, Romania, the Russian Federation, the Slovak Republic²², Slovenia, Spain, Sweden, Switzerland, Turkey, Ukraine, the United Kingdom and the United States.²³</p> <p><i>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).</i></p>
Memo: Annex II Parties	ANNEX2	<p>Includes Australia, Austria, Belgium, Canada, Denmark, Finland, France²⁴, Germany, Greece, Iceland, Ireland, Italy, Japan, Luxembourg, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland²⁵, the United Kingdom and the United States.</p> <p><i>According to Decision 26/CP.7 in document FCCC/CP/2001/13/ Add.4, Turkey has been deleted from the list of Annex II countries to the Convention. This amendment entered into force on 28 June 2002.</i></p>
Memo: Annex II North America	ANNEX2NA	Includes Canada and the United States.

¹⁸. Refer to the country note for Cyprus earlier in this section.

¹⁹. Czechia in official UN documents.

²⁰. Czechoslovakia was in the original list of Annex I countries.

²¹. Oil data for Liechtenstein are included under Switzerland.

²². Slovakia in official UN documents.

²³. 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.

²⁴. In IEA data, France also includes Monaco, which is not in the list of Annex II Parties.

²⁵. In IEA data, Switzerland includes Oil data for Liechtenstein, which is not in the list of Annex II Parties.

Countries and regions

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

Country/Region	Short name	Definition
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	
Memo: Annex B Kyoto Parties	ANNEXB	Includes Australia, Austria, Belgium, Belarus, Bulgaria, Croatia, Cyprus ²⁶ , 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. ²⁷ <i>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, Turkey 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).</i>

²⁶. Refer to the country note for Cyprus earlier in this section.

²⁷. 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

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

Country/Region	Short name	Definition
<p>Please note that the following countries have not been considered:</p> <ul style="list-style-type: none"> • 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. 		

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 countries²⁸ not covered explicitly in the *IEA World energy balances*, using a simplified approach based on more aggregated²⁹ energy data from the United Nations Statistics Division (UNSD) *2018 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).

This document is without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries and to the name of any territory, city or area. In this publication, ‘country’ refers to country or territory, as case may be. Data start in 1990 for this set of countries unless otherwise specified.

Country/Region	Short name	Definition
Memo*: Afghanistan	MAFGHANIST	
Memo*: Anguilla	MANGUILLA	

²⁸ 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.

²⁹ Such data are available for the following list of aggregated product categories (primary coal, secondary coal, oil products and crude/NGL/feedstocks)..

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 countries²⁸ not covered explicitly in the *IEA World energy balances*, using a simplified approach based on more aggregated²⁹ energy data from the United Nations Statistics Division (UNSD) *2018 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).

This document is without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries and to the name of any territory, city or area. In this publication, 'country' refers to country or territory, as case may be. Data start in 1990 for this set of countries unless otherwise specified.

Country/Region	Short name	Definition
Memo*: Antigua and Barbuda	MANTIGUABA	
Memo*: Aruba	MARUBA	
Memo*: Bahamas	MBAHAMAS	
Memo*: Barbados	MBARBADOS	
Memo*: Belize	MBELIZE	
Memo*: Bhutan	MBHUTAN	
Memo*: Burundi	MBURUNDI	
Memo*: Cabo Verde	MCABOVERDE	
Memo*: Central African Republic	MCENTRAFRI	
Memo*: Comoros	MCOMOROS	
Memo*: Cook Islands	MCOOKISLA	
Memo*: Djibouti	MDJIBOUTI	
Memo*: Dominica	MDOMINICA	
Memo*: Kingdom of Eswatini	MESWATINI	
Memo*: Fiji	MFIJI	
Memo*: Gambia	MGAMBIA	

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 countries²⁸ not covered explicitly in the *IEA World energy balances*, using a simplified approach based on more aggregated²⁹ energy data from the United Nations Statistics Division (UNSD) *2018 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).

This document is without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries and to the name of any territory, city or area. In this publication, 'country' refers to country or territory, as case may be. Data start in 1990 for this set of countries unless otherwise specified.

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

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 countries²⁸ not covered explicitly in the *IEA World energy balances*, using a simplified approach based on more aggregated²⁹ energy data from the United Nations Statistics Division (UNSD) *2018 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).

This document is without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries and to the name of any territory, city or area. In this publication, 'country' refers to country or territory, as case may be. Data start in 1990 for this set of countries unless otherwise specified.

