



RENEWABLES ANNUAL QUESTIONNAIRE 2022-2023 AND HISTORICAL REVISIONS

July 2023

Attached is the annual questionnaire for renewables and waste which provides for the submission of 2022-2023 data and historical revisions where applicable.

Countries reporting to the IEA are requested to complete the questionnaire by **30 September**. Earlier submissions are welcome.

Countries reporting to Eurostat are requested to complete the questionnaire by **31 October** ([Regulation \(EC\) No 1099/2008 on energy statistics](#)). Earlier transmissions are welcome.

Please send your questionnaire to:

- International Energy Agency (IEA/OECD), Energy Data Centre
(the IEA will forward the data to the United Nations Economic Commission for Europe in Geneva).
- European Commission, Eurostat, Energy Statistics
(for the EU Member States, European Economic Area countries, EU Candidate Countries and Potential Candidates, Energy Community Contracting Parties)
- United Nations Statistics Division, Energy Statistics Section

Transmission details are provided in the “Data communication procedures” section.

Data Communication Procedures

IEA

9 rue de la Fédération, 75739, Paris, Cedex 15, France

Please complete data for your country on the Energy Validation Outlet:

<https://evo.iea.org>

Alternatively send the completed questionnaire electronically in a CSV or Excel file as an e-mail attachment to: renewaq@iea.org

For questions regarding the questionnaire, contact renewaq@iea.org.

Eurostat

European Commission – Eurostat, Unit E.5: Energy, 2920 Luxembourg
(for EU Member States, European Economic Area countries, EU Candidate Countries and Potential Candidates, Energy Community Contracting Parties)

The completed **MS Excel** questionnaire should be transmitted via the Single Entry Point following the implementing procedures of **EDAMIS** (Electronic Data Files Administration And Management Information System): <https://webgate.ec.europa.eu/edamis/> selecting the electronic data collection **ENERGY_RENEW_A**.

Countries reporting to Eurostat are reminded of the [Revision Policy for Energy Statistics](#). If you plan to revise historic data, please remember to transmit to Eurostat the [Revision pre-announcement form](#) as soon as possible.

All countries reporting to Eurostat are required to indicate “**Years to Load**”. Countries can select either the most recent period(s), full time series or any combination of years. Eurostat will load into its database only the time periods marked.

For questions regarding the questionnaire, contact estat-energy-annual@ec.europa.eu. The fuel manager will get back to you.

United Nations

United Nations Statistics Division, Energy Statistics Section
2 UN plaza, DC2-1414, New York, NY 10017, USA

The completed questionnaire should be transmitted by e-mail to:

Mr. Leonardo Souza, Chief, Energy Statistics Section

E-MAIL ADDRESS energy_stat@un.org

FAX (1-212)-963-0623

REPORTING INSTRUCTIONS

Data should be reported for calendar years. If fiscal year data have to be used, please state this clearly and specify the period covered.

For consistency between administrations and to conform with computer software, the data reported in this questionnaire should be numerical with precision of up to 3 decimal places in the unit shown for each table.

A consistent reporting scheme should be used (of 0, 1, 2 or 3 decimal places), and communicated in the Remarks page in order to ensure understanding that 18.130 is 18.130, rather than 18.132, rounded to 18.13, thus displaying as 18.130.

Reporting should be consistent across all time series for any given year, avoiding any inconsistencies between flows or products or technologies.

The definitions and reporting conventions used in this questionnaire are the same as those used in the other annual questionnaires (Coal (Solid fossil fuels and manufactured gases), Oil, Natural gas, and Electricity and heat). Please ensure that data on fuel used for electricity and heat production reported in this questionnaire are consistent with those reported for the same categories in the Electricity and heat questionnaire. Similarly, please ensure that data on liquid biofuels for blending with transport fuels reported in this questionnaire are consistent with those reported for the relevant flows in the Oil questionnaire.

Please report all data using Net calorific values.

Where data are not available, estimates should be given and identified as such in the Remarks page.

Any data reported under Not elsewhere specified should be explained in the Remarks page.

UNITS AND CONVERSION FACTORS

Report all figures to the nearest number with up to 3 decimal points of gigawatt-hours for electricity and terajoules for heat. For fuel balances, please report all data using Net calorific values or thousand tons when specifically mentioned. Figures for calorific values should be reported to the nearest whole number of kilojoules per kilogram.

(Examples: 18,436,156 kWh should be reported as "18.436 GWh" ("18", "18.4" , "18.44"); 1,728,800 kWh should be reported as "1.729 GWh" ("2", "1.7", "1.73");)

INTERNATIONAL STANDARD INDUSTRIAL CLASSIFICATION

In 2008, the United Nations and the European Commission have published in parallel their revised classification codes.

- United Nations:
International Standard Industrial Classification of all Economic Activities – ISIC, Rev.4
- European Commission - Eurostat:
Statistical classification of economic activities in the European Community NACE, Rev.2

DEFINITIONS OF RENEWABLE ENERGY AND WASTE SOURCES

While there are a limited number of renewable energy and waste sources, there are a large number of technologies allowing their exploitation, most of which are still at the research/development stage or have not yet reached commercial maturity. The renewable energy and waste sources and associated technologies listed below are those which are considered to be economically viable or approaching economic viability.

1. Hydro power

Potential and kinetic energy of water converted into electricity in hydroelectric plants. Hydro is a product a aggregate equal to the sum of pure hydro plants, mixed hydro plants and pure pumped storage plants.

- **Pure hydro plants:** hydro plants that only use direct natural water inflow and have no capacity for hydro pump storage (pumping water uphill).
 - **Run of river plant** is a type of plant that the natural flow and elevation drop of a river are used to generate electricity.
- **Mixed hydro plants:** hydro plants with natural water inflow into an upper reservoir where part or all equipment can be used for pumping water uphill; the electricity generated is a consequence of both natural water inflow and water previously pumped uphill.
 - of which: pumping – report portion of electricity generated in the pumped hydro mode (from water that was previously pumped uphill).
- **Pure pumped storage plants:** hydro plants with no natural water inflow into the upper reservoir; the vast majority of water that generates electricity was previously pumped uphill; abstracting from the rainfall and snowfall.

