



RENEWABLES INFORMATION 2017 FINAL EDITION

DATABASE DOCUMENTATION

This documentation provides support information for the IEA *Renewables Information* database. This document can be found online at: <http://www.iea.org/statistics/topics/renewables/>.

Please address your inquiries to stats@iea.org.

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

TABLE OF CONTENTS

1. CHANGES FROM LAST EDITION.....	4
2. DATABASE STRUCTURE	5
3. FLOW DEFINITIONS.....	7
4. PRODUCT DEFINITIONS.....	27
5. GEOGRAPHICAL COVERAGE	33
6. COUNTRY NOTES AND SOURCES.....	44
7. UNITS AND CONVERSIONS	64
8. ABBREVIATIONS	68

1. CHANGES FROM LAST EDITION

Geographical coverage

Latvia became an OECD Member in July 2016. Accordingly, Latvia appears in the list of OECD Members for data starting in 1990.

In the 2017 final edition, six new regional aggregates are added as a response to user requests. Firstly, *the IEA and Accession/Association countries* is added to show the wider connections the IEA has beyond members as part of the continuous development of the IEA's work, these show member countries, accession countries and association countries as a whole. Other five regional pure geographic aggregates are also included known as: *Africa(UN)*, *Americas(UN)*, *Asia(UN)*, *Europe(UN)* and *Oceania(UN)* which are based on country aggregations in line with the UN's geographic regions. Note that these aggregates - apart from Africa – do have different coverage from existing ones (e.g. Armenia is included in *Non-OECD Europe and Eurasia* and *Asia(UN)* at the same time), and should be used with that in mind. For the list of countries in each aggregation, see section Geographical coverage.

2. DATABASE STRUCTURE

The database *Renewable information* includes annual data for:

OECD files (Last updated July 2017)

- Countries: 35 OECD countries and 8 regional aggregates (see section *Geographical coverage*);
- Years: 1990-2015 (OECD countries and regions unless otherwise specified);

RENOECDBAL.IVT OECD, Renewables Balance (GWh, TJ, ktoe)

Energy balances in matrix form (17 products; 78 flows)
Electricity and heat output by type of producer (10 flows)
Provisional data for 2016 are included.

RENOECDBES.IVT OECD, Renewables Supply and Consumption (GWh, TJ, kt)

Energy statistics in matrix form (31 products; 78 flows)
Electricity and heat output by type of producer (10 flows)
Provisional data for 2016 are included.

RENOECDCAP.IVT OECD, Net Capacity - Renewables (MW_e , m^2 , MW_{th})

Electrical capacity in matrix form (18 products)
Solar collector surface and thermal capacity (2 products)

WORLD files (Last updated July 2017)

- countries: 142 countries and regional aggregates (see section *Geographical coverage*);
- years: 1990-2015;

RENWORLDBAL.IVT WORLD, Renewables and Waste Energy Supply (GWh, TJ, ktoe)

Energy balances in matrix form (142 countries + 25 aggregates; 17 products; 7 flows)

Electricity and heat output by type of producer (2 flows)

RENWORLDBES.IVT WORLD, Renewables and Waste Statistics (GWh, TJ, kt)

Energy statistics in matrix form (142 countries + 24 aggregates; 15 products; 5 flows)

Electricity and heat output by type of producer (2 flows)

3. FLOW DEFINITIONS

OECD, Renewables Balance (ktoe): RENOECDBAL.IVT
WORLD, Renewables and Waste Energy Supply: RENWORLDBAL.IVT

Supply		
Flow	Short name	Definition
Production	INDPROD	Production refers to the quantities of fuels extracted or produced, calculated after any operation for removal of inert matter or impurities. The calculation of production of hydroelectricity, geothermal, etc. is explained in Section 4, Energy conventions and Units.
Imports	IMPORTS	Comprise amounts having crossed the national territorial boundaries of the country whether or not customs clearance has taken place.
Exports	EXPORTS	Comprise amounts having crossed the national territorial boundaries of the country whether or not customs clearance has taken place.
International marine bunkers	MARBUNK	Covers those quantities delivered to ships of all flags that are engaged in international navigation. The international navigation may take place at sea, on inland lakes and waterways, and in coastal waters. Consumption by ships engaged in domestic navigation is excluded. The domestic/international split is determined on the basis of port of departure and port of arrival, and not by the flag or nationality of the ship. Consumption by fishing vessels and by military forces is also excluded. See <i>domestic navigation, fishing and other non-specified</i> .
International aviation bunkers	AVBUNK	Includes deliveries of aviation fuels to aircraft for international aviation. Fuels used by airlines for their road vehicles are excluded. The domestic/international splits are determined on the basis of departure and landing locations and not by the nationality of the airline. For many countries this incorrectly excludes fuel used by domestically owned carriers for their international departures.
Stock changes	STOCKCHA	Reflects the difference between opening stock levels on the first day of the year and closing levels on the last day of the year of stocks on national territory held by producers, importers, energy transformation industries and large consumers. A stock build is shown as a negative number, and a stock draw as a positive number.

Supply		
Flow	Short name	Definition
Total primary energy supply	TPES	Total primary energy supply (TPES) is made up of production + imports - exports - international marine bunkers – international aviation bunkers ± stock changes.
Transfers	TRANSFER	Comprises <i>interproduct transfers, products transferred and recycled products</i> .
Statistical differences	STATDIFF	Is essentially the difference between supply and demand. It is defined as deliveries to <i>final consumption</i> + use for <i>transformation</i> and consumption within the <i>energy industry</i> + <i>losses - domestic supply - transfers</i> . Statistical differences arise because the data for the individual components of supply are often derived from different data sources by the national administration. Furthermore, the inclusion of changes in some large consumers' stocks in the supply part of the balance introduces distortions which also contribute to the statistical differences.

Transformation processes		
Flow	Short name	Definition
Transformation processes	TOTTRANF	The transformation processes comprises the conversion of primary forms of energy to secondary and further transformation (e.g. coking coal to coke, crude oil to petroleum products, and heavy fuel oil to electricity). Inputs to transformation processes are shown as negative numbers and output from the process is shown as a positive number. Transformation losses will appear in the “total” column as negative numbers.
Main activity producer electricity plants	MAINELEC	Refers to plants which are designed to produce electricity only. If one or more units of the plant is a CHP unit (and the inputs and outputs cannot be distinguished on a unit basis) then the whole plant is designated as a CHP plant. Main activity producers (formerly referred to as public supply undertakings) generate electricity for sale to third parties, as their primary activity. They may be privately or publicly owned. Note that the sale need not take place through the public grid.
Autoproducer electricity plants	AUTOELEC	Refers to plants which are designed to produce electricity only. If one or more units of the plant is a CHP unit (and the inputs and outputs cannot be distinguished on a unit basis) then the whole plant is designated as a CHP plant. Autoproducer undertakings generate electricity wholly or partly for their own use as an activity which supports their primary activity. They may be privately or publicly owned.
Main activity producer CHP plants	MAINCHP	Refers to plants which are designed to produce both heat and electricity (sometimes referred to as co-generation power stations). If possible, fuel inputs and electricity/heat outputs are on a unit basis rather than on a plant basis. However, if data are not available on a unit basis, the conventions for defining a CHP plant noted above are adopted. Main activity producers (formerly referred to as public supply undertakings) generate electricity and/or heat for sale to third parties, as their primary activity. They may be privately or publicly owned. Note that the sale need not take place through the public grid.
Autoproducer CHP plants	AUTOCHP	Refers to plants which are designed to produce both heat and electricity (sometimes referred to as co-generation power stations). If possible, fuel inputs and electricity/heat outputs are on a unit basis rather than on a plant basis. However, if data are not available on a unit basis, the conventions for defining a CHP plant noted above are adopted. Note that for autoproducer CHP plants, all fuel inputs to electricity production are taken into account, while only the part of fuel inputs to heat sold is shown. Fuel inputs for the production of heat consumed within the autoproducer’s establishment are not included here but are included with figures for the final consumption of fuels in the appropriate consuming sector. Autoproducer undertakings generate electricity and/or heat, wholly or partly for their own use as an activity which supports their primary activity. They may be privately or publicly owned.

Transformation processes		
Flow	Short name	Definition
Main activity producer heat plants	MAINHEAT	Refers to plants (including heat pumps and electric boilers) designed to produce heat only and who sell heat to a third party (e.g. residential, commercial or industrial consumers) under the provisions of a contract. Main activity producers (formerly referred to as public supply undertakings) generate heat for sale to third parties, as their primary activity. They may be privately or publicly owned. Note that the sale need not take place through the public grid.
Autoproducer heat plants	AUTOHEAT	Refers to plants (including heat pumps and electric boilers) designed to produce heat only and who sell heat to a third party (e.g. residential, commercial or industrial consumers) under the provisions of a contract. Autoproducer undertakings generate heat, wholly or partly for their own use as an activity which supports their primary activity. They may be privately or publicly owned.
Heat pumps	THEAT	Includes heat produced by heat pumps in the transformation processes. Heat pumps that are operated within the residential sector where the heat is not sold are not considered a transformation process and are not included here – the electricity consumption would appear as residential use.
Electric boilers	TBOILER	Includes electric boilers used to produce heat.
Chemical heat for electricity production	TELE	Includes heat from chemical processes that is used to generate electricity.
Blast furnaces	TBLASTFUR	Includes the production of town gas, blast furnace gas and oxygen steel furnace gas. The production of pig-iron from iron ore in blast furnaces uses fuels for supporting the blast furnace charge and providing heat and carbon for the reduction of the iron ore. Accounting for the calorific content of the fuels entering the process is a complex matter as transformation (into blast furnace gas) and consumption (heat of combustion) occur simultaneously. Some carbon is also retained in the pig-iron; almost all of this reappears later in the oxygen steel furnace gas (or converter gas) when the pig-iron is converted to steel. In the 1992/1993 annual questionnaires, Member Countries were asked for the first time to report in the <i>transformation processes</i> the quantities of all fuels (e.g. pulverised coal injection [PCI] coal, coke oven coke, natural gas and oil) entering blast furnaces and the quantity of blast furnace gas and oxygen steel furnace gas produced. The Secretariat then needed to split these inputs into the transformation and consumption components. The transformation component is shown in the row <i>blast furnaces/gas works</i> in the column appropriate for the fuel, and the consumption component is shown in the row <i>iron and steel</i> , in the column appropriate for the fuel. The Secretariat decided to assume transformation efficiency such that the carbon input into the blast furnaces should equal the carbon output. This is roughly equivalent to assuming an energy transformation efficiency of 40%.

Transformation processes		
Flow	Short name	Definition
Gas works	TGASWKS	Includes the manufacture of town gas. <i>Note: in the summary balances this item also includes other gases blended with natural gas (TBLENDGAS).</i>
Coke ovens	TCOKEOVS	Includes the manufacture of coke and coke oven gas.
Patent fuel plants	TPATFUEL	Includes the manufacture of patent fuels.
BKB plants	TBKB	Includes the manufacture of BKB.
Oil refineries	TREFINER	Includes the manufacture of finished petroleum products.
Petrochemical plants	TPETCHEM	Covers backflows returned from the petrochemical sector. Note that backflows from oil products that are used for non-energy purposes (i.e. white spirit and lubricants) are not included here, but in non-energy use.
Coal liquefaction plants	TCOALLIQ	Includes coal, oil and tar sands used to produce synthetic oil.
Gas-to-liquids (GTL) plants	TGTL	Includes natural gas used as feedstock for the conversion to liquids, e.g. the quantities of fuel entering the methanol product process for transformation into methanol.
For blended natural gas	TBLENDGAS	Includes other gases that are blended with natural gas.
Charcoal production plants	TCHARCOAL	Includes the transformation of solid biofuels into charcoal.
Non-specified (transformation)	TNONSPEC	Includes other non-specified transformation.

Energy industry and losses		
Flow	Short name	Definition
Energy industry	TOTENGY	Energy industry own use covers the amount of fuels used by the energy producing industries (e.g. for heating, lighting and operation of all equipment used in the extraction process, for traction and for distribution). It includes energy consumed by energy industries for heating, pumping, traction and lighting purposes [ISIC Rev. 4 Divisions 05, 06, 19 and 35, Group 091 and Classes 0892 and 0721].
Coal mines	EMINES	Represents the energy which is used directly within the coal industry for hard coal and lignite mining. It excludes coal burned in pit-head power stations (included under electricity plants in transformation processes) and free allocations to miners and their families (considered as part of household consumption and therefore included under residential).
Oil and gas extraction	EOILGASEX	Represents the energy which is used for oil and gas extraction. Flared gas is not included.
Blast furnaces	EBLASTFUR	Represents the energy which is used in blast furnaces.
Gas works	EGASWKS	Represents the energy which is used in gas works.
Gasification plants for biogases	EBIOGAS	Represents own consumption of biogases necessary to support temperatures needed for anaerobic fermentation.
Coke ovens	ECOKEOVS	Represents the energy used in coke ovens.
Patent fuel plants	EPATFUEL	Represents the energy used in patent fuel plants.
BKB plants	EBKB	Represents the energy used in BKB plants.
Oil refineries	EREFINER	Represents the energy used in oil refineries.
Coal liquefaction plants	ECOALLIQ	Represents the energy used in coal liquefaction plants.
Liquefaction (LNG) / regasification plants	ELNG	Represents the energy used in LNG and regasification plants.
Gas-to-liquids (GTL) plants	EGTL	Represents the energy used in gas-to-liquids plants.
Own use in electricity, CHP and heat plants	EPOWERPLT	Represents the energy used in main activity producer electricity, CHP and heat plants.
Used for pumped storage	EPUMPST	Represents electricity consumed in hydro-electric plants for pumped storage.
Nuclear industry	ENUC	Represents the energy used in the nuclear industry.
Charcoal production plants	ECHARCOAL	Represents the energy used in charcoal production plants.
Non-specified (energy)	ENONSPEC	Represents use in non-specified energy sector.
Losses	DISTLOSS	Losses in gas distribution, electricity transmission and coal transport.

Final Consumption		
Flow	Short name	Definition
Total final consumption	TFC	Equal to the sum of the consumption in the end-use sectors. Energy used for transformation processes and for own use of the energy producing industries is excluded. Final consumption reflects for the most part deliveries to consumers (see note on <i>stock changes</i>). Backflows from the petrochemical plants are not included in final consumption (see <i>from other sources</i> under supply and <i>petrochemical plants</i> in transformation).
Industry	TOTIND	Industry consumption is specified as follows: (energy used for transport by industry is not included here but is reported under transport).
Iron and steel	IRONSTL	[ISIC Group 241 and Class 2431]
Chemical and petrochemical	CHEMICAL	[ISIC Division 20 and 21] Excluding petrochemical feedstocks.
Non-ferrous metals	NONFERR	[ISIC Group 242 and Class 2432] Basic industries.
Non-metallic minerals	NONMET	[ISIC Division 23] Such as glass, ceramic, cement, etc.
Transport equipment	TRANSEQ	[ISIC Divisions 29 and 30]
Machinery	MACHINE	[ISIC Divisions 25 to 28] Fabricated metal products, machinery and equipment other than transport equipment.
Mining and quarrying	MINING	[ISIC Divisions 07 and 08 and Group 099] Mining (excluding fuels) and quarrying.
Food and tobacco	FOODPRO	[ISIC Divisions 10 to 12]
Paper, pulp and print	PAPERPRO	[ISIC Divisions 17 and 18]
Wood and wood products	WOODPRO	[ISIC Division 16] Wood and wood products other than pulp and paper.
Construction	CONSTRUC	[ISIC Division 41 and 43]
Textile and leather	TEXTILES	[ISIC Divisions 13 to 15]
Non-specified (industry)	INONSPEC	[ISIC Divisions 22, 31 and 32] Any manufacturing industry not included above. Note: Most countries have difficulties supplying an industrial breakdown for all fuels. In these cases, the <i>non-specified</i> industry row has been used. Regional aggregates of industrial consumption should therefore be used with caution.

