ELECTRICITY AND HEAT

ANNUAL QUESTIONNAIRE

2022-2023

AND HISTORICAL REVISIONS

July 2024

Attached is the annual questionnaire for electricity and heat (=AEHQ) which provides for the submission of 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 in a CSV or Excel file as an e-mail attachment to eleaq@iea.org

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

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Eurostat

European Commission – Eurostat, Unit E.5: Energy, L-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_ELECT_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.

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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, United Nations Statistics Division

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 Renewables). Please ensure that data on fuel used for electricity and heat production reported in the other annual questionnaires are consistent with those reported for the same categories in the Electricity and heat questionnaire.

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.

(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");.)

For fuel used for electricity and heat production in Table 6, please report all data using Net calorific values, except when specifically mentioned that Gross calorific values should be used, as is the case for Natural gas and the manufactured gases on the Coal questionnaire.

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 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 producers:

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.
- ***Combined heat and power (CHP) unit in full CHP mode*** refers to a CHP unit which is operated with an annual overall (transformation) efficiency of ≥ 75% or ≥ 80% depending on the used technology.

  For countries reporting to Eurostat, the technologies refer to:

  ≥ 75%: gas turbine with heat recovery, internal combustion engine, steam backpressure turbine and other technologies... …….
  ≥ 80% combined cycle, steam condensing turbine

  See also DIRECTIVE (EU) 2023/1791 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 13 September 2023 on energy efficiency and amending Regulation (EU) 2023/955 (recast), Annex III, General Principles, Part I, general principles (1) (a) and (b).

  Data for these CHP units working in full CHP mode are reported to Eurostat in the CHP questionnaire in tables 1B1 and 1C1 (Efficient CHP units)
- ***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.
- Countries reporting to Eurostat need to report CHP data based on units and not on plants.

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 produced and then consumed on-site by autoproducers should not be reported as heat production and heat consumption, except under the *Auto-consumed CHP heat* section of tables 1 and 2 of the AEHQ.
- 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 (including auto-consumed CHP heat) will remain in the figures for the final energy consumption of fuels by the relevant sector of economic activity.

Specific conventions for tables 1 and 2 of the AEHQ:

- For the category "*of which in full CHP mode*" report only the energy produced when the CHP units operate in full CHP mode. This is a subcategory of the main activity / autoproducer CHP.
- For the category "auto-consumed CHP heat", report the amount of unsold CHP heat generated and consumed on-site by autoproducers.

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

<table>
<tr><th></th><th>Electricity</th><th>CHP</th><th>Heat</th></tr>
<tr><td>Main activity producer</td><td rowspan="2">Report all production and all fuel used</td><td>Report all electricity and heat produced and all fuel used</td><td>Report all heat produced and all fuel used</td></tr>
<tr><td>Autoproducer</td><td>For electricity: report all electricity produced and all fuel used.

For heat:
For heat sold report all heat produced and corresponding fuel input (table 6 of the AEHQ).
For “Auto-consumed CHP heat” report the amount of unsold heat generated and consumed on-site by autoproducers.</td><td>For all flows, report only the amounts of heat sold and corresponding fuel input (table 6 of the AEHQ).
Note that the flow “Auto-consumed CHP heat” only applies to CHP units and not to Heat units.</td></tr>
</table>

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.

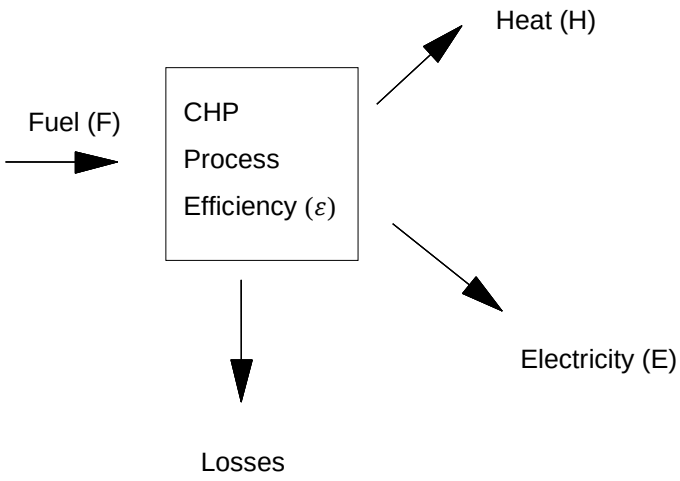
Reporting to **Eurostat** on the basis of **units** is **mandatory**; please see Regulation (EC) No 1099/2008 on energy statistics. To the maximum extent feasible, consistency of reported figures should be ensured with data reported in the *CHP questionnaire* to Eurostat (Directive 2012/27/EU on energy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

METHODOLOGY FOR APPORTIONING FUEL INPUT IN A CHP PLANT/UNIT

In cases where national administrations have not adopted a more accurate 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.

GEOGRAPHICAL NOTES

Australia excludes its external territories;

Denmark excludes the Faroe Islands and Greenland;

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

Italy includes San Marino and the 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 District of Columbia.

INSTRUCTIONS FOR COMPLETING INDIVIDUAL TABLES IN THE QUESTIONNAIRE

TABLES 1 AND 2
ANNUAL GROSS AND NET ELECTRICITY AND HEAT PRODUCTION

For a proper understanding of the definitions of categories in the table, respondents are urged to read the note 'Definitions for Electricity and Heat', reproduced on pages 3-4.

Table 1 refers to **gross** electricity and heat production:

Gross electricity production is the sum of the electrical energy production by all the generating sets concerned (including pumped storage and batteries) measured at the output terminals of the main generators.

