



UNITED NATIONS STATISTICS DIVISION

Energy Statistics Section

Guidelines for the

2019 United Nations Statistics Division

ANNUAL QUESTIONNAIRE ON ENERGY STATISTICS

New York, April 2021

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1. Background and reporting instructions

Background and purpose

The *UNSD Annual Questionnaire on Energy Statistics* (the “Questionnaire”) is part of the UNSD data collection programme. It covers statistics such as production, transformation and use of energy products in physical and energy units.

The Questionnaire is the primary source of information for the *UNSD Energy Statistics Database* and contributes to the *Energy Statistics Yearbook*, the *Energy Balances*, the *Electricity Profiles* and the *Energy Statistics Pocketbook* publications. The *Energy Statistics Yearbook* is a comprehensive collection of internationally comparable data on the supply of energy. The *Energy Balances* present energy data in a format showing an overall picture of energy production, trade, conversion and consumption for energy products utilized in the country, while *Electricity Profiles* contains detailed information on production, trade and consumption of electricity, net installed capacity and thermal power plant inputs and efficiencies. The *Energy Statistics Pocketbook* aims at providing additional information by highlighting key indicators and using different visualizations to show developments, dependencies and distributions in a way that standard data tables cannot convey.

The scope of the questionnaire and the definitions of flows and products in Annual Questionnaire on Energy Statistics are in line with the recommendations contained in the *International Recommendations for Energy Statistics* (IRES), which was adopted by the United Nations Statistical Commission in February 2011. IRES is available online at <https://unstats.un.org/unsd/energystats/methodology/ires/>.

Reporting instructions

The Questionnaire consists of two excel files: "*Country Name 2019.xls*" which contains the energy statistics for the country and which has been prefilled with data for the period 2015-2018, and "*Conversion Factors 2019.xls*" which contains the questionnaire on the country-specific Calorific Values for selected energy products.

Please note that countries are encouraged to enter data for the last two years (2019 and 2020), even if provisional and subject to revision, provided that this is indicated in the Questionnaire using the letter “P” in the note field. If 2020 data are not yet available, please fill out the Questionnaire with 2019 data and revise 2015-2018 data as necessary.

Data should be reported on the basis of a calendar year. However, if data are reported on the basis of a fiscal year, please clearly state the beginning and end of the fiscal year used.

Data should be reported in the units specified in the Energy Questionnaire. However, if different units are used, please clearly indicate them in the file. For your ease of reference, please see Annex IV for detailed information on the conversion factors between different units of mass, volume and energy, respectively.

Please also indicate the geographic coverage of the data, i.e. if the data include or exclude specific territories or areas. For example, some countries only include electricity data of specific territories and exclude other energy data from said territories.

Please indicate with the letter “C” if data cannot be submitted due to reasons of statistical confidentiality. Even though no actual figures are provided, this information is useful for many users of the statistics, as it indicates that there was activity but it cannot be reported for a specific reason.

If data are not available, please leave the cell blank, while if the data are available but equal to zero, please fill the cell with a value “0”.

Please complete both excel files and e-mail them to: energy_stat@un.org .

Any questions concerning the Questionnaire may also be sent by e-mail, fax or regular mail, as provided below.

Mail: Energy Statistics Section
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DC2-1534, 2-UN Plaza
New York, NY 10017, USA

Email: energy_stat@un.org

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We thank you in advance for your cooperation and support of the UNSD energy statistics data collection programme.

2. Product definitions

The Energy Questionnaire collects data by products and flows. For example, data for the supply, trade and use of electricity are collected. In the Questionnaire the products are arranged as follows: solid products are found first, followed by oil products, gaseous products, electricity, heat, renewable products, and uranium.

The energy products covered by the *UNSD Annual Questionnaire on Energy Statistics* are listed below and adhere to the order in which the products are arranged in the Questionnaire.

Please note that for each energy product the product code as used in the Questionnaire (two-letter code), and the Standard International Energy Product Classification (SIEC) code are provided. Please refer to Annex I for the SIEC and its correspondence to the product codes of the Questionnaire.

Coal, Peat and Oil Shale

Hard coal (CL), SIEC code 01: Coals with a gross calorific value (moist, ash-free basis) which is not less than 24 MJ/kg or which is less than 24 MJ/kg provided that the coal has a Vitrinite mean Random Reflectance greater than or equal to 0.6 per cent.

Specific information related to the Questionnaire: Data for Hard coal should be the sum of Anthracite, Coking coal and Other bituminous coal.

Anthracite (AT), SIEC code 0110: A high-rank, hard coal with a gross calorific value (moist, ash-free basis) greater than or equal to 24 MJ/kg and a Vitrinite mean Random Reflectance greater than or equal to 2.0 per cent.

Remark: It usually has less than 10 per cent volatile matter, a high carbon content (about 86-98 per cent carbon) and is non-agglomerating. Anthracite is mainly used for industrial and household heat raising.

Bituminous coal, SIEC code 012: A medium-rank hard coal with either a gross calorific value (moist, ash-free basis) not less than 24 MJ/kg and with a Vitrinite mean Random Reflectance less than 2.0 per cent, or a gross calorific value (moist, ash-free basis) less than 24 MJ/kg provided that the Vitrinite mean Random Reflectance is equal to or greater than 0.6 per cent.

Remark: Bituminous coals are agglomerating and have a higher volatile matter and lower carbon content than anthracite. They are used for industrial coking and heat raising, and household heat raising.

Coking coal (CC), SIEC code 0121: Bituminous coal that can be used in the production of a coke capable of supporting a blast furnace charge.

Other bituminous coal (OB), SIEC code 0129: Bituminous coal not included under coking coal.

Remark: Sometimes referred to as "steam coal".

Brown coal (LB), SIEC code 02: Coals with a gross calorific value (moist, ash-free basis) less than 24 MJ/kg and a Vitrinite mean Random Reflectance less than 0.6 per cent.

Specific information related to the Questionnaire: Data for Brown coal should be the sum of Sub-bituminous coal and Lignite.

Sub-bituminous coal (SB), SIEC code 0210: Brown coal with a gross calorific value (moist, ash-free basis) equal to or greater than 20 MJ/kg but less than 24 MJ/kg.

Lignite (LN), SIEC code 0220: Brown coal with a gross calorific value (moist, ash-free basis) less than 20 MJ/kg.

Peat (PT), SIEC code 11: A solid formed from the partial decomposition of dead vegetation under conditions of high humidity and limited air access (initial stage of coalification). It is available in two forms for use as a fuel, sod peat and milled peat.

Remark: Milled peat is also made into briquettes for fuel use. Peat is not considered a renewable resource as its regeneration period is long.

Oil shale / Oil sands (OS), SIEC code 2000: A sedimentary rock which contains organic matter in the form of kerogen. Kerogen is a waxy hydrocarbon-rich material regarded as a precursor of petroleum.

Remark: Oil shale may be burned directly or processed by heating to extract shale oil.

Coke oven coke (OK), SIEC code 0311, 0313 and 0314: The solid product obtained from carbonisation of coking coal at high temperature.

Remark: Coke oven coke is low in moisture, and volatile matter and has the mechanical strength to support the blast furnace charge. It is used mainly in the iron and steel industry acting as heat source and chemical agent.

Specific information related to the Questionnaire: Coke breeze and Semi cokes are included with Coke oven coke.

Coke breeze comprises particles of coke of sizes less than 10 mm. It is the residue from screening coke. The coke which is screened may be made from bituminous or brown coals.

Semi cokes consists of cokes produced by low temperature carbonization. Note that semi cokes may be made from bituminous and brown coals and are used as a heating fuel.

Gas coke (GK), SIEC codes 0312: A by-product from the carbonization of bituminous coal for the manufacture of "gas works gas".

Remark: Gas coke is used mainly for heating purposes.

Patent fuel (BC), SIEC code 0320: A composition fuel made by moulding hard coal fines into briquette shapes with the addition of a binding agent.

Remark: Sometimes referred to as "hard coal briquettes".

Brown coal briquettes (BB), SIEC code 0330: A composition fuel made of brown coal produced by briquetting under high pressure with or without the addition of a binding agent.

Remark: Either sub-bituminous coal or lignite may be used, including dried lignite fines and dust.

Peat products (BP), SIEC code 12: Includes products such as peat briquettes derived directly or indirectly from sod peat and milled peat, and other peat products not elsewhere specified, such as peat pellets.

Peat briquettes are a fuel comprising small blocks of dried, highly compressed peat made without a binding agent. It is used mainly as a household fuel.

Coal tar (CT), SIEC code 0340: A liquid by-product of the carbonization of coal in coke ovens.

Remark: Coal tar may be separated by distillation into several liquid products which may be used for pharmaceutical or wood preservative purposes.

Other coal products (CP), SIEC code 0390: Other coal products which are not listed above, and do not include Coke oven gas, Blast furnace gas, Gas works gas, or Recovered gases (products under SIEC code 037). As shown in Annex I, Other coal products includes coal products not elsewhere under SIEC code 0.

Oil

Conventional crude oil (CR), SIEC code 4100: A mineral oil of fossil origin extracted by conventional means from underground reservoirs, and comprises liquid or near-liquid hydrocarbons and associated impurities such as sulphur and metals.

Remark: Conventional crude oil exists in the liquid phase under normal surface temperature and pressure, and usually flows to the surface under the pressure of the reservoir. This is termed “conventional” extraction. Crude oil includes condensate from condensate fields, and “field” or “lease” condensate extracted with the crude oil.

The various crude oils may be classified according to their sulphur content (“sweet” or “sour”) and API gravity (“heavy” or “light”). There are no rigorous specifications for the classifications but a heavy crude oil may be assumed to have an API gravity of less than 20° and a sweet crude oil may be assumed to have less than 0.5 per cent sulphur content.

Refinery capacity: The theoretical maximum capacity of crude oil distillation plants available for operation at the end of the reference year.

