

# **APEC Energy Efficiency Template User Manual**

## APEC Energy Efficiency Template

### Introduction

Energy consumption has been continuously growing as economies and populations continue to grow. As a consequence, greenhouse gas concentration in the atmosphere is said to be growing rapidly as well, as fossil fuels represent the bulk of the energy consumed. Economies strive to improve energy efficiency by using less energy for the same amount of service provided to at least lessen the environmental impact of energy consumption. However, for some economies, for example, energy intensities continue to increase indicating that energy consumption is growing faster than economic growth.

Energy intensity is the nearest indicator to describe energy efficiency improvement. Increase or decrease of energy intensity are caused by several factors. The first are drivers such as economic and population growth that is expected to have a positive effect on energy consumption. The impact of these drivers to energy consumption are call “activity effect”. Another driver of energy consumption is industrial structural change to a more energy intensive economy. However, a change to a less energy intensive industrial structure is believed to temper growth in energy intensity. The impact of structural change is called “structural effect”. The third factor that affect energy intensity growth is the “pure energy intensity effect”. This effect is brought about by several reasons but not limited to; the use of more efficient technologies, behavior changes in the use of energy or maybe by management system; among others.

The existing energy balances could provide sufficient information in determining the factors that contributed to the increase or decrease in energy intensities of the economy as a whole. However, it is still difficult to determine the specific reasons for the changes in industrial, transport as well as residential and services sector energy intensities. In the energy balance table, industrial sector is already disaggregated by manufacturing branches while the transport sector is disaggregated by mode. The commercial and services sector as well as the residential sector are disaggregated into services and household activities, respectively. The definition of terms used in this activity were taken and consistent with UN International Recommendations for Energy Statistics (IRES), International Energy Agency (IEA), United Nations Industrial Development Organization (UNIDO), UN data and the World Bank.

For this activity, ESTO prepared the APEC Energy Efficiency Template which consists of five tables as follows:

Table 1: Activity Data

Table 2: Commercial and Public Services Sector

Table 3: Residential Sector

Table 4: Transport Sector

Table 5: Industry Sector

The explanation of the information that are needed for filling out the energy efficiency template are explained in the succeeding chapters.

## Activity Data

This part shows the possible indicators which would describe the level of energy efficiency improvement in a sector. According to IEA, an indicator in a simple way, is something that provides an indication; in a little more sophisticated terms, an indicator could be any of various statistical values that together provide an indication. The activity indicator is usually the denominator in energy efficiency ratio, for example, energy heating or cooling consumption (in kWh, joules or ktoe) per floor area (in square meter or square feet) of the residential sector. Different weather conditions effect fuel efficiency and consumption. In this way, energy efficiency improvements through the years can be determined. Most data were taken from World Bank World Development Indicators database (except for Chinese Taipei, whose data were taken from its national statistics). There are instances where data for specific year is not available, kindly fill out the missing series, especially those which are not available from World Bank. Also, the definitions indicated here are not strictly limited on how the sources, e.g. OECD and WB, defined them. Your economy may have similar statistics but the meaning may vary from the given definition, please include those data.

**Table 1 • Activity Data**

Activity/Indicator	Description	Source/Reference
<b>Total Population</b>	Total population is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship. The values shown are midyear estimates.	World Bank; Economy Data
<b>Urban population</b>	Urban population refers to people living in urban areas as defined by national statistical offices. It is calculated using World Bank population estimates and urban ratios from the United Nations World Urbanization Prospects. Aggregation of urban and rural population may not add up to total population because of different country coverages.	if not available in World Bank
<b>Rural population</b>	Rural population refers to people living in rural areas as defined by national statistical offices. It is calculated as the difference between	

Activity/Indicator	Description	Source/ Reference
	total population and urban population. Aggregation of urban and rural population may not add up to total population because of different country coverages.	World Bank; Economy Data if not available from World Bank
<b>Total Employment</b>	<p>Total employment shows the total number employed from ages 15 and over. Depending on the data availability, enter one of the following on the order of priority:</p> <p>Employment total in full-time equivalents-The number of full-time equivalent jobs, defined as total hours worked divided by average annual hours worked in full-time jobs.</p> <p>Employment total in persons</p> <p>Employees total in persons- This excludes self-employment and therefore could be inaccurate</p>	
<b>Services Employment</b>	Employees are people who work for a public or private employer and receive remuneration in wages, salary, commission, tips, piece rates, or pay in kind. Services correspond to divisions 6-9 (ISIC revision 2) or tabulation categories G-P (ISIC revision 3) and include wholesale and retail trade and restaurants and hotels; transport, storage, and communications; financing, insurance, real estate, and business services; and community, social, and personal services. Please refer to the Total Employment for the reporting order.	
<b>Total dwellings</b>	<p>Includes all dwellings</p> <ul style="list-style-type: none"> <li>- primary and secondary residences</li> <li>- occupied and unoccupied</li> <li>- only finished dwellings, dwellings under construction are excluded.</li> </ul> <p>Conventional dwellings with all basic facilities are those having floor different from earth floor, with water piped inside the housing unit or the lot where the housing unit is located, and with electricity and sewer system connected to a public network; including all shop-houses used as living quarters; including independent housing unit, apartment and housing unit in a neighborhood; housing units on the roof of buildings, places not built for habitation, mobil homes and shelters and all other domestic living quarters not elsewhere classified.</p>	UN Data, Economy Data if not available from UN
<b>Occupied Dwellings</b>	Only primary residences; Unoccupied dwellings and secondary residences are excluded.	
<b>New Dwellings</b>	Dwellings or housing units which are under construction/newly constructed during the reference period	
<b>Household Occupancy</b>	<p>In general this is the following ratio:</p> <p>Total Population/ Occupied Dwellings</p>	

