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DIGEST OF ENERGY AND WATER STATISTICS - 2007

FOREWORD

This is the tenth issue of a regular publication of the Central Statistics Office on energy and water statistics. It presents latest statistics on energy for the years 1998 to 2007, and on water for the period 2003 to 2007. 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 the Central Statistics Office, is available on the website <http://statsmauritius.gov.mu>.

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Symbols & abbreviations

-	Nil
...	Not available
000	Thousand
m ³	Cubic metres
max	Maximum
min	Minimum
mm	Millimetres
Mm ³	Million cubic metres
mn	Million
toe	Tonne of oil equivalent
ktoe	Thousand tonnes of oil equivalent
c.i.f	Cost, insurance and freight
LPG	Liquefied Petroleum Gas
DPK	Dual Purpose Kerosene
MW	Megawatt (1,000 kW)
kWh	Kilowatt hour
GWh	Gigawatt hour (million kWh)
CEB	Central Electricity Board
IPP	Independent Power Producers
GDP	Gross Domestic Product
Rod.	Island of Rodrigues
	* * * * *

Glossary

Energy sector

Bagasse	A cellulosic residue left after sugar is extracted from sugar cane. It is mostly used as a 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"> - <i>Installed capacity</i>: The nameplate capacity of the generator set. - <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. - <i>Effective capacity</i>: It is the plant capacity less any amount of derated capacity from the install capacity.
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 ⁰ C and 380 ⁰ 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 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>Agriculture: Energy used for irrigation and by other agricultural equipments;</p> <p>Commercial and distributive trade: Energy consumed by the business and commercial sector;</p> <p>Household: Consumption of energy by households;</p> <p>Manufacturing: Consumption in industry and construction; and</p> <p>Transport: Includes consumption by land vehicles, ships and local aircrafts.</p>
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 0.0036 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 ⁰ C and 300 ⁰ 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 ⁶ joules
Liquefied petroleum Gas (LPG)	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.

Losses (Distribution loss)	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.
Megawatt (MW)	A unit of electrical power, equal to 10^6 watts, i.e 1000kW
Own use (Station use and loss)	Included are consumption by station auxiliaries and losses in transformers, which are considered as integral parts of the power stations.
Primary energy	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.
Primary energy requirement	It is the sum of imported fuels and locally available fuels less re-exports to bunkers after adjusting for stock changes.
Production	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.
Renewables or Renewable sources of energy	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.
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.
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 and bagasse.
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.
Water	
Water Balance	The water balance is based on long term records of annual average rainfall and indicates how freshwater resources are distributed.
Evapotranspiration	Combined loss of water by evaporation from the soil or surface.
Surface runoff	The flow of surface water, from rainfall, which flows directly to streams, rivers, lakes and the sea.
Groundwater recharge	Process by which water is added from outside to fresh water found beneath the earth surface.
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*).

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

* 1 toe = 41.84 gigajoule (net calorific value)

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ENERGY AND WATER STATISTICS, 2007 – An overview

Introduction

This issue of the 'Digest of Energy and Water Statistics, 2007' covers the period 1998 to 2007 for energy statistics, and the years 2003 to 2007 for water statistics. The figures have been compiled in close collaboration with the Ministry of Public Utilities, the Central Electricity Board, the Central Water Authority, the petroleum companies, the Independent Power Producers and the Meteorological Services. 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 & 1.2) shows the supply and final uses of electricity and the different types of fuel in the national economy. Total primary energy requirement is obtained as the sum of indigenous production (hydro, fuelwood and bagasse) and imports less re-exports and bunkering, after stock adjustments. Final energy consumption is the total amount of energy required by end users as a final product. End-users are categorised into six sectors, namely manufacturing, transport, commercial and distributive trade, households, agriculture and other.

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 12.

2.2 Primary energy requirement

The total primary energy requirement of the country increased by only 0.4%, from 1,377 ktoe in 2006 to 1,384 ktoe in 2007 (Table 2.1). Of this, imported fuels (petroleum products and coal) accounted for 82.1% (1,136 ktoe) while locally available sources supplied the remaining 17.9% (248 ktoe).

Contrary to previous years, imported petroleum products in 2007 decreased. It went down from 822 Ktoe in 2006 to 781 ktoe in 2007. The petroleum products comprised mainly fuel oil (32.3%), diesel (26.6%), aviation fuel (18.4%) and gasoline (13.7%).