Natural gas liquids (GL), SIEC code 4200: A mixture of ethane, propane, butane (normal and iso), (iso) pentane and a few higher alkanes collectively referred to as pentanes plus.

Remark: Natural gas liquids are produced in association with oil or natural gas. They are removed in field facilities or gas separation plants before sale of the gas. All of the components of Natural gas liquids except ethane are either liquid at the surface or are liquefied for disposal.

The definition given above is the most commonly used. However, there is some use of terms based on the vapour pressure of the components which are liquid at the surface or can be easily liquefied. The three resulting groups are in order of increasing vapour pressure: condensates, natural gasoline and liquefied petroleum gas.

Natural gas liquids may be distilled with crude oil in refineries, blended with refined oil products or used directly. Natural gas liquids differ from LNG (liquefied natural gas) which is obtained by liquefying natural gas from which the Natural gas liquids has been removed.

Additives and oxygenates (AO), SIEC code 4400: Compounds added to or blended with oil products to modify their properties (octane, cetane, cold properties, etc.).

Remark: Examples are: (a) oxygenates such as alcohols (methanol, ethanol) and ethers [MTBE (methyl tertiary butyl ether), ETBE (ethyl tertiary butyl ether), TAME (tertiary amyl methyl ether)]; (b) esters (e.g., rapeseed or dimethylester, etc.); and (c) chemical compounds (such as TML, TEL and detergents). Some additives/oxygenates may be derived from biomass while others may be of fossil hydrocarbon origin.

Other hydrocarbons (OH), SIEC code 4500: Non-conventional oils and hydrogen. Non-conventional oils refer to oils obtained by non-conventional production techniques, that is oils which are extracted from reservoirs containing extra heavy oils or oil sands which need heating or treatment (e.g., emulsification) *in situ* before they can be brought to the surface for refining/processing. They also include the oils extracted from oil sands, extra heavy oils, coal and oil shale which are at, or can be brought to, the surface without treatment and require processing after mining (*ex situ* processing). Non-conventional oils may also be produced from natural gas.

Remark: The oils may be divided into two groups: (i) oils for transformation (e.g., synthetic crudes extracted from extra heavy oils, oil sands, coal and oil shale); and (ii) oils for direct use (e.g., emulsified oils such as orimulsion

and GTL liquids). Oil sands are also known as tar sands. Extra heavy oils are also known as bitumen. This is not the oil product of the same name which is made from vacuum distillation residue. Although not a hydrocarbon, hydrogen is included here unless it is a component of another gas.

Specific information related to the Questionnaire: a memo item exists to distinguish hydrogen from the other products that fall into this category, given the very different calorific values.

Aviation gasoline (AV), SIEC code 4651: Gasoline prepared especially for aviation piston engines with additives which assure performance under flight conditions. Aviation gasolines are predominantly alkylates (obtained by combining C₄ and C₅ isoparaffins with C₃, C₄ and C₅ olefins) with the possible addition of more aromatic components including toluene. The distillation range is 25°C to 170°C.

Motor gasoline (MO), SIEC code 4652: A mixture of some aromatics (e.g., benzene and toluene) and aliphatic hydrocarbons in the C₅ to C₁₂ range. The distillation range is between 25°C to 220°C.

Remark: Additives are blended to improve octane rating, improve combustion performance, reduce oxidation during storage, maintain cleanliness of the engine and improve capture of pollutants by catalytic converters in the exhaust system. Motor gasoline may also contain biogasoline products.

Of which: biogasoline (ZG): This corresponds to the part of biogasoline which is blended together with Motor gasoline.

Specific information related to the Questionnaire: For this product, please provide data only for the amount of biogasoline which has been blended with Motor gasoline. Pure biogasoline (portions which are not blended) should not be reported here. See also the definition of Biogasoline under biofuels. The blended bio component of motor gasoline that is traded should also be reported here under imports or exports.

Gasoline-type jet fuel (GJ), SIEC code 4653: Light hydrocarbons for use in aviation turbine power units, distilling between 100°C and 250°C. They are obtained by blending kerosene and gasoline or naphtha in such a way that the aromatic content does not exceed 25 per cent in volume, and the vapour pressure is between 13.7 kPa and 20.6 kPa.

Remark: Gasoline-type jet fuel is also known as “aviation turbine fuel”.

Kerosene-type jet fuel (JF), SIEC code 4661: A blend of kerosenes suited to flight conditions with particular specifications, such as freezing point.

Remark: The specifications are set down by a small number of national standards committees, most notably ASTM (U.S.), MOD (UK), GOST (Russia). Kerosene-type jet fuel may also contain blended bio jet kerosene.

Of which: bio jet kerosene (ZJ): This corresponds to the part of bio jet kerosene which is blended together with Kerosene-type jet fuel.

Specific information related to the Questionnaire: For this product, please provide data only for the amount of bio jet kerosene which has been blended with Kerosene-type jet fuel. Pure bio jet kerosene (portions which are not blended) should not be reported here. See also the definition of Bio jet kerosene under biofuels. The blended bio component of kerosene type-jet fuel that is traded should also be reported here under imports or exports.

Other kerosene (KR), SIEC code 4669: Other kerosenes are all kerosenes excluding Kerosene-type jet fuel which is listed above.

Other kerosene is kerosene which is used for heating, cooking, lighting, solvents and internal combustion engines. Other kerosene is also called burning oil, vaporizing oil, power kerosene and illuminating oil.

Kerosenes are mixtures of hydrocarbons in the range C₉ to C₁₆ and distilling over the temperature interval 145°C to 300°C, but not usually above 250°C and a flash point above 38°C.

Remark: The chemical compositions of kerosenes depend on the nature of the crude oils from which they are derived and the refinery processes that they have undergone. Kerosenes obtained from crude oil by atmospheric distillation are known as straight-run kerosenes. Such streams may be treated by a variety of processes to produce kerosenes that are acceptable for blending as jet fuels.

Kerosenes are primarily used as jet fuels. They are also used as domestic heating and cooking fuels, and as solvents. Kerosenes may include components or additives derived from biomass.

Gas oil / Diesel oil (DL), SIEC code 467: Gas oils are middle distillates, predominantly of carbon number range C₁₁ to C₂₅ and with a distillation range of 160°C to 420°C.

Remark: The principal marketed products are fuels for diesel engines (diesel oil), heating oils and marine fuel.

Gas oils are also used as middle distillate feedstock for the petrochemical industry and as solvents.

Diesel may also include blended biodiesel products.

Specific information related to the Questionnaire: Gas oil/diesel oil also includes Heavy gas oil.

Heavy gas oil is a mixture of predominantly gas oil and fuel oil which distills in the range of approximately 380°C to 540°C.

Of which: biodiesel (ZD): This corresponds to the part of biodiesel which is blended together with Gas oil / Diesel oil.

Specific information related to the Questionnaire: For this product, please provide data only for the amount of biodiesel which has been blended with Gas oil / Diesel oil. Pure biodiesel (portions which are not blended) should not be reported here. See also the definition of Biodiesel under biofuels. The blended bio component of Gas oil / Diesel oil that is traded should also be reported here under imports or exports.

Fuel oil (RF), SIEC code 4680: Comprises residual fuel oil and heavy fuel oil. Residual fuel oils have a distillation range of 350°C to 650°C and a kinematic viscosity in the range 6 to 55 cSt at 100°C. Their flash point is always above 60°C and their specific gravity is above 0.95. Heavy fuel oil is a general term describing a blended product based on the residues from various refinery processes.

Remark: Other names commonly used to describe fuel oil include: bunker fuel, bunker C, fuel oil No. 6, industrial fuel oil, marine fuel oil and black oil.

Residual and heavy fuel oil are used in medium to large industrial plants, marine applications and power stations in combustion equipment such as boilers, furnaces and diesel engines. Residual fuel oil is also used as fuel within the refinery.

Liquefied petroleum gas (LP), SIEC code 4630: Liquefied petroleum gas refers to liquefied propane (C₃H₈) and butane (C₄H₁₀) or mixtures of both. Commercial grades are usually mixtures of the gases with small amounts of propylene, butylene, isobutene and isobutylene stored under pressure in containers.

Remark: The mixture of propane and butane used varies according to purpose and season of the year. The gases may be extracted from natural gas at gas separation plants or at plants re-gasifying imported liquefied natural gas. They are also obtained during the refining of crude oil. Liquefied petroleum gas may be used for heating and as a vehicle fuel.

See also the definition for natural gas liquids. Certain oil field practices also use the term Liquefied petroleum gas to describe the high vapour pressure components of natural gas liquids.

Refinery feedstocks (FS), SIEC code 4300: Oils or gases from crude oil refining or the processing of hydrocarbons in the petrochemical industry which are destined for further processing in the refinery excluding blending. Typical feedstocks include naphthas, middle distillates, pyrolysis gasoline and heavy oils from vacuum distillation and petrochemical plants.

Naphtha (NP), SIEC code 4640: Light or medium oils distilling between 30°C and 210°C which do not meet the specification for motor gasoline.

Remark: Different naphthas are distinguished by their density and the content of paraffins, isoparaffins, olefins, naphthenes and aromatics. The main uses for naphthas are as feedstock for high octane gasolines and the manufacture of olefins in the petrochemical industry.

White spirit and special boiling point industrial spirits (WS), SIEC code 4691: White spirit and special boiling point industrial spirits (SBP) are refined distillate intermediates with a distillation in the naphtha/kerosene range. They are mainly used for non-fuel purposes and sub-divided as: (a) white spirit - industrial spirit with a flash point above 30°C and a distillation range of 135°C to 200°C; and (b) industrial spirit (SBP) - light oils distilling between 30°C and 200°C.

Remark: There are 7 or 8 grades of industrial spirit, depending on the position of the cut in the distillation range. The grades are defined according to the temperature difference between the 5 per cent and 90 per cent volume distillation points (which is not more than 60°C).