2. Geothermal

Energy available as heat emitted from within the earth's crust, usually in the form of hot water or steam. It is exploited at suitable sites:

- for electricity generation using dry steam or high enthalpy brine after flashing
- directly as heat for district heating, agriculture, etc.

3. Solar energy

Solar radiation exploited for hot water production and electricity generation. Passive solar energy for the direct heating, cooling and lighting of dwellings or other buildings is **not** included.

- **Solar photovoltaic** converts sunlight into electricity by the use of solar cells/panels which exposed to sunlight will generate electricity.
 - The following size subcategories are included in the questionnaire:
 - Less than 30 kW
 - Of which less than 10 kW
 - From 30 to 1000 kW
 - More than 1000 kW
 - For each of those, the questionnaire includes the rooftop and off-grid subcategories. Both off-grid and rooftop categories are not complementary, they are overlapping. Certain installations might fall under both of-which categories at the same time. An off-grid installation is one that is disconnected from the grid from the production perspective; hence, the installation cannot inject the electricity it produces into the grid. An installation is to be considered rooftop if it is attached to a building.
 - Report the PV electricity generation after the inverter (i.e. alternate current or AC). In case some installations have no conversion systems, i.e. electricity is used directly in DC (DC-only systems), e.g. small-scale off-grid systems, report the electricity generated in DC.
- **Solar thermal** can consist of:
 - a) solar thermal-electric plants, or
 - b) equipment for the production of domestic hot water or for the seasonal heating of swimming pools (e.g. flat plate collectors, mainly of the thermosyphon type)

4. Tide, wave, ocean

Mechanical energy derived from tidal movement, wave motion or ocean current and exploited for electricity generation.

5. Wind

Kinetic energy of wind exploited for electricity generation in wind turbines. Wind is a product aggregate equal to the sum of onshore wind and offshore wind.

- **Onshore wind:** production of electricity by wind in locations on-shore (inland, including lakes and other bodies of water located inland)
- **Offshore wind:** production of electricity by wind in locations off-shore (e.g. sea, ocean and artificial islands). In relation to off-shore wind production outside of the territorial waters of the concerned territory, all installations located in the exclusive economic zone of a country shall be taken into account.

6. Industrial waste (non-renewable)

Report waste of industrial non-renewable origin (solids or liquids) combusted directly for the production of electricity and/or heat. The quantity of fuel used should be reported on a **net** calorific value basis. Renewable industrial waste should be reported in the Solid biofuels, Biogases and/or Liquid biofuels categories. Waste incinerated without any heat recovery is excluded.

7. Municipal waste

Waste produced by households, hospitals and the tertiary sector (in general all waste that resembles household waste) combusted at specific installations for meaningful energy purposes. Waste incinerated without any heat recovery is excluded. The quantity of fuel used should be reported on a **net** calorific value basis.

- **Renewable:** Report that portion of municipal waste which is biological material.
- **Non-Renewable:** Report that portion of municipal waste which is non-biological material.

8. Solid biofuels

Covers organic, non-fossil material of biological origin which may be used as fuel for heat production or electricity generation. It comprises:

- **Charcoal:** covers the solid residue of the destructive distillation and pyrolysis of wood and other vegetal material.
- **Fuelwood, wood residues and by-products:** 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. The quantity of fuel used should be reported on a **net** calorific value basis.
 - **Wood 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.
- **Black liquor:** Energy from the alkaline-spent liquor obtained from the digesters during the production of sulphate or soda pulp required for paper manufacture.
- **Bagasse:** Fuel obtained from the fibre which remains after juice extraction in sugar cane processing.
- **Animal waste:** 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:** 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.
- **Industrial waste (renewable):** Solid renewable portion of industrial waste combusted directly at specific installations for meaningful energy purposes (for example natural rubber in waste rubber tires or natural fibres in textile wastes). The quantity of fuel used should be reported on a net calorific value basis.

9. Biogases

Gases composed principally of methane and carbon dioxide produced by anaerobic fermentation of biomass, or by thermal processes.

- **Landfill gas:** formed by the anaerobic digestion of landfill waste. The quantity of fuel used should be reported on a **net** calorific value basis.

- **Sewage sludge gas:** produced from the anaerobic fermentation of sewage sludge. The quantity of fuel used should be reported on a **net** calorific value basis.
- **Other biogases from anaerobic digestion:** such as biogases produced from the anaerobic fermentation of animal slurries and of waste in abattoirs, breweries and other agro-food industries. The quantity of fuel used should be reported on a **net** calorific value basis.
- **Biogases from thermal processes:** biogases produced from thermal processes (by gasification or pyrolysis) of biomass.

10. Liquid biofuels

The quantities of liquid biofuels reported in this category should relate only to the quantities of the pure biofuel. Indeed, liquid biofuels blended with fossil fuels must be reported in the oil questionnaire. Report under this category the following:

- **Biogasoline:** Liquid biofuels suitable to be blended with or replace motor gasoline from fossil origin.
 - Of which Bioethanol: this category includes bioethanol as part of biogasoline
- **Bio jet kerosene:** Liquid biofuels suitable to be blended with or replacing Jet kerosene from fossil origin.
- **Biodiesels:** Liquid biofuels suitable to be blended with or replace gas/diesel oil from fossil origin.
- **Other liquid biofuels:** Liquid biofuels not included in any of the previous categories.

Note: Table 1 requests data for three categories of Liquid biofuels: Biodiesels, Biogasolines and Other liquid biofuels. Table 2 requests that Liquid biofuels be split into five categories: **Biogasoline, of which Bioethanol, Bio jet kerosene, Biodiesels and Other liquid biofuels.** As a consequence, in Table 1, electricity and heat production from **Other liquid biofuels could also contain small amounts of Bio jet kerosene.** This difference in classification was made in order to reduce the amount of information requested because it is not expected that large quantity of Bio jet kerosene is being used in the transformation sector to generate electricity and heat.

Imports, exports and final consumption of liquid biofuels refer to quantities that have not been blended with transport fuels (i.e. in their pure form). Trade of liquids biofuels blended to transport fuels should be reported in the Oil questionnaire.