Final Consumption		
Flow	Short name	Definition
Transport	TOTTRANS	Consumption in the transport sector covers all transport activity (in mobile engines) regardless of the economic sector to which it is contributing [ISIC Divisions 49 to 51], and is divided into the following sub-sectors:
Domestic aviation	DOMESAIR	Includes deliveries of aviation fuels to aircraft for domestic aviation - commercial, private, agricultural, etc. It includes use for purposes other than flying, e.g. bench testing of engines, but not airline use of fuel for road transport. The domestic/international split is determined on the basis of departure and landing locations and not by the nationality of the airline. Note that this may include journeys of considerable length between two airports in a country (e.g. San Francisco to Honolulu). For many countries this incorrectly includes fuel used by domestically owned carriers for outbound international traffic.
Road	ROAD	Includes fuels used in road vehicles as well as agricultural and industrial highway use. Excludes military consumption as well as motor gasoline used in stationary engines and diesel oil for use in tractors that are not for highway use.
Rail	RAIL	Includes quantities used in rail traffic, including industrial railways.
Pipeline transport	PIPELINE	Includes energy used in the support and operation of pipelines transporting gases, liquids, slurries and other commodities, including the energy used for pump stations and maintenance of the pipeline. Energy for the pipeline distribution of natural or manufactured gas, hot water or steam (ISIC Division 35) from the distributor to final users is excluded and is reported in the <i>energy sector</i> , while the energy used for the final distribution of water (ISIC Division 36) to household, industrial, commercial and other users is included in <i>commercial/public services</i> . Losses occurring during the transport between distributor and final users are reported as <i>losses</i> .
Domestic navigation	DOMESNAV	Includes fuels delivered to vessels of all flags not engaged in international navigation (see <i>international marine bunkers</i>). The domestic/international split is determined on the basis of port of departure and port of arrival and not by the flag or nationality of the ship. Note that this may include journeys of considerable length between two ports in a country (e.g. San Francisco to Honolulu). Fuel used for ocean, coastal and inland fishing and military consumption are excluded.
Non-specified (transport)	TRNONSPE	Includes all transport not elsewhere specified. Note: <i>International marine bunkers</i> are shown in <i>Supply</i> and are not included in the transport sector as part of final consumption.
Other	TOTOTHER	Includes residential, commercial/public services, agriculture/forestry, fishing and non-specified (other).

Final Consumption		
Flow	Short name	Definition
Residential	RESIDENT	Includes consumption by households, excluding fuels used for transport. Includes households with employed persons [ISIC Division 97] which is a small part of total residential consumption.
Commercial and public services	COMMPUB	[ISIC Divisions 33, 36-39, 45-47, 52, 53, 55-56, 58-66, 68-75, 77-82, 84 (excluding Class 8422), 85-88, 90-96 and 99]
Agriculture/forestry	AGRICULT	Includes deliveries to users classified as agriculture, hunting and forestry by the ISIC, and therefore includes energy consumed by such users whether for traction (excluding agricultural highway use), power or heating (agricultural and domestic) [ISIC Divisions 01 and 02].
Fishing	FISHING	Includes fuels used for inland, coastal and deep-sea fishing. Fishing covers fuels delivered to ships of all flags that have refuelled in the country (including international fishing) as well as energy used in the fishing industry [ISIC Division 03]. <i>Prior to last year, fishing was included with agriculture/forestry and this may continue to be the case for some countries.</i>
Non-specified (other)	ONONSPEC	Includes all fuel use not elsewhere specified as well as consumption in the above-designated categories for which separate figures have not been provided. Military fuel use for all mobile and stationary consumption is included here (e.g. ships, aircraft, road and energy used in living quarters) regardless of whether the fuel delivered is for the military of that country or for the military of another country.

Electricity output (GWh)		
Flow	Short name	Definition
Electricity output in GWh	ELOUTPUT	Shows the total number of GWh generated by power plants separated into electricity plants and CHP plants. Contrary to the <i>Basic Energy Statistics</i>, electricity production for hydro pumped storage is excluded.
Electricity output-main activity producer electricity plants	ELMAINE	Shows the total number of GWh generated by main activity producer electricity plants.
Electricity output-autoproducer electricity plants	ELAUTOE	Shows the total number of GWh generated by autoproducer electricity plants.
Electricity output-main activity producer CHP plants	ELMAINC	Shows the total number of GWh generated by main activity producer CHP plants.
Electricity output-autoproducer CHP plants	ELAUTOC	Shows the total number of GWh generated by autoproducer CHP plants.

Heat output (TJ)		
Flow	Short name	Definition
Heat output in TJ	HEATOUT	Shows the total number of TJ generated by power plants separated into CHP plants and heat plants.
Heat output-main activity producer CHP plants	HEMAINC	Shows the total number of TJ generated by main activity producer CHP plants.
Heat output-autoproducer CHP plants	HEAUTOE	Shows the total number of TJ generated by autoproducer CHP plants.
Heat output-main activity producer heat plant	HEMAINH	Shows the total number of TJ generated by activity producer heat plant.
Heat output-autoproducer heat plants	HEAUTOH	Shows the total number of TJ generated by autoproducer heat plants.

OECD, Renewables Supply and Consumption : RENOECDBES.IVT
WORLD, Renewables and Waste Energy Statistics: RENWORLDBES.IVT

Supply		
Flow	Short name	Definition
Production	INDPROD	Refers to the quantities of fuels extracted or produced, calculated after any operation for removal of inert matter or impurities (e.g. sulphur from natural gas). For “other hydrocarbons” (shown with crude oil), production includes synthetic crude oil (including mineral oil extracted from bituminous minerals such as oil shale and tar sands, etc.). Production of secondary oil products represents the gross refinery output. Secondary coal products and gases represent the output from coke ovens, gas works, blast furnaces and other transformation processes.
Imports	IMPORTS	Comprises amounts having crossed the national territorial boundaries of the country whether or not customs clearance has taken place. <i>For coal:</i> Imports comprise the amount of fuels obtained from other countries, whether or not there is an economic or customs union between the relevant countries. Coal in transit is not included. <i>For oil and gas:</i> Quantities of crude oil and oil products imported under processing agreements (i.e. refining on account) are included. Quantities of oil in transit are excluded. Crude oil, NGL and natural gas are reported as coming from the country of origin; refinery feedstocks and oil products are reported as coming from the country of last consignment. <i>For electricity:</i> Amounts are considered as imported when they have crossed the national territorial boundaries of the country. If electricity is “wheeled” or transited through a country, the amount is shown as both an import and an export.
Exports	EXPORTS	Comprises amounts having crossed the national territorial boundaries of the country whether or not customs clearance has taken place. <i>For coal:</i> Exports comprise the amount of fuels supplied to other countries, whether or not there is an economic or customs union between the relevant countries. Coal in transit is not included. <i>For oil and gas:</i> Quantities of crude oil and oil products exported under processing agreements (i.e. refining on account) are included. Re-exports of oil imported for processing within bonded areas are shown as an export of product from the processing country to the final destination. <i>For electricity:</i> Amounts are considered as exported when they have crossed the national territorial boundaries of the country. If electricity is “wheeled” or transited through a country, the amount is shown as both an import and an export.

Supply		
Flow	Short name	Definition
International marine bunkers	MARBUNK	Covers those quantities delivered to ships of all flags that are engaged in international navigation. The international navigation may take place at sea, on inland lakes and waterways, and in coastal waters. Consumption by ships engaged in domestic navigation is excluded. The domestic/international split is determined on the basis of port of departure and port of arrival, and not by the flag or nationality of the ship. Consumption by fishing vessels and by military forces is also excluded. See definitions of <i>transport</i> , <i>fishing</i> , and <i>other non-specified</i> .
International aviation bunkers	AVBUNK	Includes deliveries of aviation fuels to aircrafts for international aviation. Fuels used by airlines for their road vehicles are excluded. The domestic/international split is determined on the basis of departure and landing locations and not by the nationality of the airline. For many countries this incorrectly excludes fuel used by domestically owned carriers for their international departures.
Stock changes	STOCKCHA	Reflects the difference between opening stock levels on the first day of the year and closing levels on the last day of the year of stocks on national territory held by producers, importers, energy transformation industries and large consumers. Oil and gas stock changes in pipelines are not taken into account. With the exception of large users mentioned above, changes in final users' stocks are not taken into account. A stock build is shown as a negative number, and a stock draw as a positive number.
Domestic supply	DOMSUP	Defined as <i>production + from other sources + imports - exports - international marine bunkers - international aviation bunkers ± stock changes</i> .
Transfers	TRANSFER	Comprises <i>interproduct transfers</i> , <i>products transferred</i> and <i>recycled products</i> . <i>Interproduct transfers</i> results from reclassification of products either because their specification has changed or because they are blended into another product, e.g. kerosene may be reclassified as gasoil after blending with the latter in order to meet its winter diesel specification. The net balance of <i>interproduct transfers</i> is zero. <i>Products transferred</i> is intended for petroleum products imported for further processing in refineries. For example, fuel oil imported for upgrading in a refinery is transferred to the feedstocks category. <i>Recycled products</i> are finished products which pass a second time through the marketing network, after having been once delivered to final consumers (e.g. used lubricants which are reprocessed).
Statistical differences	STATDIFF	Is essentially the difference between supply and demand. It is defined as <i>deliveries to final consumption + use for transformation and consumption within the energy industry + losses - domestic supply - transfers</i> . Statistical differences arise because the data for the individual components of supply are often derived from different data sources by the national administration. Furthermore, the inclusion of changes in some large consumers' stocks in the supply part of the balance introduces distortions which also contribute to the statistical differences.

Transformation processes		
Flow	Short name	Definition
Transformation processes	TOTTRANF	The transformation processes comprises the conversion of primary forms of energy to secondary and further transformation (e.g. coking coal to coke, crude oil to petroleum products, and heavy fuel oil to electricity).
Main activity producer electricity plants	MAINELEC	Refers to plants which are designed to produce electricity only. If one or more units of the plant is a CHP unit (and the inputs and outputs cannot be distinguished on a unit basis) then the whole plant is designated as a CHP plant. Main activity producers (formerly referred to as public supply undertakings) generate electricity for sale to third parties, as their primary activity. They may be privately or publicly owned. Note that the sale need not take place through the public grid.
Autoproducer electricity plants	AUTOELEC	Refers to plants which are designed to produce electricity only. If one or more units of the plant is a CHP unit (and the inputs and outputs cannot be distinguished on a unit basis) then the whole plant is designated as a CHP plant. Autoproducer undertakings generate electricity wholly or partly for their own use as an activity which supports their primary activity. They may be privately or publicly owned.
Main activity producer CHP plants	MAINCHP	Refers to plants which are designed to produce both heat and electricity (sometimes referred to as co-generation power stations). If possible, fuel inputs and electricity/heat outputs are on a unit basis rather than on a plant basis. However, if data are not available on a unit basis, the convention for defining a CHP plant noted above should be adopted. Main activity producers (formerly referred to as public supply undertakings) generate electricity and/or heat for sale to third parties, as their primary activity. They may be privately or publicly owned. Note that the sale need not take place through the public grid.
Autoproducer CHP plants	AUTOCHP	Refers to plants which are designed to produce both heat and electricity (sometimes referred to as co-generation power stations). If possible, fuel inputs and electricity/heat outputs are on a unit basis rather than on a plant basis. However, if data are not available on a unit basis, the convention for defining a CHP plant noted above should be adopted. Note that for autoproducer CHP plants, all fuel inputs to electricity production are taken into account, while only the part of fuel inputs to heat sold is shown. Fuel inputs for the production of heat consumed within the autoproducer's establishment are not included here but are included with figures for the final consumption of fuels in the appropriate consuming sector. Autoproducer undertakings generate electricity and/or heat, wholly or partly for their own use as an activity which supports their primary activity. They may be privately or publicly owned.

Transformation processes		
Flow	Short name	Definition
Main activity producer heat plants	MAINHEAT	Refers to plants (including heat pumps and electric boilers) designed to produce heat only and who sell heat to a third party (e.g. residential, commercial or industrial consumers) under the provisions of a contract. Main activity producers (formerly referred to as public supply undertakings) generate heat for sale to third parties, as their primary activity. They may be privately or publicly owned. Note that the sale need not take place through the public grid.
Autoproducer heat plants	AUTOHEAT	Refers to plants (including heat pumps and electric boilers) designed to produce heat only and who sell heat to a third party (e.g. residential, commercial or industrial consumers) under the provisions of a contract. Autoproducer undertakings generate heat, wholly or partly for their own use as an activity which supports their primary activity. They may be privately or publicly owned.
Heat pumps	THEAT	Includes heat produced by heat pumps in the transformation processes. Heat pumps that are operated within the residential sector where the heat is not sold are not considered a transformation process and are not included here – the electricity consumption would appear as residential use.
Electric boilers	TBOILER	Includes electric boilers used to produce heat.
Chemical heat for electricity production	TELE	Includes heat from chemical processes that is used to generate electricity.
Blast furnaces	TBLASTFUR	Includes the production of town gas, blast furnace gas and oxygen steel furnace gas. The production of pig-iron from iron ore in blast furnaces uses fuels for supporting the blast furnace charge and providing heat and carbon for the reduction of the iron ore. Accounting for the calorific content of the fuels entering the process is a complex matter as transformation (into blast furnace gas) and consumption (heat of combustion) occur simultaneously. Some carbon is also retained in the pig-iron; almost all of this reappears later in the oxygen steel furnace gas (or converter gas) when the pig-iron is converted to steel. In the 1992/1993 annual questionnaires, Member Countries were asked for the first time to report in the <i>transformation processes</i> the quantities of all fuels (e.g. pulverised coal injection [PCI] coal, coke oven coke, natural gas and oil) entering blast furnaces and the quantity of blast furnace gas and oxygen steel furnace gas produced. The Secretariat then needed to split these inputs into the transformation and consumption components. The transformation component is shown in the row <i>blast furnaces/gas works</i> in the column appropriate for the fuel, and the consumption component is shown in the row <i>iron and steel</i> , in the column appropriate for the fuel. The Secretariat decided to assume a transformation efficiency such that the carbon input into the blast furnaces should equal the carbon output. This is roughly equivalent to assuming an energy transformation efficiency of 40%.
Gas works	TGASWKS	Includes the manufacture of town gas.

Transformation processes		
Flow	Short name	Definition
Coke ovens	TCOKEOVS	Includes the manufacture of coke and coke oven gas.
Patent fuel plants	TPATFUEL	Includes the manufacture of patent fuels.
BKB plants	TBKB	Includes the manufacture of BKB.
Oil refineries	TREFINER	Includes the manufacture of finished petroleum products.
Petrochemical plants	TPETCHEM	Covers backflows returned from the petrochemical sector. Note that backflows from oil products that are used for non-energy purposes (i.e. white spirit and lubricants) are not included here, but in non-energy use.
Coal liquefaction plants	TCOALLIQ	Includes coal, oil and tar sands used to produce synthetic oil.
Gas-to-liquids (GTL) plants	TGTL	Includes natural gas used as feedstock for the conversion to liquids, e.g. the quantities of fuel entering the methanol product process for transformation into methanol.
For blended natural gas	TBLENDGAS	Includes other gases that are blended with natural gas.
Charcoal production plants	TCHARCOAL	Includes the transformation of solid biofuels into charcoal.
Non-specified (transformation) in the detailed balances	TNONSPEC	Includes other non-specified transformation.

