

## CONCEPTS AND DEFINITIONS

### DESCRIPTION OF THE ROWS OF THE ENERGY BALANCE

**Production of primary energy** (row 1): Primary energy refers to energy sources as found in their natural state (as opposed to derived or secondary energy, which is the result of the transformation of primary sources). Production of primary energy refers to the quantity of fuels which are extracted or produced, calculated after any operation for removal of inert matter. In general, production includes the quantities consumed by the producer in the production process (e.g. for heating or operation of equipment or auxiliaries) as well as supplies to other producers of energy for transformation or other uses. Data on the production of **hard coal and lignite** refer to coal after washing and screening for the removal of inorganic matter. Production of **natural gas liquids** is shown together with the production of **crude petroleum**. Data for **natural gas** refer to dry marketable production measured after purification and extraction of natural gas liquids and sulphur. Extraction losses and the amounts that have been reinjected, flared, and vented are excluded. Production includes quantities used within the natural gas industry, in gas extraction, pipeline systems and processing plants. Production of primary **electricity** refers to gross production of electrical energy of nuclear, hydro, geothermal, wind, tide, wave and solar origin. **Biomass** production includes only that portion used for fuel purposes.

**Imports** (row 2) and **exports** (row 3) refer to the amount of fuels obtained from or supplied to other countries. Fuels in transit are excluded. Imports and exports of crude petroleum also include imports and exports of feedstocks, unrefined and semi-refined oils and components derived from crude petroleum. In the energy balance format, imports are positive numbers, while exports are negative numbers and carry a negative sign (-).

**Marine/aviation bunkers** (row 4) refer to the amounts of fuels delivered to ocean-going ships or aircraft of all flags engaged in international traffic. Consumption by ships engaged in transport in inland and coastal waters, or by aircraft engaged in domestic flights, is not included. The minus sign is used for entries under this item.

**Stock changes** (row 5) (at producers, importers and industrial consumers) refer to the difference between the amounts of fuels in stocks at the beginning and end

of the year. A positive number indicates a reduction in stocks and thus an increase in available energy; the negative sign (-) indicates a net increase in stocks and thus a decrease in energy available for consumption.

**Total energy requirements** (row 6) is computed as: (6) = production (row 1) + imports (row 2) + exports (row 3) + bunkers (row 4) + stock changes (row 5).

**Energy converted** (row 7) shows the net input of primary and derived energy into the conversion or transformation process for the purpose of obtaining other derived products, and the net output of the derived energy. Inputs carry a minus sign, and outputs, which relate to gross production, are shown as positive numbers. Row 7 represents the sum of items from row 8 to row 16.

**Net transfers** (row 17) comprise the net movements of energy products between processes in different sectors, for example, the blending of natural gas in the manufactured gas stream, the diversion of products (feedstocks) for further processing in the refining industry or the transfer of products for blending. Transfers "out" carry a negative sign, and transfers "in" are shown as positive numbers.

**Consumption by the energy sector** (row 18) comprises the consumption of fuels and electricity used by the energy producing industries, e.g. for heating, lighting, and operation of all equipment used in the extraction process, for traction and distribution. It includes the quantities consumed in compression stations and pumping stations of oil and gas pipelines, as well as the station use and loss of electric power plants (including electricity used for pumping at pumped storage installations). The minus sign is used for entries under this item.

**Losses in transport and distribution** (row 19) refer to the losses of fuels and electrical energy, which occur outside the utilities or plants before reaching the final consumer. The losses carry a minus sign.

**Consumption for non-energy uses** (row 20) refers to the quantity of energy products consumed as raw materials in the chemical, petrochemical and other industries, not in order to produce energy. The minus sign is used for entries under this item.

**Statistical differences** (row 21) in the energy balance are calculated as follows: (21) = total energy

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requirements (row 6) - energy converted (row 7) - net transfers (row 17) – consumption by the energy sector (row 18) – losses in transport and distribution (row 19) – consumption for non-energy uses (row 20) – final consumption (row 22).

**Final consumption** (row 22) refers to the consumption of primary and derived energy by industry and construction, by transport and by households, agriculture and other consumers.

**Consumption by industry and construction** (row 23) is broken down into the iron and steel industry, the chemical industry and other industries and construction. Consumption in the chemical industry refers to use as fuel only. Fuels consumed by the energy sector, and all inputs into energy conversion, such as fuels used by industrial/self producers of thermal electricity, are excluded.

