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**DIGEST  
OF  
ENERGY AND WATER  
STATISTICS - 2011**



# DIGEST OF ENERGY AND WATER STATISTICS - 2011

## FOREWORD

This is the fourteenth issue of a regular publication of Statistics Mauritius on energy and water statistics. It presents latest statistics on energy for the years 2002 to 2011, and on water for the period 2007 to 2011. All data refer to the Republic of Mauritius, unless otherwise specified and may be subject to revision in subsequent issues of the digest.

It is hoped that the statistics contained in this publication will prove useful to a wide range of users including planners, policy makers and research workers.

This digest has been prepared with the collaboration of the Central Electricity Board, the Central Water Authority and several other public and private organisations. The co-operation and assistance of all these organisations are gratefully acknowledged.

This publication, together with other publications of Statistics Mauritius, is available on the website <http://statsmauritius.gov.mu>.

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## Symbols & abbreviations

-	Nil
...	Not available
000	Thousand
c.i.f	Cost, insurance and freight
CEB	Central Electricity Board
CMPHS	Continuous Multipurpose Household Survey
COICOP	Classification of Individual Consumption according to Purpose
DPK	Dual Purpose Kerosene
GDP	Gross Domestic Product
GWh	Gigawatt hour (million kWh)
HBS	Household Budget Survey
IPP	Independent Power Producers
ktoe	Thousand tonnes of oil equivalent
kWh	Kilowatt hour
LPG	Liquefied Petroleum Gas
m <sup>3</sup>	Cubic metres
max	Maximum
min	Minimum
mm	Millimetres
Mm <sup>3</sup>	Million cubic metres
mn	Million
MW	Megawatt (1,000 kW)
Rod.	Island of Rodrigues
TJ	Terajoules
toe	Tonne of oil equivalent

\* \* \* \* \*

## Glossary

### Energy sector

Bagasse	A cellulosic residue left after sugar is extracted from sugar cane. It is mostly used as fuel within the sugar milling factories.
Bunkers	Refer to the amount of fuels delivered to ocean-going ships or aircraft of all flags engaged in international traffic. Deliveries to ships engaged in transport in inland and coastal waters, or to aircraft engaged in domestic flights, are not included.
Calorific values	The energy content of a fuel is equivalent to the heat released on complete combustion of the fuel.
Capacity	The maximum power available from a power station at a point in time: <ul style="list-style-type: none"> <li>- <i>Installed capacity</i>: The nameplate capacity of the generator set.</li> <li>- <i>Plant capacity</i>: The net capacity 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.</li> <li>- <i>Effective capacity</i>: It is the plant capacity less any amount of derated capacity from the install capacity.</li> </ul>
Charcoal	Comprises the solid residue obtained by the destructive distillation of wood in the absence of air.
Coal	Fossil fuel that has a high degree of coalification, with a gross calorific value over 24MJ/kg (5700 Kcal/kg) on an ash-free but moist basis.
Conversion factors	Factors used to convert quantities from original physical units into a common accounting unit for the purpose of aggregating diverse energy sources. The 'tonne of oil equivalent' (toe) has been adopted as the accounting unit.
Diesel Oil	Consists primarily of medium oil distilling between 180 <sup>0</sup> C and 380 <sup>0</sup> C.
Energy	Means the capacity for doing work or for producing heat. Producing heat is a common manifestation of 'doing work' as are producing light and motive force.
Energy Balance	Shows in a consistent accounting framework, the production, transformation and final consumption of all forms of energy for a given geographical area and a given period of time, with quantities expressed in terms of a single accounting unit for purposes of comparison and aggregation. The energy balance thus presents an overview of the energy produced and consumed in a system, matching input and output for a specific time period, usually a year
Energy intensity	Provides a measure of the efficiency with which energy is being used in production.
Energy unit	Express fuel and energy in energy content. The International System of Units (SI unit) of energy is the Joule. Historically the 'tonne of coal equivalent' was used, but with ascendance of oil, this has been largely replaced by the 'tonne of oil equivalent' (toe), defined as 41.868 gigajoules.