Energy industry and losses		
Flow	Short name	Definition
Energy industry	TOTENGY	The energy industry covers the amount of fuels used by the energy producing industries (e.g. for heating, lighting and operation of all equipment used in the extraction process, for traction and for distribution). Energy producing industries' own use includes energy consumed by transformation industries for heating, pumping, traction and lighting purposes [ISIC Divisions 10, 11, 12, 23 and 40].
Coal mines	EMINES	Represents the energy which is used directly within the coal industry for hard coal and lignite mining. It excludes coal burned in pithead power stations (included under electricity plants in the transformation processes) and free allocations to miners and their families (considered as part of household consumption and therefore included under residential).
Oil and gas extraction	EOILGASEX	Represents the energy which is used for oil and gas extraction. Flared gas is not included.
Blast furnaces	EBLASTFUR	Represents the energy which is used in blast furnaces.
Gas works	EGASWKS	Represents the energy which is used in gas works.
Gasification plants for biogases	EBIOGAS	Represents own consumption of biogases necessary to support temperatures needed for anaerobic fermentation.
Coke ovens	ECOKEOVS	Represents the energy used in coke ovens.
Patent fuel plants	EPATFUEL	Represents the energy used in patent fuel plants.
BKB plants	EBKB	Represents the energy used in BKB plants.
Oil refineries	EREFINER	Represents the energy used in Oil refineries.
Coal liquefaction plants	ECOALLIQ	Represents the energy used in coal liquefaction plants.
Liquefaction (LNG) / regasification plants	ELNG	Represents the energy used in LNG and regasification plants.
Gas-to-liquids (GTL) plants	EGTL	Represents the energy used in gas-to-liquids plants.
Own use in electricity, CHP and heat plants	EPOWERPLT	Represents the energy used in main activity producer electricity, CHP and heat plants.
Pumped storage plants	EPUMPST	Represents electricity consumed in hydro-electric plants for pumped storage.
Nuclear industry	ENUC	Represents the energy used in the nuclear industry.
Charcoal production plants	ECHARCOAL	Represents the energy used in charcoal production plants.
Non-specified (energy)	ENONSPEC	Represents use in non-specified energy sector.
Losses	DISTLOSS	Losses in gas distribution, electricity transmission and coal transport.

Final consumption		
Flow	Short name	Definition
Final consumption	FINCONS	Equal to the sum of the consumption in the end-use sectors. Energy used for transformation and for own use of the energy producing industries is excluded. Final consumption reflects for the most part deliveries to consumers (see note on <i>stock changes</i>). Backflows from the petrochemical plants are not included in final consumption (see <i>from other sources</i> under supply and <i>petrochemical plants</i> in the transformation processes).
Industry	TOTIND	Consumption of the industry sector is specified in the following sub-sectors (energy used for transport by industry is not included here but is reported under transport):
Iron and steel	IRONSTL	[ISIC Group 241 and Class 2431]
Chemical and petrochemical	CHEMICAL	[ISIC Division 20 and 21] Excluding petrochemical feedstocks.
Non-ferrous metals	NONFERR	[ISIC Group 242 and Class 2432] Basic industries.
Non-metallic minerals	NONMET	[ISIC Division 23] Such as glass, ceramic, cement, etc.
Transport equipment	TRANSEQ	[ISIC Divisions 29 and 30]
Machinery	MACHINE	[ISIC Divisions 25 to 28] Fabricated metal products, machinery and equipment other than transport equipment.
Mining and quarrying	MINING	[ISIC Divisions 07 and 08 and Group 099] Mining (excluding fuels) and quarrying.
Food and tobacco	FOODPRO	[ISIC Divisions 10 to 12]
Paper, pulp and print	PAPERPRO	[ISIC Divisions 17 and 18]
Wood and wood products	WOODPRO	[ISIC Division 16] Wood and wood products other than pulp and paper.
Construction	CONSTRUC	[ISIC Division 41 to 43]
Textile and leather	TEXTILES	[ISIC Divisions 13 to 15]
Non-specified (industry)	INONSPEC	[ISIC Divisions 22, 31 and 32] Any manufacturing industry not included above. Note: Most countries have difficulties supplying an industrial breakdown for all fuels. In these cases, the <i>non-specified</i> industry row has been used. Regional aggregates of industrial consumption should therefore be used with caution.

Final consumption		
Flow	Short name	Definition
Transport	TOTTRANS	Consumption in the transport sector covers all transport activity (in mobile engines) regardless of the economic sector to which it is contributing [ISIC Divisions 49 to 51], and is divided into the following sub-sectors:
Domestic aviation	DOMESAIR	Includes deliveries of aviation fuels to aircraft for domestic aviation - commercial, private, agricultural, etc. It includes use for purposes other than flying, e.g. bench testing of engines, but not airline use of fuel for road transport. The domestic/international split should be determined on the basis of departure and landing locations and not by the nationality of the airline. Note that this may include journeys of considerable length between two airports in a country (e.g. San Francisco to Honolulu). For many countries this incorrectly includes fuel used by domestically owned carriers for outbound international traffic;
Road	ROAD	Includes fuels used in road vehicles as well as agricultural and industrial highway use. Excludes military consumption as well as motor gasoline used in stationary engines and diesel oil for use in tractors that are not for highway use;
Rail	RAIL	Includes quantities used in rail traffic, including industrial railways;
Pipeline transport	PIPELINE	Includes energy used in the support and operation of pipelines transporting gases, liquids, slurries and other commodities, including the energy used for pump stations and maintenance of the pipeline. Energy for the pipeline distribution of natural or manufactured gas, hot water or steam (ISIC Division 35) from the distributor to final users is excluded and should be reported in the <i>energy sector</i> , while the energy used for the final distribution of water (ISIC Division 36) to household, industrial, commercial and other users should be included in <i>commercial/public services</i> . Losses occurring during the transport between distributor and final users should be reported as <i>losses</i> ;
Domestic navigation	DOMESNAV	Includes fuels delivered to vessels of all flags not engaged in international navigation (see <i>international marine bunkers</i>). The domestic/international split should be determined on the basis of port of departure and port of arrival and not by the flag or nationality of the ship. Note that this may include journeys of considerable length between two ports in a country (e.g. San Francisco to Honolulu). Fuel used for ocean, coastal and inland fishing and military consumption are excluded;
Non-specified (transport)	TRNONSPE	Includes all transport not elsewhere specified. Note: <i>International marine bunkers</i> are shown in <i>Supply</i> and are not included in the transport sector as part of final consumption.
Other	TOTOTHER	Includes residential, commercial/public services, agriculture/forestry, fishing and non-specified (other).
Residential	RESIDENT	Includes consumption by households, excluding fuels used for transport. Includes households with employed persons [ISIC Division 97] which is a small part of total residential consumption.

Final consumption		
Flow	Short name	Definition
Commercial and public services	COMMPUB	[ISIC Divisions 33, 36-39, 45-47, 52, 53, 55-56, 58-66, 68-75, 77-82, 84 (excluding Class 8422), 85-88, 90-96 and 99]
Agriculture/forestry	AGRICULT	Includes deliveries to users classified as agriculture, hunting and forestry by the ISIC, and therefore includes energy consumed by such users whether for traction (excluding agricultural highway use), power or heating (agricultural and domestic) [ISIC Divisions 01 and 02].
Fishing	FISHING	Includes fuels used for inland, coastal and deep-sea fishing. Fishing covers fuels delivered to ships of all flags that have refuelled in the country (including international fishing) as well as energy used in the fishing industry [ISIC Division 03].
Non-specified (other)	ONONSPEC	Includes all fuel use not elsewhere specified as well as consumption in the above-designated categories for which separate figures have not been provided. Military fuel use for all mobile and stationary consumption is included here (e.g. ships, aircraft, road and energy used in living quarters) regardless of whether the fuel delivered is for the military of that country or for the military of another country.

Electricity output (GWh)		
Flow	Short name	Definition
Electricity output (GWh)	ELOUTPUT	Shows the total number of GWh generated by power plants separated into electricity plants and CHP plants.
Electricity output-main activity producer electricity plants	ELMAINE	Shows the total number of GWh generated by main activity producer electricity plants.
Electricity output-autoproducer electricity plants	ELAUTOE	Shows the total number of GWh generated by auto-producer electricity plants.
Electricity output-main activity producer CHP plants	ELMAINC	Shows the total number of GWh generated by main activity producer CHP plants.
Electricity output-autoproducer CHP plants	ELAUTOC	Shows the total number of GWh generated by auto-producer CHP plants.

Heat output (TJ)		
Flow	Short name	Definition
Heat output (TJ)	HEATOUT	Shows the total amount of TJ generated by power plants separated into CHP plants and heat plants.
Heat output-main activity producer CHP plants	HEMAINC	Shows the total amount of TJ generated by main activity producer CHP plants.
Heat output-autoproducer CHP plants	HEAUTOC	Shows the total amount of TJ generated by auto-producer CHP plants.
Heat output-main activity producer heat plants	HEMAINH	Shows the total amount of TJ generated by main activity producer heat plants.
Heat output-autoproducer heat plants	HEAUTOH	Shows the total amount of TJ generated by autoproducer heat plants.

4. PRODUCT DEFINITIONS

Biofuels and Waste		
Product	Short name	Definition
Industrial waste	INDWASTE	Industrial waste of non-renewable origin consists of solid and liquid products (e.g. tyres) combusted directly, usually in specialised plants, to produce heat and/or power. Renewable industrial waste is not included here, but with solid biofuels, biogases or liquid biofuels.
Municipal waste	MUNWASTE	Municipal waste consists of products that are combusted directly to produce heat and/or power and comprises wastes produced by households, industry, hospitals and the tertiary sector that are collected by local authorities for incineration at specific installations. Municipal waste is split into renewable and non-renewable.
Municipal waste (renewable)	MUNWASTER	The renewable part of municipal waste.
Municipal waste (non-renewable)	MUNWASTEN	The non-renewable part of municipal waste.
Solid biofuels	PRIMSBIO	Solid biofuels is defined as any plant matter used directly as fuel or converted into other forms before combustion. This covers a multitude of woody materials generated by industrial process or provided directly by forestry and agriculture (firewood, wood chips, bark, sawdust, shavings, chips, sulphite lyes <i>also known as black liquor</i> , animal materials/wastes and other solid biofuels). This category excludes charcoal.
Fuelwood, wood residues and by-products	WOODETC	Fuelwood or firewood (in log, brushwood, pellet or chip form) obtained from natural or managed forests or isolated trees. Also included are wood residues used as fuel and in which the original composition of wood is retained. Charcoal and black liquor are excluded.
Memo: wood pellets	PELLETS	Wood pellets are a cylindrical product which has been agglomerated from wood residues by compression with or without the addition of a small quantity of binder. The pellets have a diameter not exceeding 25 mm and a length not exceeding 45 mm.

Biofuels and Waste		
Product	Short name	Definition
Black liquor	BLACKLIQ	Energy from the alkaline-spent liquor obtained from the digesters during the production of sulphate or soda pulp required for paper manufacture.
Bagasse	BAGASSE	Fuel obtained from the fibre which remains after juice extraction in sugar cane processing.
Animal waste	ANIMALW	Energy from excreta of animals, meat and fish residues which, when dry, are used directly as a fuel. This excludes waste used in anaerobic fermentation plants. Fuel gases from these plants are included under biogases.
Other vegetal materials and residuals	OBIOSOL	Biofuels not specified elsewhere and including straw, vegetable husks, ground nut shells, pruning brushwood, olive pomace and other wastes arising from the maintenance, cropping and processing of plants.
Charcoal	CHARCOAL	Covers the solid residue of the destructive distillation and pyrolysis of wood and other vegetal material. Since charcoal is a secondary product, its treatment is slightly different than that of the other primary biofuels. Production of charcoal (an output in the transformation process) is offset by the inputs of primary biofuels into the charcoal production process. The losses from this process are included in the transformation processes. Other supply (e.g. trade and stock changes) as well as consumption are aggregated directly with the primary biofuels. In some countries, only primary biofuels are reported.
Biogases	BIOGASES	Gases composed principally of methane and carbon dioxide produced by anaerobic fermentation of biomass, or by thermal processes.
Landfill gas	LANDFILL	Covers gas formed by digestion of landfilled waste.
Sludge gas	SLUDGEGS	Covers gas produced from the anaerobic fermentation of sewage sludge.
Other biogases from anaerobic processes	OBIOGAS	Covers gases such as biogases produced from the anaerobic fermentation of animal slurries and of waste abattoirs, breweries and other agro-food industries.
Biogases from thermal processes	BG THERM	Biogases produced from thermal processes (by gasification or pyrolysis) of biomass.

Biofuels and Waste		
Product	Short name	Definition
Biogasoline	BIOGASOL	Biogasoline includes bioethanol (ethanol produced from biomass and/or the biodegradable fraction of waste), biomethanol (methanol produced from biomass and/or the biodegradable fraction of waste), bioETBE (ethyl-tertio-butyl-ether produced on the basis of bioethanol; the percentage by volume of bioETBE that is calculated as biofuel is 47%) and bioMTBE (methyl-tertio-butyl-ether produced on the basis of biomethanol: the percentage by volume of bioMTBE that is calculated as biofuel is 36%). Biogasoline includes the amounts that are blended into the gasoline - it does not include the total volume of gasoline into which the biogasoline is blended.
Memo: bioethanol	MBIOETHANL	Ethanol produced from biomass and/or the biodegradable fraction of waste`.
Biodiesels	BIODIESEL	Biodiesels includes biodiesel (a methyl-ester produced from vegetable or animal oil, of diesel quality), biodimethylether (dimethylether produced from biomass), Fischer Tropsh (Fischer Tropsh produced from biomass), cold pressed bio-oil (oil produced from oil seed through mechanical processing only) and all other liquid biofuels which are added to, blended with or used straight as transport diesel. Biodiesels includes the amounts that are blended into the diesel it does not include the total volume of diesel into which the biodiesel is blended.
Other liquid biofuels	OBIOLIQ	Other liquid biofuels includes liquid biofuels used directly as fuel other than biogasoline or biodiesels.
Total all energy sources	TOTAL	Total of All energy sources includes coal, oil, gas, renewables and waste, electricity, heat and others.

Electricity and Heat		
Flow	Short name	Definition
Hydro	HYDRO	Hydro power represents the potential and kinetic energy of water converted into electricity in hydroelectric plants. In RENOECDBAL and RENWORLDBAL – Electricity production from pumped storage is not included in the energy balance. In RENOECDBES and RENWORLDBES - Electricity production from pure and mixed pumped storage is included. In RENOECDCAP - Electric capacity from pure and mixed pumped storage is included.
Hydro -1MW	HYDROS	In RENOECDBES and RENOECDCAP - Hydro energy from plants < 1MW
Hydro 1-10MW	HYDROM	In RENOECDBES and RENOECDCAP - Hydro energy from plants between 1 and 10MW
Hydro 10+MW	HYDROL	In RENOECDBES and RENOECDCAP - Hydro energy from plants > 10MW
Pumped hydro	HYDPUMP	In RENOECDBES and RENOECDCAP - Pure pumped storage plants are plants with no natural inflow, producing electricity only from water previously pumped uphill.
Geothermal	GEO THERM	Geothermal energy is the energy available as heat emitted from within the earth's crust, usually in the form of hot water or steam. It is exploited at suitable sites: <ul style="list-style-type: none"> • for electricity generation using dry steam or high enthalpy brine after flashing • directly as heat for district heating, agriculture, etc.
Solar photovoltaic	SOLARPV	Electricity from photovoltaic cells.
Solar thermal	SOLARTH	Solar energy is the solar radiation exploited for hot water production and electricity generation, by: <ul style="list-style-type: none"> • flat plate collectors, mainly of the thermosyphon type, for domestic hot water or for the seasonal heating of swimming pools • solar thermal-electric plants Passive solar energy for the direct heating, cooling and lighting of dwellings or other buildings is not included.
Tide, wave and ocean	TIDE	Tide, wave and ocean represents the mechanical energy derived from tidal movement, wave motion or ocean current and exploited for electricity generation.
Wind	WIND	Wind energy represents the kinetic energy of wind exploited for electricity generation in wind turbines.