White spirit and Industrial spirits are mostly used as thinners and solvents.

Lubricants (LU), SIEC code 4692: Oils produced from crude oil, for which the principal use is to reduce friction between sliding surfaces and during metal cutting operations.

Remark: Lubricant base stocks are obtained from vacuum distillates which result from further distillation of the residue from atmospheric distillation of crude oil. The lubricant base stocks are then further processed to produce lubricants with the desired properties.

Bitumen (BT), SIEC code 4695: is a solid, semi-solid or viscous hydrocarbon with a colloidal structure, being brown to black in color.

Remark: It is obtained as a residue in the distillation of crude oil and by vacuum distillation of oil residues from atmospheric distillation. It should not be confused with the non-conventional primary extra heavy oils which may also be referred to as bitumen.

In addition to its major use for road pavements, bitumen is also used as an adhesive, a waterproofing agent for roof coverings and as a binder in the manufacture of patent fuel. It may also be used for electricity generation in specially designed power plants.

Bitumen is also known in some countries as asphalt but in others asphalt describes the mixture of bitumen and stone aggregate used for road pavements.

Paraffin waxes (PW), SIEC code 4693: Residues extracted when dewaxing lubricant oils. They have a crystalline structure which varies in fineness according to the grade, and are colourless, odourless and translucent, with a melting point above 45°C.

Remark: Paraffin waxes are also known as “petroleum waxes”.

Petroleum coke (PK), SIEC code 4694: Petroleum coke is a black solid obtained mainly by cracking and carbonizing heavy hydrocarbon oils, tars and pitches. It consists mainly of carbon (90 to 95 per cent) and has a low ash content.

The two most important categories are "green coke" and "calcined coke".

Green coke (raw coke) is the primary solid carbonization product from high boiling hydrocarbon fractions obtained at temperatures below 630°C. It contains 4-15 per cent by weight of matter that can be released as volatiles during subsequent heat treatment at temperatures up to approximately 1330°C.

Calcined coke is a petroleum coke or coal-derived pitch coke obtained by heat treatment of green coke to about 1330°C. It will normally have a hydrogen content of less than 0.1 per cent by weight.

Remark: In many catalytic operations (e.g., catalytic cracking) carbon or catalytic coke is deposited on the catalyst, thus deactivating it. The catalyst is reactivated by burning off the coke which is used as a fuel in the refining process. The coke is not recoverable in a concentrated form.

Refinery gas (RG), SIEC code 4610: Includes a mixture of non-condensable 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 or from nearby petrochemical plants.

Remark: It is used mainly as a fuel within the refinery.

Ethane (EA), SIEC code 4620: A naturally gaseous straight-chain hydrocarbon (C₂H₆).

Remark: Ethane is obtained at gas separation plants or from the refining of crude oil. It is a valuable feedstock for petrochemical manufacture.

Other oil products n.e.c. (PP), SIEC code 4699: Products (including partly refined products) from the refining of crude oil and feedstocks which are not specified above.

Remark: These products will include basic chemicals and organic chemicals destined for use within the refinery or for sale to or processing in the chemical industry such as propylene, benzene, toluene, and xylene.

Natural Gas, Manufactured Gas and Recovered Gas

Specific information related to the Questionnaire: The data for Natural gas, Gas works gas, Coke oven gas, Blast furnace gas and Other recovered gases should be reported in TJ on a Gross Calorific Value basis.

Natural gas (including LNG) (NG), SIEC code 3000: A mixture of gaseous hydrocarbons, primarily methane, but generally also including ethane, propane and higher hydrocarbons in much smaller amounts and some non-combustible gases such as nitrogen and carbon dioxide.

Remark: The majority of natural gas is separated from both "non-associated" gas originating from fields producing hydrocarbons only in gaseous form, and "associated" gas produced in association with crude oil.

The separation process produces natural gas by removing or reducing the hydrocarbons other than methane to levels which are acceptable in the marketable gas. The natural gas liquids removed in the process are distributed separately.

Natural gas also includes methane recovered from coal mines (colliery gas) or from coal seams (coal seam gas) and shale gas. When distributed it may also contain methane from anaerobic fermentation or the methanation of biomass.

Natural gas may be liquefied (LNG) by reducing its temperature in order to simplify storage and transportation when production sites are remote from centres of consumption and pipeline transportation is not economically practicable.

Gas works gas (GG), SIEC code 0360: Gases obtained from the carbonisation or gasification of carbonaceous material of fossil or biomass origins in Gas Works. The gases comprise: (a) gases obtained from carbonisation or gasification of coals, cokes, biomass or waste; and (b) substitute natural gas (a methane-rich gas) made from synthesis gas.

Remark: Synthesis gas is a mixture of mainly hydrogen and carbon monoxide obtained by cracking hydrocarbons with high temperature steam. The hydrocarbons may be taken from fossil fuels, biofuels or wastes.

Gas works gas also includes other manufactured gases, but excludes recovered gases.

Coke oven gas (OG), SIEC code 0350: A gas produced from coke ovens during the manufacture of coke oven coke.

Blast furnace gas (BG), SIEC codes 0371: The by-product gas of blast furnace operation consisting mainly of nitrogen, carbon dioxide and carbon monoxide.

Remark: The gas is recovered as it leaves the furnace. Its calorific value arises mainly from the carbon monoxide produced by the partial combustion of coke and other carbon bearing products in the blast furnace. It is used to heat blast air and as a fuel in the iron and steel industry. It may also be used by other nearby industrial plants. Note that where carbonised biomass (e.g. charcoal or animal meal) is used in blast furnaces, part of the carbon supply may be considered renewable.

Other recovered gases (BO), SIEC code 0372 and 0379: Combustible gases of solid carbonaceous origin recovered from manufacturing and chemical processes not elsewhere defined.

Remark: Examples of fuel gas production from metals and chemicals processing are in the production of zinc, tin, lead, ferroalloys, phosphorus and silicon carbide.

Specific information related to the Questionnaire: The category Other recovered gases includes Basic oxygen steel furnace gas.

Basic oxygen steel furnace gas is a by-product gas of the production of steel in a basic oxygen furnace. The gas is recovered as it leaves the furnace. The concentration of carbon monoxide in this gas is higher than that in blast furnace gas. The gas is also known as converter gas, LD gas or BOSF gas.

Electricity and Heat

Electricity, net installed capacity of electric power plants (EC): Please refer to Annex III for information.

Electricity (EL), SIEC code 7000: The transfer of energy through the physical phenomena involving electric charges and their effects when at rest and in motion.

Remark: Electricity can be generated through different processes such as: the conversion of energy contained in falling or streaming water, wind or waves; the direct conversion of solar radiation through photovoltaic processes in semiconductor devices (solar cells); or by the combustion of fuels.

See Annex III for the list of the production processes distinguished in the Questionnaire.

Heat (ST), SIEC code 8000: Heat is the energy obtained from the translational, rotational and vibrational motion of the constituents of matter, as well as changes in its physical state.

Remark: Heat can be produced by different production processes.

See Annex III for the list of the production processes distinguished in the Questionnaire.

Thermal Electricity (ET): Gross electricity production from combustible fuels.

See Annex III for the breakdown of gross electricity production from combustible fuels by source in the Questionnaire.

Heat from combustible fuels (HF): Gross heat production from combustible fuels.

See Annex III for the breakdown of gross heat production from combustible fuels by source in the Questionnaire.

Direct use of geothermal heat (DG): Heat from geothermal energy that is not sold, and used directly as final consumption.

Direct use of solar thermal heat (DS): Heat from solar thermal energy that is not sold, and used directly as final consumption.

Biofuels and Waste

Specific information related to the Questionnaire: With regard to the following listed biofuels and waste, from Fuelwood to Biogases, it is crucial to note that only quantities that have been consumed for energy purposes should be reported.

Fuelwood (FW), SIEC code 511: 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.

Remark: Charcoal and black liquor are excluded.

Charcoal (CH), SIEC code 5160: The solid residue from the carbonisation of wood or other vegetal matter through slow pyrolysis.

Bagasse (BS), SIEC code 5120: The fuel obtained from the fibre which remains after juice extraction in sugar cane processing.

Animal waste (AW), SIEC code 5130: Excreta of animals, meat and fish residues which, when dry, are used directly as a fuel.

Remark: This excludes waste used in anaerobic fermentation plants. Fuel gases from these plants are included under biogases.

Specific information related to the Questionnaire: The data in TJ should be reported on a Net Calorific Value basis.

Other vegetal material and residues (VW), SIEC code 5150: Solid primary biofuels not specified elsewhere, including straw, vegetable husks, ground nut shells, pruning brushwood, olive pomace and other wastes arising from the maintenance, cropping and processing of plants.

Specific information related to the Questionnaire: The data in TJ should be reported on a Net Calorific Value basis.

Municipal waste (MW), SIEC code 6200: Household waste and waste from companies and public services that resembles household waste and which is collected at installations specifically designed for the disposal of mixed wastes with recovery of combustible liquids, gases or heat.

Remark: Municipal wastes can be divided into renewable and non-renewable fractions.

Specific information related to the Questionnaire: The data in TJ should be reported on a Net Calorific Value basis.

Industrial waste (IW), SIEC code 6100: Non-renewable waste which is combusted with heat recovery in plants other than those used for the incineration of municipal waste.

Remark: Examples are used tires, specific residues from the chemical industry and hazardous wastes from health care. Combustion includes co-firing with other fuels.

The renewable portions of industrial waste combusted with heat recovery are classified according to the biofuels which best describe them.

Specific information related to the Questionnaire: The data in TJ should be reported on a Net Calorific Value basis.

Black liquor (PU), SIEC code 5140: The alkaline-spent liquor obtained from the digesters during the production of sulphate or soda pulp required for paper manufacture.

