



# Trends in the Power Sector in Mauritius

## *An Overview*

S. Z. Sayed Hassen and C. Bhurtun

University of Mauritius



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▲ Challenges facing the power sector in Mauritius.



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- ▲ Challenges facing the power sector in Mauritius.
- ▲ Changes that have happened over the years with respect to fuel source used to generate electricity.



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- ▲ Changes that have happened over the years with respect to fuel source used to generate electricity.
- ▲ Analysis of the importation cost distribution of each fuel used.



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- ▲ Changes that have happened over the years with respect to fuel source used to generate electricity.
- ▲ Analysis of the importation cost distribution of each fuel used.
- ▲ Comparison of the relative contribution of the government owned utility, Central Electricity Board(**CEB**) and the Independent Power Producers(**IPP**).



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- ▲ Changes that have happened over the years with respect to fuel source used to generate electricity.
- ▲ Analysis of the importation cost distribution of each fuel used.
- ▲ Comparison of the relative contribution of the government owned utility, Central Electricity Board(**CEB**) and the Independent Power Producers(**IPP**).
- ▲ Future of the Power Sector in Mauritius.





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- ▲ Comparison of the relative contribution of the government owned utility, Central Electricity Board(**CEB**) and the Independent Power Producers(**IPP**).
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- ▲ Rising cost of petroleum products and devaluation of the local currency.



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- ▲ Rising cost of petroleum products and devaluation of the local currency.
- ▲ Tendency recognised in the early 1990s by the government
  - “Bagasse Energy Development Program”
  - “Sugar Sector Strategy Plan” to encourage the setting up of bagasse/coal power plant,
  - Sugar Industries acted promptly on the incentives provided.



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- ▲ So much so that almost half of our electrical energy needs are currently generated using bagasse/coal.



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  - Sugar Industries acted promptly on the incentives provided.
- ▲ So much so that almost half of our electrical energy needs are currently generated using bagasse/coal.
- ▲ Looming threat of global liberalisation of sugar trade, i.e., a removal of all preferential tariffs from which Mauritius is currently benefiting.



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**Sources of Energy for Power  
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### ▲ Fuel Oil

- Main source of energy used for electricity generation
- Used to produce 46% of the total amount of electricity generated in 2003





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- Used to produce 46% of the total amount of electricity generated in 2003

### ▲ Coal

- Contributed 22.7% to the total amount of electricity generated in 2003



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### ▲ Bagasse

- Contributed 21.3% to the total amount of electricity generated in 2003



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- Used to produce 46% of the total amount of electricity generated in 2003

### ▲ Coal

- Contributed 22.7% to the total amount of electricity generated in 2003

### ▲ Bagasse

- Contributed 21.3% to the total amount of electricity generated in 2003

### ▲ Kerosene and Diesel Oil

- Only minor contributors to the generation of power



# Fuel Comparison

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Comparison of the percentage contribution of the 3 main fuels over the last 10 years:

FUEL TYPE	1994	1999	2003
Fuel Oil	66.0%	57.0%	46.0%
Coal	4.9%	11.9%	22.7%
Bagasse	15.6%	18.9%	21.3%

Table 1: Percentage Fuel Input for Electricity Production



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▲ Over 20% drop in percentage generation through Fuel Oil.



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- ▲ 18% rise in percentage generation through Coal.



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- ▲ 18% rise in percentage generation through Coal.
- ▲ Only 6% rise in percentage generation through bagasse but...



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Table 1: Percentage Fuel Input for Electricity Production

- ▲ Over 20% drop in percentage generation through Fuel Oil.
- ▲ 18% rise in percentage generation through Coal.
- ▲ Only 6% rise in percentage generation through bagasse but... bagasse is used only during crop season, i.e., for half of the year.





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▲ Fibrous matter that remains after sugar cane is crushed.



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- ▲ Fibrous matter that remains after sugar cane is crushed.
- ▲ Falls into a category of fuel more commonly known as “biomass”.



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- ▲ Fibrous matter that remains after sugar cane is crushed.
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- ▲ It is carbon neutral - does not contribute to the production of CO<sub>2</sub> and hence green house effects.



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- ▲ **Mauritius produces around 6 million tonnes of sugar cane every year.**



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- ▲ It is carbon neutral - does not contribute to the production of CO<sub>2</sub> and hence green house effects.
- ▲ Mauritius produces around 6 million tonnes of sugar cane every year.
- ▲ About 35% of the sugar cane mass is left as bagasse after processing, i.e., around 2 million tonnes.



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- ▲ Mauritius produces around 6 million tonnes of sugar cane every year.
- ▲ About 35% of the sugar cane mass is left as bagasse after processing, i.e., around 2 million tonnes.
- ▲ Widely available but not “freely” available...