Net Capacity - Renewables (MWe): RENOECDCAP.IVT

Renewable Capacity		
Flow	Short name	Definition
Total capacity (MWe)	TOTALCAP	The net maximum capacity is the maximum active power that can be supplied, continuously, with all plant running, at the point of outlet (i.e. after taking the power supplies for the station auxiliaries and allowing for the losses in those transformers considered integral to the station). This assumes no restriction of interconnection to the network. The net maximum electricity-generating capacity represents the sum of all individual plants' maximum capacities available to run continuously throughout a prolonged period of operation in a day. The reported figures relate to the maximum capacities on 31 st of December and are expressed in megawatts (MW). The reported electrical capacity includes both electricity (only) and CHP plants.
Hydro	HYDRO	Electric capacity from pure and mixed pumped storage is included.
Hydro <1MW	HYDROS	Is equal to the electrical capacity of hydro plants < 1MW.
Hydro 1-10MW	HYDROM	Is equal to the electrical capacity of hydro plants 1-10MW.
Hydro >10MW	HYDROL	Is equal to the electrical capacity of hydro plants > 10MW.
Pumped storage	HYDPUMP	Is equal to the electrical capacity of pure pumped hydro plants.
Mixed hydro	MIXEDHYDRO	Mixed (hydro) plants are hydro plants with natural inflow where part or all equipment can be used for pumping water uphill and also for producing electricity from natural inflow and pump storage.
Geothermal	GEO THERM	Is equal to the electrical capacity of geothermal plants.
Solar photovoltaic	SOLARPV	Is equal to the electrical capacity of solar photovoltaic plants.
Solar thermal	SOLARTH	Is equal to the electrical capacity of solar thermal plants.
Tide, wave and ocean	TIDE	Is equal to the electrical capacity of tide, wave and ocean plants.
Wind	WIND	Is equal to the electrical capacity of wind energy.
Industrial waste	INDWASTE	Is equal to the electrical capacity of industrial waste plants.
Municipal waste	MUNWASTE	Includes the electrical capacity of renewable municipal waste and non renewable municipal waste plants.
Solid biofuels	SBIOMASS	Is equal to the electrical capacity of primary solid biofuels plants.
Biogases	BIOGASES	Is equal to the electrical capacity of plants running on landfill gas, sludge gas, and other biogases from anaerobic and thermal processes.
Biodiesel	BODIESEL	Is equal to the electrical capacity of biodiesel plants.

Renewable Capacity		
Flow	Short name	Definition
Other liquid biofuels	OBIOLIQ	Is equal to the electrical capacity of liquid biofuels plants, not included in biodiesels plants.
Solar collector surface (1000 m ²)	SOLARSUR	Accumulated surface area of all solar collectors; glazed and unglazed collectors, flat-plate and vacuum tube with a liquid or air as the energy carrier, in 1000 m2.
Cap. of solar collectors (MW _{th})	SOLARTHSQ	Converted at 0.7 kWth/m ² of solar collector area, as estimated by the IEA Solar Heating & Cooling Programme.

5. GEOGRAPHICAL COVERAGE

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.		
Country/Region	Short name	Definition
Australia	AUSTRALI	Excludes the overseas territories.
Austria	AUSTRIA	
Belgium	BELGIUM	
Canada	CANADA	
Chile	CHILE	
Czech Republic	CZECH	
Denmark	DENMARK	Excludes Greenland and the Faroe Islands.
Estonia	ESTONIA	
Finland	FINLAND	
France	FRANCE	Includes Monaco and excludes the following overseas departments and territories: Guadeloupe; French Guiana; Martinique; Mayotte and Reunion; New Caledonia; French Polynesia; Saint Barthélemy; Saint Martin; Saint Pierre and Miquelon; and Wallis and Futuna;.
Germany	GERMANY	Includes the new Federal states of Germany from 1970 onwards.
Greece	GREECE	
Hungary	HUNGARY	
Iceland	ICELAND	
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.
Italy	ITALY	Includes San Marino and the Holy See.

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.

Country/Region	Short name	Definition
Japan	JAPAN	Includes Okinawa.
Korea	KOREA	
Latvia	LATVIA	
Luxembourg	LUXEMBOU	
Mexico	MEXICO	
Netherlands	NETHLAND	Excludes Suriname, Aruba and the other former Netherlands Antilles (Bonaire, Curaçao, Saba, Sint Eustatius and Sint Maarten).
New Zealand	NZ	
Norway	NORWAY	
Poland	POLAND	
Portugal	PORTUGAL	Includes the Azores and Madeira.
Slovak Republic	SLOVAKIA	
Slovenia	SLOVENIA	
Spain	SPAIN	Includes the Canary Islands.
Sweden	SWEDEN	
Switzerland	SWITLAND	Includes Liechtenstein for the oil data. Data for other fuels do not include Liechtenstein.
Turkey	TURKEY	
United Kingdom	UK	
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 ¹ and the United States Virgin Islands; trade statistics for coal include international trade to and from Puerto Rico and the United States Virgin Islands.
OECD Total	OECDTOT	Includes Australia, Austria, Belgium, Canada, Chile, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Korea, Latvia, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey, United Kingdom and United States.
OECD Americas	OECDAM	Includes Canada, Chile, Mexico and the United States.
OECD Asia Oceania	OECDAO	Includes Australia, Israel, Japan, Korea and New Zealand.

1. Natural gas and electricity data 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.

Country/Region	Short name	Definition
OECD Europe	OECD EUR	Includes Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Luxembourg, Netherlands, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom.
IEA Total	IEA TOT	Includes Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, Korea, Luxembourg, Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Spain, Sweden, Switzerland, Turkey, United Kingdom and the United States.
IEA Americas	IEA AM	Includes Canada and United States.
IEA Asia Oceania	IEA AO	Includes Australia, Japan, Korea and New Zealand.
IEA Europe	IEA EUR	Includes Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Luxembourg, Netherlands, Norway, Poland, Portugal, Slovak Republic, Spain, Sweden, Switzerland, Turkey and United Kingdom.
The IEA and Accession/Association countries	IEA FAMILY	Includes: IEA member countries: Australia, Austria, Belgium, Canada, the Czech Republic, Denmark, Estonia ⁷ , Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, Korea, Luxembourg, the Netherlands, New Zealand, Norway, Poland, Portugal, the Slovak Republic, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the United States; Accession countries: Chile and Mexico; Association countries: the People's Republic of China; India; Indonesia; Morocco; Singapore; Thailand.
Algeria	ALGERIA	
Angola	ANGOLA	
Benin	BENIN	
Botswana	BOTSWANA	
Cameroon	CAMEROON	
Congo	CONGO	
Democratic Rep. of Congo	CONGOREP	
Cote d'Ivoire	COTEIVOIRE	
Egypt	EGYPT	Data for Egypt are reported on a fiscal year basis. Data for 2014 are for 2014 1 July 2014 – 30 June 2015.
Eritrea	ERITREA	Data for Eritrea are available from 1992. Prior to that, they are included in Ethiopia.

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.

Country/Region	Short name	Definition
Ethiopia	ETHIOPIA	Ethiopia includes Eritrea prior to 1992.
Gabon	GABON	
Ghana	GHANA	
Kenya	KENYA	
Libya	LIBYA	
Mauritius	MAURITIUS	
Morocco	MOROCCO	
Mozambique	MOZAMBIQUE	
Namibia	NAMIBIA	Data for Namibia are available starting in 1991. Prior to that, data are included in Other Africa.
Nigeria	NIGERIA	
Senegal	SENEGAL	
South Africa	SOUTHAFRIC	
Sudan	SUDAN	South Sudan became an independent country on 9 July 2011. From 2012, data for South Sudan are reported separately.
United Republic of Tanzania	TANZANIA	
Togo	TOGO	
Tunisia	TUNISIA	
Zambia	ZAMBIA	
Zimbabwe	ZIMBABWE	
Other Africa	OTHERAFRIC	Includes Botswana (until 1980); Burkina Faso; Burundi; Cabo Verde; Central African Republic; Chad; Comoros; Djibouti; Equatorial Guinea; Gambia; Guinea; Guinea-Bissau; Lesotho; Liberia; Madagascar; Malawi; Mali; Mauritania; Namibia (until 1990); Niger (until 1999); Réunion; Rwanda; Sao Tome and Principe; Seychelles; Sierra Leone; Somalia; Swaziland and Uganda.

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.

Country/Region	Short name	Definition
Africa	AFRICA	Includes Algeria; Angola; Benin; Botswana (from 1981); Cameroon; Republic of the Congo (Congo); Democratic Republic of the Congo (DRC); Côte d'Ivoire; Egypt; Eritrea; Ethiopia; Gabon; Ghana; Kenya; Libya; Mauritius; Morocco; Mozambique; Namibia (from 1991); Niger (from 2000); Nigeria; Senegal; South Africa; South Sudan ² ; Sudan; United Republic of Tanzania (Tanzania); Togo; Tunisia; Zambia; Zimbabwe and Other Africa.
Argentina	ARGENTINA	
Bolivia	BOLIVIA	
Brazil	BRAZIL	
Colombia	COLOMBIA	
Costa Rica	COSTARICA	
Cuba	CUBA	
Dominican Republic	DOMINICANR	
Ecuador	ECUADOR	
El Salvador	ELSALVADOR	
Guatemala	GUATEMALA	
Haiti	HAITI	
Honduras	HONDURAS	
Jamaica	JAMAICA	
Netherlands Antilles	CURACAO	
Nicaragua	NICARAGUA	
Panama	PANAMA	
Paraguay	PARAGUAY	
Peru	PERU	
Suriname	SURINAME	Data for Suriname are available starting in 2000. Prior to that, they are included in Other Non-OECD Americas.
Trinidad and Tobago	TRINIDAD	
Uruguay	URUGUAY	
Venezuela	VENEZUELA	

2. 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.

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.

Country/Region	Short name	Definition
Other Non-OECD Americas	OTHERLATIN	Includes 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; Grenada; Guadeloupe; Guyana; Martinique; Montserrat; Puerto Rico ³ (for natural gas and electricity); 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 (until 1999); and the Turks and Caicos Islands.
Non-OECD Americas	LATINAMERI	Includes Argentina; Plurinational State of Bolivia (Bolivia); Brazil; Colombia; Costa Rica; Cuba; Curaçao ⁴ ; the Dominican Republic; Ecuador; El Salvador; Guatemala; Haiti; Honduras; Jamaica; Nicaragua; Panama; Paraguay; Peru; Suriname (from 2000), Trinidad and Tobago; Uruguay; the Bolivarian Republic of Venezuela (Venezuela) and Other Non-OECD Americas.
Bangladesh	BANGLADESH	Data for Bangladesh are reported on a fiscal year basis. Data for 2014 are for 1 July 2014-30 June 2015.
Brunei	BRUNEI	
Cambodia	CAMBODIA	Data for Cambodia are available starting in 1995. Prior to that, they are included in Other Asia.
India	INDIA	Data are reported on a fiscal year basis. Data for 2014 are for April 1 2014-March 31 2015.
Indonesia	INDONESIA	
DPR of Korea	KOREADPR	
Malaysia	MALAYSIA	
Mongolia	MONGOLIA	
Myanmar	MYANMAR	
Nepal	NEPAL	Data for Nepal are reported on a fiscal year basis.
Pakistan	PAKISTAN	
Philippines	PHILIPPINE	
Singapore	SINGAPORE	
Sri Lanka	SRILANKA	

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

4. 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.

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.

Country/Region	Short name	Definition
Chinese Taipei	TAIPEI	
Thailand	THAILAND	
Vietnam	VIETNAM	
Other non-OECD Asia	OTHERASIA	Includes Afghanistan; Bhutan; Cambodia (until 1994); Cook Islands; East Timor; Fiji; French Polynesia; Kiribati; Lao People's Democratic Republic; Macau, China; Maldives; New Caledonia; Palau (from 1994); Papua New Guinea; Samoa; Solomon Islands; Tonga; and Vanuatu.
Non-OECD Asia excluding China	ASIA	Includes Bangladesh; Brunei Darussalam; Cambodia (from 1995); India; Indonesia; Democratic People's Republic of Korea (DPRK); Malaysia; Mongolia; Myanmar; Nepal; Pakistan; Philippines; Singapore; Sri Lanka; Chinese Taipei; Thailand; Viet Nam and Other non-OECD Asia.
People's Republic of China	CHINA	In early 2016, the National Bureau of Statistics (NBS) of the People's Republic of China (China) supplied the IEA with detailed energy balances for 2000 to 2010 and the IEA revised its data accordingly. In September 2015, the NBS published China's energy statistics for 2013, as well as revised statistics for the years 2011 and 2012. These have already been taken into account by the IEA in the "Special data release with revisions for the People's Republic of China" in November 2015.
Hong Kong, China	HONGKONG	
China	CHINAREG	Includes the (People's Republic of) China; and Hong Kong, China.
Albania	ALBANIA	
Armenia	ARMENIA	
Azerbaijan	AZERBAIJAN	
Belarus	BELARUS	
Bosnia and Herzegovina	BOSNIAHERZ	
Bulgaria	BULGARIA	
Croatia	CROATIA	

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.

Country/Region	Short name	Definition
Cyprus	CYPRUS	<p>Note by Turkey: <i>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”.</i></p> <p>Note by all the European Union Member States of the OECD and the European Union: <i>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.</i></p>
FY Republic of Macedonia	FYROM	
Georgia	GEORGIA	
Gibraltar	GIBRALTAR	
Kazakhstan	KAZAKHSTAN	
Kosovo	KOSOVO	Data for Kosovo are available starting in 2000. Between 1990 and 1999, data for Kosovo are included in Serbia. Prior to 1990, they are included in Former Yugoslavia.
Kyrgyzstan	KYRGYZSTAN	
Lithuania	LITHUANIA	
Malta	MALTA	
Republic of Moldova	MOLDOVA	
Montenegro	MONTENEGRO	Data for Montenegro are available starting in 2005. Between 1990 and 2004, data for Montenegro are included in Serbia.
Romania	ROMANIA	
Russia	RUSSIA	
Serbia	SERBIA	Serbia includes Montenegro until 2004 and Kosovo until 1999.
Tajikistan	TAJIKISTAN	
Turkmenistan	TURKMENIST	
Ukraine	UKRAINE	
Uzbekistan	UZBEKISTAN	

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.

Country/Region	Short name	Definition
Non-OECD Europe and Eurasia	EURASIA	Includes Albania; Armenia; Azerbaijan; Belarus; Bosnia and Herzegovina; Bulgaria; Croatia; Cyprus ; Former Yugoslav Republic of Macedonia (FYROM); Georgia; Gibraltar; Kazakhstan; Kosovo; Kyrgyzstan; Lithuania; Malta; Republic of Moldova (Moldova); Montenegro; Romania; Russian Federation (Russia); Serbia ⁵ ; Tajikistan; Turkmenistan; Ukraine; Uzbekistan; Former Soviet Union and Former Yugoslavia.
Bahrain	BAHRAIN	
Islamic Republic of Iran	IRAN	Data are reported according to the Iranian calendar year. Data for 2014 correspond to 20 March 2014 – 19 March 2015.
Iraq	IRAQ	
Jordan	JORDAN	
Kuwait	KUWAIT	
Lebanon	LEBANON	
Oman	OMAN	
Qatar	QATAR	
Saudi Arabia	SAUDIARABI	
Syria	SYRIA	
United Arab Emirates	UAE	
Yemen	YEMEN	
Middle East	MIDDLEEAST	Includes Bahrain; Islamic Republic of Iran (Iran); Iraq; Jordan; Kuwait; Lebanon; Oman; Qatar; Saudi Arabia; Syrian Arab Republic (Syria); United Arab Emirates; and Yemen.
Non-OECD Total	NONOECDTOT	Includes all Non-OECD countries.
World marine and aviation bunkers	WORLDBUNK	Due to the structure of the database and the specific nature of international marine and aviation bunkers, including CO ₂ emissions, World marine and aviation bunkers are reported both as a flow and as an entity similar to a country or a region. World marine and aviation bunkers represent the sum of international marine and aviation bunkers from all countries. Therefore, World marine and aviation bunkers are not applicable for individual countries and regions, and they are included in the transport for the world total.

5. 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.