Gross heat production is the total heat produced by the installation and includes the heat used by the installation's auxiliaries which use a hot fluid (space heating, liquid fuel heating, etc.) and losses in the installation/network heat exchanges, as well as heat from chemical processes used as a primary energy form.

Note that for ***autoproducers***, heat used by the undertaking for its own processes is not included here; only heat sold to third parties should be reported. As only heat sold to third parties is reported, gross heat production for autoproducers will be equal to net heat production.

CHP in full CHP mode, report only the energy produced when the CHP units operate in full CHP mode. This is a subcategory of the column CHP.

Auto-consumed CHP heat is the amount of unsold heat generated and consumed on-site by autoproducers CHP units.

Table 2 refers to **net** electricity and heat production:

Net electricity production is equal to the gross electricity production less the electrical energy absorbed by the generating auxiliaries and the losses in the main generator transformers.

Net heat production is the heat supplied to the distribution system as determined from measurements of the outgoing and return flows.

Tables 1 and 2 - Electricity and Heat production are divided as follows:

1. **Nuclear**

   Energy released by nuclear fission or nuclear fusion.

2. **Hydro-power**

   Potential and kinetic energy of water converted into electricity in hydroelectric plants. Pumped storage from mixed and pure pumped storage plants should be included.

3. **Pumped hydro**

   It includes pure pumped storage plants generation and the pumped storage generation portion of mixed plants. It is included in Hydro.

4. **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, or
   - directly as heat for district heating, agriculture, etc.

5. Solar energy

Solar radiation exploited for electricity generation.

- **Solar photovoltaic** converts sunlight into electricity by the use of solar cells usually made of semi-conducting material which exposed to light will generate electricity.

  Report the PV electricity generation after the inverter (i.e alternate current or AC). In cases of installations with 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. See Annex 2 for further information.

- **Solar thermal** can consist of:

  a) solar thermal-electric plants, or

  b) equipment for the production of heat for sale (hot water or steam)

6. Tide/Wave/Ocean

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

7. Wind

Kinetic energy of wind exploited for electricity generation in wind turbines.

8. Combustible fuels

Refers to fuels that are capable of igniting or burning, i.e. reacting with oxygen to produce a significant rise in temperature. They are combusted directly for the production of electricity and/or heat.

9. Heat from chemical processes

Report only the heat originating from processes without input energy, such as a chemical reaction (e.g. the treatment of zinc oxide ore with hydrochloric acid). Note that waste heat originating from energy driven processes is not considered as a primary energy source. Therefore, it should be reported as heat produced from the corresponding fuel.

10. Other sources

Report electricity or heat production from sources other than those listed.

Examples of this include, but are not limited to:

- **Electricity:** Electricity generated using heat provided via the grid or from autoproducers, from fuel cells.
- **Heat:** Recovered waste heat from industry sold to third parties.

Please provide details of the sources included on the Remarks page.

11. Other sources - of which: from (derived/district) heat

Report the portion of electricity or heat production from other sources derived from heat e.g. recovered heat, purchased heat, waste heat.

12. Other sources - of which: from batteries

Report the portion of electricity or heat production from other sources derived from batteries.

13. Heat pumps

Report the heat output from heat pumps only where the heat is sold to third parties (i.e. in cases where production occurs in the Transformation sector).

14. Electric boilers

Report the heat from electric boilers where the output is sold to third parties. Report the electricity used in such boilers in Table 3.

TABLE 3
ELECTRICITY AND HEAT SUPPLY AND CONSUMPTION

1. Gross electricity production

See definition in "Tables 1 and 2" section.

2. Gross heat production

See definition in "Tables 1 and 2" section.

3. Own use by power plants

This is the difference between Gross and Net production, i.e. it is the electricity and heat used by power station auxiliaries directly related to generation and including that used in fuel handling plant, cooling water plant, power station services, heating, lighting, workshops and administrative buildings directly associated with the power station during both on-load and off-load periods.

4. Net electricity production

See definition in "Tables 1 and 2" section.

5. Net heat production

See definition in "Tables 1 and 2" section.

6. Imports and Exports

Amounts of electricity and heat are considered as imported or exported when they have crossed the political boundaries of the country, whether customs clearance has taken place or not. If electricity is "wheeled" or transited through a country, the amount should be reported as both an import and an export (see notes on Table 8).

7. Used for heat pumps

Report the electricity used in heat pumps for which the heat output is reported in Tables 1 and 2.

8. Used for electric boilers

Report the electricity used in electric boilers for which the heat output is reported in Tables 1 and 2.

9. Used for pumped storage in pure hydro pumping plants

Report the electricity consumed by pumping in pure hydro-electric power plants.

10. Used for pumped storage in mixed plants

Report the electricity consumed by pumping in mixed hydro-electric power plants.

11. Used for charging batteries

Report the electricity consumed for charging batteries.

12. Used for electricity production

Report heat from chemical processes used as a primary energy form, and purchased secondary waste heat consumed as input to electricity generation.

13. Energy supplied

For ***electricity***, this is the electrical energy supplied from the plant. In the case of a national network this is equal to the sum of the net electrical energy production supplied by all power stations within the country, reduced by the amount used simultaneously for pumping as well as the amount used for heat sold using heat pumps and electric boilers. It is then reduced or increased by exports to or imports from abroad. For ***heat***, this is equal to the sum of the net heat production for sale by all plants within a country reduced or increased by exports or imports from abroad.

14. Transmission and distribution losses

All losses due to transport and distribution of electrical energy and heat. For electricity, losses in transformers which are not considered as integral parts of the power plants are also included.