**Consumption by transport** (row 27) includes all fuels consumed by road traffic, by ships engaged in transport in inland and coastal waters and aircraft engaged in domestic flights, and by railways. Fuels consumed by agricultural equipment are included in agricultural consumption.

**Consumption by households and other consumers** (row 33) covers households (including free issues to employees), agriculture (including hunting, forestry and fishing) and all other sectors not included elsewhere (for example trade, communications and services such as public lighting).

### DESCRIPTION OF THE COLUMNS OF THE ENERGY BALANCE

#### HARD COAL, LIGNITE AND PEAT (column 1)

**Hard coal** – Coal that has a high degree of coalification with a gross calorific value above 23,865 KJ/kg (5,700 kcal/kg) on an ash-free but moist basis, and a mean random reflectance of vitrinite of at least 0.6. Slurries, middlings and other low-grade coal products, which cannot be classified according to the type of coal from which they are obtained, are included under hard coal. There are two sub-categories of hard coal: (i) coking coal and (ii) other bituminous coal and anthracite (also known as steam coal). Coking coal is a hard coal with a quality that allows the production of coke suitable to support a blast furnace charge. Steam coal is coal

used for steam raising and space heating purposes and includes all anthracite coals and bituminous coals not classified as coking coal.

**Lignite** – One of the two sub-categories of brown coal. Brown coal is coal with a low degree of coalification which retained the anatomical structure of the vegetable matter from which it was formed. It has a mean random reflectance of vitrinite of less than 0.6, provided that the gross calorific value (on a moist ash-free basis) is less than 23,865 KJ/kg (5,700 kcal/kg). Brown coal comprises: (i) lignite - non-agglomerating coals with a gross calorific value less than 17,435 KJ/kg (4,165 kcal/kg) and greater than 31 per cent volatile matter on a dry mineral matter free basis and (ii) sub-bituminous coal - non-agglomerating coals with a gross calorific value between 17,435 KJ/kg (4,165 kcal/kg) and 23,865 KJ/kg (5,700 kcal/kg) containing more than 31 per cent volatile matter on a dry mineral matter free basis.

**Peat** – A solid fuel formed from the partial decomposition of dead vegetation under conditions of high humidity and limited air access (initial stage of coalification). Only peat used as fuel is included. Its principal use is as a household fuel.

#### BRIQUETTES AND COKES (column 2)

**Patent fuel (hard coal briquettes)** – A composition fuel manufactured from coal fines by shaping with the addition of a binding agent (pitch).

**Lignite briquettes** – A composition fuel manufactured from lignite. The lignite is crushed, dried and molded under high pressure into an even-shaped briquette without the addition of binders.

**Peat briquettes** – A composition fuel manufactured from peat. Raw peat, after crushing and drying, is molded under high pressure into an even-shaped briquette without the addition of binders.

**Coke** – The solid residue obtained from coal or lignite by heating it to a high temperature in the absence or near absence of air. It is high in carbon and low in moisture and volatile matter. Several categories are distinguished:

**a) Coke-oven coke** – The solid product obtained from carbonization of coal, principally coking coal, at high temperature. Coke-oven coke is also called metallurgical coke and is used mainly in the iron and

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steel industry. Semi-coke, the solid product obtained from carbonization of coal at low temperature, is included with coke-oven coke. It is used mainly as a domestic fuel.

**b) Gas coke** – A by-product of coal used for the production of gas works gas in gasworks. Gas coke is mainly used as a domestic fuel.

**c) Brown coal coke** – A solid product obtained from carbonization of brown coal briquettes.

### CRUDE OIL AND NATURAL GAS LIQUIDS (NGL) (column 3)

**Crude oil** – A mineral oil consisting of a mixture of hydrocarbons of natural origin, yellow to black in color, of variable density and viscosity. Data in this category also includes lease or field condensate (separator liquids) which is recovered from gaseous hydrocarbons in lease separation facilities, as well as synthetic crude oil, mineral oils extracted from bituminous minerals such as shales and bituminous sand, and oils from coal liquefaction.

**Natural gas liquids (NGL)** – Liquid or liquefied hydrocarbons produced in the manufacture, purification and stabilization of natural gas. NGL's include, but are not limited to, ethane, propane, butane, pentane and natural gasolene. NGL's are either distilled with crude oil in refineries, blended with refined petroleum products or used directly depending on their characteristics.

