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1. Energy: Recent Developments and Prospects.

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ENERGY : RECENT DEVELOPMENTS AND PROSPECTS

This article in the series of economic analyses appearing in the "Economic Indicators" is devoted to the study of the energy sector. The emphasis is on the examination of major developments on the local energy scene, with particular reference to energy demand and supply and prospects for the medium term. Where possible, attempts have been made to bring out the factors which are at the root of policy changes.

CONTRIBUTION TO GDP

2. The national accounts series in Mauritius does not give separate data for the output of the energy sector. Value added for energy is shown under "Electricity, Gas and Water", and the output data relate to the Central Electricity Board alone which is not the only institution involved in the production of electricity.

3. Total value added of the utilities sector (Electricity, Gas and Water) at current factor cost rose from Rs 188 million in 1981 to Rs 425 million in 1985, an average annual increase of 22.0% (Table I). The slow growth in the period 1981 - 84, including a slight fall in output in 1983, was caused by the slowdown in economic activities domestically as a result of both internal and external factors as well as a rise in electricity tariffs in the wake of oil price hike.

Table I : Value Added in Electricity, Gas and Water
at Current Factor Cost (1981-85)

	<u>1981</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>
Value added in electricity, gas and water (Rs Million)	188	260	245	296	425
Gross domestic product at current factor cost (Rs Million)	8,765	10,020	10,613	12,050	13,700
Value added in electricity, gas and water as % of GDP	2.1	2.6	2.3	2.4	3.1

4. The share of electricity, gas and water in GDP rose to 3.1% in 1985. If the value added relating to electricity generation, as part of sugar processing, which is currently ascribed to sugar milling, is taken into account for computing output of the sector, the latter's contribution to GDP would be greater.

ENERGY IMPORTS

5. Energy purchases reached a peak in 1979 when 210.7 thousand tonnes of oil equivalent (toe) of petroleum products were imported (Table II).

Table II: Energy Imports 1975 - 85
Tonne of Oil Equivalent (TOE)

<u>Year</u>	<u>IMPORTS</u>	
	<u>Volume '000 (TOE)</u>	<u>Value (Rs Million)</u>
1975	145.2	194.5
1978	209.8	280.7
1979	210.7	526.2
1980	188.8	667.3
1981	187.9	889.0
1982	168.9	936.9
1983	186.2	972.2
1984	186.5	1076.2
1985 *	186.6	1256.0

Average Annual Growth Rate

1975 - 1979 = 9.7%

1980 - 1983 = - 0.5%

* includes coal imports

See Annex - Chart III

6. Traditionally, external sources have supplied 90% of the primary energy requirements of the economy, excluding the sugar industry which uses bagasse-based power for the processing of sugar. This almost total reliance on imported energy is not without implications in that it translates into massive leakages of the country's hard-earned export receipts with consequent pressure on the balance of payments.

The gravity of the situation can be gauged by the proportion of foreign exchange from sugar and molasses, annually devoted to paying for the purchase of petroleum products from overseas.

7. In 1981, energy imports alone absorbed over 50% of export revenues from sugar and molasses, indicating that 51 cents out of each rupee earned leaked out abroad. The share of energy in the total import bill in the same year stood at 17.8%. Although 1981 was an exceptionally poor year in export performance, the fact that in 1985 a little less than 4% of income from sugar and molasses was spent on energy purchases serves to underline the urgency of reducing the current heavy dependence on external energy. Efforts will, therefore, be needed to develop an energy mix in which renewable energy sources will be important.

PRIMARY ENERGY CONSUMPTION

8. As an input in the production process, energy affects the performance of other sectors while the demand for energy is influenced by the level of economic activities in the country; the more buoyant the economy, the greater is the demand, although the end use may differ from sector to sector. The consumption of primary energy (Table II) in Mauritius has generally followed the growth patterns of the economy.

9. Basically, three distinct phases could be discerned in the demand for primary energy. In the first phase, covering 1975 - 79, total primary energy consumption recorded, on average, a growth rate of 9.7% a year. This period also coincided with the sugar boom of 1974 - 75 when relatively better economic conditions were prevalent in the country. In the second phase, beginning 1980, consumption fell drastically to 168.9 thousand toe in 1982. The declining trend was reversed in the third phase, commencing in 1983, when demand picked up by almost 10% over the previous year and reached 186.6 thousand toe in 1985, reflecting a recovery of the economy. Thus a close correlation between energy requirement and the level of economic activities appears to have emerged, suggesting that the demand for energy will rise if the present growth momentum is carried through into the future.