Final Energy Consumption	<p>Energy consumption by final user- i.e. energy which is not being used for transformation into other forms of energy. The consumption by sector is presented as follows:</p> <p><i>Agriculture:</i> Energy used for irrigation and by other agricultural equipments;</p> <p><i>Commercial &amp; distributive trade:</i> Energy consumed by the business and commercial sector;</p> <p><i>Residential:</i> Consumption of energy by residential sector;</p> <p><i>Manufacturing:</i> Consumption in industry and construction; and</p> <p><i>Transport:</i> Includes consumption by land vehicles, ships and local aircrafts.</p>
Fossils fuels	Formed from the fossilized remains of dead plants and animals by exposure to heat and pressure in the Earth's crust over hundreds of millions of years.
Fuels	The term fuel is used to describe those energy sources, whether primary or secondary, that must be subjected to combustion or fission in order to release the energy stored up inside them.
Fuel wood	The term 'fuel wood' embraces all forms of woody material.
Fuel Oils	The heavy oils from the refining process and used as fuel in power stations. It is also commonly used by ships and industrial large-scale heating boilers installations as a fuel in furnaces or boilers.
Gasolene	Comprises a mixture of relatively volatile hydrocarbons with or without small quantities of activities, which have been blended to form a fuel suitable for use in spark-ignition internal combustion engines.
Gross Domestic Product (GDP)	It represents the aggregate money value of all goods and services produced within a country out of economic activity during a specified period, usually a year, before provision for the consumption of fixed capital.
Gigawatt hour (GWh)	Unit of electrical energy, equal to 3.6 terajoules (TJ).
Hydro	Energy derived from the potential and kinetic energy content of water.
Imports	Refer to amount of fuels obtained from other countries.
Indigenous production	Comprises hydro electricity, fuel wood, bagasse and electricity from wind generation.
IPP (Independent Power Producers)	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 and for sale to the CEB.
Jet fuel Kerosene-type	Refers to medium oils meeting the required properties for use in jet engines and aircraft-turbine engines.
Kerosene (exlc. Jet fuel type)	A medium oil distilling between 150 <sup>0</sup> C and 300 <sup>0</sup> C and which is used in sectors other than aircraft transport.
Kilowatt hour (kWh)	It is a precise measure of heat and work. 1kWh=3.6 x 10 <sup>6</sup> joules

Landfill Gas (LFG)	<b>Landfill gas (LFG) is a mixture of different gases, mainly methane and carbon dioxide. It is generated during the natural process of bacterial decomposition of organic material contained in solid waste landfills. LFG is an asset when it is used as a source of energy to produce electricity or heat. By using LFG to produce energy, landfills can significantly reduce emissions of methane into the atmosphere while decreasing dependency on fossil fuels to generate electricity.</b>
Liquefied petroleum Gas (LPG)	<b>Consists mainly of propane or butane, derived from oil. It is normally liquefied under pressure for transportation and storage. It is often used to power cooking stoves or heaters and to fuel some types of vehicle.</b>
Losses (transmission / distribution losses)	<b>Comprise losses in transmission and distribution of electric energy and losses in transformers, which are <i>not</i> considered as integral parts of the power stations.</b>
Megawatt (MW)	<b>A unit of electrical power, equal to <math>10^6</math> watts, i.e 1000kW</b>
Own use (Station use and loss)	<b>Included are consumption by station auxiliaries and losses in transformers, which are considered as integral parts of the power stations.</b>
Peak demand	<b>Peak demand, peak load or on peak are terms used in energy demand management describing a period in which electrical power is expected to be provided for a sustained period at a significantly higher than the average supply level. Peak demand fluctuations may occur on daily, monthly seasonal and yearly cycles.</b>
Petroleum products	<b>The primary source of petroleum products is crude oil. Petroleum or crude oil is a naturally occurring, flammable liquid found in rock formations in the Earth. Diesel oil, fuel oils, Gasolene, Kerosene and Liquefied petroleum gas(LPG) are among the major products of oil refineries.</b>
Primary energy	<b>Primary energy designates energy from sources that involve only extraction or capture, with or without separation from contiguous material, cleaning or grading, before the energy embodied in that source can be converted into heat or mechanical work. Primary energy is not derived from any other forms of energy. By convention, sources of energy that occur naturally such as coal, natural gas, fuelwood are termed primary energy.</b>
Primary energy requirement	<b>It is the sum of imported fuels and locally available fuels less re-exports to bunkers after adjusting for stock changes.</b>
Production	<b>Comprises gross production, i.e., the amount of electric energy produced, including that consumed by station auxiliaries and any losses in transformers that are considered integral parts of the power station.</b>
Quintile	<b>A statistical value of a data set that represents 20% of a given population. The first quintile represents the lowest fifth of the data (1-20%); the second quintile represents the second fifth (21% - 40%) etc.</b>
Renewables or Renewable sources of energy	<b>Renewables are natural resources that, after exploitation, can return to their previous stock levels by natural processes of growth or replenishment. Conditionally renewable resources are those whose exploitation eventually reaches a level beyond which regeneration will become impossible. Such is the case with the clear-cutting of tropical forests.</b>

