Dataset Information:

Title	Energy Use
Abstract	Greenhouse gas (GHG) emissions from direct energy use consist of carbon dioxide, methane and nitrous oxide gases associated with fuel burning and electricity generation in agriculture (including fisheries). Data is computed at Tier 1 following the 2006 IPCC Guidelines for National GHG Inventories (IPCC, 2006). Available by country, with global coverage and relative to the period 1970-present, with annual updates.
Supplemental	This sub-domain contains data on GHG emissions, associated emission factors and underlying activity data. Data are estimated per main energy carrier (fuels and electricity) used in agriculture, for the following energy carriers: Gasoline; Gas-diesel oils; Natural gas; Residual fuel oil; Liquefied petroleum gas; Hard coal and Electricity; and per selected agriculture sub-domains (i.e. irrigation, fisheries). Renewable energy (e.g. bioenergy or off-grid solar power) contributes to the GHG emission calculation indirectly, via country emission factors for electricity, which depend on a country's total energy mix. The FAOSTAT Emissions data are estimates by FAO and do not coincide with GHG data reported by member countries to UNFCCC. The database is intended primarily as a service to help member countries assess and report their emissions, as well as a useful international benchmark. The FAOSTAT Emissions data are disseminated publicly to facilitate continuous feedback from member countries.
Creation Date	2013
Last Update	2013
Data Type	Energy consumption and GHG emission by country, per gas emitted, both in Gg of GHG emitted and Gg of CO_2 equivalent
Category	Environment
Time Period	1970-present
Periodicity	Annual
Geographical Coverage	World
Spatial Unit	Country
Language	Multilingual (EN, FR, ES)

Methodology and Quality Information:

Methods and processing

For all data categories, fuel emissions are estimated at country level, using IPCC 2006:

Emissions = A * EF (1), where:

Emissions = GHG emissions in Gg yr^{-1}

A = Activity data, representing the amount of fuel consumed in kt (1000 metric tons) yr^{-1}, TJ (Terajoules) yr^{-1} or ktoe (k tons of oil equivalent) yr^{-1} for fuels, and GWh yr^{-1} for electricity.

Activity data are taken from the UNSD Energy Statistics database (*); data relative to *fuels used in fisheries*, specifically "Gas-diesel oils used in fisheries," and "Residual fuel oil used in fisheries," are taken from the IEA database "World energy balances". The following energy carriers are included as activity data:

a. Gasoline;
b. Gas-diesel oils;
c. Natural gas (including LNG);
d. Residual fuel oil;
e. Liquefied petroleum gas (LPG);
f. Hard coal;
g. Electricity;

h. Gas-diesel oils used in fisheries;
i. Residual fuel oil used in fisheries.

Data are also reported for the following aggregated groups: ''Total Energy'' (a+b+c+d+e+f+g); ''Transport fuel Consumed in Agriculture (excl. fisheries)'' (a+b-h); and ''Energy consumed in fisheries'' (h+i).

(*) When country or region disaggregation from UNSD to FAOSTAT level is necessary, yearly activity data for gas-diesel oils and gasoline are disaggregated using the number of agricultural tractors by country reported in FAOSTAT; other yearly activity data for other energy carriers are disaggregated using hectares of arable land by country.

EF = Emission factor, expressed as Gg (10^9 grams) of gas emitted per year per PJ (for fuels) or kWh (for electricity) of energy used, based on Tier 1 2006 IPCC emission factors (IPCC, 2006, Vol. 2, Ch. 2 and 3). Specifically:

- Gas-diesel oils: 74.1 Gg/PJ for CO_2, 0.00415 Gg/PJ for CH_4, 0.00286 Gg/PJ for N_2O
- Gasoline: 69.3 Gg/PJ for CO_2, 0.08 Gg/PJ for CH_4, 0.002 Gg/PJ for N_2O
- Natural gas: 64.2 Gg/PJ for CO_2, 0.01 Gg/PJ for CH_4, 0.0006 Gg/PJ for N_2O
- Residual fuel oil: 77.4 Gg/PJ for CO_2, 0.01 Gg/PJ for CH_4, 0.0006 Gg/PJ for N_2O
- LPG: 63.1 Gg/PJ for CO_2, 0.005 Gg/PJ for CH_4, 0.0001 Gg/PJ for N_2O
- Hard coal: 98.3 Gg/PJ for CO_2, 0.3 Gg/PJ for CH_4, 0.0015 Gg/PJ for N_2O.

For electricity, the country emission factors for CO_2 (electricity-only factors) reported by IEA (OECD/IEA, 2012) are used (1990 country emission factors are applied to previous years). Additional non-CO_2 emissions were estimated as a fraction of the IEA CO_2 data on the basis of the average world energy mix as: 1.2 g/kWh for CH_4 and 0.01 g/kWh for N_2O.

For all GHG estimations, conversion factors are used to convert energy activity data into equivalent amounts of TJ (for fuels) or KWh (for electricity), when needed. Conversion factors applied (net calorific values) are from OECD/IEA (2005) and are consistent with IPCC 2006 guidelines, as follows: Gas-diesel oils: 43.38 PJ/Gg; Gasoline: 44.75 PJ/Gg; Residual fuel oil: 41.87 PJ/Gg; LPG: 46.15 PJ/Gg; Hard coal: 29.65 PJ/Gg.

Finally, emissions from energy used for power irrigation are also estimated, with the assumption that power irrigation is entirely powered by electricity. Equation (1) above is used as follows:

A = Area equipped for power irrigation (surface water or groundwater), taken from the FAO AQUASTAT database. Annual values in FAOSTAT are estimated by repeating the last-available value reported in AQUASTAT within the associated time interval.

EF= Country emission factor for electricity generation (Gg CO_2/KWh) taken from OECD/IEA (2012), modified by regional factors indicating the energy needed to irrigate one hectare of land (Stout, 1990) as follows: Europe, Northern America, Oceania: 1,929 kWh/ha; Africa, Asia: 2,411 kWh/ha; Central America, South America, Caribbean: 2,170 kWh/ha.

Dimensionless conversion factors used are:
GWP-CH_4= 21; GWP-N_2O= 310.

References

OECD/IEA. 2012. CO2 emissions from fuel combustion - Highlights - 2012 edition, Paris, France.

OECD/IEA. 2005. Energy Statistics Manual. Prepared by the Energy Statistics Division (ESD) of the International Energy Agency (IEA) in co-operation with the Statistical Office of the European Communities (Eurostat), Paris, France.

IPCC. 2006. 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Prepared by the National Greenhouse Gas Inventories Programme, Eggleston H.S., Buendia L., Miwa K., Ngara T. and Tanabe K. (Eds), IGES, Hayama, Japan.

	Stout B., 1990. Handbook of Energy for World Agriculture. New York, NY: Elsevier Applied Science. UNSD. 2011. International Recommendations for Energy Statistics (IRES) – Draft version. Prepared by the United Nations Statistics Division, New York, USA.
Data Collection Method	Computed
Completeness	100% for the countries which report their annual consumption to UNSD and IEA
Links	http://www.fao.org/climatechange/micca/ghg/en/ http://data.un.org/ http://www.iea.org/statistics/topics/energybalances/ http://www.iea.org/publications/freepublications/publication/name,4010,en.html http://www.fao.org/nr/water/aquastat/main/index.stm http://unstats.un.org/unsd/energy/ires

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