11. Ambient heat

Heat energy at a useful temperature level extracted (captured) by means of heat pumps that need electricity or other auxiliary energy to function. This heat energy can be stored in the ambient air, beneath the surface of solid earth or in surface water. The reported values shall be on the basis of the same methodology as used for the reporting heat energy captured by heat pumps pursuant to Directive 2009/28/EC, however all heat pumps should be included regardless their performance level.

12. Renewable synthetic fuels

Liquid or gaseous fuels other than biofuels or biogas, the energy content of which is derived from renewable sources other than biomass (i.e. non-biological sources). These fuels are considered renewable where the energy content of the fuel comes from renewable energy sources, but excluding bioenergy. This means that renewable synthetic fuels could be made using electricity and/or heat from wind, solar, aerothermal, geothermal or water (including hydrothermal sources, tide, wave and ocean energy). They cannot be derived from bioenergy sources such as biomass, landfill gas, sewage treatment plant gas or biogases. As the available energy source of these fuels comes from electricity or heat, the input raw materials must contain no usable energy. In practice this means that renewable synthetic fuels must be made from either water and/or carbon dioxide (CO₂). The simplest is renewable hydrogen.

GEOGRAPHICAL NOTES

Australia excludes its external territories;

Denmark excludes the Faroe Islands and Greenland;

France includes Monaco and the French overseas departments of Guadeloupe, Martinique, French Guiana, Réunion and Mayotte;

Italy includes San Marino and the Vatican (Holy See);

Japan includes Okinawa;

The Netherlands excludes the Antillean constituent countries of the Kingdom of the Netherlands (Aruba, Curaçao and Sint Maarten) and the special municipalities of the Caribbean Netherlands (Bonaire, Sint Eustatius and Saba);

Portugal includes the Azores and Madeira;

Spain includes the Canary Islands, the Balearic Islands, and Ceuta and Melilla

Switzerland does not include Liechtenstein;

United States: includes 50 States, and the District of Columbia

INSTRUCTIONS FOR COMPLETING INDIVIDUAL TABLES IN THE QUESTIONNAIRE

TABLE 1 GROSS ELECTRICITY AND HEAT PRODUCTION

Report electricity generation (GWh) and heat production (TJ) in Main Activity Producers and Autoproducers. Total electricity and heat production should be reported in the case of the Main Activity Producers supply system. In the case of Autoproducers, report total electricity generation but only heat sold to third parties.

TABLE 2 A, B SUPPLY, TRANSFORMATION AND ENERGY SECTORS AND ENERGY END-USE

1. Indigenous production

- **Geothermal energy:** Report all geothermal heat exploited for electricity generation or as direct energy use, without the use of heat pumps.
- **Solar thermal:** Report all primary solar heat exploited for electricity generation or as direct energy use. Production (TJ) is the heat available to the heat transfer medium, i.e. the incident solar energy less the optical and collectors losses. Passive solar and solar photovoltaic are not included.
- **Ambient heat:** This value is automatically calculated as a sum of the ambient heat captured by heat pumps (aerothermal, geothermal and hydrothermal).

For conversion of primary heat sources (i.e. geothermal and solar thermal) to electricity or heat, only the quantity of heat available to the turbine or heat exchanger should be reported. Losses occurring before the turbine or heat exchanger should not be included.

- **Industrial waste (non-renewable):** Report waste of industrial non-renewable origin (solids or liquids) exploited for electricity generation or direct energy use. Production (TJ) represents the heat content (Net Calorific Value, NCV) of the industrial waste used as fuel. Renewable industrial waste should be reported in the Solid biofuels, Biogases and/or Liquid biofuels categories.
- **Municipal waste:** Production (TJ) represents the heat content (NCV) of the municipal waste used as fuel.
- **Solid biofuels:** Production (TJ) represents the heat content (NCV) of the biomass used as fuel.
- **Biogases:** Production (TJ) corresponds to the heat content (NCV) of the biogases produced, including the gases consumed in the installation for the fermentation processes but excluding flared gases.
- **Liquid biofuels:** Production for energy purposes of finished products only, not the total volume of liquids into which liquid biofuels may have been blended (see Definitions of Renewable Energy and Waste Sources section). Note: Table 1 requests data for three categories of Liquid biofuels: Biodiesels, Biogasolines and Other liquid biofuels. Table 2 requests that Liquid biofuels be split into five categories: Biogasoline, of which Bioethanol, Bio jet kerosene, Biodiesels and Other liquid biofuels. As a consequence, in Table 1, electricity and heat production from **Other liquid biofuels could also contain small amounts of Bio jet kerosene**. This difference in classification was made in order to reduce the amount of information requested because it is not expected that large quantity of Bio jet kerosene is being used in the transformation sector to generate electricity and heat.
- **From solid biofuels:** Production of a renewable fuel as the result of a transformation from a solid biofuel.
- **From liquid biofuels:** Production of a renewable fuel as the result of a transformation from a liquid biofuel.

- **From gaseous biofuels:** Production of a renewable fuel as the result of a transformation from a gaseous biofuel.

2. Imports and Exports

Report the quantity of energy obtained from or supplied to other countries. Amounts are considered as imported or exported when they have crossed the political boundary of the country, regardless of whether customs clearance has taken place.

3. International marine bunkers

Report the quantities of renewable fuels 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. Exclude consumption by ships engaged in domestic navigation (see domestic navigation). 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. Exclude consumption by fishing vessels (see Fishing – Other sectors) and consumption by military forces (see Not elsewhere specified – Other sectors).

4. Stock changes

Report the difference between the opening stock level and closing stock level for stocks held on national territory. A stock build is shown as a negative number and a stock draw is shown as a positive number.

5. Inland consumption (Calculated)

This is defined as:

- Indigenous production
- + Imports
- Exports
- + Stock changes

6. Statistical difference

This is equal to the difference between the calculated gross consumption (as defined above) and the observed gross consumption which corresponds to the Final energy consumption plus the Transformation sector, the Energy sector and Distribution losses. National administrations sometimes obtain the data components of domestic availability from a variety of sources. Owing to differences in concepts, coverage, timing and definitions, observed and calculated inland consumption are often not identical. Reasons for any major statistical difference should be stated in the section provided for on the Remarks page.