Activity/Indicator	Description	Source/Reference
<b>Total Dwelling Area (Residential Floor Area)</b>	Residential Floor Area (in square meter) 1) only area in occupied dwellings 2) if not available, report area for total dwellings  <b>Context according to OECD</b>  In dwelling statistics two concepts of floor space of a dwelling are used:  - useful floor space, which is the floor space of dwellings measured inside the outer walls, excluding cellars, non-habitable attics and, in multi-dwelling houses, common areas;  - living floor space, which is the total area of rooms falling under the concept of rooms.	UN Data, Economy Data if not available from UN
<b>Annual Heating Degree-Days (HDD)</b>	HDD are a simplified measure of the intensity and duration of cold weather over a certain period in a given location. The value of HDD for a period, for example a winter, is determined by subtracting for each day the average daily temperature from a preset base temperature, and then adding up the days of the period in which the average outside air temperature is lower than the base temperature. Basically, HDD can be described in the following equation (OECD/IEA, 2014) <div style="border: 1px solid black; padding: 5px; margin: 10px auto; width: fit-content;"> <math display="block">HDD = \sum_{k=1}^n (T_{base} - T_k)</math> <p style="font-size: small; margin: 0;">where: <math>T_{base}</math> is the base temperature.  <math>T_k</math> is the average temperature of day <math>k</math>.  <math>n</math> is the total number of day in the given period.</p> </div>	Economy data (definition from IEA Energy Efficiency Indicators: Fundamentals on Statistics)
<b>Annual Cooling Degree-Days</b>	Similarly, cooling degree days (CDD) are a measure of the intensity of warm weather to correct energy consumption data for space cooling.	
<b>U.S. Dollar Exchange Rate (national currency per USD)</b>	Official exchange rate refers to the exchange rate determined by national authorities or to the rate determined in the legally sanctioned exchange market. It is calculated as an annual average based on monthly averages (local currency units relative to the U.S. dollar).	
<b>Purchasing Power Parity</b>	Purchasing power parity conversion factor is the number of units of a country's currency required to buy the same amounts of goods and services in the domestic market as U.S. dollar would buy in the United States. This conversion factor is for private consumption (i.e., household final consumption expenditure). For most economies PPP figures are extrapolated from the 2011 International Comparison Program (ICP) benchmark estimates or imputed using a statistical model based on the 2011 ICP. For 47 high- and upper middle-income economies conversion factors are provided by Eurostat and the Organisation for Economic Co-operation and Development (OECD).	World Bank
<b>Consumer Prices Index</b>	The GDP implicit deflator is the ratio of GDP in current local currency to GDP in constant local currency. The base year varies by country.	World Bank
<b>Household final</b>	Household final consumption expenditure (formerly private	

Activity/Indicator	Description	Source/ Reference
<b>consumption expenditure, PPP (constant 2011 international \$)</b>	consumption) is the market value of all goods and services, including durable products (such as cars, washing machines, and home computers), purchased by households. It excludes purchases of dwellings but includes imputed rent for owner-occupied dwellings. It also includes payments and fees to governments to obtain permits and licenses. Here, household consumption expenditure includes the expenditures of nonprofit institutions serving households, even when reported separately by the country. Data are converted to constant 2011 international dollars using purchasing power parity rates.	
<b>Total Services Floor Area</b>	<b>Definition taken from OECD:</b> The floor area of buildings is the sum of the area of each floor of the building measured to the outer surface of the outer walls including the area of lobbies, cellars, elevator shafts and in multi-dwelling buildings all the common spaces. Areas of balconies are excluded.	Economy data
<b>New Services Floor Area</b>	Floor area of new buildings	
<b>GDP (constant 2010 US\$)</b>	GDP at purchaser's prices is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Data are in constant 2010 U.S. dollars. Dollar figures for GDP are converted from domestic currencies using 2010 official exchange rates. For a few countries where the official exchange rate does not reflect the rate effectively applied to actual foreign exchange transactions, an alternative conversion factor is used.	World Bank
<b>GDP (constant LCU)</b>	Same definition on GDP; data in constant local currency.	World Bank
<b>GDP (current LCU)</b>	Same definition on GDP; data are in current local currency.	
<b>GDP (current US\$)</b>	Data are in current U.S. dollars. Dollar figures for GDP are converted from domestic currencies using single year official exchange rates. For a few countries where the official exchange rate does not reflect the rate effectively applied to actual foreign exchange transactions, an alternative conversion factor is used.	
<b>GDP, PPP (constant 2011 international \$)</b>	PPP GDP is gross domestic product converted to international dollars using purchasing power parity rates. An international dollar has the same purchasing power over GDP as the U.S. dollar has in the United States. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Data are in constant 2011 international dollars.	World Bank
<b>GDP, PPP (current)</b>	Same definition as above. Data are in current international dollars.	