Transmission losses: All losses that occur at the area of responsibility of the Transmission System Operator.

Distribution losses: All losses that occur at the area of responsibility of the Distribution System Operator.

15. Non-technical losses: Losses

Losses that are not related to the technical operation of the system (for example illegal appropriation of energy/theft)

16. Total consumption (calculated)

This equals the Energy supplied minus Distribution losses.

17. Statistical difference

This equals to the difference between the calculated total consumption (as defined above) and the observed total consumption. 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.

18. Total consumption (observed)

This is the amount actually recorded in surveys of end-use sectors in industry, transport and other sectors. It should, in principle, correspond to the total consumption (calculated).

19. Energy sector

Report all electricity and purchased heat consumed by the energy sector to support the extraction (mining, oil and gas production) and plant operation of transformation activities. It should exclude Own use by plant, Used for pumped storage, Used by heat pumps and Used for electric boilers, which are reported elsewhere. Heat consumed by ***autoproducers*** for their own use should not be included. Consumption in support of the operation of pipelines (e.g. oil, gas, and coal slurry) should be reported in the Transport sector.

The Energy Sector covers ISIC[1] Divisions 05, 06, 19 and 35, Group 091, Classes 0892 and 0721 (NACE[2] Divisions 05, 06 19, and 35, Group 09.1, Classes 08.92 and 07.21). The Energy sector includes the manufacture of chemical materials for atomic fission and fusion and the products of these processes. Electricity and heat used in the manufacture of fuel briquettes and packaged fuel from coal, lignite or peat and consumption in coke ovens, gas works, blast furnaces, liquefaction plants, gasification plants, charcoal production plants and other transformation industries should also be reported here.

20. Industry sector

Report the total of the Industry sub-sectors listed under item 2 in the Table 4 instructions.

21. Transport sector

Report electricity used for all transport activity irrespective of the economic sector, in which the activity occurs (except military fuel use, see Not elsewhere specified - Other). Electricity and purchased heat used for heating and lighting at railway and bus stations and airports should be reported in Commercial and public services. The transport sector is divided into the following sub-sectors:

- ***Rail*** – Report electricity consumption for use in rail traffic, including industrial railways and consumption for use in rail transport as part of urban or suburban transport systems (e.g. metro, tram).
- ***Pipeline transport*** – Report electricity consumption in support of the operations of both submarine and overland pipelines transporting gases, liquids, slurries and other commodities up to the distributors network, including the energy used for pump stations and maintenance of the pipeline. Use for pipeline distribution of natural or manufactured gas, hot water or steam (ISIC 35) from the distributor to the final

1. International Standard Industrial Classification of all Economic Activity, Series M., No. 4/Rev. 4, United Nations, New York, 2008.
2. Statistical classification of the economic activities in the European Community (NACE Rev.2) EC-Eurostat 2008.

users is excluded and should be reported in the Energy sector while use for the final distribution of water (ISIC 36) to household, industrial, commercial and other users should be included in the Commercial/public services sector.

- ***Road*** – Report electricity use in road vehicles. This includes electricity consumption in road transport vehicles such as electric buses, electric cars and trolley buses when the electricity is supplied from **external sources** to directly generate mechanical energy or used to charge batteries. Include use by agricultural vehicles on highways. Exclude use in stationary engines (this should be reported under the relevant economic sector), non-highway use in tractors (see Agriculture/forestry – Other sector), and military use (see Not elsewhere specified – Other). It is to be noted that the consumption of vehicles running on rails in urban transport (trams, metro, etc.) should be included under Rail transport.
- ***Not elsewhere specified - Transport –*** Report electricity use for transport activities not included elsewhere. Please state on the Remarks page what is included under this heading.

22. Residential sector

Report fuel consumed by all households including "households with employed persons (ISIC and NACE Divisions 97 and 98)".

23. 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 consumption by businesses and offices in the public and private sectors. Note that electricity and purchased heat use at railway, bus stations, shipping piers 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.

24. Agriculture

Report fuels consumed by users classified as agriculture and hunting as specified in ISIC Division 01 (NACE Division 01).

25. Forestry

Report fuels consumed by users classified as forestry by ISIC as specified in ISIC Division 02 (NACE Division 02).

26. Fishing

Report electricity and purchased heat consumed for inland, coastal and deep-sea fishing as specified in ISIC and NACE Division 03. Fishing should cover energy consumption in ships of all flags that have refuelled in the country (include international fishing).

27. Not elsewhere specified – Other

Report activities not included elsewhere (such as ISIC and NACE class 8422). Please specify on the Remarks page what is included under this heading. This category should include military use for all mobile and stationary consumption (e.g. ships, aircraft, and energy used in living quarters) within the country regardless of whether the use is by the military of that country or by the military of another country.

TABLE 4
ELECTRICITY AND HEAT CONSUMPTION IN THE INDUSTRY AND ENERGY SECTORS

1. Energy sector

As defined under item 16 in Table 3 instructions, report all electricity and purchased heat energy consumed by the energy industry to support the extraction (mining, oil and gas production) and plant operation of transformation activities.

The energy sector is divided into the following sub-sectors:

- ***Coal mines*** - Report electricity and purchased heat consumed to support the extraction and preparation of coal within the coal mining industry.
- ***Oil and gas extraction*** - Report electricity and purchased heat consumed to support the operation of oil and gas extraction facilities.
- ***Patent fuel plants*** - Report electricity and purchased heat consumed at patent fuel plants.
- ***Coke ovens*** - Report electricity and purchased heat consumed at coking plants.
- ***BKB / PB plants*** - Report electricity and purchased heat consumed at briquetting plants.
- ***Gas works*** - Report electricity and purchased heat consumed at gas works plants and coal gasification plants.
- ***Blast furnaces*** - Report electricity and purchased heat consumed in blast furnaces operations.
- ***Oil refineries*** - Report electricity and purchased heat consumed at oil refineries.