Remark: The lignin contained in the liquor burns to release heat when the concentrated liquor is sprayed into a recovery furnace and heated with hot gases at 900°C.

Black liquor is used as a fuel in the pulping process.

Specific information related to the Questionnaire: The data in TJ should be reported on a Net Calorific Value basis.

Biogasoline (AL), SIEC code 5210: Liquid fuels derived from biomass and used in spark-ignition internal combustion engines.

Remark: Common examples are: bioethanol (including both hydrous and anhydrous ethanol); biomethanol; biobutanol; bio ETBE (ethyl-tertio-butyl-ether); and bio MTBE (methyl-tertio-butyl-ether).

Biogasoline may be blended with petroleum gasoline or used directly in engines. The blending may take place in refineries or at or near the point of sale.

Specific information related to the Questionnaire: The consumption of the portion of biogasoline which is blended should also be reported under 'Of which biogasoline (ZG)', as mentioned earlier in the definition for 'Of which biogasoline (ZG)'.

Biodiesels (BD), SIEC code 5220: Liquid biofuels derived from biomass and used in diesel engines.

Remark: Biodiesels obtained by chemical modification are a linear alkyl ester made by transesterification of vegetable oils or animal fats with methanol. The transesterification distinguishes biodiesel from straight vegetable and waste oils. Biodiesel has a flash point of around 150°C and a density of about 0.88 kg/litre. Biological sources of biodiesel include, but are not limited to, vegetable oils made from canola (rapeseed), soybeans, corn, oil palm, peanut or sunflower. Some liquid biofuels (straight vegetable oils) may be used without chemical modification and their use usually requires modification of the engine.

A further category of diesel fuels can be produced by a range of thermal processes (including for example gasification followed by Fischer Tropsch synthesis, pyrolysis followed by hydrogenation, or conversion of sugar to hydrocarbons using microorganisms (e.g. yeast)). A wide range of biomass feedstocks, including cellulosic materials and algal biomass could be used in such processes.

Biodiesels may be blended with petroleum diesel or used directly in diesel engines.

Specific information related to the Questionnaire: The consumption of the portion of biodiesel which is blended should also be reported under 'Of which biodiesel (ZD)', as mentioned earlier in the definition for 'Of which biodiesel (ZD)'.

Bio jet kerosene (BJ), SIEC code 5230: Liquid biofuels derived from biomass and blended with or replacing jet kerosene.

Remark: Bio jet kerosene can be produced by a range of thermal processes (including for example gasification followed by Fischer-Tropsch synthesis, pyrolysis followed by hydrogenation, or conversion of sugar to hydrocarbons using microorganisms (e.g. yeast). A wide range of biomass feedstocks, including cellulosic materials and algal biomass could be used in such processes.

Specific information related to the Questionnaire: The consumption of the portion of bio jet kerosene which is blended component should also be reported under 'Of which bio jet kerosene (ZJ)', as mentioned earlier in the definition for 'Of which bio jet kerosene (ZJ)'.

Other liquid biofuels (OL), SIEC code 5290: Liquid biofuels not elsewhere specified.

Biogases (BI), SIEC code 53: Gases arising from the anaerobic fermentation of biomass and the gasification of solid biomass (including biomass in wastes).

Remark: The biogases from anaerobic fermentation are composed principally of methane and carbon dioxide and comprise landfill gas, sewage sludge gas and other biogases from anaerobic fermentation.

Biogases can also be produced from thermal processes (by gasification or pyrolysis) of biomass and are mixtures containing hydrogen and carbon monoxide (usually known as syngas) along with other components. These gases may be further processed to modify their composition and can be further processed to produce substitute natural gas.

These gases are produced either from anaerobic fermentation or from thermal processes.

Specific information related to the Questionnaire: For the purposes of this Questionnaire please report the total quantity of biogases produced, regardless of their production process. The data in TJ should be reported on a Net Calorific Value basis.

Uranium (UR), included in SIEC code 9100: The uranium content of uranium ores and concentrates intended for treatment for uranium recovery.

3. Flows

3.1. Flow definitions

In this section 3, the list of energy flows covered by the UNSD *Annual Questionnaire on Energy Statistics* are explained. Note that in the Questionnaire, the combination of product and flow codes determine the specific data point, for example, CL01 refers to the production (01) of Hard Coal (CL). A sample of how these flows are presented in the Questionnaire is shown in Figure 3.1.1.

Figure 3.1.1: Sample layout of flows in the UN Energy Questionnaire

| Hard Coal (CL); Metric tons, thousand (WSR) | |
|--|--|
| | CL01 Production |
| | CL022 Receipts from other sources |
| Product code | CL03 Imports |
| | CL04 Exports |
| Flow code | CL051 International marine bunkers |
| | CL06 Stock changes |
| | CLGA Total energy supply |
| | CLSD Statistical differences |
| | CL08 Transformation |
| | CL088 Transformation in electricity, CHP and heat plants |
| | CL08811 Electricity plants - Main activity producers |
| | CL08812 Electricity plants - Autoproducers |
| | CL08821 CHP plants - Main activity producers |
| | CL08822 CHP plants - Autoproducers |
| | CL08831 Heat plants - Main activity producers |
| | CL08832 Heat plants - Autoproducers |
| Transformation | CL081 Coke ovens |
| | CL082 Gas works |
| | CL083 Briquetting plants |
| | CL084 Blast furnaces |
| | CL085LP Coal liquefaction plants |
| | CL089 Other transformation |
| | CL09 Energy industries own use |
| | CL0911 Coal mines |
| | CL0921 Coke ovens |
| | CL0922 Gas works |
| | CL0923 Briquetting plants |
| | CL0924 Blast furnaces |
| | CL0925 Oil refineries |
| | CL0927 Electricity, CHP and heat plants |
| | CL0930 Coal liquefaction plants |
| | CL0928 Other energy industry own use |
| Energy Industries Own Use | CL101 Losses |
| | CLNA Final consumption |
| | CL11 Non-energy uses |
| | CL12 Final energy consumption |
| | CL121 Manufacturing, construction and non-fuel mining industry |
| | CL1211 Iron and steel |
| | CL1213 Chemical and petrochemical |
| | CL1214 Other manuf., const. and non-fuel min. ind. |
| | CL1214a Non-ferrous metals |
| | CL1214b Non-metallic minerals |
| | CL1214c Transport equipment |
| | CL1214d Machinery |
| | CL1214e Mining and quarrying |
| | CL1214f Food and tobacco |
| | CL1214g Paper, pulp and print |
| | CL1214h Wood and wood products |
| | CL1214i Construction |
| | CL1214j Textile and leather |
| | CL1214o Not elsewhere specified (industry) |
| | CL122 Transport |
| | CL1222 Rail |
| | CL1224 Domestic navigation |
| | CL1225 Not elsewhere specified (transport) |
| | CL123 Other |
| | CL1231 Households |
| | CL1232 Agriculture, forestry and fishing |
| | CL1235 Commerce and public services |
| | CL1234 Not elsewhere specified (other) |
| Final consumption | |
| | Final energy consumption |

Please find below the definitions of major/aggregate flows which are listed in the Questionnaire. The codes for the flows are provided beside the names in parentheses. Further breakdown and information of Energy industries, Transformation and Final consumption are presented in sections 3.2 through 3.6.

Production (01): is defined as the capture, extraction or manufacture of fuels or energy in forms which are ready for general use. In energy statistics, two types of production are distinguished, primary and secondary. **Primary production** is the capture or extraction of fuels or energy from natural energy flows, the biosphere and natural reserves of fossil fuels within the national territory in a form suitable for use. Inert matter removed from the extracted fuels and quantities reinjected, flared or vented are not included. The resulting products are referred to as “primary” products. **Secondary production** is the manufacture of energy products through the process of transformation of primary fuels or energy. The quantities of secondary fuels reported as production include quantities lost through venting and flaring during and after production. In this manner, the mass, energy and carbon within the primary source(s) from which the fuels are manufactured may be balanced against the secondary fuels produced. Fuels, electricity and heat produced are usually sold but may be partly or entirely consumed by the producer.

Production of Natural gas refers to dry marketable production. Please refer to Annex II for further information regarding the production of Natural gas.

Specific information related to the Questionnaire: For Electricity and Heat production are separated by different types of technology/processes. For detailed information regarding these processes, please refer to Annex III.

Receipts from other sources for solid fossil fuels and derived products (022): consists of two components: (a) recovered slurries, middlings and other low-grade coal products, which cannot be classified according to type of coal and includes coal recovered from waste piles and other waste receptacles; and (b) fuels whose production is covered in other sections of SIEC, for example from oil products (e.g., petroleum coke addition to coking coal for coke ovens), from natural gas (e.g., natural gas addition to gas works gas for direct final consumption), and from biofuels and waste (e.g., industrial waste as binding agent in the manufacturing of patent fuel).

Receipts from other sources for natural gas (022): refers to the production of gas from energy products that have been already accounted for in the production of other energy products. Examples are blending of petroleum gases or biogases with natural gas.

Receipts from other sources for oil (022): refers to the production of oil and oil products from energy products that have been already accounted for in the production of other energy products. For example, the liquids produced from coal liquefaction plants, and the liquid output from coke ovens should be reported as receipts from other sources, as should backflows from the petrochemical industry.

Imports (03): comprise all fuel and energy entering the national territory. Goods simply being transported through a country (goods in transit) and goods temporarily admitted are excluded but re-imports, which are domestic goods exported but subsequently readmitted, are included. The bunkering of fuel outside the reference territory by national merchant ships and civil aircraft engaged in international travel is excluded from imports. Fuels delivered to national merchant ships and civil aircraft which are outside of the national territory and are engaged in international travel should be classified as “International Marine Bunkers” or “International Aviation Bunkers”, respectively, in the country where such bunkering is carried out.