End-Use of Primary Energy

10. The end-use pattern of primary energy consumption has not undergone any significant change. Overall, three end-uses of energy have become evident in the last decade, as shown below:

Table III: End-Use of Primary Energy, 1975-85 in toe
(Percentage Share)

<u>Year</u>	<u>Electricity Generation</u>	<u>Transport</u>	<u>Straight Domestic Cooking Fuel</u>
1975	34.8	52.0	13.2
1980	41.2	46.8	12.0
1981	43.0	46.3	10.7
1982	43.9	45.1	11.0
1983	44.6	44.2	11.2
1984	46.0	43.2	10.8
1985	50.3	39.7	10.0

11. Electricity generation has become by far the single most important end-use of primary energy (50% in 1985), followed by transport (40%). The overwhelming share of electricity is natural in a country where the electricity network covers the whole island and where the rapidly expanding industrial sector is making a heavy demand on electrical energy. Electricity production will continue to claim a relatively higher share of primary energy because of population increases, improved income levels which are closely associated with rising per capita consumption of electricity, and growing industrialisation and tourism development. Transport is also expected to exercise heavy pressure on energy demand, due largely to the country's transport system which is wholly road-based.

12. When the sectoral distribution of energy consumption from imported fuel is analysed, transport emerges as the major consumer, accounting for 48.8% of total energy from this source followed by the commercial sector (27.1%), which also includes the CEB, the industrial (12.1%) and domestic (12%) sectors.

Table IV: Sectoral Distribution of Commercial Energy
1980 and 1985 ('000 toe)

	<u>Sector</u>									
	<u>1980</u>					<u>1985</u>				
	<u>Trans- port</u>	<u>Domes- tic</u>	<u>Indus- try</u>	<u>Commer- cial</u>	<u>Total</u>	<u>Trans- port</u>	<u>Domes- tic</u>	<u>Indus- try</u>	<u>Commer- cial</u>	<u>Total</u>
<u>Direct</u>										
<u>Petroleum</u>										
<u>Products</u>										
Gasoline	42,301	-	-	-	42,301	37,579	-	-	-	37,579
Diesel	59,023	-	-	-	59,023	56,851	-	-	-	56,851
Kerozene	-	20,936	-	-	20,936	-	18,056	-	-	18,056
LPG	-	1,340	-	670	2,010	-	1,945	-	973	2,918
Fuel Oil	-	-	25,826	38,738	64,564	-	-	21,222	31,833	53,055
<u>Coal</u>	-	-	-	2,731	2,731	-	-	-	18,224	18,224
<u>Indirect</u>										
Share in total electric con- sumption		2,917	1,957	1,464	6,338	-	3,071	2,311	1,622	7,004
Toe equivalent consumed	101,324	25,193	27,783	43,603	197,903	94,430	23,072	23,533	52,652	193,687
Total % share	51.2	12.8	14.0	22.0	100	48.8	12.0	12.1	27.1	100

Consumption of Petroleum Products

13. As the largest component of primary energy in Mauritius, petroleum products have closely followed the demand trend. Thus between 1975 and 1978, the consumption of petroleum products rose at an average annual rate of 13.2% with the consumption of fuel oil growing at a much higher rate 18.1% (Table V).

Table V: Petroleum Product Consumption, 1975-85 (toe)

<u>Year</u>	<u>Gasoline</u>	<u>Gas Oil</u> <u>(Diesel)</u>	<u>Kerosene</u>	<u>Fuel Oil</u>	<u>LPG</u>	<u>Total</u>
1975	32,523	53,009	17,595	41,036	1,106	145,269
1978	49,688	64,554	26,178	67,696	1,732	210,848
1979	48,126	60,037	26,176	74,263	2,105	210,707
1980	42,301	59,023	20,936	64,564	2,010	188,834
1981	38,245	59,590	17,728	70,359	2,011	187,933
1982	35,545	55,651	16,884	58,598	2,263	168,941
1983	36,108	53,878	17,397	76,426	2,441	186,250
1984	35,980	55,079	17,063	72,984	2,736	183,842
1985	37,579	56,851	18,056	53,055	2,918	168,459

Average
Annual
Growth
Rate

1975-1978 = 13.2%

1978-1983 = -2.5%

14. Two factors were responsible for the high growth rate of fuel oil consumption prior to 1978: (i) increased electricity generation based on fuel oil; and (ii) the substitution away from diesel to fuel oil for thermal power production. In the five years to 1983, the consumption of petroleum products dropped in almost all sectors as the country went through a period of economic slowdown. In the transport sector in particular, the reactions of the private motorists were quick and sharp to a 250% increase in the price of gasoline; demand plummeted at an average annual rate of 6% during 1978-83. The relative stabilization in prices since 1985 combined with a slight fall in retail prices in 1986 have since revived consumption.