Country/Region	Short name	Definition
World	WORLD	Includes OECD Total, non-OECD Total, World marine bunkers and World aviation bunkers. This also same as sum of the five UN aggregates (Africa(UN), Americas(UN), Asia(UN), Europe(UN) and Oceania(UN)), World marine bunkers and World aviation bunkers.
Africa (UN)	AFRICATOT	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; Ethiopia; Gabon; Gambia; Ghana; Guinea; Guinea-Bissau; Kenya; Lesotho; Liberia; Libya; Madagascar; Malawi; Mali; Mauritania; Mauritius; Morocco; Mozambique; Namibia; Niger; Nigeria; Réunion; Rwanda; Sao Tome and Principe; Senegal; the Seychelles; Sierra Leone; Somalia; South Africa; South Sudan (from 2012), Sudan; Swaziland; the United Republic of Tanzania (Tanzania); Togo; Tunisia; Uganda; Zambia; Zimbabwe.
Americas (UN)	AMERICAS	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; Dominica; the Dominican Republic; Ecuador; El Salvador; the Falkland Islands (Malvinas); Guatemala; the French Guiana; Grenada; Guadeloupe; Guyana; Haiti; Honduras; Jamaica; Martinique; Mexico; Montserrat; Nicaragua; Panama; Paraguay; Peru; Puerto Rico (for natural gas and electricity); 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).
Asia (UN)	ASIATOT	Includes Afghanistan; Armenia; Azerbaijan; Bahrain; Bangladesh; Bhutan; Brunei Darussalam; Cambodia; the People's Republic of China; Cyprus; Georgia; Hong Kong, China; India; Indonesia; the Islamic Republic of Iran; Iraq; Israel; 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.

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.

Country/Region	Short name	Definition
Europe (UN)	EUROPE	Includes Albania; Austria; Belarus; Belgium; Bosnia and Herzegovina; Bulgaria; Croatia; the Czech Republic; Denmark; Estonia; Finland; the Former Yugoslav Republic of Macedonia; France; Germany; Gibraltar; Greece; Hungary; Iceland; Ireland; Italy; Kosovo ⁶ ; Latvia; Lithuania; Luxembourg; Malta; the Republic of Moldova (Moldova); Montenegro; the Netherlands; Norway; Poland; Portugal; Romania; the Russian Federation; Serbia; the Slovak Republic; Slovenia; Spain; Sweden; Switzerland; Ukraine; the United Kingdom.
Oceania (UN)	OCEANIA	Includes Australia; New Zealand; Cook Islands; Fiji; French Polynesia; Kiribati; New Caledonia; Palau; Papua New Guinea; Samoa; the Solomon Islands; Tonga; Vanuatu.

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.

6. COUNTRY NOTES AND SOURCES

General notes

Energy data for OECD countries are submitted by all OECD Member countries to the IEA secretariat in a common format and methodology to allow for international comparisons.

One general issue regarding renewable statistics is that the variety of definitions for the word “renewable” may not refer to the same energy sources. Some of the definitions of renewable energy used by national and international bodies include specific renewables technologies such as large hydro, geothermal, peat, municipal waste or industrial waste while others exclude them. Similarly, renewables may or may not include non-commercial biofuels, which has substantial effects regarding renewable data for developing countries.

The Renewable Energy Working Party of the International Energy Agency set down the following broad definition:

“Renewable Energy is derived from natural processes that are replenished constantly. In its various forms, it derives directly or indirectly from the sun, or from heat generated deep within the earth. Included in the definition is energy generated from solar, wind, biofuels, geothermal, hydropower and ocean resources, and biofuels and hydrogen derived from renewable resources.”

Therefore, in this publication the renewable products are: hydro (large, medium and small), geothermal, solar photovoltaic, solar thermal, tide, wave, ocean, wind, solid biofuels, biogases, liquid biofuels and renewable municipal waste. All these definitions are consistent with the International Recommendations for Energy Statistics (IRES).

It follows that total renewables does not include industrial waste, non-renewable municipal waste, waste heat, net heat generated by heat pumps, and electricity generated with hydro pumped storage.

While some OECD member countries accept industrial waste and non-renewable municipal waste as renewable energy sources, many countries exclude them on the grounds that they are not biodegradable. Under the IEA methodology, industrial waste and non-renewable municipal waste are excluded from the definition of renewable energy sources. However, these data are included in this publication in order to account for the full range of statistics collected in the Annual Renewables and Waste Questionnaire.

Even though data quality improves with each new edition due to the continuous efforts of the IEA in partnership with national administrations, it is important to highlight that difficulties exist in the collection of some data. As a result, there can be breaks in the time series for the countries, as explained in the country notes.

For example, one continuing problem is the breakdown between municipal waste and industrial waste. In some countries industrial waste statistics are not of the same quality as those for other products, because renewables and waste data collection systems were not in place in many countries in the early 1990s. Furthermore, the breakdown between the renewable and non-renewable portions of municipal waste is sometimes not known and as a result is based on estimates. The breakdown is important because most countries include the renewable (biodegradable) part of municipal waste in their renewables definition, while they exclude the remainder. The classification of waste as renewable is also important because the non-renewable component is counted when calculating

CO₂ emissions. In cases where the breakdown of municipal waste into renewable and non-renewable components was not reported, the IEA Secretariat estimated equal shares of renewable and non-renewable components.

Data collection from off-grid systems that work independently or are connected to a local distribution system remains a problem. These systems are frequently omitted in national statistics due to difficulties in collecting these data. This is, for example, the case regarding solar energy data, where for a number of countries, production is likely to be higher than indicated in this publication although capacity is more accurate. Collection of the data presents national governments with some unique challenges. Renewable energy systems tend to be smaller than conventional systems, and harder to track. Operators tend to be more diverse and more numerous.

Many systems are connected to the grid at the distribution level, rather than at the transmission level, and so do not require interconnection permits. National governments are seeking to improve data collection methods to capture the total nature of their renewable energies. In general, the dispersion of renewables and waste production, specifically off-grid production (such as domestic solar collectors and/or small wind turbines), creates transparency and measurement problems. Thus, the nature and structure of the renewables energy market impedes data quality and reliability when compared to that of the traditional fossil fuels, which mainly produce heat and electricity in grid-connected plants.

This report is focused on the data from 1990 onward, due to the limited availability of data prior to 1990. Non-commercial biofuels are included in the IEA definition, but data are not always complete. Electricity from fuel cells using hydrogen from renewable, as well as non-renewable, sources is not included in this publication due to a lack of reliable information.

When using these data, special attention should also be given to the percentage that renewables represents in TPES in countries where the net trade of electricity is large and also represents a significant percentage. In these cases, the high net imports of electricity can heavily influence the percentage of renewables in TPES.

Additional information on the methodologies and reporting conventions used here are included in the notes in *World Energy Balances*.

Historical data (1990-2015)

The annual historical data in Part II of this report are taken from the IEA/OECD databases of Energy Statistics which are based on annual submissions from all OECD Member countries.

i) IEA/OECD renewables statistics

This database of annual statistics for OECD countries covers hydroelectricity, solid biofuels, geothermal, renewable municipal waste, wind, gas from biomass, liquid biofuels, solar photovoltaic, solar thermal, tide/wave/ocean, non-renewable municipal waste and industrial waste. It includes electricity and heat production from renewable sources and supply/demand balances of renewable and waste products.

The main data from this system are published annually in this publication.

ii) IEA/OECD electricity statistics

This database of annual statistics for OECD countries covers generating capacity and electricity production from main activity producer and autoproducer plants. It includes information on electricity production by fuel type and supply/demand balances for electricity and for heat sold to third parties from different types of power and heat plants.

The main data from this system are published annually in the IEA/OECD publication *Electricity Information*.

iii) World energy balances

Overall energy balances are constructed annually for all OECD countries from the basic energy statistics systems of the IEA. The overall energy balance data are expressed in a common energy unit of tonnes of oil equivalent (toe) and presented in a standard matrix format. The balances are published annually in the IEA/OECD publication *Energy Balances of OECD Countries* in which detailed country notes referring to historical data can be found.

iv) OECD main economic indicators

OECD Main Economic Indicators is a monthly compilation of a range of indicators on recent economic developments for the 35 OECD member countries. Please refer to this publication for detailed notes regarding the selected indicators.

v) Other sources

GDP: The main source of these data for 1990 to 2016 is the OECD *National Accounts Statistics* database. Growth rates from the series in the *OECD Economic Outlook* No 98 and other data previously published by the OECD were also used to estimate data for **Hungary** (prior to 1991) and **Slovak Republic** (prior to 1992). Data for **Estonia** (prior to 1992) are IEA Secretariat estimates based on GDP growth rates from the World Bank.

The GDP data have been compiled for individual countries at market prices in local currency and annual rates. These data have been scaled up/down to the price levels of 2010 and then converted to US dollars using the yearly average 2010 exchange rates.

Population: The main source of these data for 1990 to 2016 is the OECD *National Accounts Statistics* database. Data for 2016 for **Australia, Canada, Chile, Greece, Iceland, Israel, Japan, Korea, Mexico, New Zealand, the Slovak Republic, Switzerland, Turkey and the United States** were estimated using the growth rates from the population series in *OECD Economic Outlook No. 95*, long-term baseline projections. Growth rates from the *OECD Factbook 2015* were used to estimate data for **Estonia** (prior to 1993), **Israel** (prior to 1995) and **Slovenia** (prior to 1995).

Australia

Source

Department of Industry, Canberra.

General notes

- All data refer to the fiscal year (e.g. July 2014 to June 2015 for 2015).
- The data for **biogasoline** and **biodiesel** are not available before 2003 and 2004 respectively.
- There are breaks in the time series for many data between 2002 and 2003 due to the adoption of the National Greenhouse and Energy Reporting (NGER) data as the main energy consumption data source for the Australian Energy Statistics.
- In 2002, the Australian administration started to use a new survey methodology and reclassified the types of plants between main activity producers and autoproducers.

- From 1996, a different industry consumption breakdown for **biofuels and waste** is available and leads to breaks in time series.

Supply

- Indigenous production of **biodiesel** decreased substantially in 2016 because one of major **biodiesel** producers ceased production in January 2016.
- **Biogas** production data at sewage treatment works are not available.
- The production data of electricity from **wind** are available from 1994.

Transformation

- Electricity production from **solar PV** starts in 1992 and from **solar thermal** in 2003.
- Prior to 1995, electricity production from **biogases** is included in natural gas.

Consumption

- In the 2017 edition of this publication, there has been a revision to the time series of **solid biofuels** consumption in “Paper, pulp and printing” sector. This time series has been revised back to 2010 resulting in break in time series between 2009 and 2010.
- In the 2016 edition of this publication, the Australian administration revised **primary solid biofuels** back to 2010 which impact mostly final consumption in Food and Tobacco. This created breaks in time series.
- The consumption data of **biogases** in industry is not available before 2003.

Austria

Source

Bundesanstalt Statistik Österreich, Vienna.

General notes

- In the 2016 and 2017 edition, widespread data revisions were received due to enhanced reporting for 2005 onwards as a consequence of the Austrian Energy Efficiency Act (Bundes-Energieeffizienzgesetz). For some time series, these revisions were extrapolated back to 1990. As a consequence, there may be breaks between 2004 and 2005, and 1989 and 1990.

- Data for **solar photovoltaic** and **wind** are available from 1993.

Transformation

- A large autoproducer electricity plant was reclassified as an autoproducer CHP plant and therefore creates a break in time series for **municipal waste** in 2011.
- Due to a change in the survey methodology, the heat produced in small plants (capacity inferior to 1 MW) is not reported starting in 2002.
- Electricity plants data may include some CHP plants operating in electricity only mode.
- Prior to 2002, data for **biogases** only include plants of 1 MW or larger.
- Electricity generation from **geothermal** started in 2002.

Consumption

- In the 2016 edition, improvement in the iron and steel industry data have allowed more precision in the consumption, among other for **industrial wastes** in blast furnaces.
- In the 2016 edition, the consumption of **solid biofuels** in the residential sector was revised down from 2005 data.

Belgium

Source

Observatoire de l'Energie, Brussels.

General notes

- Renewable **municipal wastes** include a share of renewable **industrial wastes**.
- No information on **wood pellets** and **animal waste** is available prior to 2012.
- Data for **biodiesels** and **biogasoline** are available starting in 2009.

Supply

- Data on pure **biogasoline** and **biodiesels** trade are not available for 2009 and 2010.

Transformation

- No information is available on heat production in main activity CHP plants for **industrial waste** in 2007.

- In 2003, combustion of **municipal waste** for electricity and heat generation purposes increased significantly. However, because a large portion of the heat produced is not used (sold), plant efficiencies dropped significantly between 2002 and 2003.
- In 2000, most autoproducer electricity plants using **combustible fuels** were reclassified as autoproducer CHP plants; the heat production from these plants was used for internal industrial processes and not sold to third parties until 2005.
- For 1998 and 1999, electricity production at CHP plants with annual heat output below 0.5 TJ is reported with electricity only plants.

Consumption

- **Industrial waste** consumption in the chemical sector started in 2013.
- **Other liquid biofuels** consumed in power plants reported before 2011 can include **biodiesel**.
- New data on consumption cause breaks in time series for **primary solid biofuels** between 2011 and 2012.

Canada

Source

Natural Resources Canada, Ottawa.

General notes

- The split of **municipal waste** reported assumes 65% renewable and 35% non-renewable.
- Starting in 2009, a new data source has been used by Canadian administration for electricity production from **solar**, **wind**, and **tide**. This new source covers production from **solar** and **wind** only from plants with capacity higher than 500 kW.
- The IEA Secretariat has estimated the data for **biogases**, **industrial and municipal waste** from 1990 to 2004, **biogasoline (ethanol)** from 1998 to 2004 based on information supplied by Natural Resources Canada.

Supply

- Canadian **biodiesel** production increased significantly in 2014 because a large producer came online at the end of 2013. In 2016 again, there was big increase in production of **biodiesel** due to a large plant coming online in Alberta. This is also

the reason for the increase in export, as Canada exports most of its **biodiesel** to the US.

- There were no exports of **biogasoline** since 2013.

Transformation

- In the 2017 edition of this publication, electrical capacity of **other liquid biofuels** have been reported without any relevant inputs or outputs due to the lack of data.
- In the 2016 edition of this publication, there was a reclassification from autoproducer to main activity producer for plants fuelled by **biogases** and **municipal waste**.
- In the 2016 edition of this publication, the electrical capacity of **solid biofuels** revised back to 2005, which makes break in time series between 2004 and 2005.
- Only gross maximum electrical capacity is available.
- Production capacity figures for **biodiesel** and **biogasoline** are not available.

Consumption

- The **solid biofuels** consumption for the residential sector in 2015 is equal to 2014 data because firewood data lag one year behind.

Chile

Source

Ministerio de Energia, Santiago.

General notes

- The Chilean administration applied a new revised methodology for *final consumption* of **primary solid biofuels**. This may lead to breaks in time series between 2013 and 2014.
- **Charcoal** production and consumption have been estimated by the IEA Secretariat until 2013. From 2014 data, only **solid biofuels** input to **charcoal** production plant is estimated.
- The split of electricity generation by main activity and autoproducer by fuel was estimated by the Chilean administration for the period 1990 to 2003.
- From 1990, consumption in paper and pulp includes forestry and consumption in agriculture is included in non-specified industry.

Supply

- Production of **landfill gas** ceased in 2001 as landfill sites stopped producing adequate gas to continue collection.
- **Solar thermal heat** production has been estimated by the IEA Secretariat using data published by Chilean ministry of energy.

Transformation

- **Biofuels** are co-fired with other fuels for electricity production. For plants where multiple fuels are used for electricity production, capacities are reported under the dominant fuel.
- Regarding electricity generation from **solar PV** and **wind**, Chilean administration applied a new methodology for 2014 and this resulted in breaks in time series between 2013 and 2014. The revision for the previous years is pending.
- A new survey on primary **solid biofuels** causes breaks in production and input to autoproducer CHP between 2011 and 2012.
- Data for heat production in CHP and heat plants are not available.
- The split of **hydro** generation by plant size is available from 1996 for main activity and from 2000 for autoproducers.

Consumption

- **Solar thermal** consumption data are not available so all consumption data are allocated to the non-specified (other) sector.

Czech Republic

Source

Ministry of Industry and Trade, Prague.

General notes

- The restructuring of the Czech electricity market leads to breaks in the time series in all sectors between 1998 and 1999.
- Data for **municipal waste** and **solid biofuels** are not available prior to 1990 and **liquid biofuels** data are not available prior to 1992.

Transformation

- In 2012, a main activity producer electricity plant using **solid biofuels** started to produce heat and was reclassified as main activity CHP plant.