Activity/Indicator	Description	Source/ Reference
<b>international \$)</b>	For most economies PPP figures are extrapolated from the 2011 International Comparison Program (ICP) benchmark estimates or imputed using a statistical model based on the 2011 ICP. For 47 high- and upper middle-income economies conversion factors are provided by Eurostat and the Organisation for Economic Co-operation and Development (OECD).	
<b>GDP deflator (base year varies by country)</b>	The GDP implicit deflator is the ratio of GDP in current local currency to GDP in constant local currency. The base year varies by country.	World Bank
<b>Services, etc., value added (constant 2010 US\$)</b>	Services correspond to ISIC divisions 50-99. They include value added in wholesale and retail trade (including hotels and restaurants), transport, and government, financial, professional, and personal services such as education, health care, and real estate services. Also included are imputed bank service charges, import duties, and any statistical discrepancies noted by national compilers as well as discrepancies arising from rescaling. Value added is the net output of a sector after adding up all outputs and subtracting intermediate inputs. It is calculated without making deductions for depreciation of fabricated assets or depletion and degradation of natural resources. The industrial origin of value added is determined by the International Standard Industrial Classification (ISIC), revision 3. Data are in constant 2010 U.S. dollars.	World Bank; Economy data, especially if data is not available from World Bank
<b>Services, etc., value added (constant LCU)</b>	Same definition as above. Data are in constant local currency.	
<b>Services, etc., value added (current LCU)</b>	Same definition as above. Data are in current local currency.	
<b>Services, etc., value added (current US\$)</b>	Same definition as above. Data are in current U.S. dollars.	
<b>Industry value added</b>	The value added of a manufacturing industry (industry value added) is a survey concept that refers to the given industry's net output derived from the difference of gross output and intermediate consumption. Value added is calculated without deducing consumption of fixed assets represented by depreciation in economic accounting concepts.	<b>UNIDO</b>
<b>Manufacturing value added (MVA)</b>	Manufacturing value added (MVA) of an economy is the total estimate of net-output of all resident manufacturing activity units obtained by adding up outputs and subtracting intermediate inputs.	
<b>10 - 12: Manufacture of food products, beverages, tobacco products</b>	Includes the following manufacturing industries as classified in ISIC: 0. Manufacture of food products - 101 Processing and preserving of meat	<b>ISIC Rev 4</b>

Activity/Indicator	Description	Source/ Reference
	<ul style="list-style-type: none"> <li>- 102 Processing and preserving of fish, crustaceans and molluscs</li> <li>- 103 Processing and preserving of fruit and vegetables</li> <li>- 104 Manufacture of vegetable and animal oils and fats</li> <li>- 105 Manufacture of dairy products</li> <li>- 106 Manufacture of grain mill products, starches and starch products</li> <li>- 107 Manufacture of other food products</li> <li>- 108 Manufacture of prepared animal feeds</li> <li>11. Manufacture of beverages</li> <li>- 110 Manufacture of beverages</li> <li>12. Manufacture of tobacco products</li> <li>- 120 Manufacture of tobacco products</li> </ul>	
<b>13 - 15: Manufacture of textiles, wearing apparel, leather and related products</b>	<ul style="list-style-type: none"> <li>13. Manufacture of textiles</li> <li>- 131 Spinning, weaving and finishing of textiles</li> <li>- 139 Manufacture of other textiles</li> <li>14. Manufacture of wearing apparel</li> <li>- 141 Manufacture of wearing apparel, except fur apparel</li> <li>- 142 Manufacture of articles of fur</li> <li>- 143 Manufacture of knitted and crocheted apparel</li> <li>15. Manufacture of leather and related products</li> <li>- 151 Tanning and dressing of leather; manufacture of luggage, handbags, saddlery and harness; dressing and dyeing of fur</li> <li>- 152 Manufacture of footwear</li> </ul>	<b>International Standard Industrial Classification of All Economic Activities (ISIC)</b>
<b>16: Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials</b>	<ul style="list-style-type: none"> <li>16. Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials</li> <li>- 161 Sawmilling and planing of wood</li> <li>- 162 Manufacture of products of wood, cork, straw and plaiting materials</li> </ul>	
<b>17-18: Manufacture of paper and paper products  Printing and reproduction of recorded media</b>	<ul style="list-style-type: none"> <li>17. Manufacture of paper and paper products</li> <li>- 170 Manufacture of paper and paper products</li> <li>18. Printing and reproduction of recorded media</li> <li>-181 Printing and service activities related to printing</li> <li>- 182 Reproduction of recorded media</li> </ul>	
<b>19-21: Manufacture of</b>	<ul style="list-style-type: none"> <li>19. Manufacture of coke and refined petroleum products</li> </ul>	