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Pricing of Petroleum Products

15. Energy conservation and demand management objectives have largely shaped the Government's policy with regard to the pricing of petroleum products. The need to regulate energy demand and to ensure more efficient utilization is dictated by the country's total dependence on foreign sources for its petroleum product requirements. Other factors such as OPEC-driven price increases have been equally important in framing the pricing policy. Table VI shows evolutions in retail prices of petroleum products over the period 1975-86:

Table VI: Average Retail Prices of Petroleum Products

1975-86 (Rs/Gallon)

<u>Year</u>	<u>Premium Gasoline</u>	<u>Regular Gasoline</u>	<u>Kerosene</u>	<u>Diesel</u>	<u>Fuel Oil</u>
1975	6.75	5.70	3.60	3.80	2.86
1978	9.45	8.45	4.25	5.20	2.85
1979	22.00	21.00	10.45	12.00	6.57
1980	26.00	24.25	13.10	16.65	10.49
1981	32.50	32.00	18.50	20.50	14.53
1982	33.00	32.50	18.00	20.00	13.79
1983	33.00	32.50	16.00	20.00	15.17
1984	37.00	N.I.	18.00	22.00	16.60
1985	37.00	N.I.	18.00	21.10	18.24
1986	35.00	N.I.	15.00	19.60	13.31

N.I. - Not imported

See Annex - Chart II

The pricing of low-grade fuels, namely diesel and kerosene, has been aimed at (i) promoting a more intensive use of public transport as opposed to private vehicles; and (ii) reducing costs of energy to low-income groups for whom kerosene is the principal cooking fuel.

16. The preoccupation for conserving energy and containing demand will continue to guide the Government's future pricing policy for petroleum products to ensure that a sudden relaxation in prices does not feed through higher demand, eventually leading to increased imports with concomittent pressure on the balance of payments. This legitimate concern has been behind the recent modest reduction in gasoline prices despite the softening of oil prices on the world market. Liquefied Petroleum Gas (LPG) prices have, however, been substantially out in order to shift domestic consumers to this form of energy. LPG is more efficient than electricity for cooking purposes and it is also Government's Policy to encourage the segments of the population to use LPG to reduce the risks of accidents from the use of kerosene lamps.

Electricity Production and Consumption

17. Electric power production now claims a 50% share of total primary energy consumed domestically. Naturally, the demand patterns of these two forms of energy have generally moved together and are in line with the trends in the national economy. Thus between 1975 and 1978, electricity consumption grew on average at 15% a year, reflecting a better economic climate in the country. However, in 1979-82, the demand fell from 294 GWh to 293 GWh as the economy moved from a period of relative prosperity to economic stagnation following crop failures in the early 1980's, low industrial investment, reduced sugar revenue and rising oil prices which were translated into higher electricity tariffs. Table VII shows electricity consumption trends for the period 1975-85.

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Table VII: Electricity Consumption Trends and Average Tariff
Rates at Current Price 1975-85

<u>Year</u>	<u>Electricity Consumed</u> <u>(GWh)</u>	<u>Average Tariff</u> <u>Rates - Rs/KWh</u>
1975	184.1	0.31
1978	280.4	0.50
1979	294.7	0.65
1980	289.5	1.03
1981	291.0	1.22
1982	293.1	1.33
1983	302.1	1.37
1984	305.1	1.59
1985	321.0	1.72

See Annex - Chart I

18. Tariffs have been an important instrument for regulating electrical power demand. They have shown a steady upward movement since 1975, reflecting high costs of thermal power generation because of rising fuel oil prices. Average tariffs went up from Rs 0.31/KWh in 1975 to Rs 0.65/KWh in 1979, an increase of 110%. Further rises took place in subsequent years. The rate adjustment has also been necessary to guarantee an adequate rate of return on capital to The Central Electricity Board (CEB). This requirement together with the need to contain demand will continue to determine the tariff regime in the future.

19. Table VIII gives electricity generation by source. Beginning in 1984, the dominance of thermal power in electrical power supply

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has been reduced, the share declining from a peak of 82% in 1983 to less than 45% in 1985. Given the limited potential of hydro-power to make any significant impact on electricity generation, any additional demand for electrical energy will have to be met either from thermal sources (including coal) or by bagasse-based energy or a combination of both. In the present circumstances, the key to trimming the energy import bill lies in a programme to improve the efficiency for steam and power generation from bagasse. Through improvements in the boilers, the sugar industry could produce more surplus bagasse for power generation and become a major supplier of electricity to the national economy. Studies to determine the availability of bagasse surplus and the investment needed have already been initiated in the context of charting a least-cost power system expansion programme. In the years to come, bagasse will become a subject of intense national interest for the satisfaction of the medium and long-term electricity needs of the economy, both to achieve a greater measure of self-sufficiency in energy requirements and to bring down real costs of energy to consumers.