  Nuclear industry - Report electricity and purchased heat consumed by nuclear industry for production and manufacturing of nuclear fuels for atomic fission and fusion. It includes mining, processing, reprocessing of nuclear fuels, and treatment, disposal, and storage of radioactive nuclear waste.
- .***Coal liquefaction*** - Report electricity and purchased heat consumed at liquefaction plants.
- ***Liquefaction (LNG) / regasification*** - Report electricity and purchased heat consumed at natural gas liquefaction and regasification plants.
- ***Gasification plants (biogas)*** - Report electricity and purchased heat consumed at biogas gasification plants.
- ***Gas-to-liquid (GTL)***- Report electricity and purchased heat consumed at the Gas-to-liquid conversion plants.
- ***Charcoal production plants*** - Report electricity and purchased heat consumed at charcoal production plants.
- ***Not elsewhere specified - Energy*** - Report electricity and purchased heat consumed for other purposes not reported above. Please specify on the Remarks page what is included under this heading.

2. Industry sector

Report the electricity and purchased heat consumption by the industrial undertaking in support of its primary activities in the appropriate sub-sectors:

- **Iron and steel:** ISIC Group 241 + Class 2431 (NACE Groups 24.1, 24.2, 24.3, Classes 24.51 and 24.52). To avoid double counting, electricity used in blast furnaces should be reported in the Energy sector.
- **Chemical and petrochemical:** ISIC and NACE Divisions 20 and 21.
- **Non-ferrous metals:** ISIC Group 242 + Class 2432 (NACE Group 24.4, 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.
- **Mining (excluding energy producing industries) and quarrying:** ISIC Divisions 07 and 08 + Group 099 (NACE Divisions 07 and 08 + Group 09.9).
- **Food, beverages and tobacco:** ISIC and NACE Divisions 10, 11 and 12.

- **Pulp, paper and printing:** ISIC and NACE Divisions 17 and 18. Includes reproduction 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 electricity and heat consumption does not correspond to the above ISIC codes, please estimate the breakdown by industry and include in Not elsewhere specified only consumption in sectors which is not covered above. Please specify on the Remarks page what is included under this heading. ISIC and NACE Divisions 22, 31 and 32 are included here.

TABLE 5
NET ELECTRICITY AND HEAT PRODUCTION BY AUTOPRODUCERS

For a proper understanding of the definitions below respondents are urged to read the note 'Definitions for Electricity and Heat' reproduced on page 3.

For a description of sectors, please refer to the reporting instructions for Table 3, and for individual energy sector activities and industry classifications, please refer to the reporting instructions for Table 4.

TABLES 6 A, B, C, D
GROSS ELECTRICITY AND HEAT PRODUCTION FROM COMBUSTIBLE FUELS

For a proper understanding of the definitions of categories in the table respondents are urged to read the note 'Definitions for Electricity and Heat', reproduced on page 3.

The reported quantity of heat produced at autoproducer CHP units should be only that sold (see definitions on page 3). Accordingly, the quantity of fuel required for this heat will be the proportional part of the fuel attributed to the total heat production at the unit. A methodology for the division of the total fuel used at the plant between heat and electricity is given on page 5.

The total Electricity and Heat reported here in Table 6 should be equal to the total from "Combustible fuels" in Table 1. Fuels used for 'starting up' a unit should be included with other fuels used in the unit. The quantity of fuels used to drive heat pumps should not be included in data reported in this table but noted separately, if available, on the Remarks page. Heat output (that is sold) from heat pumps should be reported in Tables 1 and 2.

Definitions of Combustible fuels:

1. Anthracite

High rank coal normally used for industrial and residential applications. It has generally less than 10% volatile matter and a high carbon content (about 90% fixed carbon). Its gross calorific value is equal to or greater than 24000 kJ/kg (5 732 kcal/kg) on an ash-free but moist basis.

2. Coking coal

Bituminous coal with a quality that allows the production of a coke suitable to support a blast furnace charge. Its gross calorific value is equal to or greater than 24000 kJ/kg (5 732 kcal/kg) on an ash-free but moist basis.

3. Other bituminous coal

Coal used for steam raising purposes and includes all bituminous coal that is not included under coking coal, nor anthracite. It is characterized by higher volatile matter than anthracite (more than 10%) and lower carbon content (less than 90% fixed carbon). Its gross calorific value is equal to or greater than 24000 kJ/kg (5 732 kcal/kg) on an ash-free but moist basis.

4. Sub-bituminous coal

Non-agglomerating coal with a gross calorific value equal to or greater than 20000 kJ/kg (4 777 kcal/kg) and less than 24000 kJ/kg (on an ash-free but moist basis) and containing more than 31% volatile matter on a dry mineral matter free basis.

5. Lignite

Non-agglomerating coal with a gross calorific value less than 20 000 kJ/kg (4 777 kcal/kg) (on an ash-free but moist basis) and greater than 31% volatile matter on a dry mineral matter free basis.

6. Patent fuel

A composition fuel manufactured from hard coal fines with the addition of a binding agent.