In the statistical difference formula, the total final energy consumption is used without considering non-energy uses. The reason behind this lies in the absence of supply information for non-energy uses within the collected data. Therefore, the statistical difference exclusively pertains to energy uses.

7. Transformation sector

Report the quantities of renewables and waste used for the conversion of primary forms of energy to secondary (e.g. solid biofuels to electricity) or used for the transformation to derived energy products (e.g.: biogases used for blended natural gas). The Transformation Sector is divided into:

- **Main activity producer electricity** - Report quantities of renewables and waste used to produce electricity by all main activity producers. For countries reporting to Eurostat, reported quantities should be aggregated by type of unit and not by type of plant.
- **Main activity producer combined heat and power (CHP)** - Report quantities of renewables and waste used to produce electricity and heat by all main activity producers. For countries reporting to Eurostat, reported quantities should be aggregated by type of unit and not by type of plant.
- **Main activity producer heat** - Report quantities of renewables and waste used to produce heat by all main activity producers. For countries reporting to Eurostat, reported quantities should be aggregated by type of unit and not by type of plant.

- **Autoproducer electricity** - Report quantities of renewables and waste used to produce electricity by all autoproducers. For countries reporting to Eurostat, reported quantities should be aggregated by type of unit and not by type of plant. Otherwise, fuel used by plants containing at least one CHP units is to be reported under Autoproducer CHP.
- **Autoproducer combined heat and power (CHP)** - Report quantities of renewables and waste used that correspond to the quantity of electricity produced and heat sold by all autoproducers. For countries reporting to Eurostat, reported quantities should be aggregated by type of unit and not by type of plant.
- **Autoproducer heat** - Report quantities of renewables and waste used to produce heat sold by all autoproducers. For countries reporting to Eurostat, reported quantities should be aggregated by type of unit and not by type of plant
- **Patent fuel plants:** Report quantities of renewables and waste used to produce patent fuel. Renewables and waste used for heating and operation of equipment should not be reported here, but reported as consumption in the Energy sector.
- **BKB plants:** Report quantities of renewables and waste used to produce BKB and PB. Renewables and waste used for heating and operation of equipment should not be reported here, but reported as consumption in the Energy sector.
- **Blast furnaces** - Report actual quantities of renewable energy (e.g. charcoal) transformed in blast furnaces. Renewable energy used for heating and operations of equipment should not be reported here, but reported as consumption in the Energy sector.
- **Blended in the gas grid:** Report quantities of biogases blended with natural gas which are injected to the natural gas network.
- **Blended with liquid fossil fuels:** Report quantities of liquid biofuels which are not delivered to the final consumption directly but are blended and used with other petroleum products reported in the oil questionnaire.
- **From solid to solid transformation - charcoal production plants:** Report quantities of wood used for the production of Charcoal.
- **From solid to liquid transformation:** Report quantities of solid biofuels transformed into liquid biofuels, e.g. using pyrolysis at medium temperature.¹
- **From gas to liquid transformation:** Report quantities of renewable gaseous fuels transformed into liquid biofuels.¹
- **From liquid to gas transformation:** Report quantities of liquid biofuels transformed into gaseous biofuels.¹
- **From liquid to liquid transformation:** Report quantities of a certain liquid biofuels transformed into a different liquid biofuel (e.g. in bio-refineries).¹
- **For hydrogen production:** Report quantities of fuels used to produce hydrogen.
- **Not elsewhere specified - Transformation:** Data should only be reported here as a last resort. If the breakdown to the above categories is not possible, administrations should specify the nature of the transformation. Please explain on the Remarks page the basis for any estimates.

8. Energy sector

Report renewable energies and waste consumed by the Energy sector to support the transformation activities. For example: renewable energies and waste used for heating, lighting or operating pumps/compressors. Note those quantities of renewable energies and waste transformed into another energy form should be reported under the Transformation sector.

The Energy sector includes ISIC² Divisions 05, 06, 19 and 35 and Group 091 and Class 0892 and 0721 (NACE³ Divisions 05, 06, 19 and 35 and Group 09.1 and Class 08.92 and 07.21).

1. Note that, in accordance with the International Recommendations for Energy Statistics (IRES), charcoal is the sole renewable product classified as secondary. When reporting, it is essential to include only energy products and exclude feedstocks. For instance, sugar cane used to produce bioethanol does not fall under the category of energy commodities to be reported in the primary solid biofuels transformation from solid-to-liquid.

The energy sector is divided into:

- **Gasification plants (biogas):** Report renewables and waste consumed as energy necessary to support temperatures needed for anaerobic fermentation.
- **Own use in electricity CHP and heat plants:** Report consumption of renewables and waste in *main activity producer* electricity plants, combined heat and power plants (CHP) and heat plants.
- **Coal mines:** Report renewables and waste consumed as energy to support the extraction and preparation of coal within the coal mining industry. Renewables and waste consumed in pithead power stations should be reported in the Transformation sector.
- **Patent fuel plants:** Report renewables and waste consumed as energy at patent fuel plants.
- **Coke ovens:** Report renewables and waste consumed as energy at coking plant.
- **Oil refineries:** Report renewables and waste consumed as energy at petroleum refineries.
- **BKB plants:** Report renewables and waste consumed as energy at BKB / PB plants.
- **Gas works:** Report renewables and waste consumed as energy at gas works plants and coal gasification plants.
- **Blast furnaces:** Report renewables and waste consumed as energy in blast furnace operations.
- **Charcoal production plants:** Report renewables and waste consumed as energy at charcoal plants.
- **Not elsewhere specified - Energy:** Data should only be reported here as a last resort. If the breakdown to the above categories is not possible, administrations should specify the nature of the plants. Please explain on the Remarks page the basis for any estimates.

9. Distribution losses

Report all losses which occur due to transport and distribution.

10. Total final energy consumption

Observed is equal to total energy consumption in industry, transport and other sectors.

Calculated is defined as Gross consumption minus the Transformation sector, the Energy sector, Distribution losses and Statistical differences.

11. Industry sector

Report renewable energies and waste consumed by industrial undertakings in support of their primary activities.