Exports (04): comprise all fuel and other energy products leaving the national territory with the exception that exports exclude quantities of fuels delivered for use by merchant (including passenger) ships and civil aircraft, of all nationalities, during international transport of goods and passengers. Goods simply being transported through a country (goods in transit) and goods temporarily withdrawn are excluded but re-exports, foreign goods exported in the same state as previously imported, are included. Fuels delivered to foreign merchant ships and civil aircraft engaged in international travel are classified as “International Marine Bunkers” or “International Aviation Bunkers”, respectively.

It should be noted that the definitions of imports and exports used in energy statistics are those adopted by international merchandise trade statistics for a system of recording known as “general trade system”, that is all

energy products entering and leaving the national territory a country and which add to or subtract from the stock of material resources of a country are recorded as energy imports and exports except for the bunkering of international fleet which is excluded from the trade figures. It should also be noted that, in the energy balances, imports and exports exclude nuclear fuels as these are not within the scope of energy balances.

International marine bunkers (051): are quantities of fuels delivered to merchant (including passenger) ships, of any nationality, for consumption during international voyages transporting goods or passengers. International voyages take place when the ports of departure and arrival are in different national territories. Fuels delivered for consumption by ships during domestic transportation, fishing or military uses are not included here. For the purposes of energy statistics International marine bunkers are not included as exports.

International aviation bunkers (052): are quantities of fuels delivered to civil aircraft, of any nationality, for consumption during international flights transporting goods or passengers. International flights take place when the ports of departure and arrival are in different national territories. Fuels delivered for consumption by aircraft undertaking domestic or military flights are not included. For the purposes of energy statistics International aviation bunkers are not included as exports.

Stocks: For the purposes of energy statistics, stocks are quantities of energy products that can be held and used to: (a) maintain service under conditions where supply and demand are variable in their timing or amount due to normal market fluctuations, or (b) supplement supply in the case of a supply disruption. Stocks used to manage a supply disruption may be called "strategic" or "emergency" stocks and are often held separately from stocks designed to meet normal market fluctuations.

Stock changes (06): The increase (stock build) or decrease (stock draw) in the quantity of stock over the reporting period. They are calculated as a difference between the closing and opening stocks.

Transfers (07): comprise product transferred and interproduct transfers. *Product transferred* refers to the reclassification (renaming) of products which is necessary when finished oil products are used as feedstock in refineries. *Interproduct transfers* refer to the movements of fuels between product categories because of reclassification of a product which no longer meets its original specification. The transferred product is often blended with its host.

Transformation (08): is the process where the movement of part or all of the energy content of a product entering a process to one or more different products leaving the process (e.g., coking coal to coke, crude oil to petroleum products, and heavy fuel oil to electricity).

Please refer to the section 3.3 on Transformation processes for more detail.

Energy industries own use (09): refers to consumption of fuels and energy for the direct support of the production, and preparation for use of fuels and energy. Quantities of fuels which are transformed into other fuels or energy are not included here but within the transformation use. Neither are quantities which are used within parts of the energy industry not directly involved in the activities listed in the definition. These quantities are reported within final consumption.

Please refer to the section 3.2 on Energy industries for more detail.

Losses (101): refer to losses during the transmission, distribution and transport of fuels, heat and electricity. Losses also include venting and flaring of manufactured gases, losses of geothermal heat after production and pilferage of fuels or electricity. Production of secondary gases includes quantities subsequently vented or flared. This ensures that a balance can be constructed between the use of the primary fuels from which the gases are derived and the production of the gases.

Final consumption (NA): refers to all fuel and energy that is delivered to users for both their energy and non-energy uses not involving transformation process.

Non-energy uses (11): comprise uses of fuels for chemical feedstocks and for non-energy products. Chemical feedstocks are fuels used as raw materials for the manufacture of products which contain the hydrogen and/or carbon taken from the fuel. Non-energy products are fuel products used mainly for their physical and chemical properties. Examples are lubricants, paraffin waxes, coal tars and oils as timber preservatives, etc.

Final energy consumption (12): refers to all fuel and energy that are delivered to users for their energy use. It includes the use of energy products for energy purposes (excluding for transportation) by energy consumers and the use of energy for transport by all economic units

Final energy consumption is further disaggregated by energy user groups. More information on these categories of energy consumers are listed in respective sections on Manufacturing, construction and non-fuel industry (section 3.4), Transport (section 3.5), and Other (section 3.6).

Further detail on the main categories of energy consumers is available in the International Standard Industrial Classification of All Economic Activities (ISIC).

3.2. Energy industries

Definition of energy industries: Energy production is an energy flow of major importance. Data on energy production is required for various policy and analytical purposes; therefore the provision of further details on energy production is one of the priorities of energy statistics. Energy can be produced by various economic units. However, not all of them should be treated as belonging to energy industries. In order to ensure international comparability, it is recommended that energy industries are defined as economic units whose principal activity is the primary energy production, transformation of energy and distribution of energy. This means that the value added generated by these activities exceed that of any other activity carried out within the same economic unit.

The activities of the energy industries which are contained in the Questionnaire, under 'Energy industries own use', are listed below.

Coal mines are plants extracting coal through underground or open-cast mining. In addition to the extraction activity itself, the operation of coal mines also includes operations such as grading, cleaning, compressing, etc., leading to a marketable product.

Coke ovens are large ovens within which coke oven coke, coke oven gas and coal tars are produced by high temperature carbonisation of coking coal.

Coal liquefaction plants are plants where coal is used as a feedstock to produce liquid fuels by hydrogenation or carbonisation. They are also known as coal to liquid (CTL) plants.

Patent fuel plants are plants manufacturing patent fuels.

Brown coal briquette plants are plants manufacturing brown coal briquettes.

Specific information related to the Questionnaire: Patent fuel plants, Brown coal briquette plants and Peat briquette plants are collectively presented as Briquetting plants.

Gas works (*and other conversion to gases*) are plants manufacturing gases for distribution to the public either directly or after blending with natural gas. Note that gases are collectively referred to as "Gas Works Gas and other manufactured gases for distribution"; short name – gas works gas. Some gas works may produce coke as well as gas.

Natural gas separation plants are plants involved in the separation of associated gas from crude oil, and/or the separation of condensate, water, impurities and natural gas liquids from natural gas. In addition to the above, the activities of these plants may also involve fractionation of the recovered natural gas liquids.

Gas to liquid (GTL) plants are plants in which natural gas is used as feedstock for the production of liquid fuels. The liquid fuels are usually used as vehicle fuels. Note that the gas-to-liquid plants are quite different from LNG plants which convert gaseous natural gas into liquid natural gas.

LNG plants/regasification plants are plants for carrying out liquefaction and/or regasification of natural gas for the purpose of transport. This activity can be carried out on or off the actual mine site.

Blast furnaces produce blast furnace gas as a by-product when making pig iron from iron ore. During the process, carbon, mainly in the form of coke, is added to the blast furnace to support and reduce the iron oxide charge and provide heat. Blast furnace gas comprises carbon monoxide and other gases formed during the heating and reduction process.

Oil and gas extraction are activities of extracting crude petroleum, mining and extraction of oil from oil shale and oil sands and production of natural gas and recovery of hydrocarbon liquids. This includes overall activities of operating and/or developing oil and gas field properties, including such activities as drilling, completing and

equipping wells, operating separators, emulsion breakers, desilting equipment and field gathering lines for crude petroleum and all other activities in the preparation of oil and gas up to the point of shipment from the producing property.

Oil refineries are plants which transform crude oil and other hydrocarbons into finished oil products. Typical finished products are liquefied petroleum gases, naphtha, motor gasoline, gas oils, aviation fuels, other kerosene, and fuel oils.

Charcoal plants are plants in which wood or other vegetal matter is carbonised through slow pyrolysis to produce charcoal.

Biogas production plants are plants for capture and/or manufacturing of biogases. Biogases arise from the anaerobic fermentation of biomass. They can be derived from several sources including landfills, sewage sludge and agricultural residues. They also include synthesis gas produced from biomass.

Nuclear fuel extraction and fuel processing refers to plants involved in the mining of ores chiefly valued for uranium and thorium content, the concentration of such ores, production of yellowcake, enrichment of uranium and thorium ores, and/or the production of fuel elements for nuclear reactors.

Electricity, CHP and heat plants are involved in the production of electricity and heat either through transformation of combustible fuels, nuclear energy or from renewable sources. Please refer to Annex III for more information.

Pumped-storage plants are plants where electricity is used during periods of lower demand to pump water into reservoirs for subsequent release and electricity generation during periods of higher demand. Less electricity is eventually produced than is consumed to pump the water into the higher reservoir.

Other energy industry not elsewhere specified is the residual category which refers to any energy industry not covered elsewhere in the list above.

3.3. Transformation processes

A *transformation process* is the movement of part or all of the energy content of a product entering the process to one or more different products leaving the process. There are two groups of transformation processes:

- (a) The physical or chemical conversion of a product into another product or products whose intrinsic properties differ from those of the original product. Examples are:
 - chemical or physical changes to the input product(s) resulting in the creation of products containing new chemical compounds. (e.g., refining);
 - physical changes to the input which involves separation into several different products with intrinsic physical properties which are different from those of the input material (e.g., coke oven carbonisation of coal);
 - conversion of heat into electricity; and
 - production of heat from combustion, fission or electricity.
- (b) The aggregation or blending of products, sometimes involving a change of physical shape. Examples are:
 - blending gases to meet safety and quality requirements before distribution to consumers; and
 - briquetting of peat and brown coal.

These transformation processes are currently identified by the plants in which they occur, namely:

- Electricity plants
- Combined heat and power plants
- Heat plants
- Coke ovens
- Patent fuel plants
- Brown coal briquette plants
- Coal liquefaction plants
- Gas works (and other conversion to gases)
- Blast furnaces
- Peat briquette plants
- Natural gas blending plants
- Gas to liquid (GTL) plants
- Oil refineries
- Petrochemical plants
- Charcoal plants
- Heat pumps
- Electric boilers
- Other transformation processes not elsewhere classified

Most of the plants in the above list have already been described above in section 3.2. Descriptions of the remaining plants are given below:

Peat briquette plants are plants manufacturing peat briquettes.