7. Coke oven coke

The solid product obtained from carbonization of coal, principally coking coal, at high temperature, it is low in moisture and volatile matter. Coke oven coke is used mainly in the iron and steel industry acting as energy source and chemical agent. Coke breeze and foundry coke are included in this category. Semi-coke (a solid

product obtained from carbonization of coal at low temperature) should be included in this category. This heading also includes coke, coke breeze and semi-coke made from lignite coal.

8. Gas coke

By-product of hard coal used for production of town gas in gas works. Gas coke is used for heating purposes.

9. Coal tar

A result of the destructive distillation of bituminous coal or of the low-temperature carbonisation of brown coal. Coal tar from bituminous coal is the liquid by-product of the distillation of coal to make coke in the coke oven process. Coal tar can be further distilled into different organic products (e.g. benzene, toluene, naphthalene), which normally would be reported as a feedstock to the petrochemical industry.

10. BKB (Brown coal briquettes)

BKB is a composition fuel manufactured from lignite coal, or sub-bituminous coal, produced by briquetting under high pressure without the addition of a binding agent. These figures include dried lignite fines and dust.

11. Gas works gas

Covers all types of gases produced in public utility or private plants, whose main purpose is manufacture, transport and distribution of gas. It includes gas produced by carbonization (including gas produced by coke ovens and transferred to gas works gas), by total gasification with or without enrichment with oil products (LPG, residual fuel oil, etc.), and by reforming and simple mixing of gases and/or air. The quantity of fuel should be reported on a **gross** calorific value basis.

12. Coke oven gas

Obtained as a by-product of the manufacture of coke oven coke for the production of iron and steel. The quantity of fuel should be reported on a **gross** calorific value basis.

13. Blast furnace gas

Produced during the combustion of coke in blast furnaces in the iron and steel industry. It is recovered and used as a fuel partly within the plant and partly in other steel industry processes or in power stations equipped to burn it. The quantity of fuel should be reported on a **gross** calorific value basis. In addition, off-gases from all iron-production reduction processes utilising air as the oxygen source (such as Direct reduced iron) should be reported here.

14. Other recovered gases

By-product of the production of steel in an oxygen furnace, recovered on leaving the furnace. The gases are also known as converter gas, LD gas or BOS gas. Also covers non-specified manufactured gases not mentioned above, such as combustible gases of solid carbonaceous origin recovered from manufacturing and chemical processes not elsewhere defined. The quantity of recuperated fuel should be reported on a **gross** calorific value basis.

15. Peat

A combustible soft, porous or compressed, fossil sedimentary deposit of plant origin with high water content (up to 90 per cent in the raw state), easily cut, of light to dark brown colour. Peat used for non-energy purposes is not included. Milled peat is included here.

16. Peat products

Products such as peat briquettes derived directly or indirectly from sod peat and milled peat.

17. Oil shale and oil sands

Oil shale and oil sands are sedimentary rock which contains organic matter in the form of kerogen. Kerogen is a waxy hydrocarbon-rich material regarded as a precursor of petroleum. Oil shale may be burned directly or processed by heating to extract shale oil. Shale oil and other products derived from liquefaction should be reported under “Other oil products”.

18. Crude oil

Crude oil is a mineral oil of natural origin comprising a mixture of hydrocarbons and associated impurities, such as sulphur. It exists in the liquid phase under normal surface temperature and pressure and its physical characteristics (density, viscosity, etc.) are highly variable. This category includes field or lease condensate recovered from associated and non-associated gas where it is commingled with the commercial crude oil stream.

19. Natural gas liquids (NGL)

NGL are liquid or liquefied hydrocarbons recovered from natural gas in separation facilities or gas processing plants. Natural gas liquids include ethane, propane, butane (normal and iso-), (iso) pentane and pentanes plus (sometimes referred to as natural gasoline or plant condensate)..

20. Refinery gas

Refinery gas includes a mixture of non-condensed gases mainly consisting of hydrogen, methane, ethane and olefins obtained during distillation of crude oil or treatment of oil products (e.g. cracking) in refineries. This also includes gases which are returned from the petrochemical industry.

21. Liquefied petroleum gases (LPG)

LPG are light paraffinic hydrocarbons derived from the refinery processes, crude oil stabilisation and natural gas processing plants. They consist mainly of propane (C3H8) and butane (C4Hl0) or a combination of the two. They could also include propylene, butylene, isobutene and isobutylene. LPG are normally liquefied under pressure for transportation and storage.

22. Naphtha

Naphtha is a feedstock destined for either the petrochemical industry (e.g. ethylene manufacture or aromatics production) or for gasoline production by reforming or isomerisation within the refinery. Naphtha comprises material in the 30ºC and 2l0ºC distillation range or part of this range.

23. Kerosene type jet fuel

This is a distillate used for aviation turbine power units. It has the same distillation characteristics between 150ºC and 300ºC (generally not above 250ºC) and flash point as kerosene. In addition, it has particular specifications (such as freezing point) which are established by the International Air Transport Association (IATA).

24. Other kerosene

Kerosene comprises refined petroleum distillate and is used in sectors other than aircraft transport. It distils between 150ºC and 300ºC.

25. Gas/diesel oil (distillate fuel oil)

Gas/diesel oil is primarily a medium distillate distilling between 180 ºC and 380 ºC. It is comprised of road diesel, heating and other gasoil.

26. Fuel oil

This covers all residual (heavy) fuel oils (including those obtained by blending). Kinematic viscosity is above 10 cSt at 80 ºC. The flash point is always above 50 ºC and density is always more than 0.90 kg/l.

27. Bitumen (including Orimulsion)

Bitumen is a solid, semi-solid or viscous hydrocarbon with a colloidal structure, being brown to black in colour, obtained as a residue in the distillation of crude oil, by vacuum distillation of oil residues from atmospheric distillation. Bitumen is often referred to as asphalt and is primarily used for construction of roads and for roofing material. This category includes fluidized and cut back bitumen as well as Orimulsion.

