

# History of central electricity board biology essay

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## **Introduction**

### **History of Central Electricity Board (CEB)**

The Central Electricity Board (CEB) is an organization wholly owned and controlled (parastatal body) by the Government of Mauritius and reporting to the Ministry of Energy and Public Utilities. It was established in 1952, CEB's business activity is to "prepare and carry out development schemes with the generation, transmission, distribution and sale of electricity" as being stated by the Central Electricity Board Act of 25 January 1964. The power industries in Mauritius have known a far-reaching change over the past few years. At the time of independence, demand for electricity across the island increased up to 31MW and total energy sales of 91, 234GWh reached 98GWh. Since there was an increase in population and housing constructions were mushrooming across Mauritius, CEB was called to connect with schools, Central Water Authority (CWA), housing estates and morcellement (apportionment of land for residential areas) From the early 1970's, CEB networks have continuously been spreading for the provision of electricity in new industries such as the export processing zones. Besides, the tourist sector, the textile sector and the construction sector have flourished in the 1980's, CEB therefore optimized its transmission and distribution networks in all directions across the island. As a result, in 1981, the national rural electrification program was completed and the island was electrified 100%.

### **THE INDEPENDENT POWER PRODUCER (IPP)**

In the early 1990's, Mauritius has private firms generating electricity since the latter was first available on the island. They are known as Independent

Power Producers (IPPs). The IPP has been empowered by policy directives, which include the Bagasse Energy Development Programme (BEDP) which ultimately enhanced the number of seasonal Independent Power Producers (IPPs). Besides this, the signing of the Agreement, Power Purchase Agreement (PPAs) with FUEL Steam and Power Generation Co. (FUEL), Consolidated Energy Ltd (CEL) and Compagnie Thermique de Belle Vue (CTBV) were as a result increased the number of Independent Power Producer (IPP). The production of electricity by the CEB is around 40% of the total requirement from the four thermal power stations and eight hydroelectric plants; and the remaining 60% is purchased from the Independent Power Producer (IPP). Electricity production by Independent Power Producers (IPP) today represents between 40 to 45 per cent of total national consumption. More than half of this percentage is generated from bagasse. At present, it is the sole organization responsible for the generation of electricity to the population. In 2011, CEB produced about 1, 096GWh of energy by its thermal plants and hydroelectric plants. Of which they comprise of 45% of the country's requirements and the remaining 55% (1, 337 GWh) of energy from the Independent Power Producers (IPP).

## **CEB's Power Stations**

### **Hydro Power plants**

The nine hydroelectric power stations have a total effective capacity of 55.8MW. The hydro power plant accounts for around 9% of the island's total effective capacity. During substantial rainfall, these plants can achieve 10% to 12% of demand for electricity. La Nicoliere Feeder Canal (a small hydro plant of a capacity of 350KW) was recently commissioned by CEB. As from

that date, the plant has generated about 1.7 GWh. Similarly, there is another project at the Midlands Dam commissioned for 2013. With reference to a study, it is being said that the hydroelectric plants' capacity have reached their limit. Yet, there is a possibility for a re-development programme. That is, the setting up of mini and micro hydro plants to reinforce the existing dam's capacities. This development forms part of the Government's ESAP (Energy Sector Assistance Programme). Additionally, the project involves increasing the dam's capacity from 240 metres to 243 metres which would be achieved by 2014. Moreover, CEB has aimed by 2013 to identify potential areas where the setting up of mini and micro hydroelectric plants would be appropriate.

### **Evolution of Hydroelectric Plants' capacity (2003-2011)**

The above table depicts the evolution of the nine hydroelectric plant capacity from 2003 to 2011. The CEB's objective was to achieve 59.8 MW of electricity in 2010, however it had an effectiveness of 53.5 MW. Besides this, the capacity of hydroelectric plant was the most effecting during the year 2003, 2004 and 2005.

### **Thermal Power plants**

CEB has four thermal plants. Among the four power plants, three of them are namely; Fort George, Saint-Louis and Fort-Victoria power stations which produce electricity from Heavy Fuel Oil (HFO). On the other hand, the fourth one, that is, Nicolay Power Station operates on kerosene. The following gives some data on these four thermal plants. The Fort George Power Station The Fort George Power Station is considered to be the largest power plant by the

CEB as it supplies 25% of the total energy generation for Mauritius. Fort George was commissioned by five heavy fuel oil operated engines of an effectiveness capacity of 134MW. The engines are highly efficient – typically 44.5% to 45.8%. Saint-Louis Power StationThe Saint-Louis Power Station has in all eight engines amongst which are five Diesel and three Wartsila engines with a total capacity effectiveness of 74MW. Fort Victoria Power StationThe Fort Victoria Power plant has eight Mirlees engines providing a total output of 42MW. Since these engines were used up and were operating inefficiently, consequently caused negative impact on the environment (noise and air pollution), there was a re-development plan which consists of a commissioning of two new Wartsila unit of 15MW each, and this was the phase-one of the re-development plan. Apart from this, a second phase of re-development was initiated in 2011 whereby four Wartsila units of 15MW each were commissioned in 2012. Currently, Fort Victoria has a total capacity of 107MW to the CEB's grid. It is Interesting to point out that recent redevelopment of engines in Fort Victoria has a useful life of 25-30 years meaning that they can smoothly and safely generate electricity throughout the country until 2040 unless there is no major breakdownNicolay Power StationNicolay Power plant is the only one producing electricity by kerosene. It has three open-cycle gas turbines with a total effective capacity of 75MW. The plant incurs the highest running costs.