Specific information related to the Questionnaire: Patent fuel plants, Brown coal briquette plants and Peat briquette plants are collectively presented as Briquetting plants.

Natural gas blending plants are plants, separate from gas works, in which substitute natural gas, petroleum gases or biogases are mixed with natural gas for distribution in the gas mains. Where blending of substitute natural gas with natural gas takes place within gas works the blending is considered part of the gas works process.

Petrochemical plants are plants that convert hydrocarbon feedstock into organic chemicals, intermediate compounds and finished products such as plastics, fibres, solvents and surfactants. Feedstock used by the plant is usually obtained from the refinery and includes naphtha, ethane, propane and middle distillate oils (e.g., gas oil). The carbon and hydrogen in the feedstock is largely transferred to the basic chemicals and products subsequently made from them. However, certain by-products are also created and returned to the refinery (such as pyrolysis gasoline) or burned for fuel to provide the heat and electricity required for the cracking and other processes in the petrochemical plant. Note that since energy transformation is not the principle activity of petrochemical plants they do not belong to energy industries and, as a group, are treated as energy consumers.

For further information on Heat pumps and Electric boilers, please refer to Annex III.

Electricity, CHP and heat plants

The following section provides more information on electricity, CHP and heat plants. Statistics on electricity and heat data are collected according to the type of producer and type of generating plant. Two types of producers are distinguished:

- **Main Activity Producer:** Enterprises which produce electricity or heat as their principal activity. Formerly known as public utilities, the enterprises may be privately or publicly owned companies.
- **Autoproducers (Electricity):** Enterprises which produce electricity but for whom the production is not their principal activity.

Autoproducers (Heat): Enterprises which produce heat for sale but for whom the production is not their principal activity. Deliveries of fuels for heat generated by an establishment for its own use are classified within the part of final consumption where they are consumed.

Three types of generating plants are identified as follow:

- **Electricity plants** refer to plants producing only electricity. The electricity may be obtained directly from natural sources such as hydro, geothermal, wind, tidal, marine, solar energy or from fuel cells or from the heat obtained from the combustion of fuels or nuclear reactions.
- **Combined Heat and Power (CHP)** produce both heat and electricity from at least one generating unit in the plant. They are sometimes referred to as “co-generation” plants.
- **Heat plants** refer to plants (including heat pumps and electric boilers) designed to produce heat only for deliveries to third parties. Deliveries of fuels for heat generated by an establishment for its own use are classified within the part of final consumption where they are consumed.

| <i>Types of Plant:</i> | <i>Electricity only</i> | <i>CHP</i> | <i>Heat only</i> |
|---------------------------|---|---|--|
| <i>Types of Producer:</i> | | | |
| Main activity producers | | Report all electricity and heat produced and all fuel used | Report all heat produced and all fuel used |
| Autoproducers | Report all production and all fuel used | Report all electricity produced and heat sold with corresponding fuel used | Report heat sold and corresponding fuel used |

Gross electricity and heat production from combustible fuels

The following section provides information on a breakdown of electricity and heat generation from combustible fuels by source:

From hard coal (01CL): Gross electricity or heat production from hard coal (CL).

From brown coal (01LB): Gross electricity or heat production from brown coal (LB).

From peat (01PT): Gross electricity or heat production from peat (PT) and peat products (BP).

From oil shale (01OS): Gross electricity or heat production from oil shale (OS).

From solid coal products (01CP): Gross electricity or heat production from solid coal products. It includes Coke oven coke (OK), Gas coke (GK), Patent fuel (BC), Brown coal briquettes (BB), Coal tar (CT).

From crude oil, NGLs and other hydrocarbons (01CR): Gross electricity or heat production from Crude oil (CR), NGLs (GL) and other hydrocarbons (OH).

From gas oil/ diesel oil (01DL): Gross electricity or heat production from non-bio Gas oil/ diesel oil ((DL) excluding (ZD)).

From fuel oil (01RF): Gross electricity or heat production from Fuel oil (RF).

From other oil products (01PP): Gross electricity or heat production from other oil products. It includes non-bio Motor gasoline ((MO) excluding biofuels (ZG)), non-bio Kerosene-type jet fuel ((JF) excluding biofuels (ZJ)), Other kerosene (KR), Liquefied petroleum gas (LP), Naphtha (NP), Bitumen (BT), Petroleum coke (PK), Refinery gas (RG), Ethane (EA) and Other oil products n.e.c. (PP).

From natural gas (01NG): Gross electricity or heat production from natural gas (NG).

From manufactured gases (01MG): Gross electricity or heat production from manufactured gases. It includes Gas works gas (GG), Coke oven gas (OG), Blast furnace gas (BG) and Other recovered gases (BO).

From solid biofuels (01SBF): Gross electricity or heat production from solid biofuels. It includes Fuelwood (FW), Charcoal (CH), Bagasse (BS), Animal waste (AW), Other vegetal material and residues (VW) and Black liquor (PU).

Of which: from bagasse (01BS): Gross electricity or heat production from Bagasse (BS).

From renewable municipal waste (01RW): Gross electricity or heat production from renewable Municipal waste ((MW) excluding non-renewable waste).

From non-renewable waste (01NRW): Gross electricity or heat production from non-renewable waste. It included Industrial waste (IW) and non-renewable Municipal waste ((MW) excluding renewable waste).

From liquid biofuels (01LBF): Gross electricity or heat production from liquid biofuels Biogasoline (AL), Biodiesels (BD) and Bio jet kerosene (BJ).

From biogases (01BI): Gross electricity or heat production from Biogases (BI). **Other transformation processes not elsewhere classified** refers to the residual category of transformation processes not specified elsewhere. The input of natural gas liquids into gas separation plants giving output of secondary oil products is included here.

3.4. Final consumption by manufacturing, construction and non-fuel mining industry

In the Energy Questionnaire, quantities consumed in industries should be reported using the illustrated below breakdown.

Table 3.4.1: Main categories of energy consumers in Manufacturing, Construction and Non-fuel Mining Industry

| Categories of energy consumers | Codes for the UN Energy Questionnaire | Correspondence to ISIC Rev. 4 |
|--|---------------------------------------|---|
| Manufacturing, construction and non-fuel mining industry | 121 | |
| Iron and steel | 1211 | ISIC Group 241 and Class 2431. Note that the consumption in coke ovens and blast furnaces are defined as part of Transformation Processes and Energy Industry Own Use. |
| Chemical and petrochemical | 1213 | ISIC Divisions 20 and 21, excluding ISIC 2011. Note that the consumption by plants manufacturing charcoal or enrichment/production of nuclear fuels (found in ISIC 2011) is excluded, as these plants are considered part of the energy industries. |
| Other manufacturing, construction and non-fuel mining industry | 1214 | |
| Non-ferrous metals | 1214a | ISIC Group 242 and Class 2432 |
| Non-metallic minerals | 1214b | ISIC Division 23 |
| Transport equipment | 1214c | ISIC Divisions 29 and 30 |
| Machinery | 1214d | ISIC Divisions 25, 26, 27 and 28. Fabricated metal products, machinery and equipment other than transport equipment. |
| Mining and quarrying | 1214e | ISIC Divisions 07 and 08 and Group 099, excluding the mining of uranium and thorium ores (Class 0721) and the extraction of peat (Class 0892). |
| Food and tobacco | 1214f | ISIC Divisions 10, 11 and 12 |
| Paper, pulp and print | 1214g | ISIC Divisions 17 and 18. Includes production of recorded media. |
| Wood and wood products (Other than pulp and paper) | 1214h | ISIC Division 16 |
| Construction | 1214i | ISIC Divisions 41, 42 and 43 |
| Textile and leather | 1214j | ISIC Divisions 13, 14 and 15 |
| Not elsewhere specified (industry) | 1214o | ISIC Divisions 22, 31, 32 |

The above-mentioned flows are not all exclusive and some flows relate to others as follows.

- The sum of the quantities used under Questionnaire codes 1211, 1213 and 1214 is equal to the quantity consumed under Questionnaire code 121.
- The sum of the quantities used under Questionnaire codes 1214a through 1214o, as shown above, should be the same as the quantity consumed under Questionnaire code 1214.

3.5. Final consumption by transport

Provided below are the flows of final consumption in transport, including the flow codes. Details of the different modes of transport are also presented.

Table 3.5.1: Main categories for final consumption in Transport

| Categories of energy consumers | Codes for the UN Energy Questionnaire |
|-------------------------------------|---------------------------------------|
| Transport | 122 |
| Road | 1221 |
| Rail | 1222 |
| Domestic aviation | 1223 |
| Domestic navigation | 1224 |
| Pipeline transport | 1226 |
| Not elsewhere specified (transport) | 1225 |

Transport (122): is defined as the consumption of fuels and electricity used in transport of goods or persons between points of departure and destination within the national territory irrespective of the economic sector within which the activity occurs. The classification of the consumption of fuels by merchant ships and civil aircraft undertaking transport of goods or persons beyond the national territory is covered under the definitions for International Marine and Aviation Bunkers and are therefore excluded from this definition. However, deliveries of fuels to road vehicles going beyond national borders cannot be readily identified and by default are included here.

Road (1221) refers to fuels and electricity delivered to vehicles using public roads. Fuels delivered for “off-road” use and stationary engines should be excluded. Off-road use comprises vehicles and mobile equipment used primarily on commercial, industrial sites or private land, or in agriculture or forestry. The deliveries of fuels related to these uses are included under the appropriate final consumption heading. Deliveries for military uses are also excluded here but included under “not elsewhere specified” for other energy consumers (flow code 1234). The fuel use by freight transport by road and by trolley buses is included here.