28. Petroleum coke

Petroleum coke is a black solid by-product, obtained mainly by cracking and carbonising petroleum derived feedstock, vacuum bottoms, tar and pitches in processes such as delayed coking or fluid coking. It consists mainly of carbon (90 to 95%) and has a low ash content. It is used as a feedstock in coke ovens for the steel

industry, for heating purposes, for electrode manufacture and for production of chemicals. The two most important qualities are "green coke" and "calcinated coke". This category also includes "catalyst coke" deposited on the catalyst during refining processes; this coke is not recoverable and is usually burned as refinery fuel.

29. Other oil products

All products not specifically mentioned above, for example: tar, sulphur, and shale oil. Report oil products not specifically mentioned above, and identify such product in the Remarks page.

30. Natural gas

Natural gas consists mainly of methane occurring naturally in underground deposits. This includes colliery gas. The quantity of fuel used should be reported on a **gross** calorific value basis.

31. Industrial waste (non-renewable)

Wastes of industrial non-renewable origin (solids or liquids) combusted directly for the production of electricity and/or heat. Renewable industrial waste should be reported in the Solid biomass, Biogas and/or Liquid Biofuels categories. The quantity of fuel used should be reported on a **net** calorific value basis.

32. Municipal waste (renewable)

Renewable: Report that portion of waste produced by households, industry, hospitals and the tertiary sector which is biological material collected by local authorities and incinerated at specific installations. The quantity of fuel used should be reported on a **net** calorific value basis.

33. Municipal waste (non-renewable)

Non-Renewable: Report that portion of waste produced by households, industry, hospitals and the tertiary sector which is non-biological material collected by local authorities and incinerated at specific installations. The quantity of fuel used should be reported on a **net** calorific value basis.

34. 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.
- **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

35. Biogases

A gas composed principally of methane and carbon dioxide produced by anaerobic digestion of biomass, or by thermal processes.

- **Landfill gas:** formed by the digestion of landfilled 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 biogas 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:** biogas produced from thermal processes of renewable forms of energy.

36. Biodiesels

This category includes liquid biofuels suitable to be blended with or replace gas/diesel oil from fossil origin.

37. Biogasolines

Liquid biofuels suitable to be blended with or replace motor gasoline from fossil origin.

38. Other liquid biofuels

This category includes liquid biofuels not included in biodiesels.

Note: In the Renewables and waste questionnaire, fuel inputs of Liquid biofuels are reported for five categories: Biogasoline, of which Bioethanol, Bio jet kerosene, Biodiesels and Other liquid biofuels, whereas the output is reported for two categories: Biodiesels and Other liquid biofuels. In the Electricity questionnaire, both the inputs and outputs are reported for the two categories: Biodiesels and Other liquid biofuels. As a consequence, in Table 6 of this questionnaire, gross electricity and heat production from combustible fuels, **Other liquid biofuels could also contain small amounts of Biogasoline and Bio jet kerosene**. This difference in classification between the two questionnaires was made in order to reduce the amount of information requested because it is not expected that large quantities of Biogasoline and Bio jet kerosene are being used in the transformation sector to generate electricity and heat.

TABLE 7A
NET MAXIMUM ELECTRICAL CAPACITY AND PEAK LOAD

Net electrical capacity, peak load and date of peak load occurrence are monitored to measure energy security-related factors such as reserve margin, and capacity available during load peaking periods.

Net maximum electrical capacity

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. This excludes overload capacity, which can only be sustained for a short period of time (e.g. internal combustion engines momentarily running above their rated capacity). 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.

Newly installed capacity

Newly installed capacity is the net maximum capacity of the power plants installed at the reference year.

Decommissioned capacity

Decommissioned capacity is the net maximum capacity of the power plants that were decommissioned at the reference year. Mothballed installations are not fully decommissioned.

1. Classification by sources

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 units. Data for fuel cells should be reported in the row *Other sources*.

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.

Solar PV capacities should be reported under both the alternating current (AC) and direct current (DC) categories. For more information, consult Annex 2.

All other source definitions are as per instructions for Tables 1 and 2.

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 units are those which lend to maximum electricity production).

2. Combustible fuels: type of generation.

Data on fuel firing capability are important inputs into planning responses to national and international fuel disruptions, and the capacity reported under *Combustible fuels* is further divided according to the technology of the generating plant.

- ***Steam**:* steam turbines are of two main types -non-condensing (or open cycle), also called backpressure turbines, and condensing turbines (or closed cycle). In non-condensing turbines, the exhaust steam leaving the turbine is used either as co-generated process steam or, more rarely, released into the atmosphere. In a condensing turbine, the exhaust steam is condensed and the water thus formed supplies the feed water for the generator. The boilers supplying steam turbines can be fuelled by all forms of fossil fuels;
- ***Internal combustion***: the internal combustion engines referred to in this heading are primarily the engines based on, but not limited to, the gasoline (Otto) or diesel cycles, which work on the spark ignition or the compression ignition principle. Diesel-type engines can use a variety of fuels ranging from natural gas to liquid fuels;

- ***Gas turbines***: the gas turbine utilises high temperature, high pressure post-combustion gas and extracts a portion of its energy, converting it into useful rotational energy as the gas exits the combustion chamber. Fuels used in the combustion process can be natural gas, coal gases, liquid fuels or even pulverised solids;
- ***Combined cycle***: the combined cycle system refers to electricity produced by coupling two heat engines in a sequence to drive generators. The heat discharged from one heat engine serves as the energy source for the next engine. A gas turbine is generally used as the first heat engine, and a conventional condensing steam turbine at the second stage.
- ***Other*** *(please specify)*

Peak load

The highest value of the power absorbed or supplied by a network or combination of networks within the country.