Activity/Indicator	Description	Source/ Reference
<b>chemicals and chemical products &amp; basic pharmaceutical products and pharmaceutical preparations; including petrochemicals</b>	<ul style="list-style-type: none"> <li>- 191 Manufacture of coke oven products</li> <li>- 192 Manufacture of refined petroleum products</li> <li>20. Manufacture of chemicals and chemical products                             <ul style="list-style-type: none"> <li>- 201 Manufacture of basic chemicals, fertilizers and nitrogen compounds, plastics and synthetic rubber in primary forms</li> <li>- 202 Manufacture of other chemical products</li> <li>- 203 Manufacture of man-made fibres</li> </ul> </li> <li>21. Manufacture of basic pharmaceutical products and pharmaceutical preparations                             <ul style="list-style-type: none"> <li>- 210 Manufacture of pharmaceuticals, medicinal chemical and botanical products</li> </ul> </li> </ul>	
<b>22-23: Manufacture of rubber and plastics products/ Manufacture of other non-metallic mineral products</b>	<ul style="list-style-type: none"> <li>22. Manufacture of rubber and plastics products                             <ul style="list-style-type: none"> <li>- 221 Manufacture of rubber products</li> <li>- 222 Manufacture of plastics products</li> </ul> </li> <li>23. Manufacture of other non-metallic mineral products                             <ul style="list-style-type: none"> <li>- 231 Manufacture of glass and glass products</li> <li>- 239 Manufacture of non-metallic mineral products n.e.c.</li> </ul> </li> </ul>	
<b>24: Manufacture of basic metals</b>	<ul style="list-style-type: none"> <li>24. Manufacture of basic metals                             <ul style="list-style-type: none"> <li>- 241 Manufacture of basic iron and steel</li> <li>- 242 Manufacture of basic precious and other non-ferrous metals</li> <li>- 243 Casting of metals</li> </ul> </li> </ul>	
<b>25-28: Manufacture of fabricated metal products, machinery and equipment</b>	<ul style="list-style-type: none"> <li>25. Manufacture of fabricated metal products, except machinery and equipment                             <ul style="list-style-type: none"> <li>- 251 Manufacture of structural metal products, tanks, reservoirs and steam generators</li> <li>- 252 Manufacture of weapons and ammunition</li> <li>- 259 Manufacture of other fabricated metal products; metalworking service activities</li> </ul> </li> <li>26. Manufacture of computer, electronic and optical products                             <ul style="list-style-type: none"> <li>- 261 Manufacture of electronic components and boards</li> <li>- 262 Manufacture of computers and peripheral equipment</li> <li>- 263 Manufacture of communication equipment</li> <li>- 264 Manufacture of consumer electronics</li> <li>- 265 Manufacture of measuring, testing, navigating and control equipment; watches and clocks</li> <li>- 266 Manufacture of irradiation, electromedical and</li> </ul> </li> </ul>	

Activity/Indicator	Description	Source/ Reference
	electrotherapeutic equipment - 267 Manufacture of optical instruments and photographic equipment - 268 Manufacture of magnetic and optical media 27. Manufacture of electrical equipment - 271 Manufacture of electric motors, generators, transformers and electricity distribution and control apparatus - 272 Manufacture of batteries and accumulators - 273 Manufacture of wiring and wiring devices - 274 Manufacture of electric lighting equipment - 275 Manufacture of domestic appliances - 279 Manufacture of other electrical equipment 28. Manufacture of machinery and equipment n.e.c. - 281 Manufacture of general-purpose machinery - 282 Manufacture of special-purpose machinery	
<b>29-30: Manufacture of motor vehicles, trailers, other transport equipment</b>	29. Manufacture of motor vehicles, trailers and semi-trailers - 291 Manufacture of motor vehicles - 292 Manufacture of bodies (coachwork) for motor vehicles; manufacture of trailers and semi-trailers - 293 Manufacture of parts and accessories for motor vehicles 30. Manufacture of other transport equipment - 301 Building of ships and boats - 302 Manufacture of railway locomotives and rolling stock - 303 Manufacture of air and spacecraft and related machinery - 304 Manufacture of military fighting vehicles - 309 Manufacture of transport equipment n.e.c.	<b>International Standard Industrial Classification of All Economic Activities (ISIC)</b>
<b>05 - 09: Mining and quarrying</b>	05. Mining of coal and lignite - 051 Mining of hard coal - 052 Mining of lignite 06. Extraction of crude petroleum and natural gas - 061 Extraction of crude petroleum - 062 Extraction of natural gas 07. Mining of metal ores - 071 Mining of iron ores - 072 Mining of non-ferrous metal ores	