Secondary energy	Secondary energy designates energy from all sources of energy that results from transformation of primary sources. e.g charcoal from fuelwood.
Statistical differences	This is the difference between calculated and observed inland consumption.
Solar	Energy derived from solar radiation directly by photovoltaic effect, or indirectly by thermal transformation.
Stock change / Statistical error	This is the difference between calculated and observed inland consumption.
Terajoule	The terajoule (TJ) is equal to one trillion joules( $10^{12}$ J). (A joule is a genetic unit of energy in the International System of units. The work required to continuously produce one <u>watt</u> of <u>power</u> for one <u>second</u> ).
Thermal plants	Comprises of conventional thermal plants of all types, whether or not equipped for the combined generation of heat and electric energy. They include steam-operated generating plants and plants using internal combustion engines or gas turbines.
Thermal sources of electricity	These include coal, oil, bagasse and landfill gas.
Transformation	Those fuels used directly in producing other fuels.
Watt (W)	The conventional unit to measure a rate of flow of energy. One watt amounts to 1 Joule per second.
Wind energy	Energy derived from the action of the wind.
<u>Water Sector</u>	
Evapotranspiration	Combined loss of water by evaporation from the soil or surface.
Groundwater recharge	Process by which water is added from outside to fresh water found beneath the earth surface.
Surface runoff	The flow of surface water, from rainfall, which flows directly to streams, rivers, lakes and the sea.
Water Balance	The water balance is based on long term records of annual average rainfall and indicates how freshwater resources are distributed.
1mm rainfall	1 litre of rainwater per square metre of surface area.

\* \* \* \* \*

### Energy conversion factors

The following energy conversion factors have been used to express the energy content of the different fuels in terms of a common accounting unit, namely the 'tonne of oil equivalent' (toe).

<b>Energy source</b>	<b>Tonne</b>	<b>toe</b>
Bagasse	1	0.16
Charcoal	1	0.74
Coal	1	0.62
Diesel Oil	1	1.01
Dual Purpose Kerosene (DPK)	1	1.04
Fuel oil	1	0.96
Fuelwood	1	0.38
Gasolene	1	1.08
Liquefied Petroleum Gas (LPG)	1	1.08
	<b>GWh</b>	<b>toe</b>
Electricity	1	86
Hydro/Wind	1	86
	<b>Terajoules(TJ)</b>	<b>toe</b>
Energy unit	0.041868	1

\* \* \* \* \*

## **ENERGY AND WATER STATISTICS, 2011 – An overview**

### **Introduction**

This issue of the 'Digest of Energy and Water Statistics, 2011' covers the period 2002 to 2011 for energy statistics, and the years 2007 to 2011 for water statistics. The figures have been compiled in close collaboration with the Central Electricity Board (CEB), the Central Water Authority (CWA), the Water Resources Unit (WRU), the Meteorological Services, the petroleum companies and the Independent Power Producers (IPPs). All data refer to the Republic of Mauritius, unless otherwise specified. Some of the figures, given in the text below, have been rounded off for easy interpretation.

The energy data have been compiled according to the recommendation of the United Nation Manual, Series F No. 29 on Energy Statistics.

## **2. Energy**

### **2.1 The energy balance**

The energy balance (Tables 1.1-1.4) shows the supply and demand (final uses) of energy. In order to compare the energy content of the different fuels, a common accounting unit, namely tonne of oil equivalent (toe) is used. The conversion factors are given on page 9.

The energy supply presented as the total primary energy requirement decreased from 1,431 ktoe to 1,427 ktoe (-0.3%) while the demand presented as the total final consumption increased from 854 ktoe to 862 ktoe (+0.9%). The difference between the supply and the demand is mainly due to fuel transformed into electricity.

### **2.2 Primary energy requirement**

Total primary energy requirement is obtained as the sum of imported and locally available fuels less re-exports and bunkering, after adjusting for stock changes. As shown in Table 2.1, the total primary energy requirement was 1,427 ktoe in 2011, down by 0.3% from 1,431 ktoe in 2010 leading to a decrease of 0.9% in the per capita primary energy requirement from 1.12 toe to 1.11 toe.

In 2011, 83.8% (1,196 ktoe) of the total primary energy requirement were met from imported fuels (petroleum products and coal) compared to 83.1% (1,189) in 2010. Locally available sources (hydro, wind, landfill gas, bagasse and fuelwood) which are all renewable accounted for 16.2% (231 ktoe) in 2011 compared to 16.9% (242 ktoe) in 2010. It is to be noted that as from August 2011, part of the primary energy requirement was marginally met from landfill gas.

Energy supply from petroleum products increased by 3.0% from 775 ktoe in 2010 to 798 ktoe in 2011. It comprised mainly fuel oil (31.1%), diesel (26.3%), gasoline (16.3%) and aviation fuel (16.8%). In 2011, coal requirement was 398 ktoe indicating a decrease of 3.9% over the 414 ktoe of 2010.

Local productions which are all renewable stood at 231 ktoe in 2011. Bagasse contributed 94.4% of the renewable sources and the remaining 5.6% was from hydro, wind, landfill gas and fuelwood.