Country/Region	Short name	Definition
Memo*: Saint Kitts and Nevis	MSTKITTNE	
Memo*: Saint Lucia	MSTLUCIA	
Memo*: Saint Vincent and the Grenadines	MSTVINCENT	
Memo*: Samoa	MSAMOA	
Memo*: Sao Tome and Principe	MSAOTOME	
Memo*: Seychelles	MSEYCHELLE	
Memo*: Sierra Leone	MSIERRALEO	
Memo*: Solomon Islands	MSOLOMONIS	
Memo*: Somalia	MSOMALIA	
Memo*: Timor-Leste	MTIMORLES	
Memo*: Tonga	MTONGA	
Memo*: Tuvalu	MTUVALU	
Memo*: 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'.

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

Country/Region	Short name	Definition
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.
Kenya	KENYA	Electricity data are reported on a fiscal year basis, beginning on the 1 July Y and ending on the 30 June of Y+1.
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.

Fiscal year

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

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

Country/Region	Short name	Definition
Pakistan	PAKISTAN	Data are reported on a fiscal year basis. By convention fiscal year Y/Y+1 is labelled as year Y.
South Africa	SOUTHAFRIC	Nuclear 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.
United Republic of Tanzania	TANZANIA	Oil data are reported on a fiscal year basis, beginning on the 1 July Y and ending on the 30 June Y+1.

4. METHODOLOGY: CO₂/KWH EMISSION FACTORS

Data source

The estimates of CO₂ 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 documentation³⁰. These definitions, based on the *United Nations International Recommendations on Energy Statistics*³¹, 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** CO₂ emissions per kWh, for electricity or for electricity and heat generation, the numerator presents the CO₂ 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.

In the CO₂ 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.

30. http://wds.iea.org/wds/pdf/WorldCO2_documentation.pdf

31. http://unstats.un.org/unsd/energy/ires/IRES_Whitecover.pdf.

- Non-renewable wastes includes industrial waste and non-renewable municipal waste.
- Biofuels includes both biofuels and renewable wastes. Note that these emission factors are included for information, as CO₂ emissions from biofuel are not accounted for in the total CO₂ emissions of the energy sector according to the IPCC guidelines.

Note: Emissions per kWh should be used with caution due to data quality problems relating to electricity efficiencies for some countries.

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:

- When the observed efficiency is over 100% (i.e. there are problems in data quality).
- 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

CO₂kWh 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:

- CO₂kWh : Carbon factors (in CO₂/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.

CO₂kWh 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:

- CO₂kWh : Carbon factors (in CO₂/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.

Comparison between electricity-only and combined electricity and heat ratios

For the majority of OECD countries, the electricity-only indicator is not significantly different from the combined electricity and heat indicator, shown in previous editions of this publication and in the online database. For the OECD total in 2014, the electricity-only indicator is 4% higher, while 19 of the OECD's 34 countries saw a difference of 5% or less. Of the 15 countries with differences of more than 5%, 7 countries had large amounts of non-emitting electricity generation, giving them a small ratio to begin with (thus more prone to change). In addition, non-emitting generation is generally electricity-only, and so when the heat-only and heat CHP emissions are removed from the calculation, greater weight is attached to the non-emitting generation, with a lower level for the final indicator.

The countries in the OECD with larger differences are generally coal-intensive countries with large amounts of heat generation. As mentioned, in general, heat plants are more efficient than electricity-only or CHP plants; therefore, excluding heat plants from the calculation increases CO₂ intensity. The same is true if we allocate a high efficiency to the heat part of CHP generation; this decreases the efficiency of the electricity part and thus increases electricity's carbon intensity. Further, CHP and heat plants are more likely to be powered by CO₂-light natural gas while electricity-only plants tend to be powered by CO₂-heavy coal, making the new ratio more CO₂ intensive for these countries.

5. METHODOLOGY: OTHER FACTORS

Provisional carbon emission factors

The carbon factor for the latest year (Y) is only available for OECD countries and selected non-OECD countries. The available data for the year Y only include the breakdown of electricity generated by fuel, but not the fuel input to plant. Therefore, the assumption required 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:

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

Only the total carbon emission factor is included for the provisional year.

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 countries. This adjustment can be positive or negative, and is calculated as follows:

$$CO_2kWh_{trade} = \frac{C_{Indigenous} + C_{Imported} - C_{Exported}}{Net\ electricity} - CO_2kWh$$

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

- CO_2kWh_{trade} : Adjustment of the carbon factor (in CO_2/kWh) for emissions induced by the trade of electricity with partner countries.

- $CO_2kWh_{partner}$: 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:

$$CO_2kWh_{loss} = CO_2kWh \times loss\ factor$$

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.

CH4 and N2O 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. For the purpose of comparability with international data submission guidelines, the factors from the 4th Assessment of the IPCC are used.

Designation or Name	Chemical formula	100-Year GWP
Carbon dioxide	CO_2	1
Methane	CH_4	25
Nitrous oxide	N_2O	298

Note that the uncertainty associated with CH₄ and N₂O 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*³² for more information about the uncertainty associated to emission factors.