Activity/Indicator	Description	Source/ Reference
	08. Other mining and quarrying - 081 Quarrying of stone, sand and clay - 089 Mining and quarrying n.e.c. 09. Mining support service activities - 091 Support activities for petroleum and natural gas extraction - 099 Support activities for other mining and quarrying	
<b>41 - 43: Construction</b>	41. Construction of buildings - 410 Construction of buildings 42. Civil engineering - 421 Construction of roads and railways - 422 Construction of utility projects - 429 Construction of other civil engineering projects 43. Specialized construction activities - 431 Demolition and site preparation - 432 Electrical, plumbing and other construction installation activities - 433 Building completion and finishing - 439 Other specialized construction activities	<b>International Standard Industrial Classification of All Economic Activities (ISIC)</b>
<b>31-32: Other Manufacturing/Industries Not Elsewhere Specified</b>	All other manufacturing and industries not mentioned above and not elsewhere classified	
<b>Vehicle stocks</b>	Number of vehicles registered at a given date and licensed to use roads open to public traffic.  <i>Also includes imported second-hand vehicles and other road vehicles according to national practices; excluding military.</i>	<b>EUROSTAT</b>

Activity/Indicator	Description	Source/ Reference
<b>Passenger transport</b>	<p>Vehicles designed, exclusively or primarily, to carry one or more persons; designed to seat no more than nine persons (including the driver). (<i>Vehicles designed for the transport of both passengers and goods should be classified either among the passenger road vehicles or among the goods road vehicles, depending on their primary purpose, as determined either by their technical characteristics or by their category for tax purposes</i>). These include:</p> <p><b>Cars, SUV and personal light trucks</b> (SUV = Sport Utility Vehicle; includes taxis, personal mini-vans); using gasoline, diesel, LPG or electricity.</p> <p><b>Motorcycles</b> both 2 and 3 wheelers</p> <p><b>Bus</b> - includes urban, sub-urban and intercity buses includes mini-buses for public transport. vehicle designed to carry more than 24 persons (including the driver), and with provision to carry seated as well as standing passengers. (<i>The vehicles may be constructed with areas for standing passengers, to allow frequent passenger movement, or designed to allow the carriage of standing passengers in the gangway.</i>)</p> <p><b>Trains/Railway transport</b>- Railway vehicle for the conveyance of passengers, even if it comprises one or more compartments with spaces specially reserved for luggage, parcels, mail, etc. These include Metro rails/subway, Light rails, railcar, trams.</p> <p><i>These vehicles include special vehicles such as sleeping cars, saloon cars, dining cars, ambulance cars and vans carrying accompanied road passenger vehicles. Each separate vehicle of an indivisible set for the conveyance of passengers is counted as a passenger railway vehicle. Included are railcars if they are designed for passenger transport.</i></p> <p><b>Domestic airplanes/aircrafts</b>-An aircraft configured for the transport of passengers and their baggage. Any freight, including mail, is generally carried in cargo holds in the belly of the aircraft.</p> <p><b>Domestic ships/Inland waterways</b> - Any movement of passengers using an Inland Waterways Transport (IWT) vessel between two places (a place of loading/embarkation and a place of unloading/disembarkation) within a national territory irrespective of the country in which the IWT vessel is registered</p>	<b>Illustrated Glossary for Transport Statistics 4th edition (EUROSTAT)</b>
<b>Freight transport</b>	The same types of vehicles listed above but for use of transporting freight, goods, cargoes, other than passengers.	
<b>Passenger transport [passenger-kilometres/passenger-miles]</b>	<b>Passenger-miles traveled:</b> The total distance traveled by all passengers. It is calculated as the product of the occupancy rate in vehicles and the vehicle miles (kilometres) traveled. <i>Ex 1 passenger-kilometre represents the transport of one passenger over one kilometer.</i>	

Activity/Indicator	Description	Source/ Reference
<p><b>Vehicle kilometres</b></p>	<p>Unit of measurement representing the movement of a road vehicle over one kilometre.</p> <p><i>The distance to be considered is the distance actually run. It includes movements of empty road motor vehicles. Units made up of a tractor and a semi-trailer or a lorry and a trailer are counted as one vehicle. The number reported should be approximately the result of the multiplication of the vehicles in stock by the distance travelled by an average vehicle.</i></p>	<p><b>Illustrated Glossary for Transport Statistics 4th edition (EUROSTAT)</b></p>
<p><b>Freight tonne-kilometres</b></p>	<p>Unit of measurement of goods transport which represents the transport of one tonne by road over one kilometre.</p> <p><i>The distance to be taken into consideration is the distance actually run.</i></p>	

## Energy Data

Energy data on commercial, residential, transport and industry sectors should be reported, and in disaggregation indicated in the following. Reporting unit can be either in PJ or ktoe.