In 2007, coal reached 355 ktoe, which showed a 18.2% increase over the 300 ktoe of 2006. This increase of coal in the primary energy requirements was partly due to the coming into operation, in April 2007, of the 'Compagnie Thermique de Savannah Limitée' (CTSav), an Independent Power Producer which generates electricity from coal and bagasse.

The local production (248 ktoe) comprised renewables including bagasse (93.9%), hydro electricity (2.9%) and fuelwood (3.2%).

The total primary energy requirement index, with 1990 as base year (1990 = 100), witnessed a slight change, moving from 188.4 in 2006 to 189.4 in 2007 while the per capita primary energy requirement stood at 1.10 toe, as in 2006 (Table 1.3).

Energy intensity defined as total primary energy requirement (toe) per Rs 100,000 of GDP (in 1990 rupees) provides a measure of the efficiency with which energy is being used in production. As shown in Table 1.3, energy intensity, which was 1.66 in 2006, went down to 1.58 in 2007. A lower ratio usually reflects a more efficient use of energy.

2.2.1 Local production

Total energy production from local renewable sources fell by 3.5% from 255 ktoe in 2006 to 248 ktoe in 2007. This was primarily due to a lower production of bagasse. Thus generation from bagasse decreased from 240 ktoe to 232 ktoe. However, production of hydroelectricity increased from 6.6 ktoe in 2006 to 7.2 ktoe in 2007. (Table 2.1)

2.2.2 Imports of energy sources

Data on imports of energy sources show that some 1,482 ktoe of petroleum products and coal were imported in 2007 compared to 1,338 ktoe in 2006, representing an increase of 10.7%. Petroleum products increased from 1,034 ktoe to 1,080 ktoe (+4.5%) while coal increased from 304 ktoe to 402 ktoe (+32.2%)(Table 2.3). As a result of ascending prices of petroleum products and coal, the import bill was 15% higher in 2007, Rs 21,639 million against Rs 18,822 million in 2006 (Table 2.5).

2.2.3 Re-exports and bunkering

Of the 1,482 ktoe of imported energy sources in 2007, about 314 ktoe (21.2%) were supplied to foreign vessels and aircraft. Re-exports consisted of 121 ktoe of aviation fuel (38.7%), 120 ktoe of diesel oil (38.1%), and 73 ktoe of fuel oil (23.2%). The following changes were noted compared to the previous year: Aviation fuel +17%, Fuel Oil +54%, Diesel -3%, overall +14%. (Table 2.6).

2.3 Electricity

2.3.1 Electricity Generation

Some 2,465 GWh (212 ktoe) of electricity was generated in 2007 as compared with 2,350 GWh (202 ktoe) in 2006, representing an increase of 4.9 %. The Independent Power Producers (IPPs) supplied 59.3 % of the electricity generated while the Central Electricity Board (CEB), only 40.7%. Thermal energy represented 96.6% and hydro/wind the remaining 3.4%. The peak demand in 2007 was 367.6 MW in the Island of Mauritius, showing a slight change over previous year's 367.3 MW, while that of the Island of Rodrigues reached 5.9 MW. (Tables 3.1 – 3.6).

It is to be noted that in 2007 the share of electricity produced for sales by Independent Power Producers (55%) exceeded that of CEB for the first time, with the contribution of the new IPP, the 'Compagnie Thermique de Savannah Limitée'.

2.3.2 Fuel input for electricity generation

The different types of fuel used for electricity generation are shown in Table 3.7. The mix of fuels used to generate electricity continues to evolve with fuel oil and kerosene decreasing, coal going up and bagasse almost remaining at the same level. The overall increase was 5% with 675 ktoe in 2006 and 707 ktoe in 2007. The major components of the fuel input were coal (48.4%), fuel oil (27.3%) and bagasse (23.8%).

2.33 Electricity sales

Electricity sold increased by 5.1% from 1,880 GWh in 2006 to 1,975 GWh in 2007. The average sales price of electricity went up by 4.2 % from Rs 3.60 per kWh to Rs 3.75 per kWh during the same period (Table 4.7).

The consumption of electricity per capita per annum stood at 1,567 kWh in 2007 compared to 1,501 kWh in 2006 (Table 1.3).

2.4 Final energy consumption

Final energy consumption decreased by 2.1% from 876 ktoe in 2006 to 858 ktoe in 2007. Transport and Manufacturing were the two largest energy-consuming sectors accounting for 46.9% and 30.1% of energy consumed respectively. They were followed by Residential (12.4%), Commercial and Distributive Trade (7.4%) and Agriculture (0.6%). The details on the different types of fuel consumed by each sector and the respective amounts are given in Tables 4.1 – 4.6.