Report quantities consumed in heat plants or CHP plants for the production of heat used by the plant itself. Quantities consumed for the production of heat that is sold, and for the production of electricity should be reported under the appropriate Transformation sector.

- **Iron and steel:** ISIC Group 241 and Class 2431 (NACE Groups 24.1, 24.2, 24.3 and Classes 24.51 and 24.52). To avoid double counting, fuel used in Blast furnaces should be reported in the transformation sector.
- **Chemical and petrochemical:** ISIC and NACE Divisions 20 and 21.
- **Non-ferrous metals:** ISIC Group 242 and Class 2432 (NACE Group 24.4 and Classes 24.53 and 24.54).
- **Non-metallic minerals:** ISIC and NACE Division 23. Report glass, ceramic, cement and other building materials industries.
- **Transport equipment:** ISIC and NACE Divisions 29 and 30.
- **Machinery:** ISIC and NACE Divisions 25, 26, 27 and 28. Report fabricated metal products, machinery and equipment other than transport equipment.

2. International Standard Industrial Classification of all Economic Activity, Series M, No 4/Rev. 4, United Nations, New York, 2008

3. Statistical classification of the economic activities in the European Community (NACE Rev.2) EC-Eurostat, 2008.

- **Mining (excluding energy producing industries) and quarrying:** ISIC Divisions 07 and 08 and Group 099 (NACE Divisions 07 and 08 and Group 09.9).
- **Food, beverages and tobacco:** ISIC and NACE Divisions 10, 11 and 12.
- **Paper, pulp and printing:** ISIC and NACE Divisions 17 and 18. Includes production of recorded media.
- **Wood and wood products (other than pulp and paper):** ISIC and NACE Division 16.
- **Construction:** ISIC and NACE Divisions 41, 42 and 43.
- **Textile and leather:** ISIC and NACE Divisions 13, 14 and 15.
- **Not elsewhere specified - Industry:** If your country's industrial classification of fuels consumption does not correspond to the above ISIC or NACE codes, please estimate the breakdown by industry and include in Not elsewhere specified only consumption in sectors which is not covered above. ISIC and NACE Divisions 22, 31 and 32 are included here.

12. Transport sector

Report fuels used in all transport activity irrespective of the economic sector in which the activity occurs (except military fuel use, see Other sectors). Fuels used for heating and lighting at railway and bus stations and airports should be reported in Commercial and public services. Please note:

- **Rail:** Report all consumption by rail traffic, including industrial railways and transport as part of urban or suburban transport systems (e.g. metro, tram).
- **Road:** Report fuels for use in road vehicles. Includes fuel used by agricultural vehicles on highways. Excludes military use (see Other sectors - Not elsewhere specified). Excludes liquid biofuels reported as Blended with fossil fuels and biogases reported as Blended in the gas grid.
- **International aviation:** Report quantities of renewable aviation fuels delivered to aircraft for international aviation bunkers. The domestic/international split should be determined on the basis of departure and landing locations and not by the nationality of the airline. Exclude fuels used by airlines for their road vehicles (see Not elsewhere specified – Transport sector) and military use of aviation fuels (see Not elsewhere specified – Other sectors).
- **Domestic aviation:** Report quantities of renewable aviation fuels delivered to aircraft for Domestic aviation – commercial, private, agricultural, etc. Include fuel used for purposes other than flying, e.g. bench testing of engines. 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). Exclude fuels used by airlines for their road vehicles (see Not elsewhere specified – Transport sector) and military use of aviation fuels (see Not elsewhere specified – Other sectors).
- **Domestic navigation:** Report fuels delivered to vessels of all flags not engaged in international navigation. Domestic navigation 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).
- **Not elsewhere specified - Transport:** Report fuels used for transport activities not included elsewhere. Please state on the Remarks page what is included under this heading.

13. Other sectors

- **Commercial and public services:** These activities are covered by ISIC and NACE Divisions 33, 36, 37, 38, 39, 45, 46, 47, 52, 53, 55, 56, 58, 59, 60, 61, 62, 63, 64, 65, 66, 68, 69, 70, 71, 72, 73, 74, 75, 77, 78, 79, 80, 81, 82, 84 (excluding Class 8422), 85, 86, 87, 88, 90, 91, 92, 93, 94, 95, 96 and 99. Report fuels consumed by business and offices in the public and private sectors. Note that electricity and purchased heat use at railway, bus stations and airports should be reported in this category and not shown in the Transport sector. Also includes fuel used by all non-transport activities of ISIC and NACE Divisions 49, 50 and 51.
- **Residential:** Report fuels consumed by all households including "households with employed persons (ISIC and NACE Divisions 97 and 98)".

- **Agriculture and forestry:** Report fuels consumed by users classified as agriculture, hunting and forestry by ISIC as follows: ISIC Divisions 01 and 02 (NACE Divisions 01 and 02).
- **Fishing:** Report fuels used for inland, coastal and deep-sea fishing. Fishing should cover fuels delivered to ships of all flags that have refuelled in the country (include international fishing). Also include energy used in the fishing industry as specified in ISIC and NACE Division 03.
- **Not elsewhere specified – Other:** Report activities not included elsewhere (such as ISIC and NACE class 8422). This category includes military fuel use for all mobile and stationary consumption (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. Please state on the Remarks page what is included under this heading.

14. Table 2B

- **Ambient Heat:** Please supply the ambient heat captured by the heat pump (i.e. the renewable energy input into the heat pump). Please report it on Net Calorific Basis. Please note that the useful heat delivered by the heat pumps (output) should not be reported here, but in Table 1. Report the subcategory “Of which from heat pumps with SPF above the threshold”. For countries reporting to Eurostat, the SPF (seasonal performance factor) threshold should be in accordance with Directives 2009/28/EC and (EU) 2018/2001 on the promotion of the use of energy from renewable sources.
- **Thermal Energy Input to Heat pumps:** Report the thermal energy input (e.g. natural gas) used for running the heat pump. Please report it on Net Calorific Value basis.
- **Electricity Input to Heat pumps:** Report the electricity input used for running the heat pump.

TABLE 3 A

TECHNICAL CHARACTERISTICS OF INSTALLATIONS AT THE END OF THE YEAR

Report the technical characteristics of renewable energy and waste installations. The average net calorific values of Liquid biofuels and Charcoal should also be reported at the end of this table.