Use of the adjustment indicators

In order to allow more flexibility for the users depending on their reporting needs, the CO₂ emission factors are presented in a disaggregated manner. Since the CO₂ 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 CO₂ per kWh at the final user point. Please note that in order to calculate completely the scope 3 emissions, the losses from Well to Tank (WTT) would have to be included as well, and these figures are not provided here.

This factor can also be completed with the CH₄ and N₂O figures to obtain a more complete greenhouse gas per kWh indicator. As stipulated above, these figures are to be taken with caution due to the uncertainty associated with the corresponding IPCC emission factors. The CH₄ and N₂O adjustment for trade and losses are not provided here due to the negligible impact compared to the uncertainty associated with the figure.

Implied emission factors from direct combustion of fuels

In most cases fuels are combusted directly for other purposes than electricity generation. The implied emissions factors (IEF) vary according to the fuel used, and are computed as weighted average of the consumption across all sectors excluding electricity generation, as follows:

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

Where:

- IEF : Implied emission factors for fuel combustion other than for electricity and heat generation, in kg CO₂ / kg of fuel
- $E_{Industry}$: Total CO₂ emissions from fuel combustion in the *Industry* sector plus emission in the *Energy* sector except electricity and CHP plants in kg CO₂.
- $E_{Transport}$: Total CO₂ emissions from fuel combustion in the *Transport* sector in kg CO₂.
- E_{Others} : Total CO₂ emissions from fuel combustion in the *Residential, Commercial and Public services, Agriculture/Forestry, Fishing and Other non-specified* sectors in kg CO₂.
- FC_{sector} : Total fuel consumption in the respective sector, expressed in kg.

Which is equivalent to:

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

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.

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

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

6. UNITS AND CONVERSIONS

General conversion factors for energy

To:	TJ	Gcal	Mtoe	MBtu	GWh
From:	multiply by:				
terajoule (TJ)	1	2.388x10 ²	2.388x10 ⁻⁵	9.478x10 ²	2.778x10 ⁻¹
gigacalorie (Gcal)	4.187x10 ⁻³	1	1.000x10 ⁻⁷	3.968	1.163x10 ⁻³
million tonnes of oil equivalent (Mtoe)	4.187x10 ⁴	1.000x10 ⁷	1	3.968x10 ⁷	1.163x10 ⁴
million British thermal units (MBtu)	1.055x10 ⁻³	2.520x10 ⁻¹	2.520x10 ⁻⁸	1	2.931x10 ⁻⁴
gigawatt hour (GWh)	3.600	8.598x10 ²	8.598x10 ⁻⁵	3.412x10 ³	1

Conversion factors for mass

To:	kg	t	lt	st	lb
From:	multiply by:				
kilogramme (kg)	1	1.000x10 ⁻³	9.842x10 ⁻⁴	1.102x10 ⁻³	2.205
tonne (t)	1.000x10 ³	1	9.842x10 ⁻¹	1.102	2.205x10 ³
long ton (lt)	1.016x10 ³	1.016	1	1.120	2.240x10 ³
short ton (st)	9.072x10 ²	9.072x10 ⁻¹	8.929x10 ⁻¹	1	2.000x10 ³
pound (lb)	4.536x10 ⁻¹	4.536x10 ⁻⁴	4.464x10 ⁻⁴	5.000x10 ⁻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	8.327x10 ⁻¹	2.381x10 ⁻²	1.337x10 ⁻¹	3.785	3.785x10 ⁻³
U.K. gallon (gal U.K.)	1.201	1	2.859x10 ⁻²	1.605x10 ⁻¹	4.546	4.546x10 ⁻³
barrel (bbl)	4.200x10 ¹	3.497x10 ¹	1	5.615	1.590x10 ²	1.590x10 ⁻¹
cubic foot (ft ³)	7.481	6.229	1.781x10 ⁻¹	1	2.832x10 ¹	2.832x10 ⁻²
litre (l)	2.642x10 ⁻¹	2.200x10 ⁻¹	6.290x10 ⁻³	3.531x10 ⁻²	1	1.000x10 ⁻³
cubic metre (m ³)	2.642x10 ²	2.200x10 ²	6.290	3.531x10 ¹	1.000x10 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 CO₂

The *2006 GLs* and the *UNFCCC Reporting Guidelines on Annual Inventories* both ask that CO₂ emissions and removals be reported in Gg (gigagrammes) of CO₂. A million tonnes of CO₂ is equal to 1 000 Gg of CO₂, 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 CO₂ emissions in tonnes of carbon instead of tonnes of CO₂. To convert from tonnes of carbon, multiply by 44/12, which is the molecular weight ratio of CO₂ to C.

7. 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 <i>Geographical coverage and country notes</i>)
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