### Commercial and Public Services Sector

This sector covers a large number of economic activities, which can be private, public or a combination of the two. Activities are grouped into the following main categories: offices, retail space, public administration, health care, education, warehousing, food service and sales and lodging, arts, entertainment, and recreation. Disaggregation of end use data can be based on consumption surveys.

**Table 2: Commercial and Public Services Sector**

	Unit	2008	2009	2010	2011	2012	2013	2014
<b>Energy Consumption in Commercial and Public Services Sector (Annual)</b>								
<b>Space Heating</b>								
1	Oil & Petroleum Products	PJ						
2	Natural Gas	PJ						
3	Coal & Coal Products	PJ						
4	Combust. Renewables & Waste	PJ						
5	Heat	PJ						
6	Electricity	PJ						
7	Other	PJ						
<b>Space Cooling</b>								
8	Oil & Petroleum Products	PJ						
9	Natural Gas	PJ						
10	Coal & Coal Products	PJ						
11	Combust. Renewables & Waste	PJ						
12	Heat	PJ						
13	Electricity	PJ						
14	Other	PJ						
<b>Lighting</b>								
15	Electricity	PJ						
16	Other	PJ						
<b>Other Building Energy Use in Services Sector</b>								
17	Oil & Petroleum Products	PJ						
18	Natural Gas	PJ						
19	Coal & Coal Products	PJ						
20	Combust. Renewables & Waste	PJ						
21	Heat	PJ						
22	Electricity	PJ						
23	Other	PJ						
<b>Non-Building Energy use (please specify) (e.g. Street lighting)</b>								
24	Oil & Petroleum Products	PJ						
25	Natural Gas	PJ						
26	Coal & Coal Products	PJ						
27	Combust. Renewables & Waste	PJ						
28	Heat	PJ						
29	Electricity	PJ						
30	Other	PJ						

#### Space Heating:

Space heating systems can be centralized or distributed. Services buildings are often equipped with central heating, ventilation and air-conditioning (HVAC) systems that heat rooms based on forced air, floor heating, or water heating. Space heating technologies may include furnace systems, boiler systems, external district steam or hot water systems, geothermal devices, co-generation, heat pumps, solar panels or greenhouses, etc. Heating systems may use a number of energy sources, such as electricity, natural gas, coal, fuel oil, liquefied petroleum gas (LPG), kerosene, biomass, and active or passive solar energy.

#### Space Cooling:

Centralized or room-based cooling systems are used to regulate the indoor temperature in warmer months. Cooling systems include: packaged air-conditioning systems (which could also be used for heating), individual room air-conditioning units, heat pumps that cool the area by ejecting heat (or the reverse during the heating season), district chilled water, e.g. from a nearby body of water, and central chillers that produce chilled water to cool the air. Most of the cooling systems in the services sector run exclusively on electricity.

### **Lighting:**

Lighting is one of the key end uses of the services sector, and it is mainly powered by electricity. Interior and exterior lighting fixtures include: incandescent lighting, fluorescent lamps, high-intensity discharge lamps, compact fluorescent light bulbs, and solid state lighting, using semi-conducting materials such as light-emitting diodes (LEDs) and organic LEDs. Other energy sources, such as kerosene, are still used to provide lighting where access to electricity is limited. Their share is expected to decrease over time. New sources, such as solar photovoltaic panels, have begun to penetrate the market, and their share is expected to increase in time.

### **Other Building Energy Use in Commercial and Public Services Sector:**

Other equipment includes a large variety of end uses and varies depending on the type of business activity or service category. It may include office equipment (servers, printers, photocopiers, fax machines, lifts and other), commercial refrigerators, food preparation equipment, commercial laundry equipment, automated bank machines, etc.

### **Residential Sector**

The residential sector includes all energy-using activities (i.e. heating, cooking, appliances, etc.) related to private dwellings where at least one person resides. A wide range of dwellings would qualify, ranging from a modern multi-story apartment building in the center of a megalopolis to a nomad tent in the middle of the desert. The end uses of residential include space heating, space cooling, water heating, lighting, cooking and appliances, and the disaggregation of the services sector is similar, except for other equipment which includes cooking, appliances and many more end uses.