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- ▲ Imported from South-Africa/Mozambique and is generally low in sulphur content.



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- ▲ Imported from South-Africa/Mozambique and is generally low in sulphur content.
- ▲ High CO<sub>2</sub> emission.





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- ▲ Imported from South-Africa/Mozambique and is generally low in sulphur content.
- ▲ High CO<sub>2</sub> emission.
- ▲ Dust and ash residues need attending to after combustion and secondary usages identified.



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- ▲ Imported from South-Africa/Mozambique and is generally low in sulphur content.
- ▲ High CO<sub>2</sub> emission.
- ▲ Dust and ash residues need attending to after combustion and secondary usages identified.
- ▲ 92% of coal imported in 2003 was used by the IPP to produce electricity.



# Tabulation of Cost Representation of Fuel

Cost Representation of Fuel used for Electricity Generation							
		1994		1999		2003	
Fuel Oil	Tonnes	147129		190683		200067	
	Average Import Price(Rs/tonne)	1696		2914		5045	
	Cost(Rs in million)	249.5	74.2%	555.7	66.6%	1009.3	71.3%
Diesel Oil	Tonnes	2844		3064		2423	
	Average Import Price(Rs/tonne)	2807		3769		7137	
	Cost(Rs in million)	8.0	2.4%	11.5	1.4%	17.3	1.3%
Kerosene	Tonnes	14789		41948		9864	
	Average Import Price(Rs/tonne)	3355		4040		8350	
	Cost(Rs in million)	49.6	14.7%	169.5	20.3%	82.4	5.8%
Coal	Tonnes	31949		112123		287176	
	Average Import Price(Rs/tonne)	919		870		1064	
	Cost(Rs in million)	29.4	8.7%	97.5	11.7%	305.6	21.6%
Bagasse	Tonnes	395800		714000		1046794	
	Average Import Price(Rs/tonne)	—		—		—	
	Cost(Rs in million)	—	—	—	—	—	—
TOTAL COST (Rs in million)		336.5	100%	834.2	100%	1414.6	100%

Table 2: Cost representation of each fuel used for electricity generation



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## Observations:

- ▲ Imported volume of diesel oil for electricity generation has remained more or less constant.



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## Observations:

- ▲ Imported volume of diesel oil for electricity generation has remained more or less constant.
- ▲ Imported volume of kerosene for electricity generation dropped from 41948 tonnes (1999) to 9864 tonnes (2003).



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## Observations:

- ▲ Imported volume of diesel oil for electricity generation has remained more or less constant.
- ▲ Imported volume of kerosene for electricity generation dropped from 41948 tonnes (1999) to 9864 tonnes (2003).
- ▲ Price of diesel oil and kerosene increased by over 150%.



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- ▲ Price of diesel oil and kerosene increased by over 150%.
- ▲ Coal experienced largest volume change (about 900%) while its average import price has remained very stable.



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- ▲ Price of diesel oil and kerosene increased by over 150%.
- ▲ Coal experienced largest volume change (about 900%) while its average import price has remained very stable.
- ▲ Bagasse has experienced an increase of about 200%. However only 1046796 tonnes of it was used, i.e., about 50% of our potential capacity.





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- ▲ Fuel Oil represents 46.0% of the fuel input for electricity generation, yet . . .



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- ▲ Bagasse has experienced an increase of about 200%. However only 1046796 tonnes of it was used, i.e., about 50% of our potential capacity.
- ▲ Fuel Oil represents 46.0% of the fuel input for electricity generation, yet . . . the cost associated with its purchase represents 71.3% of the total cost of imported fuel to generate electricity!



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- ▣ Bagasse to Coal Ratio  
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At 2003,

▲ CEB - Installed capacity of 408 MW



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At 2003,

▲ CEB - Installed capacity of 408 MW

▲ IPP - Installed capacity of 236.8 MW

- Firm Producers (producing electricity all year round)
  - Compagnie Thermique de Belle-Vue Ltée
  - Fuel Steam and Power Generation Co. Ltd
  - Consolidated Energy Ltd



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At 2003,

▲ CEB - Installed capacity of 408 MW

▲ IPP - Installed capacity of 236.8 MW

- Firm Producers (producing electricity all year round)
  - Compagnie Thermique de Belle-Vue Ltée
  - Fuel Steam and Power Generation Co. Ltd
  - Consolidated Energy Ltd
- Continuous Producers (producing electricity during crop season only)
  - There are seven(7) of them



# Independent Power Producers

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At 2003,

Effective Capacity	MW
Firm Producers	121.0
Continuous Producers	84.8
TOTAL	205.8



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At 2003,

Effective Capacity	MW
Firm Producers	121.0
Continuous Producers	84.8
TOTAL	205.8

▲ Total Effective Capacity of Mauritius is 568.3 MW.