2.4.1 Manufacturing

Energy used for manufacturing processes decreased by 2.5% from 271 ktoe in 2006 to 264 ktoe in 2007. The contribution of electricity was 76 ktoe, bagasse, 64 ktoe, , fuel oil, 58 ktoe and diesel oil, 49 ktoe.

2.4.2 Transport

In 2007, some 411 ktoe of energy were used for transportation, representing a decrease of 3.5% over last year. Consumption of gasoline increased from 96 ktoe to 107 ktoe (11%) while that of diesel oil decreased from 175 ktoe to 153 ktoe (-12.6%). Consumption of aviation fuel was 147 ktoe in 2006 compared with 144 ktoe in 2007 while the use of LPG in the transport sector decreased slightly, from 7.4 ktoe in 2006 to 7.2 ktoe in 2007.

2.4.3 Residential

Energy consumed by households in 2007 was almost the same as that of 2006, 109 ktoe. The two main sources of energy for households were electricity and LPG, representing 50.8% and

41.8% respectively of total energy consumed by households. Consumption of electricity increased by 4.1% whilst that of LPG by 1.2%.

2.4.4 Commercial and Distributive Trade

Total energy consumption by “Commercial and Distributive Trade” sector rose by 4% only, from 62.7 ktoe in 2006 to 65.2 ktoe in 2007. In this sector, electricity consumption increased from 50 ktoe to 53 ktoe (+6.2%) while LPG from 12.4 ktoe to 11.8 ktoe (-4.5%).

2.4.5 Agriculture

Energy consumption in Agriculture increased slightly from 4.8 ktoe in 2006 to 4.9 ktoe in 2007. Electricity and diesel were the only two sources of energy used in this sector. In 2007, about 2.4 ktoe of electricity were used mainly for irrigation and 2.5 ktoe of diesel oil were used mainly for derocking of land and for the preparation of soil prior to plantation.

3 Water

3.1 Water balance

The estimated water balance for the Island of Mauritius is shown in Table 6.1. The water balance indicates how fresh water resources are distributed. In 2007, the Island of Mauritius registered 3,644 million of cubic metres (Mm^3) of rainfall. Some 1,093 Mm^3 of water was lost through evapotranspiration, while surface run-off and ground water recharge were 2,186 Mm^3 and 364 Mm^3 respectively.

3.2 Rainfall

Table 6.6 shows the amount of rainfall recorded around the island of Mauritius. During the year 2007, the mean amount of rainfall recorded around was 1,954 millimetres, a 2% increase compared with 1,914 millimetres registered in 2006. February was the wettest month, registering a mean rainfall of 572 mm whereas November was the driest month with a mean rainfall of only 45mm.

For the Island of Rodrigues, the mean rainfall registered in 2007 was 945 millimetres compared with 1,189 in 2006. February recorded the highest amount of rainfall with 315 mm and November the least with 7 mm. (Table 6.7)

3.3 Water storage level

In 2007, the minimum and maximum percentage water storage level of the different reservoirs was as follows:

Reservoir	Minimum (%)	Maximum (%)
Mare aux Vocoas	40 (Dec)	100 (Mar)
La Nicoliere	42 (Dec)	100 (Feb - Apr)
Piton du Milieu	48 (Dec)	100 (Feb,Mar,Jun)
La Ferme	13 (Jan)	100 (Mar, Apr)
Mare Longue	32 (Jan)	100 (Feb, Mar)
Midlands Dam	36 (Dec)	100 (Feb - Jun)

The mean water level, in 2007 for all reservoirs combined together (excluding Midlands Dam) varied from 40% to 99% (Table 13). It is to be noted that the mean water level is computed as the average level during a month while the normal is the long term mean averaged over the period 1990 to 1999.

3.4 Water production

In 2007 potable water treated by the different treatment plants totalled to 206 Mm³, a 10% increase compared with 187 Mm³ in 2006. During the same year, average water production from surface and ground water represented 48.9% and 51.1% respectively (Table 6.9).

3.5 Water sales and revenue collectible

Total volume of water sold increased from 108.6 Mm³ in 2006 to 110.6 Mm³ in 2007 (+1.8%). In 2007, potable water made up 86.0% of the volume sold and the remaining 14% consisted of non-treated water. Water for domestic consumption amounted to 73 Mm³, accounting for nearly 66% of the total volume of water sold (Table 6.10).

The amount of revenue collectible for the year 2007 amounted to Rs 1,004.5 million, that is an increase of 2.5% over the amount of Rs 979.8 million for 2006 (Table 15).

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