In this issue 'Energy intensity', which provides a measure of the efficiency with which energy is being used, has been calculated using GDP at 2000 rupees. Table 1.5 shows that 'Energy intensity', which stood at 0.79 in 2010, fell to 0.76 in 2011, reflecting a more efficient use of energy.

### ***2.2.1 Local Production (Renewable)***

Total energy production from local renewable sources went down by 4.5% from 242 ktoe in 2010 to 231 ktoe in 2011. It was mainly due to a decrease of 42.7% in the production of hydro/wind electricity from 8.9 ktoe in 2010 to 5.1 ktoe in 2011 and a decrease of 3.1% of bagasse from 225 ktoe to 218 ktoe (Table 2.1).

### ***2.2.2 Imports of energy sources***

In 2011, some 1,577 ktoe of petroleum products and coal were imported compared to 1,500 ktoe in 2010, representing an increase of 5.1%. Imports of petroleum products went up from 1,091 ktoe to 1,168 ktoe (+7.1%) while that of coal remained almost the same at around 409 ktoe (Table 2.3).

The import value of petroleum products and coal increased by 25.3% from Rs 24,721 million in 2010 to Rs 30,974 million in 2011. The import value of petroleum products and coal as a percentage of total imports was 21.0% in 2011 compared to 18.0% in 2010 (Table 2.5).

### ***2.2.3 Re-exports and bunkering***

Of the 1,577 ktoe of imported energy sources in 2011, around 402 ktoe (25.5%) were supplied to foreign marine vessels and aircrafts. Re-exports and Bunkering has gone up by 14.2% over the 2010 figure of 352 ktoe. Re-exports consisted of 124 ktoe of aviation fuel (30.7%), 178 ktoe of fuel oil (44.2%) and 101 ktoe of diesel oil (25.1%) (Table 2.6).

## **2.3 Electricity**

### ***2.3.1 Electricity Generation***

The peak power demand in 2011 reached 412.5 MW (+2.1%) in the Island of Mauritius as compared with 404.1 MW in 2010 (Table 3.1).

Some 2,730 GWh (235 ktoe) of electricity was produced in 2011 as compared with 2,689 GWh (231 ktoe) in 2010, representing an increase of 1.5%. Around 80% (2,178 GWh) of the electricity generated were from non-renewable sources and the remaining 20% (552 GWh) from renewable sources. The total amount of electricity generated from renewable resources (hydro, wind, landfill gas and bagasse) decreased by 4.3% from 577 GWh in 2010 to 552 GWh in 2011 (Table 3.5).

The Independent Power Producers (IPPs) supplied 58.6% of the total electricity generated while the Central Electricity Board (CEB) provided the remaining 41.4%. Thermal energy represented 97.8% of overall generation.

### **2.3.2 Fuel input for electricity generation**

The different types of fuel used for electricity production are shown in Table 3.7. Fuel input decreased from 778 ktoe in 2010 to 773 ktoe in 2011 (-0.6%). The major components of the fuel input were coal (49.5 %), fuel oil (26.7%) and bagasse (23.2%).

### **2.3.3 Electricity sales**

Electricity sales increased by 2.5% from 2,174 GWh (187 ktoe) in 2010 to 2,228 GWh (192 ktoe) in 2011. During the same period, the average sales price of electricity went up by 9.0% from Rs 5.22 to Rs 5.69 per kWh (Table 4.7).

The per capita consumption of electricity sold went up by 2.1% from 1,697 kWh in 2010 to reach 1,733 kWh in 2011 (Table 1.5).

## **2.4 Final energy consumption**

Final energy consumption is the total amount of energy required by end users as a final product. End-users are mainly categorized into five sectors, namely manufacturing, transport, commercial and distributive trade, households and agriculture. Final energy consumption increased by 1.0% from 854 ktoe in 2010 to 863 ktoe in 2011. "Transport" and "Manufacturing" were the two largest energy-consuming sectors accounting for 50.5% and 25.7% of energy consumed respectively. They were followed by "Household" (13.6%), "Commercial and Distributive Trade" (9.4%) and "Agriculture" (0.5%). Details on the different types of fuel consumed by each sector and the respective amounts are given in Tables 4.1 to 4.4.

### **2.4.1 Manufacturing**

Between 2010 and 2011, energy used for manufacturing processes decreased by 3.9% from 231 ktoe to 222 ktoe. In 2011, electricity contributed around 79 ktoe (35.6%); diesel oil 43 ktoe (19.4%) and that of fuel oil and bagasse was 39 ktoe (17.6%) for each.

### **2.4.2 Transport**

Energy consumption by "Transport" sector stood at 435 ktoe, representing an increase of 3.1% over the previous year's figure of 422 ktoe. Consumption of fuel for land transport increased from 291 ktoe to 293 ktoe (+0.7%). Consumption of aviation fuel increased from 123 ktoe in 2010 to 134 ktoe in 2011 (+8.9%) and that of sea transport was around 8.0 ktoe.