**Table 3: Residential Sector**

Energy Consumption in Residential Sector (Annual)		Unit	2009	2010	2011	2012	2013	2014
<b>Space Heating</b>								
1	Oil & Petroleum Products	PJ						
2	Natural Gas	PJ						
3	Coal & Coal Products	PJ						
4	Combust. Renewables & Waste	PJ						
5	Heat	PJ						
6	Electricity	PJ						
7	Other	PJ						
<b>Space Cooling</b>								
8	Oil & Petroleum Products	PJ						
9	Natural Gas	PJ						
10	Coal & Coal Products	PJ						
11	Combust. Renewables & Waste	PJ						
12	Heat	PJ						
13	Electricity	PJ						
14	Other	PJ						
<b>Water Heating</b>								
15	Oil & Petroleum Products	PJ						
16	Natural Gas	PJ						
17	Coal & Coal Products	PJ						
18	Combust. Renewables & Waste	PJ						
19	Heat	PJ						
20	Electricity	PJ						
21	Other	PJ						
<b>Cooking</b>								
22	Oil & Petroleum Products	PJ						
23	Natural Gas	PJ						
24	Coal & Coal Products	PJ						
25	Combust. Renewables & Waste	PJ						
26	Heat	PJ						
27	Electricity	PJ						
28	Other	PJ						
<b>Lighting</b>								
29	Oil & Petroleum Products	PJ						
30	Electricity	PJ						
31	Other	PJ						
<b>Kitchen Facilities</b>								
32	Oil & Petroleum Products	PJ						
33	Natural Gas	PJ						
34	Coal & Coal Products	PJ						
35	Combust. Renewables & Waste	PJ						
36	Heat	PJ						
37	Electricity	PJ						
38	Other	PJ						
<b>Laundry Facilities</b>								
39	Electricity	PJ						
40	Other	PJ						
<b>TV / PC / Entertainment</b>								
41	Electricity	PJ						
42	Other	PJ						
<b>Other Appliances</b>								
43	Electricity	PJ						
44	Other	PJ						
<b>Other Energy Use in Residential Sector</b>								
45	Oil & Petroleum Products	PJ						
46	Natural Gas	PJ						
47	Coal & Coal Products	PJ						
48	Combust. Renewables & Waste	PJ						
49	Heat	PJ						
50	Electricity	PJ						
51	Other	PJ						

**Space Heating:**

Space heating systems can be central or distributed. Services buildings are often equipped with central heating, ventilation and air-conditioning (HVAC) systems that heat rooms based on forced air, floor heating, or water heating. Space heating technologies may include furnace systems, boiler systems, external district steam or hot water systems, geothermal devices, co-generation, heat pumps, solar panels or greenhouses, etc. Heating systems may use a number of energy sources, such as electricity, natural gas, coal, fuel oil, liquefied petroleum gas (LPG), kerosene, biomass, and active or passive solar energy.

**Space Cooling:**

Central or room-based cooling systems are used to regulate the indoor temperature in warmer months. Cooling systems include: packaged air-conditioning systems (which could also be used for heating), individual room air-conditioning units, heat pumps that cool the area by ejecting heat (or the reverse during the heating season), district chilled water, e.g. from a nearby body of water, and central chillers that produce chilled water to cool the air. Most of the cooling systems in the services sector run exclusively on electricity.

**Water heating:**

Heated water is used for showers, bathing, washing, etc. A number of tank-based or tankless systems can be used to heat the water. Water heating can be produced alone or in combination with space heating systems.

The main energy sources used by water heating systems include natural gas, LPG, electricity, biomass and, increasingly, solar thermal energy in a growing number of countries. Residential water heating is also known as domestic hot water.

**Cooking:**

Meals can be prepared using a wide range of stoves, from advanced induction stoves to traditional three-stone stoves. A number of energy sources are used for cooking such as natural gas, electricity, biomass, LPG, kerosene and coal. Beside stoves, ovens are also included in the energy consumption for cooking. Cooking appliances such as toasters and microwave ovens, due to the difficulty in separating their respective consumption, are better reported under appliances.

**Lighting:**

Lighting is one of the key end uses of the services sector, and it is mainly powered by electricity. Interior and exterior lighting fixtures include: incandescent lighting, fluorescent lamps, high-intensity discharge lamps, compact fluorescent light bulbs, and solid state lighting, using semi-conducting materials such as light-emitting diodes (LEDs) and organic LEDs. Other energy sources, such as kerosene, are still used to provide lighting where access to electricity is limited. Their share is expected to decrease over time. New sources, such as solar photovoltaic panels, have begun to penetrate the market, and their share is expected to increase in time.

**Kitchen Facilities:**

This is the total energy consumption used by all kitchen appliances excluding cooking: refrigerators, freezers, microwaves, mixers, dish washers, etc.

**Laundry Facilities:**

This is the total energy consumption used by all laundry appliances: washing machines, laundry dryers, etc.

**TV / PC / Entertainment:**

This is the total energy consumption used by PC and living room appliances: PC, printer, TV, radio, audio-sets, home video game, etc.