1. Net maximum electrical capacity - classification by technology

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 should relate to the maximum capacities on 31st of December and be expressed in megawatts (MW). The reported electrical capacity should include both electricity (only) and CHP plants.

Pumped storage capacity from pure pumped storage plants should be reported in ‘Hydro’, under ‘Pure pumped storage’. The entire capacity from mixed plants should be reported in ‘Hydro’, under ‘Mixed plants’. Capacity from conventional hydro plants should be reported in ‘Hydro’, under ‘Pure hydro’. The sum of pure hydro, mixed and pure pumped storage should equal the total ‘Hydro’.

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. Pure pumped storage plants are plants with no natural inflow, producing electricity only from water previously pumped uphill.

Capacity of solar PV should be reported in ‘Solar photovoltaic’, under detailed plant sizes, rooftop and off-grid when applicable. Report capacities in their corresponding category, AC (alternate current) or DC (direct current) values. For more information, consult Annex 3.

Wind capacity should be reported under relevant category (onshore / offshore) based on the plant location.

If, for some reason, only gross capacity data can be provided, please state this clearly. It is assumed that all equipment is in full working order, that the power produced can be disposed of without any restrictions and that optimum conditions prevail as regards primary sources (i.e. flow and head in the case of hydro plant; grade and quantity of fuel in hand and water supply, temperature, and purity in the case of thermal plant, and assuming that the output and method of production in CHP plant are those which lead to maximum electricity production).

2. Solar collectors surface

The solar collectors surface relates to the production of solar thermal heat; solar collectors surface used for electricity generation are not to be reported here (solar PV and concentrated solar power). Please report the surface of all solar collectors; glazed and unglazed collectors, flat-plate and vacuum tube with a liquid or air as the energy carrier.

3. Liquid biofuels plants capacity

Please report the production capacity, at the end of the year, in terms of tonnes of products per year.

4. Liquid biofuels densities

Please report the average density of each liquid biofuel, in kilograms per litre.

5. Average net calorific values

Please report the *net* calorific values. Net data will be used for calculating the conversion factors for the Energy Balances. If detailed information on calorific values for each flow is not available, please report an average value.

Calorific values should be reported in kilojoules per kilogramme where available. If calorific values are reported in other units, please indicate what units are used.

TABLE 3 B TECHNICAL CHARACTERISTICS OF HEAT PUMPS INSTALLATIONS AT THE END OF THE YEAR

Report the technical characteristics of heat pump installations.

1. Net maximum thermal capacity - classification by technology

The net maximum capacity is the maximum active thermal energy that can be supplied, continuously, with all plant running.

The reported figures should relate to the maximum capacities on 31st of December and be expressed in megawatts (MW_{th}) and all heat pumps should be included.

If, for some reason, only gross capacity data can be provided, please state this clearly.

Report the subcategory “Of which from heat pumps with SPF above the threshold”. For countries reporting to Eurostat, the SPF (seasonal performance factor) threshold should be in accordance with Directives 2009/28/EC and (EU) 2018/2001 on the promotion of the use of energy from renewable sources.

2. Average Seasonal Performance Factor (SPF)

The SPF is weighted average seasonal performance factor, which refers to the ‘net seasonal coefficient of performance in active mode’ ($SCOP_{net}$) for electricity driven heat pumps or ‘net seasonal primary energy ratio in active mode’ ($SPER_{net}$) for thermally driven heat pumps.

Report the subcategory “Of which from heat pumps with SPF above the threshold”. For countries reporting to Eurostat, the SPF (seasonal performance factor) threshold should be in accordance with Directives 2009/28/EC and (EU) 2018/2001 on the promotion of the use of energy from renewable sources.

3. Average time usage

The Average time usage means the assumed annual number of hours a heat pump has to provide heat to deliver the total usable heat delivered by heat pumps. The figure should be reported in the unit of hour (hr).

Report the subcategory “Of which from heat pumps with SPF above the threshold”. For countries reporting to Eurostat, the SPF (seasonal performance factor) threshold should be in accordance with Directives 2009/28/EC and (EU) 2018/2001 on the promotion of the use of energy from renewable sources.

TABLE 4 PRODUCTION OF SOLID BIOFUELS AND BIOGASES

Report the energy production in **net** Terajoules (TJ) produced from the fuels indicated in the table.

TABLE 5 and TABLE 6 IMPORTS BY COUNTRY OF ORIGIN AND EXPORTS BY COUNTRY OF DESTINATION

For geographical definitions see Geographical notes section.

The tables concern 6 selected fuels listed as follow: biogasoline, of which bioethanol, bio jet kerosene, biodiesel, other liquid biofuels and wood pellets

Imports: Imports of fuels should be reported by ultimate origin (the country in which the fuels were produced). Only imports destined for use in the country are considered.

Exports: Only report exports of domestically produced fuels. Exports should be reported by ultimate destination (the country in which the fuels will be consumed). Fuels transiting your country should not be included.

Where no origin or destination can be reported, consider whether the quantities can be reported under one of the non-specified regional aggregates (Other Africa, Other Asia Oceania, etc.) otherwise the country “Not elsewhere specified” might be used.

Statistical differences may arise if only total import and export are available on the above basis, while the geographical breakdown is based on a different survey, source or concept. In this case, report the differences in the ‘Not elsewhere specified’ category.