### LIGHT PETROLEUM PRODUCTS (column 4)

**Light products** are defined here as liquid products obtained by distillation of crude petroleum at temperatures between 30°C and 350°C, and/or which have a specific gravity between 0.625 and 0.830. They comprise:

**Aviation gasolene** – Motor spirit prepared especially for aviation piston engines, with an octane number varying from 80 to 145 RON and a freezing point of -60°C.

**Motor gasolene** – Light hydrocarbon oil for use in internal combustion engines such as motor vehicles, excluding aircraft. It distills between 35°C and 200°C, and is treated to reach a sufficiently high octane number of generally between 80 and 100 RON. Treatment may be by reforming, blending with an aromatic fraction, or

the addition of benzole or other additives (such as tetraethyl lead).

**Natural gasolene** – Light spirit extracted from wet natural gas, often in association with crude petroleum. It is used as a petroleum refinery and petrochemical plant input and is also used directly for blending with motor spirit without further processing.

**Jet fuel** – Consists of gasolene-type jet fuel and kerosene-type jet fuel.

**Gasolene-type jet fuel** – All light hydrocarbon oils for use in aviation gas-turbine engines. It distills between 100°C and 250°C with at least 20% of volume distilling at 143°C. It is obtained by blending kerosene and gasolene or naphtha in such a way that the aromatic content does not exceed 25% in volume. Additives are included to reduce the freezing point to -58°C or lower, and to keep the Reid vapour pressure between 0.14 and 0.21 kg/cm<sup>2</sup>.

**Kerosene-type jet fuel** – Medium oil for use in aviation gas-turbine engines with the same distillation characteristics and flash point as kerosene, with a maximum aromatic content of 20% in volume. It is treated to give a kinematic viscosity of less than 15 cSt at -34°C and a freezing point below -50°C.

**Kerosene** – Medium oil distilling between 150°C and 300°C; at least 65% of volume distills at 250°C. Its specific gravity is roughly 0.80 and its flash point is above 38°C. It is used as an illuminant and as a fuel in certain types of spark-ignition engines, such as those used for agricultural tractors and stationary engines. Other names for this product are burning oil, vaporizing oil, power kerosene and illuminating oil.

**Naphtha** – Light or medium oil distilling between 30°C and 210°C, for which there is no official definition, but which does not meet the standards laid down for motor spirit. The properties depend upon consumer specification. The C:H ratio is usually 84:14 or 84:16, with a very low sulphur content. Naphtha may be further blended or mixed with other materials to make high-grade motor gasolene or jet fuel, or may be used as a raw material for manufactured gas. Naphtha is sometimes used as input to feedstocks to make various kinds of chemical products, or may be used as a solvent.

**White spirit (industrial spirit)** – A highly refined distillate with a boiling point ranging from 135°C

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to 200°C, which is used as a paint solvent and for dry-cleaning purposes.

### HEAVY PETROLEUM PRODUCTS (column 5)

**Heavy products** are defined here as products obtained by the distillation of crude petroleum at temperatures above 350°C, and which have a specific gravity higher than 0.83. Products which are not used for energy purposes, such as insulating oils, lubricants, paraffin wax, bitumen and petroleum coke, are excluded. Heavy products comprise:

**Residual fuel oil** – A heavy oil that makes up the distillation residue. It comprises all fuels (including those obtained by blending) with a kinematic viscosity above 27.5 cSt at 38°C. Its flash point is always above 50°C and its specific gravity is higher than 0.90. It is commonly used by ships and industrial large-scale heating installations as a fuel in furnaces or boilers.

**Gas-diesel oil (distillate fuel oil)** – Heavy oils distilling between 200°C and 380°C, but distilling less than 65% in volume at 250°C, including losses, and 85% or more at 350°C. Its flash point is always above 50°C and its specific gravity is higher than 0.82. Heavy oils obtained by blending are grouped together with gas oils on the condition that their kinematic viscosity does not exceed 27.5 cSt at 38°C. Also included are middle distillates intended for the petrochemical industry. Gas-diesel oils are used as a fuel for internal combustion in diesel engines, as a burner fuel in heating installations, such as furnaces, and for enriching water gas to increase its luminosity. Other names for this product are diesel fuel, diesel oil, gas oil and solar oil.