# Independent Power Producers

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At 2003,

Effective Capacity	MW
Firm Producers	121.0
Continuous Producers	84.8
TOTAL	205.8

- ▲ Total Effective Capacity of Mauritius is 568.3 MW.
- ▲ IPP have the capacity to generate over 36% of the power generated by the country.



# Generated Electricity Available for Sales

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YEAR	1994	1999	2003
CEB	87%	75.8%	60.4%
IPP export to CEB	13%	24.2%	39.6%

Table 3: Percentage share of electricity generated available for sales



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Table 3: Percentage share of electricity generated available for sales

- ▲ Over the last 10 years, IPP have increased their share of the market quite considerably (by over 26%).



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Table 3: Percentage share of electricity generated available for sales

- ▲ Over the last 10 years, IPP have increased their share of the market quite considerably (by over 26%).
- ▲ With another firm producer coming into operation by October 2005, adding another 30MW to their effective production capacity, the IPP will further eat up CEB's share.



# Bagasse to Coal Ratio used by IPP

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FUEL	1994		1999		2003	
Coal ( GWh )	46 . 0	37 . 5%	155 . 2	45 . 2%	433 . 4	59 . 4%
Bagasse ( GWh )	76 . 6	62 . 5%	188 . 5	54 . 8%	296 . 1	40 . 6%
TOTAL ( GWh )	122 . 6	100 . 0%	343 . 7	100 . 0%	729 . 5	100 . 0%

Table 4: GWh sold to CEB by IPP using bagasse and coal



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TOTAL ( GWh )	122.6	100.0%	343.7	100.0%	729.5	100.0%

Table 4: GWh sold to CEB by IPP using bagasse and coal

- ▲ Bagasse used to generate a lot more power than 10 years ago even though it is not available as an all year round fuel.



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Table 4: GWh sold to CEB by IPP using bagasse and coal

- ▲ Bagasse used to generate a lot more power than 10 years ago even though it is not available as an all year round fuel.
- ▲ Increasing percentage of coal usage to generate power.



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- ▲ Organisation for Economic Cooperation and Development (OECD) pushing forward with the liberalisation of sugar trade and removal of all preferential tariffs.



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- ▲ Sale of electricity from bagasse by sugar factories may help compensate for potential losses.



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- ▲ Mauritius is investing in more efficient bagasse-to-electricity processes
  - 1994 - 16 kWh/tonne of cane
  - 2003 - 61 kWh/tonne of canebut ...



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- but ... Réunion Island produces 110 kWh/tonne of cane !



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- ▲ New Power Purchase Agreements with “Centrale Thermique de Savannah Ltée” operating on both bagasse and coal and generating up to 74 MW - operational June 2007.



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- ▲ New Power Purchase Agreements with “Centrale Thermique de Savannah Ltée” operating on both bagasse and coal and generating up to 74 MW - operational June 2007.
- ▲ Centralisation of activities of two sugar factories increasing cane processing capability from 500k tonnes to 1.2 million tonnes.



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- ▲ In the next couple of years, electricity export from bagasse alone is likely to exceed 500 GWh.



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- ▲ In the next couple of years, electricity export from bagasse alone is likely to exceed 500 GWh.
- ▲ With further improvements in milling activities, prompt processing and use of high pressure boilers and turbo-alternators across the country, an estimated 750 GWh can be obtained through the use of the same amount of bagasse.





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- ▲ “Utility Regulatory Authority” coordinates and controls licensing of electrical services including generation, transmission and distribution.



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- ▲ New “Electricity Bill Act” to cater for greater transparency and fair competition between operators.
- ▲ “Utility Regulatory Authority” coordinates and controls licensing of electrical services including generation, transmission and distribution.
- ▲ The regulatory body lays down strict guidelines regarding various areas of concern among which: safety, reliability, quality of service, efficiency, procedures for joint ventures and for sharing/selling of equipments between operators.



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- ▲ Mauritius - African LEADER as far as sustainable energy development is concerned.
  - In 2003, 16% of the total electricity production in Mauritius was generated using bagasse, representing the highest proportion of renewable power generated in ANY African country.



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- ▲ We are far from being self-sufficient but we are no more highly vulnerable to hydrocarbon shocks, as far as electricity generation is concerned.



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- ▲ Hundreds of jobs have been created in the process and will be created in the future.



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- ▲ We are far from being self-sufficient but we are no more highly vulnerable to hydrocarbon shocks, as far as electricity generation is concerned.
- ▲ Hundreds of jobs have been created in the process and will be created in the future.
- ▲ We still have to optimise our processes but in the mean time, we can be a reference for other African countries to learn from our successes and mistakes in implementing this new technology in our sugar industry.





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