Rail (1222) refers to fuels and electricity delivered for use in rail vehicles, including industrial railways. This includes urban rail transport (including trams) and is part of the fuel and energy consumption by this activity.

Domestic aviation (1223) refers to quantities of aviation fuels delivered to all civil aircraft undertaking a domestic flight transporting passengers or goods, or for purposes such as crop spraying and the bench testing of aero engines. A domestic flight takes place when the departure and landing airports are on national territory. In cases where distant islands form part of the national territory this may imply long flights through the air space of other countries but the flights are, nevertheless, part of domestic aviation. Military use of aviation fuels should not be included in domestic aviation but included under energy balance item “not elsewhere specified” for other energy consumers (flow code 1234). The use of fuel by airport authorities for ground transport *within* airports is also excluded here but included under “Commerce and public services”.

Domestic navigation (1224) refers to fuels delivered to vessels transporting goods or people and undertaking a domestic voyage. A domestic voyage is between ports of departure and destination in the same national territory without intermediate ports of call in foreign ports. Note, that this may include journeys of considerable length between two ports in a country (e.g., San Francisco to Honolulu). Fuels delivered to fishing vessels are excluded here but included under “fishing”.

Pipeline transport (1226): refers to fuels and electricity used in the support and operation of pipelines transporting gases, liquids, slurries and other commodities between points within the national territory. It comprises the consumption at pumping stations and for maintenance of the pipeline. Consumption for maintaining the flow in pipelines carrying natural gas, manufactured gas, hot water and steam in distribution networks is excluded here but included under the appropriate heading within “Energy industries own use”. Consumption for the transport of natural

gas in transmission networks is included. Consumption of fuels or electricity for maintaining the flow in pipelines carrying water is included in “Commerce and public services”. A transmission pipeline transports its contents to distribution pipelines for eventual delivery to consumers. Transmission pipelines for gas usually operate at pressures considerably higher than those used in the distribution pipelines.

Transport not elsewhere specified (1225): refers to deliveries of fuels or electricity used for transport activities not covered within the modes of transport defined elsewhere. Most of the forms of transport listed in ISIC Class 4922 (other land transport) are included in the modes of transport defined elsewhere. However, consumption of electricity for téléphériques (telfers), and ski and cable lifts would be included here.

3.6. Final consumption by other

The residual category of consumers, which have not already been mentioned in other categories, is named 'Other' in the Energy Questionnaire. The composition of the sub-categories for Other are shown below.

As stated in the section on Transport, consumption of transport, bunkering, etc. related to defence activities should be reported under "Not elsewhere specified (other)", Questionnaire flow code 1234.

Table 3.6.1: Main categories for final consumption in Other

| Categories of energy consumers | Codes for the UN Energy Questionnaire | Correspondence to ISIC Rev. 4 |
|--|--|---|
| Other | 123 | |
| Household | 1231 | ISIC Divisions 97 and 98 |
| Commerce and public services | 1235 | ISIC divisions 33, 36-39, 45-96 and 99, excluding ISIC 8422 |
| Agriculture, Forestry | 1232 | ISIC Divisions 01 and 02 |
| Fishing | 1232 | ISIC Divisions 03 |
| Not elsewhere specified (other) (Includes defence activities) | 1234 | Defence activities category is ISIC Class 8422 |

Annex

Annex I – SIEC and Questionnaire product codes

Table A.1: Correspondence between SIEC codes and the Questionnaire product codes

| SIEC Headings | | | Correspondences |
|----------------------------------|-------|--|---|
| Section / Division / Group | Class | | Codes for the UN Energy Questionnaire |
| 0 | | Coal | |
| 01 | | Hard coal | CL |
| | 011 | 0110 Anthracite | AT |
| | 012 | Bituminous coal | |
| | | 0121 Coking coal | CC |
| | | 0129 Other bituminous coal | OB |
| 02 | | Brown coal | LB |
| | 021 | 0210 Sub-bituminous coal | SB |
| | 022 | 0220 Lignite | LN |
| 03 | | Coal products | |
| | 031 | Coal coke | |
| | | 0311 Coke oven coke | |
| | | 0313 Coke breeze | OK |
| | | 0314 Semi cokes | |
| | | 0312 Gas coke | GK |
| | 032 | 0320 Patent fuel | BC |
| | 033 | 0330 Brown coal briquettes (BKB) | BB |
| | 034 | 0340 Coal tar | CT |
| | 035 | 0350 Coke oven gas | OG |
| | 036 | 0360 Gas works gas (and other manufactured gases for distribution) | GG |
| | 037 | Recovered gases | |
| | | 0371 Blast furnace gas | BG |
| | | 0372 Basic oxygen steel furnace gas | BO |
| | | 0379 Other recovered gases | |
| | 039 | 0390 Other coal products | CP |
| 1 | | Peat and peat products | |
| 11 | | Peat | PT |
| | 111 | 1110 Sod peat | |
| | 112 | 1120 Milled peat | |
| 12 | | Peat products | BP |
| | 121 | 1210 Peat briquettes | |
| | 129 | 1290 Other peat products | |
| 2 | | Oil shale / Oil sands | |
| 20 | | Oil shale / Oil sands | |
| | 200 | 2000 Oil shale / Oil sands | OS |
| 3 | | Natural gas | |
| 30 | | Natural gas | |
| | 300 | 3000 Natural gas | NG |

Table A.1: Correspondence between SIEC codes and the Questionnaire product codes (continued)

| SIEC Headings | | Correspondences |
|----------------------------------|--|---|
| Section / Division / Group | Class | Codes for the UN Energy Questionnaire |
| 4 | Oil | |
| 41 | Conventional crude oil | |
| 410 | 4100 Conventional crude oil | CR |
| 42 | Natural gas liquids (NGL) | |
| 420 | 4200 Natural gas liquids (NGL) | GL |
| 43 | Refinery feedstocks | |
| 430 | 4300 Refinery feedstocks | FS |
| 44 | Additives and oxygenates | |
| 440 | 4400 Additives and oxygenates | AO |
| 45 | Other hydrocarbons | |
| 450 | 4500 Other hydrocarbons | OH |
| 46 | Oil products | |
| 461 | 4610 Refinery gas | RG |
| 462 | 4620 Ethane | EA |
| 463 | 4630 Liquefied petroleum gases (LPG) | LP |
| 464 | 4640 Naphtha | NP |
| 465 | Gasolines | |
| | 4651 Aviation gasoline | AV |
| | 4652 Motor gasoline | MO |
| | 4653 Gasoline-type jet fuel | GJ |
| 466 | Kerosenes | |
| | 4661 Kerosene-type jet fuel | JF |
| | 4669 Other kerosene | KR |
| 467 | Gas oil / diesel oil and Heavy gas oil | DL |
| | 4671 Gas oil / Diesel oil | |
| | 4672 Heavy gas oil | |
| 468 | 4680 Fuel oil | RF |
| 469 | Other oil products | |
| | 4691 White spirit and special boiling point industrial spirits | WS |
| | 4692 Lubricants | LU |
| | 4693 Paraffin waxes | PW |
| | 4694 Petroleum coke | PK |
| | 4695 Bitumen | BT |
| | 4699 Other oil products n.e.c. | PP |

Table A.1: Correspondence between SIEC codes and the Questionnaire product codes (continued)

| SIEC Headings | | Correspondences |
|-----------------------------------|---|--|
| Section / Division / Group | Class | Codes for the UN Energy Questionnaire |
| 5 | Biofuels | |
| 51 | Solid biofuels | |
| | 511 Fuelwood, wood residues and by-products | FW |
| | 5111 Wood pellets | |
| | 5119 Other Fuelwood, wood residues and by-products | |
| | 512 5120 Bagasse | BS |
| | 513 5130 Animal waste | AW |
| | 514 5140 Black liquor | PU |
| | 515 5150 Other vegetal material and residues | VW |
| | 516 5160 Charcoal | CH |
| 52 | Liquid biofuels | |
| | 521 5210 Biogasoline | AL |
| | 522 5220 Biodiesels | BD |
| | 523 5230 Bio jet kerosene | BJ |
| | 529 5290 Other liquid biofuels | OL |
| 53 | Biogases | BI |
| | 531 Biogases from anaerobic fermentation | |
| | 5311 Landfill gas | |
| | 5312 Sewage sludge gas | |
| | 5319 Other biogases from anaerobic fermentation | |
| | 532 5320 Biogases from thermal processes | |
| 6 | Waste | |
| 61 | Industrial waste | |
| | 610 6100 Industrial waste | IW |
| 62 | Municipal waste | |
| | 620 6200 Municipal waste | MW |
| 7 | Electricity | |
| 70 | Electricity | |
| | 700 7000 Electricity | EL |
| 8 | Heat | |
| 80 | Heat | |
| | 800 8000 Heat | ST |
| 9 | Nuclear fuels and other fuels n.e.c. | |
| 91 | Uranium and plutonium | |
| | 910 9100 Uranium and plutonium | |
| | <i>Uranium for this questionnaire (included under SIEC code 9100)</i> | UR |
| 92 | Other nuclear fuels | |
| | 920 9200 Other nuclear fuels | |
| 99 | Other fuels n.e.c. | |
| | 990 9900 Other fuels n.e.c. | |

Annex II – Natural Gas Production

The production of natural gas refers to the dry marketable production within national boundaries, including offshore production. Production is measured after purification and extraction of Natural gas liquids and sulphur. Extraction losses and quantities reinjected, vented or flared are not included in the figures for production. Production includes quantities used within the natural gas industry; in gas extraction, pipeline systems and processing plants. Production is disaggregated for the following:

- **Associated gas:** natural gas produced in association with crude oil;
- **Non-associated gas:** natural gas originating from fields producing hydrocarbons only in gaseous form;
- **Colliery and coal seam gas:** methane produced at coal mines or from coal seams, piped to the surface and consumed at collieries or transmitted by pipeline to consumers.