### **Evolution of Thermal Power Plant capacity (2003-2012)**

It can be noted from the above table that the capacityof the hydroelectric plants have known an effectiveness throughout the year 2003 to 2011. The plants' capacity in 2003 was 308MW as compared to 339.6 in 2011.

## **IMPORTS OF ENERGY SOURCES (1994-2001)**

### **ENERGY SOURCES**

#### **THOUSAND/TONNE**

**1994**

**1995**

**1996**

**1997**

**1998**

**1999**

**2000**

**2001**

#### **Diesel Oil**

210. 0226. 2222256282. 7295. 6339. 7338

#### **Fuel Oil**

199. 4207. 5194. 4249. 2274. 1246. 3218. 8275. 1

#### **Coal**

38. 566. 438. 527. 886. 3128. 9222. 4347. 5

#### **Kerosene**

25. 939. 681. 176. 654. 144. 227. 412

From the above diagram it can be noted that the overall imports of energy sources such as diesel oil fuel, coal and kerosene increased. Coal, fuel oil and bagasse are the highest amount of energy being imported as compared to kerosene.

## **IMPORTS OF ENERGY SOURCES (2002-2011)**

### **ENERGY SOURCE**

### **THOUSAND/TONNE**

**2002**

**2003**

**2004**

**2005**

**2006**

**2007**

**2008**

**2009**

**2010**

**2011**

### **Diesel Oil**

346. 4309. 2319. 7329. 9327. 5307. 5328. 5288310. 4309. 9

### **Fuel Oil**

208. 6288288337. 5304. 4333. 9291343. 7341. 5434. 8

### **Coal**

312289331379. 3490. 3647. 8606. 5559. 9660. 6660. 2

**kerosene**

14. 320. 229. 827. 963. 75. 94. 16. 74. 3 During 2002 to 2011, the amount of diesel oil has been decreasing which shows an efficient use of energy.

However, fuel oil and coal have been increasing drastically.

**EVOLUTION OF ELECTRICITY PRODUCTION FROM 1994 TO 2001****ENERGY****SOURCES****YEAR****GWh****1994****1995****1996****1997****1998****1999****2000****2001****Coal**

50. 953. 110. 829. 193. 3188. 5363. 3465. 3

**Diesel&Fuel Oil**

699. 3682. 1699. 3857. 1842912. 7827. 7864. 4



## **Kerosene**

47. 6105. 8219154. 2161. 9136. 642. 812. 1

## **Bagasse**

163. 4177. 5225. 2249. 6320. 1298. 9430. 5477. 6

## **Hydro**

75. 8135104. 593. 2104. 73095. 770. 8

## **PERCENTAGE (%)**

## **ENERGY SOURCES**

**1994**

**1995**

**1996**

**1997**

**1998**

**1999**

**2000**

**2001**

## **Coal**

4. 94. 60. 92. 16. 111. 920. 424. 4

## **Diesel&fuel Oil**

66. 758. 55561. 354. 757. 646. 545. 2

**Kerosene**

4. 59. 117. 21110. 58. 62. 40. 6

**Bagasse**

15. 615. 217. 717. 820. 818. 924. 225

**Hydro**

7. 211. 68. 26. 76. 81. 95. 43. 7The table above depicts evolution of electricity production from various fuels (coal, diesel and fuel oil, kerosene, bagasse and hydro) during the year 1994 to 2001. Electricity production from coal increased by 4. 9% in 1994(50. 9GWh) as compared to 24. 4% in 2001 (465. 3 GW). Diesel and fuel oil were mostly utilized with a production of 864. 4Gwh (45. 2%) in 2001. Electricity production from bagasse also increased from 15. 6% in 1994 to 25% in 2001. However, production from hydro and kerosene decreased of which 47. 6GWh of kerosene was used in 1994 as compared to 12. 1 GWh in 2001. On the other hand, hydro had a utility of 75. 8GWh in 1994 (7. 2%) and 70. 8GWh in 2001 (3. 7%).

**EVOLUTION OF ELECTRICITY PRODUCTION FROM 2002 TO 2011****ENERGY SOURCES****Year/GWh**

2002200320042005200620072008200920102011

**Coal**

505. 5497. 6470. 3609. 7798. 3993. 61, 128. 701, 015. 301, 115. 901, 108.