1. Peak load demand

The peak load demand is the highest simultaneous demand for electricity satisfied during the year. Note that the electricity supply at the time of peak demand may include demand satisfied by imported electricity or alternatively the demand may include exports of electricity. Total peak load on the national grid is not the sum of the peak loads during the year on every power station as they may occur at different times.

2. Available capacity at time of peak

The available capacity of an installation at peak period is the maximum power at which it can be operated under the prevailing conditions at the time, assuming no external constraints. It depends on the technical state of the equipment and its ability to operate, and may differ from the *Net maximum capacity* due to lack of water for hydro capacity, plant maintenance, unanticipated shutdown, or other outages at the time of peak load.

3. Date of peak load occurrence

Report the date on which the peak load was reached.

4. Time of peak load occurrence

Report the hour that peak load was reached

TABLE 7B
NET MAXIMUM ELECTRICAL CAPACITY OF COMBUSTIBLE FUELS

The total net maximum capacity reported under *Combustible fuels* in Table 7a, subdivided by main activity producer and autoproducer, is further subdivided by fuel firing capability in Table 7b. Firing capability is separated into single fuel and multiple fuel categories.

1. Single-fired capacity

Refers to units equipped to burn only one fuel type on a continuous basis. Power stations consisting of several units burning different types of fuel but with each individual unit capable of burning only one fuel should be considered as single-fired and have their capacity divided accordingly among the following conventional fuel types:

- ***Coal and coal products*** - including all types of coal and most derived coal products, including blast furnace gas, coke oven gas and 'other recovered gases', but not gas works gas;
- ***Liquid fuels*** - covers crude oil and all oil products, including refinery gas and petroleum coke;
- ***Natural gas*** - covers natural gas and gas works gas (synthetic natural gas, syngas, or equivalent);
- ***Peat*** **–** covers peat and peat products;
- ***Biofuels and waste*** - covers solid biofuels, liquid biofuels and biogases; municipal waste and industrial waste.

2. Multi-fired / co-fired capacity

Refers to units with supply access to more than one nominated type of fuel and capable of generating electricity using these fuel types either in alternation (multi-firing), or in combination on a continuous basis

(co-firing). These units should be capable of generating their maximum capacity, or a large proportion thereof, using any one of the fuels nominated. A multi-fired unit can have either one boiler capable of using more than one fuel, or two boilers, each using a single fuel, but feeding the same generator in alternation, or simultaneously.

Generally, multi-fired capacity will fall into dual-fired or tri-fired groups. This includes solids and liquids, solids and natural gas, liquids and natural gas, and solids, liquids and natural gas. In the section for reporting the multi-fired capacity, please list the primary fuel using the fuel classifications provided for single-fired capacity. Also, list the alternate fuel(s) in the column indicated using the fuel classifications provided for single-fired capacity. This is determined by the fuels used to operate the unit or plants for the year which is reported. Note that while capacity numbers (in MW) exist in columns A and B, for rows 1 to 21, the corresponding fields describing the fuels are free text and **essential** to provide context to the capacity numbers. Additionally, there are only a limited number of rows, so descriptions may have to be very broad. As the questionnaire does not allow for the reporting of multi-fired capacity for units fired by multiple fuels of the same physical state e.g. coal and solid biofuels (solid/solid), report these capacities as single-fired capacities under whichever fuel is used in the larger amount.

TABLES 7C (MAIN ACTIVITY) AND 7D (AUTOPRODUCER)
NET MAXIMUM ELECTRICAL CAPACITY OF COMBUSTIBLE FUELS
BY FUEL TYPE AND TECHNOLOGY

Tables 7c and 7d cover the capacity breakdowns summarised in Table 7b in considerably more detail, using both the broad fuel categories described in the Table 7b instructions, and the technology options described in Table 7a. As in those two tables, capacities are further classified by being main activity (reported in Table 7c) and autoproducer (Table 7d), and also differentiate between 100% electricity, and CHP units/plants, on the basis described in the Electricity and Heat definitions.

While table 7b does not distinguish between **multi-firing** fuels in alternation, or **co-firing** in concert, tables 7c and 7d, do, and capacities should be reported under which intent best describes the plant purpose and practice. Note also that the "tri-firing" option, (present in Table 7b) is not available here.

The primary fuel types are limited to the combustible fuel categories described in Table 7b, while the secondary fuel types are the same, but also with the option of non-specified. The fuel that is in predominant use should be the primary fuel, and in the case of a true 50/50 mix, one fuel should be deemed to be the primary fuel, rather than double entering the capacity in both applicable options. Similarly, units or plants should not be prorated between fuels, so a 180 MW unit that was co-fired with 90% coal and 10% biomass, should not be reported as 162 MW coal/biofuels and 18 MW biofuels/coal.

Note that due to the newness of these tables, data, particularly historically may not be available with maximum granularity, so all totals, for fuels regardless of technology, or fuels and technology, regardless of firing mechanism are not formulas as the breakdown may not be known. However this means that each total will need to be independently calculated and entered.

TABLE 8
IMPORTS BY ORIGIN AND EXPORTS BY DESTINATION OF ELECTRICITY

Report the gross trade in electricity between all countries including quantities in transit. The countries of origin for imports and destination for exports are neighbouring countries from which the electricity has been received (imports) and to which it has been sent (exports). See Geographical notes for country definitions.