TABLE 7 NON-ENERGY USE OF RENEWABLES

Please report here renewable fuels used for non-energy purposes (e.g. bio-lubricants, bio-asphalt, biogas used as a feedstock in refineries, etc.). These data are collected independently of biofuels used for energy use. Therefore, the supply side of fuels used for non-energy purposes is not collected. Only biofuels replacing fossil fuels are collected. The list of products and uses that should be reported under the non-energy use of renewables includes the following items:

- Biogas replacing natural gas or LNG as a feedstock for industry (e.g. chemical and petrochemical or other)
- Bio-methanol used to replace fossil methanol in industry (e.g. in the automobile industry as coolant or as a feedstock in the production of formaldehyde, DME, acetic acid, MTBE, and others).
- Bio-ethanol replacing fossil ethanol as feedstock (e.g. to produce ethyl acetate, acetic acid, ethylene, or solvents for cosmetics, pharmaceuticals, detergents, inks, coating)
- Biomass (lignin) or organic waste used for bio-bitumen/bio-asphalt production
- Vegetable oil used as industrial feedstock for the production of bio-lubricants, vegetable waxes and bio-naphtha

- Bio-based plastics (from starch, cellulose, vegetable oils, lignin/wood, proteins and polysaccharides) replacing petrol-based plastics (e.g. polyethylene, polypropylene, PET...), e.g. for packaging, bags, cutlery and any other application replacing fossil plastics.
- Primary or secondary solid biofuels replacing fossil coking coal in the carbon anodes for the production of steel (not the blast furnace process)
- Primary or secondary solid biofuels replacing fossil coal (and syngas) for the production of ammonia, hydrogen, methanol, dimethyl ether, acetic acid and anhydride, acetylene, carbide chemicals and aromatic hydrocarbons

The following exceptions are excluded from reporting non-energy use:

- Biomass used in construction and furniture
- Bio-alcohols or other bio-feedstocks used in food industry
- Cotton/natural fibres used in textile industry
- Biomass used for paper/cardboard production

ANNEX 1: DEFINITIONS FOR ELECTRICITY AND HEAT

The questionnaires seek information on the fuel requirements for, and the generation of electricity and heat according to producer and generating plant types.

Types of producer:

Producers are classified according to the purpose of production:

- **Main activity producer** 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** 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.

Types of Units:

Units are classified according to their technical design:

- **Electricity unit** refers to a unit designed to produce/generate electricity only.
- **Combined heat and power (CHP) unit** refers to a unit which is designed to produce/generate both heat and electricity simultaneously. It is sometimes referred to as a co-generation.
- **Heat unit** refers to a unit which is designed to produce/generate only heat.

Types of Plants:

Plant is defined as a set of units. Plants are classified according to the combination of units:

- **Electricity plant** refers to a plant which is composed of electricity units only.
- **Heat plant** refers to a plant which is composed of heats units only.
- **Combined heat and power (CHP) plant** refers to all other combinations of units. For example, it can be a plant that has one CHP unit. Another example of CHP plant is a combination of one electricity unit and one heat unit.

Reporting conventions for Electricity and Heat:

It should be noted that:

- **Electricity** production reported for *Autoproducers* should be the total quantity of electricity generated.
- All **heat** production from *Main activity producers* should be reported. However, heat production reported for *Autoproducers* should comprise only the heat sold to third parties. Heat consumed by autoproducers should not be reported as heat production and heat consumption.
- Report in the transformation sector only those quantities of fuels used to generate the amounts of electricity and heat reported in the questionnaire. Thus the quantities of fuel consumed for the production of heat by autoproducers which is not sold will remain in the figures for the final consumption of fuels by the relevant sector of economic activity.

The reporting requirements for *transformation sector* activities can be summarised schematically as follows:

	Electricity	CHP	Heat
Main activity producer	Report all production and all fuel used	Report all electricity and heat produced and all fuel used	Report all heat produced and all fuel used
Autoproducer		Report all electricity produced and only heat sold and corresponding fuel used	Report only heat sold and corresponding fuel used

In this questionnaire, the term **Combustible fuels** refers to fuels that are capable of igniting or burning, i.e. reacting with oxygen to produce a significant rise in temperature.

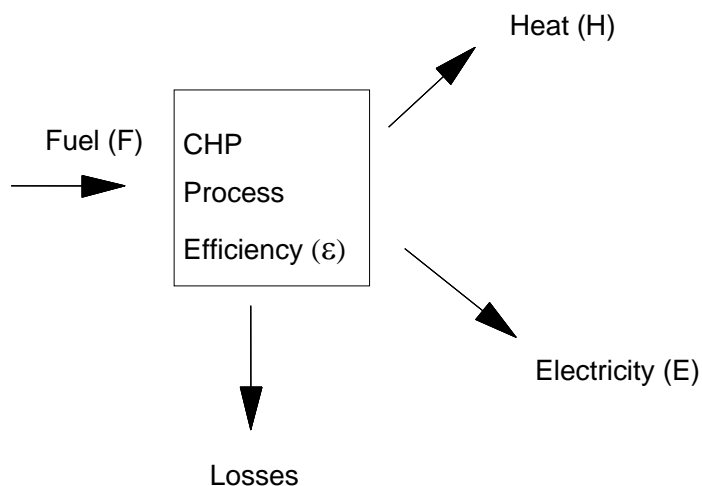
Reporting to **Eurostat** on the basis of **units** is **mandatory**; please see [Regulation \(EC\) No 1099/2008 on energy statistics](#). To the maximum extent feasible, consistency of reported figures should be ensured with data reported in the *CHP questionnaire* to Eurostat ([Directive 2012/27/EU on energy efficiency](#)). Please see the [reporting instructions for Eurostat's CHP questionnaire](#).

Reporting to the **IEA**: If possible, fuel inputs and electricity/heat outputs should be reported 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 plant noted above should be adopted.

ANNEX 2: METHODOLOGY FOR APPORTIONING FUEL INPUT IN A CHP PLANT

In cases where national administrations have not adopted a methodology for this purpose, the following approach is proposed where the fuel input is divided between electricity and heat in proportion to their shares of the CHP useful energy output.

In CHP units the relationship between the fuel input and the output electricity and heat, without regard to the type of thermodynamic process, may be modelled simply in the diagram below.