### OTHER PETROLEUM PRODUCTS (column 6)

**Lubricants** – Viscous, liquid hydrocarbons rich in paraffin waxes, distilling between 380°C and 500°C, obtained by vacuum distillation of oil residues from atmospheric distillation. Additives may be included to alter their characteristics. Their main characteristics are: a flash point greater than 125°C; a pour point between –25°C and +5°C depending on the grade; a strong acid number (normally 0.5 mg/g); an ash content less than or equal to 0.3%; and a water content less than or equal to 0.2%. Included are cutting oils, white oils, insulating oils, spindle oils and lubricating greases.

**Feedstocks** – Products or a combination of products derived from crude oil destined for further processing in the refining industry other than blending.

They are transformed into one or more components and/or finished products. This definition covers naphtha imported for refinery intake and naphtha returned from the chemical industry to the refining industry.

**Plant condensate** – Liquid hydrocarbons condensed from wet natural gas in natural gas processing plants. It is used as a petroleum refinery input.

**Bitumen** – Solid or viscous hydrocarbon with a colloidal structure, brown or black in color, which is obtained as a residue by vacuum distillation of oil residues from atmospheric distillation. It is sometimes soluble in carbon bisulphite, non-volatile, thermoplastic (generally between 150°C and 200°C), often with insulating and adhesive properties. It is used mainly in road construction. Natural asphalt is excluded.

**Petroleum waxes** – Saturated aliphatic hydrocarbons obtained as residues extracted when dewaxing lubricant oils, with a crystalline structure with C greater than 12. Their main characteristics are as follows: they are colorless, in most cases odorless and translucent; they have a melting point above 45°C, a specific gravity of 0.76 to 0.78 at 80°C, and a kinematic viscosity between 3.7 and 5.5 cSt at 99°C. These waxes are used for candle manufacture, polishes and waterproofing of containers, wrappings, etc.

**Petroleum coke** – A shiny, black solid residue obtained by cracking and carbonization in furnaces. It consists mainly of carbon (90 to 95%) and generally burns without leaving any ash. It is used mainly in metallurgical processes. It excludes those solid residues obtained from carbonization of coal.

**Other petroleum products** – Products of petroleum origin (including partially refined products) not otherwise specified.

**Natural Gas Liquids** (not elsewhere specified) – LPG or Plant condensate is treated as natural gas liquid (n.e.s).

### LIQUEFIED AND OTHER PETROLEUM GASES (column 7)

**Liquefied petroleum gas (LPG)** – Hydrocarbons which are gaseous under conditions of normal temperature and pressure but are liquefied by compression or cooling to facilitate storage, handling and transportation. They are (i) extracted by stripping of natural gas at crude petroleum and natural gas

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sources; (ii) extracted by stripping of imported natural gas in installations of the importing country; and (iii) produced both in refineries and outside of refineries in the course of processing crude petroleum or its derivatives. It comprises propane ( $C_3H_8$ ), butane ( $C_4H_{10}$ ), or a combination of the two. Also included is ethane ( $C_2H_6$ ) from petroleum refineries or natural gas producers' separation and stabilization plants.

**Refinery gas** – Non-condensable gas obtained during distillation of crude oil or treatment of oil products (e.g. cracking) in refineries. It consists mainly of hydrogen, methane, ethane and olefins, and is used principally as a refinery fuel. Refinery gas is also known as still gas.

### NATURAL GAS (column 8)

**Natural gas** – Gases consisting mainly of methane occurring naturally in underground deposits. It includes both non-associated gas (originating from fields producing only hydrocarbons in gaseous form) and associated gas (originating from fields producing both liquid and gaseous hydrocarbons), as well as methane recovered from coal mines and sewage gas. Production of natural gas refers to dry marketable production, measured after purification and extraction of natural gas liquids and sulphur. Extraction losses and the amounts that have been reinjected, flared, and vented are excluded from the data on production.

### DERIVED GASES (column 9)

**Gasworks gas** – Gas produced by public utilities or private plants whose main activity is the production, transport and distribution of such gas. It includes gas produced by carbonization, by total gasification with or without enrichment with oil products, by cracking of natural gas, and by reforming or mixing gases.