Table VIII : Electricity Generation by Source, 1975 - 1985

<u>Year</u>	<u>Hydro</u>		<u>Thermal</u>		<u>Purchases from sugar factories</u>		<u>Total</u>
	<u>GWh</u>	<u>%</u>	<u>GWh</u>	<u>%</u>	<u>GWh</u>	<u>%</u>	<u>GWh</u>
1975	56.2	25.1	151.2	67.5	16.7	7.4	224.1
1980	82.7	23.3	245.4	69.2	26.8	7.5	355.1
1981	59.7	16.5	271.2	75.0	30.5	8.5	361.9
1982	93.3	25.7	226.1	62.3	42.7	12.0	362.6
1983	34.4	10.0	304.4	82.0	32.0	8.0	371.3
1984	63.8	17.0	280.5	74.0	33.6	9.0	378.7
1985	114.2	29.2	173.6	44.5	103.6	26.3	391.4

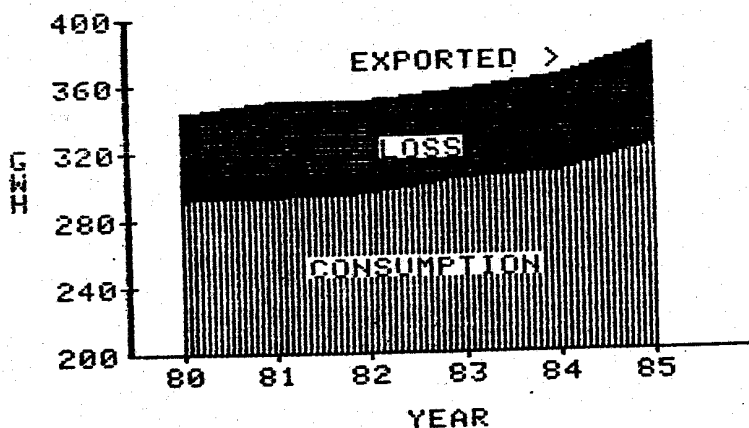
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Energy Outlook

20. Energy demand in Mauritius appears to be sensitive to both price movements and to changes in general economic conditions, as revealed by events in the 1975-85 decade. The experience of the second half of the 1970's is particularly revealing when energy consumption showed a spectacular growth despite the four-fold jump in oil prices on the world market. Mauritius was insulated from its impact thanks to the sugar boom of 1974-75. For the future the country cannot count on such a bonanza and efforts will be necessary to trim energy imports in order not to strain the country's external payments situation. Energy conservation and demand management measures together with efforts to make a more efficient use of indigenous sources of energy, namely bagasse and hydro-power, will assume critical importance in this context. The use of other renewable sources of energy like biogas, solar and wind power will continue to be encouraged. A rational pricing policy to regulate energy demand, improved traffic management and maintenance practices, renewal of transport fleet and energy audits for large industrial and commercial consumers to identify potential for substantial energy savings would all individually and collectively help create an environment more conducive to energy savings and conservation in the country.

CHART I

ELECTRICITY EXPORTED & CONSUMED*



*EXPORTED FROM THE GRID

CHART II

**AVERAGE RETAIL PRICES
-PETROLEUM PRICES-**

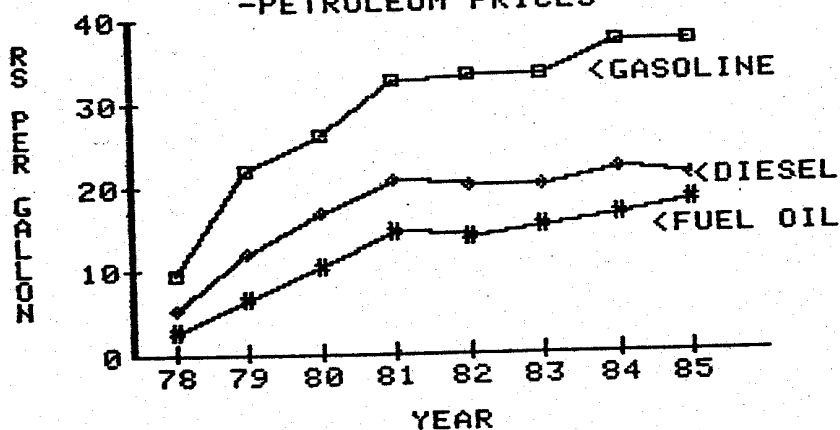


CHART III

CONSUMPTION OF PETROLEUM PRODUCTS