Gas reinjected (NG103): The reinjection of gas into an oil reservoir in an attempt to increase oil recovery.

Gas flared (NG104A): Gas disposed of by burning in flares usually at the production sites or at gas processing plants.

Gas vented (NG104B): Gas released into the air on the production site or at processing plants.

Extraction loss/shrinkage (NG105): Losses during the extraction process of gas, and the reduction in volume of wet natural gas due to extraction of some of its constituents.

Annex III – Electricity and Heat

Electricity, net installed capacity of electric power plants (EC): is the maximum active power that can be supplied continuously, with all plants 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. Does not include overload capacity that 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.

Gross electricity production (EL01): is the sum of the electrical energy production by all the generating units/installations concerned (including pumped storage) measured at the output terminals of the main generators.

Gross heat production (ST01): is the total heat produced by the installation and includes the heat used by the installation's auxiliaries, which use a hot fluid (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, the production of heat covers only the heat sold to third parties; thus gross heat production for autoproducers is equal to net heat production.

As already mentioned in section 3.3 on Transformation, there are two types of producers of Electricity and Heat: Main activity producers and Autoproducers. The production of Electricity and Heat in the Questionnaire are collected based on the types of producers as well as the types of processes by which they are generated. Please refer to section 3.3 for information on the types of producers. The types of processes for Electricity and Heat generation are provided in this section.

Own use (EL0927 or ST0927): is the difference between the gross and the net production.

Net electricity production (EL019): 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 (ST019): is the heat supplied to the distribution system as determined from measurements of the outgoing and return flows.

There are different types of technology/processes for the generation of electricity and heat. In this Questionnaire, the production of electricity and heat are disaggregated by these processes, as shown in the table below. Detailed information on these processes is also provided in this annex.

Table A.2: Electricity and Heat production by types of technology/processes

| Electricity production by type of process | Product and Flow codes for the UN Energy Questionnaire | Heat production by type of process | Product and Flow codes for the UN Energy Questionnaire |
|---|--|------------------------------------|--|
| Nuclear electricity | EL015N and EL016N | Nuclear heat | ST015N and ST016N |
| Hydro electricity | EL015HY and EL016HY | Geothermal heat | ST015G and ST016G |
| Pumped hydro | EL015PH and EL016PH | Solar thermal heat | ST015ST and ST016ST |
| Geothermal electricity | EL015G and EL016G | Heat from combustible fuels | ST015C and ST016C |
| Solar electricity | EL015S and EL016S | Heat from chemical sources | ST015H and ST016H |
| Solar photovoltaic | EL015SP and EL016SP | Heat from heat pumps | ST015HP |
| Solar thermal | EL015ST and EL016ST | Heat from electric boilers | ST015EB |
| Tide, wave and marine electricity | EL015T and EL016T | Heat from other sources | ST015O and ST016O |
| Wind electricity | EL015W and EL016W | | |
| Electricity from combustible fuels | EL015C and EL016C | | |
| Electricity from chemical heat | EL015H and EL016H | | |
| Electricity from other sources | EL015O and EL016O | | |

Electricity production processes

Nuclear electricity: Electricity produced from a nuclear power plant.

Hydro electricity: Electricity produced from devices driven by fresh, flowing or falling water.

Pumped hydro: Electricity from pumped storage plants.

Geothermal electricity: Electricity generated from the heat from geothermal sources.

Solar Electricity: Electricity generated from solar photovoltaics and from solar thermal sources.

Electricity from solar photovoltaics: Electricity produced by the direct conversion of solar radiation through photovoltaic processes in semiconductor devices (solar cells), including concentrating photovoltaic systems.

Electricity from solar thermal: Electricity produced from solar radiation captured by concentrating solar thermal systems.

Tidal electricity: Electricity generated from devices driven by tidal currents or the differences of water level caused by tides.

Wave electricity: Electricity produced from devices driven by the motion of waves.

Other marine electricity: Electricity generated from devices which exploit sources of marine energy not elsewhere specified. Examples of sources are non-tidal currents, temperature differences and salinity gradients in seas and between sea and fresh water.

Wind electricity: Electricity produced from devices driven by wind.

Electricity from combustible fuels: Electricity generated from the combustion of fuels which are capable of igniting or burning, i.e. reacting with oxygen to produce a significant rise in temperature.

Electricity from chemical sources: Electricity generated from heat coming from chemical sources.

Electricity from other sources: Electricity generated from processes not identified above.

Heat production processes

Nuclear heat: For the purposes of energy statistics, nuclear energy is the heat obtained from the steam (or other working fluid) produced by the nuclear reactor. A working fluid is the substance circulated in a closed system to convey heat from the source of heat to its point(s) of use.

Geothermal heat: Heat extracted from the earth. The sources of the heat are radioactive decay in the crust and mantle and heat from the core of the earth. Heat from shallow geothermal sources will include heat gained by the earth by direct sunlight and rain. The heat is usually extracted from the earth in the form of heated water or steam.

Solar thermal heat: Heat generated from solar thermal (concentrating and non-concentrating). Heat from concentrating solar thermal: High temperature heat produced from solar radiation captured by concentrating solar thermal systems. The high temperature heat can be used to generate electricity, drive chemical reactions, or be used directly in industrial processes. Heat from non-concentrating solar thermal: Low temperature heat produced from solar radiation captured by non-concentrating solar thermal systems. The heat can be used for applications such as space heating, cooling, water heating, district heating and industrial processes.

Heat from combustible fuels: Heat generated from the combustion of fuels which are capable of igniting or burning, i.e. reacting with oxygen to produce a significant rise in temperature.

Heat from chemical sources: Heat from chemical sources.

Heat from pumps: Heat output that is sold to third parties from devices designed to move thermal energy opposite to the direction of spontaneous heat flow. They are normally powered by electricity but some are powered by combustible fuels.

Heat from electric boilers: Heat generated from boilers powered by electricity that is sold to third parties.

Heat from other sources: Heat generated from processes not identified above.

Annex IV – Conversion of Volume, Mass and Energy Units

The tables below provide factors which can be used to convert between different units of mass, volume and energy respectively.

Cross conversion between the different unit categories, i.e. conversion from mass to volume, mass to energy and volume to energy, and vice versa, are not provided. Such conversion factors can vary even within the same product based on density and energy content. Therefore, if possible, such conversions should use factors specific to the product available in your country.

For further information on conversion between units, please refer to IRES and *Energy Statistics: Definitions, Units of Measure and Conversion Factors* found on the website of the United Nations (http://unstats.un.org/unsd/publication/SeriesF/SeriesF_44E.pdf).

Table A.3: Conversion between different units of mass

| INTO \ FROM | Kilograms | Metric tons | Long tons | Short tons | Pounds |
|-------------|-------------|-------------|-----------|------------|--------|
| | MULTIPLY BY | | | | |
| Kilograms | 1 | 0.001 | 0.000984 | 0.001102 | 2.2046 |
| Metric tons | 1000 | 1 | 0.984 | 1.1023 | 2204.6 |
| Long tons | 1016 | 1.016 | 1 | 1.12 | 2240 |
| Short tons | 907.2 | 0.9072 | 0.893 | 1 | 2000 |
| Pounds | 0.454 | 0.000454 | 0.000446 | 0.0005 | 1 |

Note: The units of the rows can be converted into the units of the columns by multiplying with the conversion factors in the table.

Example: Kilograms can be converted to Metric tons by multiplying by 0.001.

Table A.4: Conversion between different units of volume

| INTO \ FROM | U.S. gallons | Imperial gallons | Barrels | Cubic feet | Litres | Cubic meters |
|------------------|--------------|------------------|---------|------------|--------|--------------|
| | MULTIPLY BY | | | | | |
| U.S. gallons | 1 | 0.8327 | 0.02381 | 0.1337 | 3.785 | 0.0038 |
| Imperial gallons | 1.201 | 1 | 0.02859 | 0.1605 | 4.546 | 0.0045 |
| Barrels | 42 | 34.97 | 1 | 5.615 | 159 | 0.159 |
| Cubic feet | 7.48 | 6.229 | 0.1781 | 1 | 28.3 | 0.0283 |
| Litres | 0.2642 | 0.22 | 0.0063 | 0.0353 | 1 | 0.001 |
| Cubic meters | 264.2 | 220 | 6.289 | 35.3147 | 1000 | 1 |

Note: The units of the rows can be converted into the units of the columns by multiplying with the conversion factors in the table.

Example: Barrels can be converted to Cubic metres by multiplying by 0.159.

Table A.5: Conversion between different units of energy

| FROM \ INTO | TJ | Million Btu | GCal | GWh | ktoe | ktce |
|---------------------|-------------------------|---------------------|----------------------|-------------------------|------------------------|------------------------|
| | MULTIPLY BY | | | | | |
| Terajoule (TJ) | 1 | 947.8 | 238.84 | 0.2777 | 2.388×10^{-2} | 3.411×10^{-2} |
| Million Btu | 1.0551×10^{-3} | 1 | 0.252 | 2.9307×10^{-4} | 2.52×10^{-5} | 3.6×10^{-5} |
| GigaCalorie (Gcal) | 4.1868×10^{-3} | 3.968 | 1 | 1.163×10^{-3} | 10^{-4} | 1.429×10^{-4} |
| Gigawatt hour (GWh) | 3.6 | 3412 | 860 | 1 | 8.6×10^{-2} | 1.229×10^{-1} |
| ktoe | 41.868 | 3.968×10^4 | 10^4 | 11.63 | 1 | 1.429 |
| ktce | 29.308 | 2.778×10^4 | 0.7×10^{-4} | 8.14 | 0.7 | 1 |

Note: The units of the rows can be converted into the units of the columns by multiplying with the conversion factors in the table.

Example: Gigawatt hour can be converted to Terajoule by multiplying by 3.6.