Physical quantities should be given. If only contracted quantities are available, please indicate clearly on the Remarks page.

Amounts are considered as imported or exported when they have crossed the political boundaries of the countries, whether customs clearance has taken place or not.

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 exist if only total imports and exports are available on the above basis, while the geographical breakdown is based on a different survey, source or concept. In this case the figures by origin/destination should be adjusted proportionally to the correct total if no more applicable or refined adjustment methodology is merited.

TABLE 9
BATTERY STORAGE

Table 9 refers to battery storage. Report the storage capacity of batteries, the rated power capacity of batteries, the electricity injected in the grid from batteries and the electricity used from the grid to charge batteries. The information below should be declared for batteries connected to the grid and used as storing/balancing element. Only batteries with a storage capacity equal to or above 1 MWh and only exchanges with the grid need to be declared.

Each of the elements above should be split in the following size groups of storage capacity:

- Below 1 MWh
- From 1 MWh to 10 MWh
- From more than 10 MWh to 100 MWh
- More than 100 MWh.

Storage capacity of batteries – It is defined as the total quantity of energy the battery can store. The reporting unit is megawatt hour (MWh).

Rated power capacity of batteries – It is defined as the maximum rate of discharge the battery can achieve, starting from a fully charged state. The reporting unit is megawatt (MW).

Electricity used from the grid to charge batteries – It is the energy absorbed from the grid to charge batteries. (GWh)

TABLE 10
ELECTRICITY PRODUCTION BY SECTOR AND SOURCE

Report total net production of electricity by autoproducers, broken down by sector and by source. In addition, report the portion of this production with is auto-consumed.

Production is to be reported according to the following sectoral disaggregation:

- Energy sector
- Industry sector
- Residential
- Commercial and public services
- Other sectors

Production is to be reported according to the following source disaggregation:

- Solar PV
- Solid, liquid and gaseous biofuels
- Other renewables
    - Of which: wind
- Natural gas
- Other (non-renewables)

REMARKS PAGE

Report on this page all comments or additional data, if available, including as follows:

- the quantity of combustible fuels (in appropriate physical units and in TJ) used to drive heat pumps (used in the Transformation sector). These data should not be included in Table 6.
- the quantity of waste heat (TJ) used in heat pumps (used in the Transformation sector). These data will not have been reported elsewhere in the questionnaire.

ANNEX 1: LIST OF ABBREVIATIONS

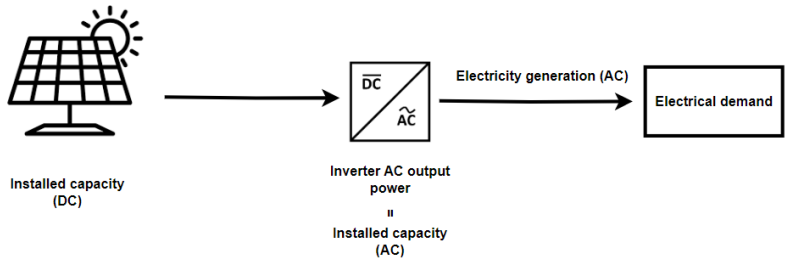
BKB	brown coal briquettes
CHP	combined heat and power (unit / plant)
CV	calorific value
EU	European Union
GCV	gross calorific value
GJ	gigajoule, or one joule x 10^9 (see joule)
GJ/t	gigajoule per tonne
GWh	gigawatt-hour, or one watt x one hour x 10^9
IEA	International Energy Agency
ISIC	International Standard Industrial Classification
J	joule
kg	kilograms
kJ	kilojoules
ktonnes	kilotonnes, or one tonne x 10^3
kWh	kilowatt-hour, or one watt x one hour x 10^3
LPG	liquefied petroleum gas; refers to propane, butane and their isomers, which are gases at atmospheric pressure and normal temperature
MJ/m^3	megajoule/cubic metre
Mm^3	million cubic metres
Mtoe	million tonnes of oil equivalent
MW	megawatt, or one watt 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}
toe	tonne of oil equivalent

ANNEX 2: SOLAR PV CAPACITY

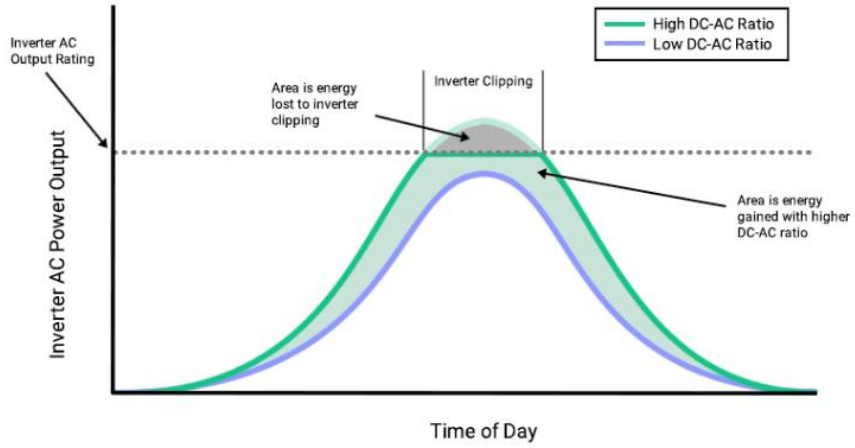
CONTEXT

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 is an illustration of a common PV system scheme.



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 7a and 7b, report both the DC and AC solar PV capacities. 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 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 3: Table Relations in the Electricity and Heat Questionnaire