The following relationship defining overall efficiency (ε) is:

$$\varepsilon = (H + E) / F$$

The definition given proposes that the imputed fuel use for electricity, F_e , and (as a consequence) that for heat, F_h , are:

$$F_e = F - H / \varepsilon = F (E / (E + H))$$

$$F_h = F - E / \varepsilon = F (H / (E + H))$$

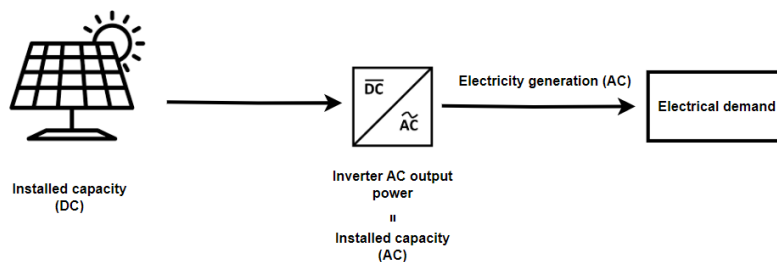
The formula should be used only where national administrations have not already adopted a methodology for the purpose of reporting CHP on a unit basis. Please note that reporting to Eurostat on the basis of units is mandatory. Please see the [reporting instructions for Eurostat's CHP questionnaire](#).

ANNEX 3: SOLAR PV CAPACITY

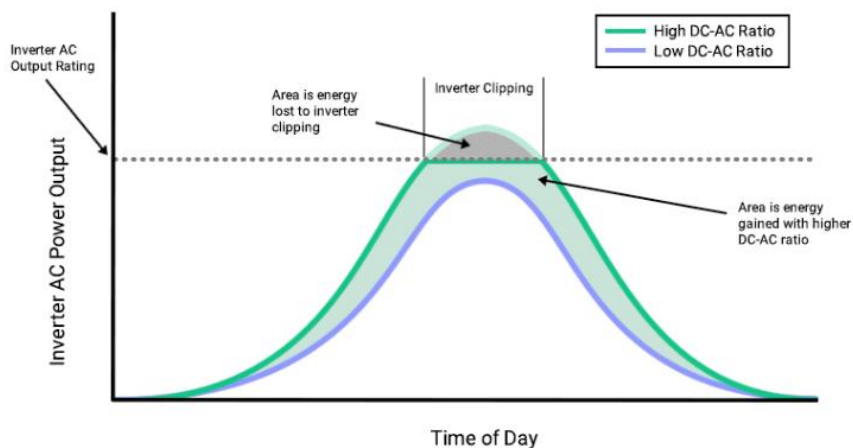
CONTEXT

A solar PV system works by capturing sunlight using photovoltaic cells and converting it into DC (direct current) electricity. The DC electricity is then usually converted into AC (alternate current) electricity using an inverter, as most electrical devices and systems use AC power.

Therefore, there are differences between the solar PV capacity in DC and in AC. The former is the electrical capacity of the installed panel(s) that generate(s) electricity in DC. The latter is the electrical capacity of the AC side of the DC-AC conversion system, i.e. the maximum AC power the inverter(s) can provide. Below an illustration of a common PV system scheme is reported.



In the past, the DC capacity was similar to the AC. However, due to recent developments in the DC-AC conversion system sizing, these two values may now differ by 20-30%. During the solar system sizing phase, a possible design choice, for a given investment, is to install a DC capacity greater than the inverter AC output rating. The outcome of this approach is shown in the picture below, where the curves represent the AC output power in case AC and DC rating are similar (blue curve) and in case the DC power rating is significantly greater than the AC (green curve). In the latter case, some energy is lost because the inverter cannot work during the peak (“inverter clipping” area) but some energy is gained in the off-peak period because of the greater DC capacity installed.



WHAT TO REPORT AND HOW

In Table 3a, report both the DC capacity and the AC capacity for each Solar PV product. Each Solar PV category has two versions: one ending with (DC), the other with (AC). Report the DC and AC capacity accordingly.

WHAT TO DO IF ONLY ONE TYPE OF CAPACITY IS AVAILABLE

It is recommended to investigate these figures with your data providers and/or estimate an average DC/AC conversion ratio for each Solar PV category. In case this is not possible, report either only DC or only AC capacity based on the kind of data at your disposal for each category. It is reminded that it is mandatory to report at least one of them.

TYPICAL RATIOS

The ratio between DC and AC capacity for various solar PV systems follows distinct patterns. For residential rooftop systems, the ratio usually remains at 1 to 1, while for larger commercial and industrial (C&I) systems, it generally falls within the range of 1.0 to 1.1. In the case of utility-scale systems, the ratio typically ranges from 1.2 to 1.3; however, in some instances, particularly in utility-scale systems, the ratio can occasionally reach as high as 1.5. These usual ranges must be used carefully as they are installation-specific and influenced by country-specific policies and practices. It is always recommended to investigate these figures with your data providers.

SYSTEMS WITH PARTIAL OR NO CONVERSION

In some cases, such as in remote areas with limited access to the electrical grid, it may be more practical to use direct current without converting it to AC. This is known as a DC-only system. In these systems, the DC electricity generated by the photovoltaic cells is directly used to power DC devices. Since the amount of capacity of these systems is generally small, a DC-only category has not been deemed necessary. In this case, report only the DC capacity and specify in the remarks the amount of capacity of this kind.

In addition, some large-scale PV plants, particularly those that are connected to the electrical grid, may use both DC and AC systems in different parts of the plant. For example, the photovoltaic cells may generate DC electricity, which is then converted to AC electricity for distribution on the grid, but some portions of the plant may use DC power directly. In this case, report the total electricity generated, DC and AC, under electricity generation and the AC and DC capacities as usual. Report the amount of DC-only component in the remarks sheet as for the previous case.

ELECTRICITY GENERATION

Report the electricity generation after the inverter. In case some installations have no conversion systems, i.e. electricity is used directly in DC (DC-only systems), e.g. small-scale off-grid systems, report the electricity generated in DC.

ANNEX 4: LIST OF ABBREVIATIONS

BKB	Brown coal briquettes
CHP	combined heat and power (plant)
CV	calorific value
EFTA	European Free Trade Association
EU	European Union
IEA	International Energy Agency
ISIC	International Standard Industrial Classification
J	joule
kg	kilograms
kJ	kilojoules
MW	megawatt, or one watt x 10 ⁶
MWh	Megawatt/hour, or one watt x one hour x 10 ⁶
NACE	Statistical Classification of Economic Activities in the European Community
NCV	net calorific value
PB	Peat briquettes
PV	photovoltaic
TJ	terajoule, or one joule x 10 ¹²

ANNEX 5: TABLE RELATIONS IN THE RENEWABLE AND WASTE QUESTIONNAIRE