**Other Appliances:**

Other appliances include a wide range of appliances from electronic equipment such as vacuum cleaners, irons, etc.

## Transport sector

Defined as the consumption of fuels and electricity used to transport 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 the transport of goods or persons to another national territory is covered under the definitions for International Marine and Aviation Bunkers and is 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. In some analyses and publications, road, rail, air and water as well as the different vehicle types used in each case, are indifferently referred to as “modes” of transportation.

**Table 4: Transport sector**

Table 4		Unit	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Remarks
Total Energy Use in Transport Sector		Mtoe													
1	Motor Gasoline														
2	Automotive Diesel & Light Fuel Oil														
3	LPG (Liquefied Petroleum Gas)														
4	Heavy Fuel Oil														
5	Jet Fuel & Aviation Gasoline	Mtoe													
6	Natural Gas														
7	Electricity														
8	Coal & Coal Products														
9	Other														
Road transport (SUVs, cars, personal light trucks, vans)															
1	Motor Gasoline (including biofuels)														
2	Automotive Diesel (including biofuels)														
3	LPG (Liquefied Petroleum Gas)														
4	Fuel oil	Mtoe													
5	Natural Gas														
6	Electricity														
7	Other														
Railways															
8	Diesel & Light Fuel Oil	Mtoe													
9	Heavy Fuel Oil														
10	Natural Gas														
11	Electricity														
12	Coal & Coal Products														
13	Other														
Domestic aviation (air transport)															
14	Jet Fuel & Aviation Gasoline	Mtoe													
15	Other														
Inland waterways															
16	Motor Gasoline (including biofuels)														
17	Diesel & Light Fuel Oil														
18	Heavy Fuel Oil	Mtoe													
19	Natural Gas														
20	Coal & Coal Products														
21	Other														

### Road transport

Road 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. The fuel use for freight transport by road and by trolley buses is included here.

### Railways

Rail refers to fuels and electricity delivered for use in rail vehicles, including industrial railways. This includes urban rail transport (including trams), trains, metro rails/subways, light rails.

### Domestic aviation

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, requiring long flights through the air space of other countries, those flights are,

nevertheless, considered part of domestic aviation. Military use of aviation fuels should not be included in domestic aviation but under the energy balance item “not elsewhere specified”. 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/Inland waterways**

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.

**Industry sector**

Manufacturing, construction and non-fuel mining industries. The final consumption recorded under this category covers the use of energy products for energy purposes by economic units belonging to the industry groups listed below. It, however, excludes the use of energy products for transport, which is recorded under *Transport*.

**Table 5: Industry sector**

Table 5		Unit	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Remarks
<b>Total Industry Use</b>		ktoe																
1	Oil & Petroleum Products																	
2	Natural Gas																	economy submission
3	Coal & Coal Products																	
4	Combust. Renewables & Waste	ktoe																
5	Heat																	
6	Electricity																	
7	Other																	
<b>10 - 12 * Manufacture of food products, beverages,</b>																		
1	Oil & Petroleum Products																	
2	Natural Gas																	
3	Coal & Coal Products																	
4	Combust. Renewables & Waste	ktoe																
5	Heat																	
6	Electricity																	
7	Other																	
<b>13 - 15 * Manufacture of textiles, wearing apparel,</b>																		
8	Oil & Petroleum Products																	
9	Natural Gas																	
10	Coal & Coal Products																	
11	Combust. Renewables & Waste	ktoe																
12	Heat																	
13	Electricity																	
14	Other																	
<b>16 * Manufacture of wood and of products of w</b>																		
15	Oil & Petroleum Products																	
16	Natural Gas																	
17	Coal & Coal Products																	
18	Combust. Renewables & Waste	ktoe																
19	Heat																	
20	Electricity																	
21	Other																	
<b>17.18 * Manufacture of paper and paper products</b>																		
22	Oil & Petroleum Products																	
23	Natural Gas																	
24	Coal & Coal Products																	
25	Combust. Renewables & Waste	ktoe																
26	Heat																	
27	Electricity																	
28	Other																	
<b>19 - 21 * Manufacture of chemicals and</b>																		
36	Oil & Petroleum Products																	
37	Natural Gas																	
38	Coal & Coal Products																	
39	Combust. Renewables & Waste	ktoe																
40	Heat																	
41	Electricity																	
42	Other																	
<b>22.23 * Manufacture of non-metallic mineral proc</b>																		
43	Oil & Petroleum Products																	
44	Natural Gas																	
45	Coal & Coal Products																	
46	Combust. Renewables & Waste	ktoe																
47	Heat																	
48	Electricity																	
49	Other																	
<b>24 * Manufacture of basic metals (Iron and steel)</b>																		
50	Oil & Petroleum Products																	
51	Natural Gas																	
52	Coal & Coal Products																	
53	Combust. Renewables & Waste	ktoe																
54	Heat																	
55	Electricity																	
56	Other																	