- Data on **biogases** used in main activity producer CHP and autoproducer heat plants start in 1997.
- **Industrial waste** use in main activity producer electricity plants is **included** with **solid biofuels** from 1996.

Consumption

- In the 2017 edition, due to a new survey in households made by the Czech Statistical Office in 2015 (ENERGO 2015), **solid biofuels** consumption in residential sector has been considerably revised upwards since 1990.
- Hospital waste previously reported as **municipal waste** is reported under **industrial waste** since 2008.
- New survey systems cause breaks in final consumption in 1999 and in 2002. Breaks in both supply and consumption of biofuels and waste occur again in 2003.
- Data for direct use of **solar** energy are available from 2003.

Denmark

Source

Danish Energy Agency, Copenhagen.

General note

- In the 2014 edition, total heat production was revised back to 1994, due to the availability of new data for heat production from **liquid biofuels**.

Supply

- In the 2015 edition, the Danish administration revised the **geothermal heat** production from 1990 to 2009.

Transformation

- From 2012, **biogasoline** trade designated to be blended with motor gasoline is included under **bio-diesels**, for confidentiality reasons.
- From 2012, **biodiesel** production was confidential and gathered with imports.
- **Biodiesels** and **biogasoline** consumption for electricity and heat production are reported under **other liquid biofuels**, for confidentiality reasons.
- Data for **other liquid biofuels** main activity heat plants are available from 1994.

- Due to the high number of heating companies burning **wood chips** that are equipped with boilers with flue-gas condensation, the **solid biofuels** heat plants show a high efficiency.
- **Fish oil** used in main activity producer heat plants is included with **solid biofuels**.
- For some years heat plants for **biogases** show efficiencies larger than 100%, on a net calorific value basis, due to the use of condensing boilers that recover the latent heat of vaporisation.
- Based on the reported production from **solar thermal** collectors and installed surface of these, a decline in specific production [kWh/m²] is observed. The main reason of this is that the sources of the production data and installed surface are different each other. The production data origins from the “energy-producer-survey” that most certainly misses some of the newly established installations. Danish administration expects that this divergence will probably become smaller again in the next cycle.

Consumption

- In the 2017 edition of this publication, Danish administration used the 2014 figures of **municipal waste** consumption in industrial sector for the 2015 figures. These figures will be revised in the 2018 edition.
- In the 2016 edition, the Danish statistics revised energy consumption in industry sectors causing some breaks in **solid biofuels** consumption between 2010 and 2011.

Estonia

Source

Statistics Estonia, Tallinn.

General notes

- Data for Estonia are available starting in 1990. Prior to that, they are included in the Former Soviet Union in World Energy Statistics.
- Data for **biogases** include **landfill gas** starting in 2005.

Transformation

- For plants where multiple fuels are used for electricity production, capacities are reported under the dominant fuel.

Finland

Source

Statistics Finland, Helsinki.

General notes

- A new survey system and a reclassification of the data lead to breaks in the time series between 1999 and 2000 for most products and sectors. The new survey system is more detailed and has better product coverage, especially in electricity, CHP and heat production, as well as in industry.
- Prior to 2004, **industrial waste** also included other energy forms such as **hydrogen**, **heat from chemical processes**, **natural gas** and **blast furnace gas**.
- Data for **biogases** and **industrial waste** are available from 1996.

Supply

- Due to confidentiality reasons, the **biodiesel** production includes trade figures and stock changes for 2015. Regarding **biogasoline**, import covers production, exports and stock changes.

Transformation

- The capacities of co-firing plants are reported under the dominant fuel.
- In the 2016 edition, the allocation of **solar photovoltaic** between main activity and autoproducer plants was revised.
- In 2014, the new consumption of **other liquid biofuels** in main activity electricity plant corresponds to biopyrolysis oil made from wood chips.
- The increase in heat production from **municipal waste** in 2014 is due to the opening of a new plant.
- Heat output from autoproducer CHP plants is available starting in 1996 and from autoproducer heat plants starting in 2000.
- Before 1999, all electricity production from autoproducers running on **fuelwood** is allocated to CHP plants.
- Prior to 1992, outputs from the use of combustible renewables and waste to generate electricity and/or heat were included in peat. Therefore, the IEA Secretariat estimated the breakdown of outputs from **municipal waste** and **solid biofuels** based on reported inputs.

France

Source

Ministère de la Transition Écologique et Solidaire, Paris.

General notes

- In 2014, a new survey on **Solid biofuels** and **Biogases** causes breaks in time series between 2013 and 2014. **Biogas** was previously reported under **Solid biofuels**.
- From 2012, the energy consumption is more detailed due to a new national survey.
- Prior to 2005, all the **geothermal** heat consumption was reported as direct use. From 2005 data, some quantities are reported as output of heat plants, resulting in breaks in time series for production, transformation and consumption.

Transformation

- Electricity plants data may include some CHP plants operating in electricity only mode. And heat plants data may include some CHP plants operating in heat only mode.
- Data for heat produced from combustible fuels in heat only plants are available starting from 2012.
- Electricity production from **geothermal** started in 2011 and stopped in 2012 due to the maintenance of the only plant.
- From 2011, all **photovoltaic** plants with capacity above 100kWp are considered as main activity producers, while all plants with capacity below that value are considered autoproducers.
- Plants using **municipal waste** were reclassified as autoproducer CHP plants from 1995, which leads to a break in time series. Breaks in time series in 2005 for **municipal waste** and **solid biofuels** are caused by sectoral reclassifications.
- Data on electricity production from **wind** is available from 1990.

Consumption

- Production and consumption of **industrial waste** are reported from 2013. Prior to that, they were included in **municipal waste**.
- A revision of the **solid biofuels** and **biogases** time series created breaks in the direct use time series between 2004 and 2005.

- The breakdown of the final energy consumption of **biogases** was estimated by the French administration from 1970 to 2003.

Germany

Source

Federal Ministry for Economic Affairs and Energy, Berlin.

General notes

- Changes in the reporting system lead to breaks in time series between 1996 and 1997, 2002 and 2003, 2006 and 2007 and between 2010 and 2011.
- In 2011, numerous changes to methodology and classifications have caused many breaks in time series.
- Starting in 2008, **municipal waste** and **industrial waste** data were collected separately. This leads to breaks in the time series between 2007 and 2008.
- Data on **geothermal** heat production and direct consumption were revised by the German administration and are only available starting in 2003.
- GDP figures prior to 1991 are based on conversions made by the German Institute for Economic Research (Deutsches Institut für Wirtschaftsforschung) and the former Statistical Office of the GDR (Statistisches Amt der DDR).

Supply

- Trade data for **biogasoline** are available from 2004 and for **biodiesels** from 2003.

Transformation

- **Industrial wastes** are co-fired with other fuels for electricity production. For plants where multiple fuels are used for electricity production, capacities are reported under the dominant fuel.
- Due to a reclassification of **wind** energy and **solar photovoltaic** in the official data of the German Federal Statistical Office since 2011, the production is now only reported under main activity producer plants.
- Prior to 2003 electricity production in electricity plants includes production from CHP plants and heat production in CHP plants includes production from heat plants.

- In some instances, electricity generation from **hydro-electricity**, **solar** and **wind** in autoproducer electricity plants are confidential or non-available and therefore are included in main activity producer electricity plants.

Consumption

- For **solid biofuels** consumption in the commercial and public services sector, new data were derived in cooperation with the Federal Research Institute for Rural Areas, Forestry and Fisheries by applying a different calculation approach based on the total demand for material and energy use of the resource wood in Germany. This had resulted in breaks in time series between 2013 and 2014.

Greece

Source

Ministry for Environment and Energy, Athens.

General notes

- New information on **solid biofuels** is available from 1996 and leads to breaks between 1995 and 1996.
- Data for **biofuels and waste** input and output to transformation are available from 1992.
- Data for **biogases** are available from 1990 and data for **industrial waste** from 1992.

Supply

- No heat production of **solar heat** is reported although it exists.

Transformation

- The big increase in delivery of **industrial wastes** to autoproducer CHP plant in 2010 is mainly due to the opening of a new plant.
- Inputs of **solid biofuels** to **charcoal** production are estimated for 2007 to 2010 by the IEA Secretariat assuming an efficiency of 40%.
- **Industrial waste** used in autoproducer CHP plants decreased substantially in 2006 because a plant closed.

Consumption

- **Solid biofuels** consumption in commercial/public services is included in residential until 2011.

- The consumption of **solid biofuels** in the paper, pulp and printing industry is not available from 2003 to 2012.
- Direct use of **geothermal heat** in residential is available starting in 2004.

Hungary

Source

Hungarian Energy and Public Utility Regulatory Authority, Budapest.

General notes

- Data for **biogases** are available from 2000; for **industrial waste** from 2003; for **biodiesel** production from 2007.
- Data for **wind** and **solar thermal** are available from 2001.
- The Hungarian administration reclassified some of their plants between 1996 and 2000, which caused some breaks in the time series.

Supply

- A 2012 change in **biogasoline** reporting methodology results in break in time series between 2011 and 2012.

Transformation

- In 2014, some CHP plants running on **Industrial waste** and **solid biofuels** produced only heat and were reclassified to heat plants.
- From 2014 data, more data suppliers were involved in the process, causing new autoproducer time series to appear for **geothermal** and **industrial waste** plants.
- Data on electricity and heat production from **solid biofuels** in autoproducer CHP plants are available from 1995.
- **Geothermal heat** production from main activity producer heat plants is also available from 1995.

Consumption

- In the 2017 edition, the Hungarian administration has revised **solid biofuels** consumption in other sectors back to 2010 based on the new survey from Hungarian Central Statistical Office (HCSO). This resulted in break in time series between 2009 and 2010.

- A new reporting methodology for the direct use of **geothermal** energy was applied from 2014 resulting in break in time series between 2013 and 2014.
- Data for direct use of **geothermal heat** are available from 1990.

Iceland

Source

National Energy Authority, Reykjavik.

General notes

- Energy industry own use of electricity refers mainly to the use of electricity by the **geothermal** industry to pump **geothermal** water from underground sources.
- In the 2015 edition, the Icelandic administration revised **geothermal heat** production and heat consumption back to 1990. This affects mainly the **geothermal** direct use, the **geothermal heat** production and the final consumption of heat. Prior to 1990, all heat for space heating was reported in residential.

Supply

- The increase in **hydroelectric** and **geothermal** electricity production and capacity between 2007 and 2008 is due to the expansion of the aluminium industry.

Transformation

- For 2016, access to improved data revealed considerably better **geothermal** heat plant efficiencies than previously inferred, with increases in **geothermal** heat production seen during this period. The Icelandic administration plans to revise previous years' figures in succeeding editions.
- From 2013 data, the Hellisheidi **geothermal** power plant, previously reported under main activity electricity plant, was categorised as main activity CHP plant.
- The use of **municipal waste** to produce heat is available from 1993 and stops in 2010.
- In 1998, 60 MW of generating capacity was installed in the **geothermal** CHP plant at Nesjavellir. Since the plant was inoperable for four months, production of **geothermal heat** is almost same with 1997. The extra electricity capacity caused electricity production from **geothermal** to almost double over the same period.

- Electricity production from **geothermal** sources in main activity producer CHP plants is available from 1992.

Consumption

- **Biodiesel** consumption data for 2014 are estimated by Icelandic administration based on 2013.
- Revisions in the direct use of **geothermal heat** from 2013 create breaks in time series between 2012 and 2013.
- **Biogases** used for transport purposes were reported for the first time in 2007.
- The **geothermal** consumption on industrial sector is reported under non-specified industry, as the Icelandic administration decided not to estimate the allocation amongst the sub-sectors of industry.

Ireland

Sources

- Department of Communications, Energy and Natural Resources, Dublin.
- Sustainable Energy Authority of Ireland, Cork.

General notes

- Data for **municipal waste** are available from 2009.
- Data for **solid biofuels** and **biogases** are available from 1990.
- The **solid biofuels** capacity only refers to CHP. The electricity generated by **solid biofuels** from main activity producer electricity plants, refers to an 118MW co-firing plant using milled peat and biomass. As the primary fuel is peat, this capacity is reported under peat.

Supply

- Prior to 2011, production and trade of **biogasoline** and **biodiesels** cannot be distinguished due to confidentiality issues.

Transformation

- In 2012 and 2013, the renewable fraction of tyre-derived fuel (12%) used by a cement plant was reported by the administration under **renewable municipal waste**; the non-renewable fraction (88%) was reported under **industrial waste**.
- In 2012, a new main activity electricity plant burning **municipal waste** (the Meath plant) started operation

- There is no **Pumped Hydro** capacity reported in 2010 and 2011 due to the fact that Ireland's pumped storage station, Turlough Hill, was taken offline for an overhaul late in 2010 and did not come back online until February 2012.
- Electricity production from **wind** begins in 1992 and from **biogases** in 1996.

Consumption

- The consumption of pure **biodiesel** in the industry sector and in the road transport refers to one site, which is no longer in operation since 2014.
- Data for direct use of **solar thermal** heat are available from 1990.

Israel

Source

Israel Central Bureau of Statistics, Jerusalem.

General notes

- The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli administration. The use of such data by the OECD and/or the IEA 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.
- In the 2017 edition, **Solar thermal** production and direct consumption were revised and are now estimated by the IEA Secretariat from 2012 onwards, using data published in the IEA-Solar Heating and Cooling Programme Annual Report. These estimations may create breaks in time series between 2011 and 2012.
- Data on the breakdown of **hydroelectric** plants by size became available in 2009.

Transformation

- In 2014, the breakdown of **hydro** electricity production by size is revised due to more accurate data.
- **Biogas** input to transformation sector was estimated by the IEA Secretariat from 2013 data point.
- **Hydroelectricity** production data for 2012 were estimated based on the previous years.
- Electricity production from **wind** begins in 2001.

Consumption

- Data on imports and consumption of **charcoal** were estimated since 2012 based on figures for 2011.

Italy

Sources

- Ministry of Economic Development, Rome.
- Terna, Rome.

General notes

- The methodology of data collection for the **geothermal** sector changed in 2010, causing a break in time series between 2009 and 2010.
- A change in methodology lead to breaks in time series for industry and transformation between 2003 and 2004.

Supply

- **Biogasoline** includes **bio-ETBE**.
- From 2014, a distinction between trade and production became available for **other liquids biofuels**.

Transformation

- The methodology of data collection for **photovoltaic** electricity production changed in 2009 and the distinction between main activity and auto-producer plants could not be determined, causing a break in the time series.
- In 2008, data for **biofuels and waste** were reclassified, which results in several breaks in the time series for transformation.
- Heat production is reported starting in 2004 and includes self-generation in industry.
- Up to 2003, **solid biofuels** capacity includes industrial waste capacity.
- From 2000 onwards, the Italian administration defines electricity and heat production from auto-producers as generation from producers that consume more than 70% of their own electricity production. However, for the 2000 to 2002 period, all electricity production from autoproducers is reported with main activity producers.

Consumption

- The final consumption of **biogas** has been constant from 2013 to 2015 as these figures are the result of a survey which is not carried out annually. Figures are expected to be revised after the next survey.

- In the 2016 edition, the methodology used to calculate **solid biofuels** consumption in the residential sector for 2002 to 2014 was updated and this created a break in time series between 2001 and 2002. This also affects the indigenous production of **solid biofuels**. The revisions were limited backwards to 2002 because of reliability issues.

Japan

Source

The Institute of Energy Economics Japan, Tokyo.

General notes

- Starting in 1990, data are reported on a fiscal year basis (e.g. April 2015 to March 2016 for 2015).
- Due to time constraints, amounts reported under solid biofuels data for 2016 may not reflect full-scale national coverage, causing a break in time series. Revisions are expected in the 2018 edition.
- Consumption data for commercial/public services may include consumption in small and medium-size industries. The Japanese administration expects that this shortcoming be corrected in the near future.
- There was a large revision in **municipal waste** data in the 2016 edition of this publication. This revision has removed data for **municipal waste** for the entire time series up to 2010, which create breaks in time series between 2009 and 2010.
- For **municipal waste** data, the breakdown between renewable and non-renewable **municipal waste** is estimated by the IEA Secretariat.
- The net calorific value for **charcoal** since 2010 was estimated as equal to 2009 by the IEA Secretariat.