20

## **Diesel&Fuel Oil**

887. 49851, 058. 301, 0381, 023. 30915. 7827. 2938976. 61, 058. 70

## **Kerosene**

1832. 344. 356. 25. 73. 26. 615. 318. 911. 6

## **Bagasse**

452. 1448. 9469. 6452. 9445. 7467. 9486. 4485474. 1489. 5

## **Hydro**

85. 9117. 8122. 3114. 976. 683. 9108122. 4100. 756. 5

The above table depicts how electricity production varied from 2002 to 2011. Electricity production from hydro and bagasse depend on the rainfall and the quality of cane harvested. We can notice an increase in electricity production from bagasse in 2011 from 100. 7GWh in 2010 to 56. 5GWh in 2011. On the other hand, electricity production from coal fell by 0. 7%, that is from 1, 115. 9GWh in 2010 to 1108. 2GWh in 2011 whereas electricity production from Heavy Fuel oil and diesel decreased by 8. 4% (from 976. 6GWh in 2010 to 1, 058. 2 GWh in 2011). Bagasse increased by 3. 2%. Therefore it can be said that total electricity production increased by 1. 5% as compared to 4. 3% in 2010. Electricity generated from renewable sources yielded 551. 9% (20. 2%) which is less when compared to 2010 with a contribution. It is interesting to note that the overall production of electricity in Mauritius is around 2. 402 billion KWh.

# **ELECTRICITY GENERATED DURING THE YEAR 1994-2001**

**ENERGY**

**YEAR**

**GWh**

**Hydro**

**Wind**

**Thermal**

**Total**

**1994**

75. 80. 2971. 81, 047. 8

**1995**

1350. 01, 030. 51, 165. 5

**1996**

104. 50. 11, 167. 61, 272. 2

**1997**

93. 20. 01, 3051, 398. 2

**1998**

104. 7

-

1, 434. 21, 538. 9

**1999**

30

-

1, 554. 81, 584. 9

**2000**

95. 7

-

1, 681. 91, 777. 5

**2001**

70. 8

-

1, 8401, 910. 8 In 2001, around 1, 910. 8 GWh of electricity was generated as compared to 1, 777. 5 GWh in 2000 showing an increase of 6. 9%. The Central electricity Board generated 55% and the Independent Power Producer (IPP) , 45%. Thermal energy represented 94% and hydro the remaining 6%.

## **ELECTRICITY GENERATED DURING THE YEAR 2002-2011**

**Energy**

**Year**

**GWh**

**Hydro**

**Wind**

**Landfill Gas**

**Thermal**

**Total**

**2002**

85. 86

-

-

1, 8631, 948. 86

**2003**

117. 77

-

-

1, 963. 752, 081. 52

**2004**

122. 270. 43

-

2, 042. 512, 165. 22

## **2005**

114. 880. 44

-

2, 156. 832, 272. 15

## **2006**

76. 640. 41

-

2, 273. 182, 350. 23

## **2007**

83. 860. 40

-

2, 380. 392, 464. 65

## **2008**

108. 030. 37

-

2, 448. 842, 557. 24

## **2009**

122. 411. 50

-

2, 453. 332, 577. 44

**2010**

100. 732. 51

-

2, 585. 472, 688. 71

**2011**

56. 482. 833. 142, 6682, 730. 45The peak demand electricity demand in 2011 reached 412. 5MW (+2. 1%) across the island as compared with 404. 1MW in 2010. About 2, 730GWh (235 Ktoe) of electricity was produced in 2011 as compared with 2, 689 GWh (231 Ktoe) in 2010, showing a rise of 1. 5%. Some 80% (2, 178GWh) of the electricity generated were from non-renewable resources and the renewable resources. The remaining 20% (552 GWh) were from renewable resources. The sum of electricity generated from renewable sources (hydro, wind, landfill gas and bagasse) fell by 4. 3% from 577GWh in 2011. The independent Power Producers (IPPs) supplied 58. 6% of the total electricity generated while CEB provided the other 41. 4%. Thermal energy represented 97. 8% of overall generation.

**CEB's VISION AND FUTURE PLANS**

Becoming a world-class commercial electricity utility and enabling the social and economic development is the CEB'S visionThe vision of the Government to make Mauritius a sustainable island, " Maurice Ile Durable" lays stress on the exploitation and utilization of renewable resources. With the on-going



increase in the prices of fossil fuels and worries about their future stocks, increasing the share of renewable resources in the fuel mix has become the gateway, though this option appear more expensive in the medium term. To this end, the Mauritian Government is targeting to achieve by 2025 around 35% self-sufficiency in terms of electricity supply via a progressive rise in the use of renewable energies, as per the advancement in technologies namely; sea-wave energy, geothermal and others. Initiatives have already been put into action by the CEB for this objective. They comprise of setting up of micro hydro and wind-farm projects as well as the development of a Grid Code and Feed-in Tariffs so as third parties be able to have access to CEB's power system by producing electricity on renewable Small Scale Distributed Generators (SSDG) with a unit capacity of not more than 50 KW. Several large scale renewable energy projects from private promoters are also on the track for the goal. The main objective of the CEB remains the diversification of the energy mix and also to reduce the electricity production on fossil fuels and at the same time being aware of the environmental impacts. The project at Point-aux- cave is CEB's long term plan which aims to produce electricity on advanced technologies so as to reduce negative impacts on the environment. The plant will be operating by pulverized coal-fired power plant of 2X 55MW. The plant will also comply with local environmental regulations.