**Coke-oven gas** – By-product of the carbonization process in the production of coke in coke ovens.

**Blast furnace gas** – By-product in blast furnaces recovered on leaving the furnace.

### ELECTRICITY (column 10 and electricity profiles)

**Production** refers to gross production, which includes the consumption by station auxiliaries and any losses in the transformers that are considered integral parts of the station. Included also is total electric energy

produced by pumping installations without deduction of electric energy absorbed by pumping.

Production data includes solar, tide, wave, wind, wastes, wood and fuel cell production when reported.

**Public utilities** (electricity profiles) - Undertakings whose essential purpose is the production, transmission and distribution of electric energy, primarily for use by the public. These may be private companies, co-operative organizations, local or regional authorities, nationalized undertakings or governmental organizations.

**Self-producers** (electricity profiles) - Undertakings which, in addition to their main activities, themselves produce (individually or in combination) electric energy intended in whole or in part to meet their own needs.

**Primary electricity** refers to electrical energy of geothermal, hydro, nuclear, tide, wind, wave/ocean and solar origin. Its production is assessed as the heat value of electricity (3.6 TJ/million kWh).

**Secondary electricity or thermal** comprises conventional thermal plants of all types, whether or not equipped for the combined generation of heat and electric energy. Accordingly, they include steam-operated generating plants with condensation (with or without extraction) or with back-pressure turbines, and plants using internal combustion engines or gas turbines, whether or not these are equipped for heat recovery.

**Station use and loss** includes consumption by station auxiliaries and losses in transformers which are considered as integral parts of the electric energy generating plants.

**Net production** is gross production minus station use and loss.

**Imports and exports** refer to the amounts of electric energy transferred to and from the country concerned, respectively, which are measured at the metering points on the lines crossing the frontiers. Included are imports and exports of electric energy made by means of high-voltage lines crossing frontiers as well as imports and exports made by means of low-voltage lines for use in the immediate vicinity of the frontier, if the quantities so transferred are known.

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**Net installed capacity** (electricity profiles) is measured at the terminals of the stations, i.e., after deduction of the power absorbed by the auxiliary installations and the losses in the station transformers, if any. Data concerning capacity refer to 31 December of the year under consideration.

### **PRIMARY BIOMASS ENERGY** (column 11)

**Fuelwood** – All wood in the rough used for fuel purposes. Production data include the portion used for charcoal production, using a factor of 6 to convert from a weight basis (metric tons) to the volumetric equivalent (cubic metres) of charcoal.

**Bagasse** – The cellulosic residue left after sugar is extracted from sugar cane. It is often used as a fuel within the sugar milling industry.

**Animal wastes** – Excreta of cattle, horses, pigs, poultry etc., and (in principle) excreta of humans, used as a fuel.

**Vegetal wastes** – Mainly crop residues (cereal straw from maize, wheat, paddy rice, etc.) and food processing wastes (rice hulls, coconut husks, ground-nut shells, etc.) used for fuel. Bagasse is excluded.

**Municipal wastes** – Consist of products that are combusted directly to produce heat and/or power and comprise wastes produced by the residential, commercial and public services sectors that are collected by local authorities for disposal in a central location. Hospital waste is included in this category.

**Industrial wastes** – Consist of solid and liquid products other than solid biomass and animal products mentioned above (e.g. tires) combusted directly, usually in specialised plants, to produce heat and/or power.

**Alcohol** – Ethanol (ethyl alcohol) and methanol (methyl alcohol) for use as a fuel. Ethanol can be produced from sugar, starch and cellulose and is used mainly in transport (on its own or blended with gasoline). Methanol can be produced from wood, crop residues, grass, and the like, and can be used in internal combustion engines.

**Biogas** – A by-product of the fermentation of biomass, principally animal wastes, by bacteria. It consists mainly of methane gas and carbon dioxide.

### **DERIVED BIOMASS ENERGY** (column 12)

**Charcoal** – The solid residue, consisting mainly of carbon, obtained by the destructive distillation of wood in the absence of air.

### **OTHER ENERGY SOURCES** (column 13)

**Heat** – Heat obtained from (a) combined heat and power (CHP) plants generating electricity and useful heat in a single installation; (b) district heating (DH) plants and (c) nuclear power plants and geothermal sources. The heat may be in the form of steam, hot water or hot air.

**TOTAL ENERGY** (column 14) - Summation of column 1 through column 13.