Transformation

- The capacities of co-firing plants are reported under the dominant fuel.
- In the 2017 edition, the Japanese administration revised electrical capacity for combustible fuels back to 2003 creating breaks in time series between 2002 and 2003. Due to the data unavailability, **municipal waste** plant generation capacity now includes plants operating on **black liquor** since 2012, following the revision. Prior to 2012, **black liquor** capacity was included under **solid biofuels** capacity.
- The IEA Secretariat estimated the **photovoltaic (PV)** electricity generation from autoproducers

starting in 1992 based on an average capacity factor of 12% and capacity data for autoproducers. Autoproducer PV capacity is derived from data from the Japanese administration as well as the IEA Photovoltaic Power Systems Programme (IEA-PVPS) report, “Trends in Photovoltaic Applications” published in 2016.

- Input data of **solid biofuels** to **charcoal** production are estimated by the IEA Secretariat assuming an efficiency of 40%.
- Data on heat produced for sale by autoproducer heat plants are not available.
- Electricity and heat produced in CHP plants are not included in the CHP data time series, but instead are reported as separate electricity or heat components.
- Heat production from **geothermal** and **solar thermal** sources in Japan is not reported by the Japanese administration.
- Production of electricity from **solar photovoltaic** and **wind** in autoproducer electricity plants is understated as it only covers generation from plants with capacity of 1000kW or more.
- The **industrial waste** consumption in the transformation sector (non-specified) surged in 2013, because of the increase in use of waste plastics for coke production.
- From 2005 to 2007, the electricity produced in main activity electricity plants from **solar photovoltaic** decreased because plants were out of operation due to maintenance.
- Prior to 1998, the electricity produced using TRT technology (Top pressure Recovery Turbines) was included with electricity generated from **wood, wood waste** and other **solid waste**.
- Data on electricity production from **wind** began in 1993.

Korea

Source

Korea Energy Economics Institute, Ulsan.

General notes

- Due to the change of reporting methodology, breaks in time series may occur between 2013-2014 and 2014-2015.
- Prior to 2009, autoproducer heat production includes amounts of unsold heat.

- Electricity statistics from 1971 to 1993 have been estimated by the IEA Secretariat based on the Korean National Statistics. Data from 1994 have been submitted by the Korean administration. This leads to breaks in time series between 1993 and 1994. Before 1994, electricity production from main activity producer CHP plants is included with main activity producer electricity only plants. Heat data are available starting in 1993.

Transformation

- Inputs to autoproducer heat plants have been estimated by the IEA Secretariat because of efficiency issues for **municipal waste** prior to 2011 and in 2012 and for **biogas** in 2008, 2011 and 2012.
- New plants were included in the Korean survey creating breaks in time series in 2011.
- In 2007, some main activity heat plants and autoproducers in the commercial/public services sector were reclassified as main activity CHP plants, resulting in a break in the time series between 2006 and 2007 for **biogases**.
- Prior to 2007, the consumption of **landfill gas** in main activity CHP plants may have been included in main activity heat plants. Difficulties in ownership classification are also the reason **landfill gas** data only appears one time in the commercial and public services sector in 2006.
- Between 1993 and 1999, the breakdown of heat output by type of fuel was estimated by the IEA Secretariat. In 2000, the Korean administration started to report heat statistics for some heat plants which were not reported before.

Consumption

- Data for direct use of **geothermal heat** are available from 2002. **Geothermal** direct use data are overstated as it refers to heat production by **geothermal** heat pumps, which include inputs of electricity and/or gas in the transformation process.

Latvia

Source

Central Statistical Bureau, Riga.

Transformation

- From 2012 to 2015, electrical capacity of **solar photovoltaic** was not reported, because capacity

was under 0.5 MW. For the same reason, electrical capacity of **biodiesel** for 2010 to 2015 was not reported.

- From 2012 onwards, the increase in electricity production from **solid biofuels** is due to the deployment of six new main activity producer CHP plants running on **wood chips**.
- Due to a reclassification in 2004, there was break in time series of electricity production from auto-producer electricity plant fuelled by **biogas** between 2003 and 2004.

Luxembourg

Source

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

General notes

- Most of the **hydro** production shown for Luxembourg is from the Vianden **pumped storage** plant and is exported directly to Germany.
- The Luxembourgian administration started including trade figure of **wood chips** in trade figure of **Solid biofuels** from 2015 data. This creates breaks in time series between 2014 and 2015.
- Data for **solar thermal** are available starting in 2001 and for **solar PV** starting in 2000.
- Data on **solid biofuels** are available from 1992.

Transformation

- The production of electricity from **solid biofuels** from 2013 corresponds to the opening of a new plant burning **wood wastes**.
- In 2011, the blending of **biogases** with **natural gas** started.
- Data on electricity production from **biogases** are available from 1998 and heat production from 2010.

Mexico

Source

Secretaría de Energía, Mexico City.

General note

- The Mexican administration is currently undertaking major work on revisions of the time series back to 1990. These revisions could not be implemented in the 2017 edition. As a consequence, breaks in time series appear between 2007 and 2008. Revisions to historical data are pending.

Supply

- Data for **bagasse** production is available from 2008.
- Data on the production of **sewage sludge gas** are available from 1997.

Transformation

- Electricity production from **solid biofuels** and **biogases** data are available respectively from 1991 and 1997.
- Data on electricity production from **wind** and **solar photovoltaic** are available from 1990.

Consumption

- Data for **solid biofuels** used in autoproducer electricity plants from 1991 to 2005 have been estimated by the Mexican administration.
- Data on **biogases** consumption are available from 1997.
- Direct use of **solar thermal heat** is available from 1990.

Netherlands

Source

The Netherlands Central Bureau of Statistics, The Hague.

Supply

- From 2009 to 2012, and again from 2014 the production and trade of pure **biogasoline** were confidential; net imports were estimated by the Dutch administration based on consumption.
- Trade data for **municipal waste** are available from 2011.

Transformation

- All **municipal solid waste** autoproducer electricity and heat only plants have been reclassified by Statistics Netherlands as autoproducers CHP from 2012, causing breaks in the time series.

- Prior to 2008, a few small autoproducer electricity plants using **solid biofuels** were included with main activity plants for reasons of confidentiality.
- In 2006, for **municipal waste** some plants changed ownership and were reclassified from electricity only to CHP plants as they started heat projects.
- For **biofuels and waste**, all electricity and heat produced prior to 1995 is included in CHP plants.
- Electricity production from **solar photovoltaic** is available from 1990.
- Heat produced from **biofuels and waste** is available from 1990.

Consumption

- From 2014, a better allocation of heat own use was available for **biogas** digester prewarming, and in **municipal waste** burning plants for flue gas cleaning.
- The final consumption of **solid biomass** in the residential and agriculture sector increased in 2014 due to the results of new surveys and parameters.
- Direct use of **geothermal heat** in agriculture/forestry starting in 2008 is due to a new project extracting deep **geothermal heat**.

New Zealand

Source

Ministry of Business, Innovation and Employment, Wellington.

General note

- Prior to 1994, data refer to fiscal year (April 1993 to March 1994 for 1993). From 1994 data refer to calendar year.

Transformation

- Electricity production from autoproducer **geothermal** plant data are available from 1990.
- The New Zealand administration has updated efficiencies for electricity production from **geothermal heat** from 10% to 15% from 1990 onwards; this causes a break in the time series between 1989 and 1990.

Consumption

Data on direct use of **geothermal heat** are available from 1990 and direct use of **solar thermal heat** from 2002.

Norway

Source

Statistics Norway, Oslo.

General notes

- Prior to 2007, equal shares of renewable and non-renewable **municipal waste** were estimated because the actual split was not known.
- Data for **industrial waste** and **biogases** are available from 1991.

Supply

- In 2014, the **biodiesel** production facility closed.
- **Liquid biofuels** imports data are available starting in 2006.

Transformation

- No data on electricity production from **solar energy** are submitted separately to the IEA by the Norwegian administration.
- In the 2016 edition, Norway corrected the **industrial waste** consumption in heat plants, and reclassified some the corresponding heat output under other sources.
- For 2003 to 2009, estimates of **solar thermal collector** capacity were made by the IEA Secretariat using data published in the IEA-Solar Heating and Cooling Programme Annual Report.
- Heat production from **biogases** data are available from 1995.
- Electricity production from **wind** data are available from 1993.

Consumption

- Distribution losses for **biogases** are included in commercial/public services prior to 2003.

Poland

Source

Central Statistical Office, Warsaw.

General notes

- Several breaks in the **industrial wastes** time series are caused by difficulties in the classification of wastes.

- Data on **biodiesels** are available from 2005, **bio-gasoline** from 2003, and **other liquid biofuels** from 2009.
- In 2008, a new questionnaire was launched which increased the coverage of renewable and waste data.
- In 1993 and 1995, new estimation methodologies were used for **solid biofuels** data and this creates a break in time series between 1992 / 1993 and 1994 / 1995.

Supply

- Under current Polish law, only producers and importers of **biodiesel** are obliged to fulfil the National Indicative Target of share of biofuels in the total usage of transportation fuels. Since the regulation is currently not applied to retail distributors they, for economic reason, rather export the **biodiesel** than sell it domestically. This results in low domestic consumption and increase of exports in 2016.
- Production of **other liquid biofuels** increased in 2015 because new companies started to report their biofuel production to the Polish administration.

Transformation

- For plants where multiple fuels are used for electricity production, capacities are reported under the dominant fuel.
- State support for biomass co-firing was reduced in 2016, resulting in electricity production from **solid biofuels** falling during this period.
- In 2008, a number of CHP plants were reclassified from autoproducer to main activity producer due to an industry re-organisation.
- Before 2000, **industrial wastes** were used interchangeably with **light fuel oil** in some plants, which might result in breaks in the time series.
- Prior to 2010, heat supply and consumption can include autoproducers unsold heat. Previous attempts to address such issue may have caused breaks for heat production and fuel in autoproducer heat plants (1993) and in autoproducer CHP plants, and for heat consumption in industry sub-sectors.

Consumption

- Data for **biogases** refer only to the gas from fermentation of biomass.
- Data for direct use of **geothermal heat** are available from 2000 and direct use of **solar thermal** heat

in commercial/public services from 2002 and in residential from 2009.

- Until 1998, data for **industrial waste** include **other recovered gases** which have to be reported in Coal questionnaire, causing a break between 1997 and 1998.
- Between 1992 and 1993, due to data availability, there is a large increase in **solid biofuels** for residential, commercial/public services and agriculture/forestry.

Portugal

Source

Direcção Geral de Energia e Geologia, Lisbon.

General notes

- The production capacity of **other liquid biofuels** for the years 2006 to 2012 are estimated by the Portuguese administration.
- Data are available from 1994 for **biogases**, from 1999 for **municipal waste** and from 2003 for **industrial waste**.
- Data for **solid biofuels** were revised by the National administration from 1990 to 2001, which may result in breaks in time series between 1989 and 1990.

Transformation

- The power station that burns **industrial waste** started to work as a CHP plant in 2007, whereas previously it was only producing electricity.
- In 2007, some power plants that were previously reported as main activity CHP have been reclassified as autoproducer CHP.
- New plants fuelled by **solid biofuels** and by **municipal waste** started in 1999.
- Data for production of electricity from **solar photovoltaic** and **wind** are available from 1989.

Consumption

- Data on **solid biofuels** were further revised based on a new survey on industry, resulting in breaks in sub-sectoral consumption for 2012.
- Between 2009 and 2010 a new survey on energy consumption in households creates a break in time series in the **solid biofuels** consumption in residential time series.

- Data for direct use of **solar thermal heat** are available from 1989 and direct use of **geothermal heat** from 1994.

Slovak Republic

Source

Statistical Office of the Slovak Republic, Bratislava.

General notes

- The Slovak Republic became a separate state in 1993 and harmonised its statistics to EU standards in 2000. These two facts lead to several breaks in time series between 1992 and 1993, and between 2000 and 2001.
- Data for **solar photovoltaic** are available from 2010.
- Prior to 2001, the data reported as **industrial waste** include **biogases** and **municipal waste**.
- **Hydroelectricity** capacity breakdown by plant size is available from 2001.

Transformation

- Prior to 2001, electricity generation from primary **solid biofuels**, **municipal waste** and **biogases** are included with **industrial waste**.

Consumption

- Data for direct use of **geothermal heat** are available from 2001 and direct use of **solar thermal heat** from 2005.

Slovenia

Source

Statistical Office of the Republic of Slovenia, Ljubljana.

General notes

- Data for Slovenia are available starting in 1990. Prior to that, they are included in Former Yugoslavia in World Energy Statistics.
- A new energy data collection system was implemented in January 2001, causing some breaks in time series between 1999 and 2000.

Consumption

- The break in time series between 2008 and 2009 for **solid biofuels** is due to revisions based on a new household survey which is to be carried out on an annual basis.
- Direct use of **solar thermal** and **geothermal heat** is available from 2009.
- Breaks in total final consumption for **industrial waste** prior to 2008 are a result of a sectoral reclassification.

Spain

Source

Ministerio de Energía, Turismo y Agenda Digital, Madrid.

General notes

- Spain is working on the improvement of data collection and as such, breaks in time series exist; historical revisions are expected in the 2018 edition.
- New reporting systems were implemented in 2000 and again in 2006 which resulted in a reclassification of many plants from main activity to auto-producer and vice versa. This leads to breaks in the time series for the transformation sector and final consumption sectors between 1999 and 2000 and again between 2005 and 2006.
- The Spanish administration verifies that production and consumption of **industrial waste** do exist but data are not available after 2001.

Transformation

- Since January 2013, the tax exemption for biofuels has expired, and the mandatory **biodiesel** blending target has been reduced from 7% to 4.1%, causing a significant decrease in the amount of pure **biodiesel** sent to blending.
- From 2013 data, a revision of the industry sector of some companies causes breaks in time series for **solid biofuels**, **municipal wastes** and **biogases**.
- A reclassification of plants from main activity to autoproducer in 2008 has led to breaks in electricity production between 2008 and 2009.
- The National Energy Commission reclassified plants that consume **biogases**, leading to breaks in time series between 2007 and 2008.

- Data for electricity from **solar thermal** plants are available from 2007.
- Prior to 2006, inputs of **biogases** used to generate process heat by autoproducers were included as inputs to transformation when they should have been reported in the appropriate industry in final consumption.
- From 2005, residential rooftop **solar photovoltaic** electricity production data are included in main activity electricity plants according to the Spanish administration classification, previously they were reported under autoproducer.
- The breakdown of **hydro** production by plant size is reported from 1999.
- Electricity production from **wind** and **solar** are reported from 1989 when data became available.
- Prior to 1989 inputs and outputs from the use of biofuels and waste to generate electricity and/or heat (i.e. comprising solid and liquid biofuels, industrial waste, municipal waste and biogases) are reported under non-specified biofuels and waste.

Consumption

- Prior to 2006, inputs of **biogases** used to generate process heat were erroneously included as inputs to transformation when they should have been reported in the appropriate industry in final consumption.
- The breakdown of **solid biofuels** direct use in the industry sector prior to 1999 is not available.
- Data for direct use of **geothermal heat** are available from 1990 and from 1994 for **solar thermal heat**.

Sweden

Sources

- Statistics Sweden, Örebro.
- Swedish Energy Agency, Eskilstuna.

General notes

- There are some breaks in time series between 2015 and 2016 in **pumped hydro**, **industrial waste** and **other liquid biofuels** figures due to the lack of data. The figures are expected to be modified in the 2018 edition.
- From 1990 to 2006, **municipal waste** was reported as 60% non-renewable and 40% renewable. In

2007, reanalysis of the waste revealed the content was 40% non-renewable and 60% renewable. This results in breaks in the time series between 2006 and 2007 for both renewable and non-renewable **municipal waste**.

Supply

- 2015 data for **primary solid biofuels** were revised downwards because estimated figures in the last edition came from quarterly surveys whereas in this 2017 edition, final statistics for 2015 are published.

Transformation

- Heat production from **solid biofuels** in autoproducer CHP includes waste heat and chemical heat.
- For 2012 and 2013, small quantities of **bio-methanol** used to produce electricity are included in **other liquid biofuels**, under production, as well as input and output of autoproducer CHP.
- Prior to 1992, data on electricity production from **biogases** are included with **solid biofuels**.

Consumption

- Due to confidentiality issues, **solid biofuels** consumption in food, beverages and tobacco is reported with paper, pulp and printing for 2014 data.
- Consumption data by sector for **biogases** are available from 2011.
- In 2011, there was a change in the reporting methodology for consumption of **solid biofuels and waste** in the residential sector, which is responsible for breaks in concerned time series between 2010 and 2011.
- Data on direct use of **solar thermal** are available from 1989.

Switzerland

Sources

- Swiss Federal Office of Energy (SFOE), Ittigen.
- Carbura, Swiss Organisation for Stockholding of Liquid Fuels, Zurich.

General note

From 1999, data on consumption result from a new survey and are not comparable with data of previous years.

Supply

- Due to a new program launched in September 2014 in which CO₂ emissions due to traffic can be compensated by substituting fossil gasoline and diesel by biofuels, the imports and road consumption of **biodiesels** and **biogasoline** increased sharply in 2015.

Transformation

- The capacity reported for **biogases** only refers to the sum of capacities of **landfill** and **sewage sludge gas**.
- All **hydro electricity** production is reported under large scale hydro (> 10 MW) due to the fact that production data are not being collected by different size capacity categories.
- In 2015, the big decrease seen in electricity and heat production from **industrial wastes** is due to one large main activity CHP plant significantly reduced their activity.
- From 2012, the **municipal waste** autoproducer plant previously reported as electricity plant met the CHP requirements and was reclassified as such.
- **Biogas** is no longer being used for heat production as of 2011.
- The autoproducer heat plant that produced heat for sale using **municipal waste** was closed in 2006.
- Electricity production from **wind** data are available from 1996 and from 1990 for **solar photovoltaic**.

Consumption

- **Geothermal** direct use is over-stated as it refers to heat production by **geothermal heat pumps**, which include inputs from electricity and/or gas in the transformation process.
- Consumption data for **biogases** in the transport sector are available from 1996 to 2012 as a **biogas** fuel station had stopped selling **biogas** in 2013.
- Data for direct use of **geothermal heat** and **solar thermal heat** are available from 1990.

Turkey

Source

Ministry of Energy and Natural Resources (Enerji ve Tabii Kaynaklar Bakanlığı), Ankara.

General notes

- The Turkish administration only intermittently surveys **renewables and waste** used for power and heat. Due to this fact, some breaks may appear in the **biofuels and waste** time series.
- In the 2006 edition, the Turkish Statistical Office started providing electricity and heat output on the basis of a new survey that revised time series back to 2000. This causes breaks in the time series between 1999 and 2000. Not all of the input time series have been revised.
- In 1995, the Turkish administration reclassified auto-producer plants by type and source to be consistent with IEA definitions. This caused breaks between 1994 and 1995 for electricity production.

Transformation

- In the middle of 2014, most autoproducer electricity, heat and CHP plants in Turkey were reclassified as main activity producer due to a change in the legislation. This has resulted in electricity and heat amounts for autoproducer plants to record sharp generation changes from 2014 onwards.
- Data on electricity generated from **biofuels** are available from 1991.
- Electricity production from **wind** is available starting in 1998.

Consumption

- Prior to 1998, consumption in the **wood and wood products** sector includes that of the paper, pulp and printing industry.

United Kingdom

Source

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

General notes

- In the 2017 edition, the UK government revised the data time series for **municipal waste** and **solid biofuels** back to 2001. As a result, breaks in time series may occur between 2000 and 2001.
- The launch of a feed-in-tariff scheme in April 2010 resulted in a rapid increase of capacity and corresponding electricity production growth from **solar PV** in the following years

Supply

- In 2009, the **biogasoline** production was above the reported production capacity. This is because of the fact that the capacity had reduced at the end of the year, due to closure.

Transformation

- From 2015, the UK administration started collecting data from the main activity **solar PV** companies. Prior to this, all data were included under autoproducers.
- The consumption of **solid biofuels** has increased in 2015, as the largest power station in the UK half-way through the year converted a further unit from **coal** to **biomass**, plus the previously converted unit had a full year of operation in 2015 rather than just the last few months of 2014.
- Prior to 2013, due to data confidentiality reasons, one or two main-activity **municipal waste** plants had to be included within the autoproducer plant category. Since 2013, as there have been at least three main-activity companies, these plants have been reclassified from autoproducer plant to main activity electricity plant, with some CHP plants included under main electricity due to confidentiality reasons.
- New data for electricity production from main activity electricity **wind** plant became available in 2007.
- Heat production started to be reported from 2008 onward.
- Electricity production data for **solar PV** are available from 1999.

Consumption

- The UK administration undertook a survey of domestic wood consumption in 2015 and revised figures back to 2008. This resulted in breaks in time series for solid biofuels consumption in residential sector between 2007 and 2008.

United States

Source

U.S. Energy Information administration, Washington DC.

General notes

- Capacity is net summer capacity.

- Due to the change in reporting methodology for **liquid biofuels**, breaks in time series occur between 2012 and 2013. This is especially noticeable in **biodiesel** time series. Potential revisions to historical data could occur in the 2018 edition.
- **Solar PV** electricity production reported for main activity producers refers only for grid-connected central power stations. The IEA Secretariat estimated US **photovoltaic (PV)** electricity generation from autoproducers starting in 1999 by multiplying the dispersed and distributed **PV** capacity estimated by the US administration by an average capacity factor of 12%. The capacity factor was based on a report published in 2007 by the IEA Photovoltaic Power Systems Programme, Cost and Performance Trends in Grid-Connected Photovoltaic Systems and Case Studies.
- **Geothermal** supply and transformation data are estimated by the IEA Secretariat starting in 2009 because of efficiency discrepancies.
- Data on **liquid biofuels** became available in 1993.
- Data on **industrial waste** and gas from **biomass** for 1990 and 1991 were estimated by IEA Secretariat.

Transformation

- The EIA collects generation and consumption data from all plants 1 MW or more in capacity.
- In 2015, many plants did not report **industrial waste** capacity as a primary energy source. This results in break in time series between 2014 and 2015.
- From 2007 to 2009, **industrial waste** includes recovered heat from industrial processes. From 2010, the electricity produced from recovered heat is reported under other sources.
- The **solar collector surface** figures are estimated by IEA Secretariat since 2010.
- In the 2009 edition, the US administration changed their methodology for calculating heat production in CHP plants, and revised data back to 2006. This leads to breaks in time series between 2005 and 2006.
- For the United States, prior to 2000, autoproducers include small and independent power producers, which under IEA definitions are considered main activity producers.
- Prior to 1999, **solar thermal electricity** production includes generation from natural gas because some

natural gas units are attached to **solar thermal** plants and their production could not be separated.

- In the 2003 edition, the US administration reclassified some plants to autoproducers. This reclassification causes more breaks between 1998 and 1999.
- Heat production data for **solid biofuels** became available in 1991.

Consumption

- Due to an improved estimation methodology, there are some breaks in time series of industrial sector and other sector between 2009 and 2010 for many fuels types: For the industrial sector, this can be found in **geothermal**, **biogases** and **industrial waste** (paper, pulp and printing). For other sectors,

breaks can be shown in **geothermal** and **solar thermal**.

- Prior to 2008, heat produced by heat pumps was reported as **geothermal** use in residential and commercial/public services.
- Direct use of **solar thermal heat** in residential is available from 1999.
- Due to problems in reporting, there are numerous breaks in time series for the US data, particularly in 1992, 1999, 2001 and 2002. Care should be taken when evaluating consumption by sector since inputs of fuel to autoproducers are included in final consumption for some years. No data are available for most energy products in the construction and mining and quarrying industries.

7. UNITS AND CONVERSIONS

Primary energy conventions

When constructing an energy balance, it is necessary to adopt conventions for primary energy from several sources, such as nuclear, geothermal, solar, hydro, wind, etc. The two types of assumptions that have to be made are described below.

Choice of the primary energy form

For each of these sources, there is a need to define the form of primary energy to be considered; for instance, in the case of hydro energy, a choice must be made between the kinetic energy of falling water and the electricity produced. For photovoltaic electricity, the choice is between the solar radiation received and the electricity produced.

The principle adopted by the IEA is that the primary energy form should be the first energy form downstream in the production process for which multiple energy uses are practical. The application of this principle leads to the choice of the following primary energy forms:

- **Heat** from geothermal and solar thermal;
- **Electricity** from hydropower, wind, tide/wave/ocean and solar photovoltaic.

Calculation of the primary energy equivalent

There are essentially two methods that can be used to calculate the primary energy equivalent of the above energy sources: the partial substitution method and the physical energy content method.

The partial substitution method (the method used by the IEA): In this method, the primary energy equivalent of the above sources of electricity generation represents the amount of energy that would be necessary

to generate an identical amount of electricity in conventional thermal power plants. The primary energy equivalent is calculated using an average generating efficiency of these plants. This method has several shortcomings, including the difficulty in choosing an appropriate generating efficiency and the fact that the partial substitution method is not relevant for countries with a high share of hydroelectricity. For these reasons, the IEA has, as most of the international organizations have, adopted the physical energy content method.

The physical energy content method: This method uses the physical energy content of the primary energy source as the primary energy equivalent. As a consequence, there is an obvious link between the principles adopted in defining the primary energy forms of energy sources and the primary energy equivalent of these sources.

For instance, in the case of solar thermal and geothermal electricity production, where heat is selected as the primary energy form by the IEA, the primary energy equivalent is the quantity of heat generated in the geothermal or solar thermal plant for electricity generation. In the case of hydropower, wind, tide and solar PV, where electricity is selected as the primary energy form, the primary energy equivalent is the physical energy content of the electricity generated in the plant, which amounts to assuming an efficiency of 100%.

For geothermal, if no country-specific information was reported, the primary energy equivalent is calculated as follows:

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

Since these two types of energy balances differ significantly in the treatment of electricity from solar, hydro, wind, etc., the share of renewables in total energy supply will appear to be very different depending on the method used. As a result, when looking at the percentages of various energy sources in total supply, it is important to understand the underlying conventions that were used to calculate the primary energy balances.

Units

Original units

Electricity is expressed in gigawatt hours and heat is expressed in terajoules

Non-combustible renewables have original units of their primary energy form (see Primary energy conventions for the primary energy form of non-combustible renewables).

Primary solid biofuels, biogases, municipal waste, and industrial waste are presented in their original units in terajoules on a net calorific basis. The Secretariat does not receive information on volumes and other characteristics of these fuels.

Liquid biofuels and charcoal have original units in 1000 tonnes.

Energy balance units

The IEA energy balance methodology is based on the net calorific content of the energy commodities and a common unit of account. The unit of account adopted by the IEA is the tonne of oil equivalent (toe) which is defined as 10^7 kilocalories (41.868 gigajoules). This quantity of energy is, within a few percent, equal to the net heat content of 1 tonne of crude oil. Throughout this publication 1 tonne means 1 metric ton or 1000 kg.

Conversion (from original units to toe)

The change from using the original units to tonnes of oil equivalent implies choosing coefficients of equivalence between different forms and sources of energy. This problem can be approached in many different ways. For example, one could adopt a single equivalence for each major primary energy source in all

countries, e.g. 29 307 kJ/kg (7 000 kcal/kg) for hard coal, 41 868 kJ/kg (10 000 kcal/kg) for oil, etc.

The main objection to this method is that it results in distortions since there can be a wide spread between calorific values of fuels (i.e. liquid biofuels) in different countries.

For charcoal, biogasoline, biodiesels and other liquid biofuels, specific factors have been used for production, imports and exports based on consultations with experts from the national administrations.

The balances are expressed in terms of “net” calorific value. The difference between the “net” and the “gross” calorific value for each fuel is the latent heat of vaporisation of the water produced during combustion of the fuel. For coal and oil, net calorific value is about 5% less than gross, for most forms of natural and manufactured gas the difference is 9-10%, while for electricity and heat there is no difference as the concept has no meaning in this case. The use of net calorific value is consistent with the practice of the Statistical Offices of the European Communities and the United Nations.

Electricity data are converted from original units of gigawatt hours to million tonnes of oil equivalent using the relationship: 1 terawatt hour = 0.086 Mtoe.

Biofuels and waste

Data for primary solid biofuels, biogases, municipal waste and industrial waste are converted from original units in terajoules to energy balance units in tonne of oil equivalent using 1 terajoule = 0.00002388 Mtoe.

Data for charcoal and liquid biofuels are converted from original units in tonnes to energy balance units in tonne of oil equivalent using the average net calorific values given at the end of this section. Unless country-specific information has been provided, data are converted using the following average net calorific values:

- Charcoal: 30 800 kJ/kg
- Biogasoline: 26 800 kJ/kg
- Biodiesels: 36 800 kJ/kg
- Other liquid biofuels: 36 800 kJ/kg

Electricity

Figures for electricity production, trade, and final consumption are calculated using the energy content of the electricity (i.e. at a rate of 1 TWh = 0.086 Mtoe).

Hydroelectricity production and electricity produced by other non-thermal means (wind, tide/wave/ocean, photovoltaic, etc.) are accounted for similarly using 1 TWh = 0.086 Mtoe.

The primary energy equivalent of nuclear electricity is calculated from the gross generation by assuming a 33% conversion efficiency, i.e. 1 TWh = $(0.086 \div 0.33)$ Mtoe.

In the case of electricity produced from geothermal heat, if the actual geothermal efficiency is not known,

then the primary equivalent is calculated assuming an efficiency of 10%, so 1 TWh = $(0.086 \div 0.1)$ Mtoe.

Heat

Information on heat is supplied in terajoules (TJ) and 1 TJ = 0.00002388 Mtoe.

In the case of heat produced in a geothermal plant, if the actual geothermal efficiency is not known, then the primary equivalent is calculated assuming an efficiency of 50%, so 1 TWh = $(0.086 \div 0.5)$ Mtoe.

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

General conversion factors for energy

To:	TJ	Gcal	Mtoe	MBtu	GWh
From:	<i>multiply by:</i>				
TJ	1	2.388×10^2	2.388×10^{-5}	9.478×10^2	2.778×10^{-1}
Gcal	4.187×10^{-3}	1	1.000×10^{-7}	3.968	1.163×10^{-3}
Mtoe	4.187×10^4	1.000×10^7	1	3.968×10^7	1.163×10^4
MBtu	1.0551×10^{-3}	2.520×10^{-1}	2.520×10^{-8}	1	2.931×10^{-4}
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:	<i>multiply by:</i>				
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:	<i>multiply by:</i>					
U.S. gallon (gal)	1	8.327×10^{-1}	2.381×10^{-2}	1.337×10^{-1}	3.785	3.785×10^{-3}
U.K. gallon (gal)	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)

8. ABBREVIATIONS

kW	:	kilowatt
kW _p	:	kilowatt peak
kW _{th}	:	kilowatt thermal
GW	:	gigawatt
MW	:	megawatt (electric)
MW _{th}	:	megawatt thermal
kWh	:	kilowatt hour
MWh	:	megawatt hour
GWh	:	gigawatt hour
TWh	:	terawatt hour
GJ	:	gigajoule (10 ⁹ joules)
TJ	:	terajoule (10 ¹² joules)
EJ	:	exajoule (10 ¹⁸ joules)
m ²	:	metre squared
t	:	metric ton = tonne
kt	:	kilotonne (1000 tonnes)
1 toe	:	tonne of oil equivalent
1 ktoe	:	kilotonne of oil equivalent
1 Mtoe	:	million tonnes of oil equivalent
GDP	:	Gross domestic product
RES	:	Renewable energy Sources
TPES	:	Total primary energy supply
0 or 0.0	:	negligible
c	:	confidential data
e	:	estimated data
..	:	data not available
x	:	not applicable