BioGen : Site Visit to MPOB Experimental Mill

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Introduction

The BioGen team at Pusat Tenaga Malaysia has been organized a site visit to MPOB Experimental Mill at Labu, Negeri Sembilan on 12 May 2003. Totally, 22 personnel have been attended the visit including 14 members of BioGen, 4 representatives from UNDP, 2 representatives from Energy Commission and 2 independent consultants. The visit was primarily intended to:

- Explain to the consultant the exact nature of his job in relation to the physical location of the site and also introduce him to the mill management.
- Assess the distance from the mill to the nearest TNB grid line.
- Establish communication between BioGen Team and the mill management as the BioGen Team will have to visit the mill quite frequently.
- Introduce the UNDP representatives to the mill Management.

This report presents an overview of the visit, the background of the experimental mill and also highlights the potential capacity for RE power generation from palm oil residues.

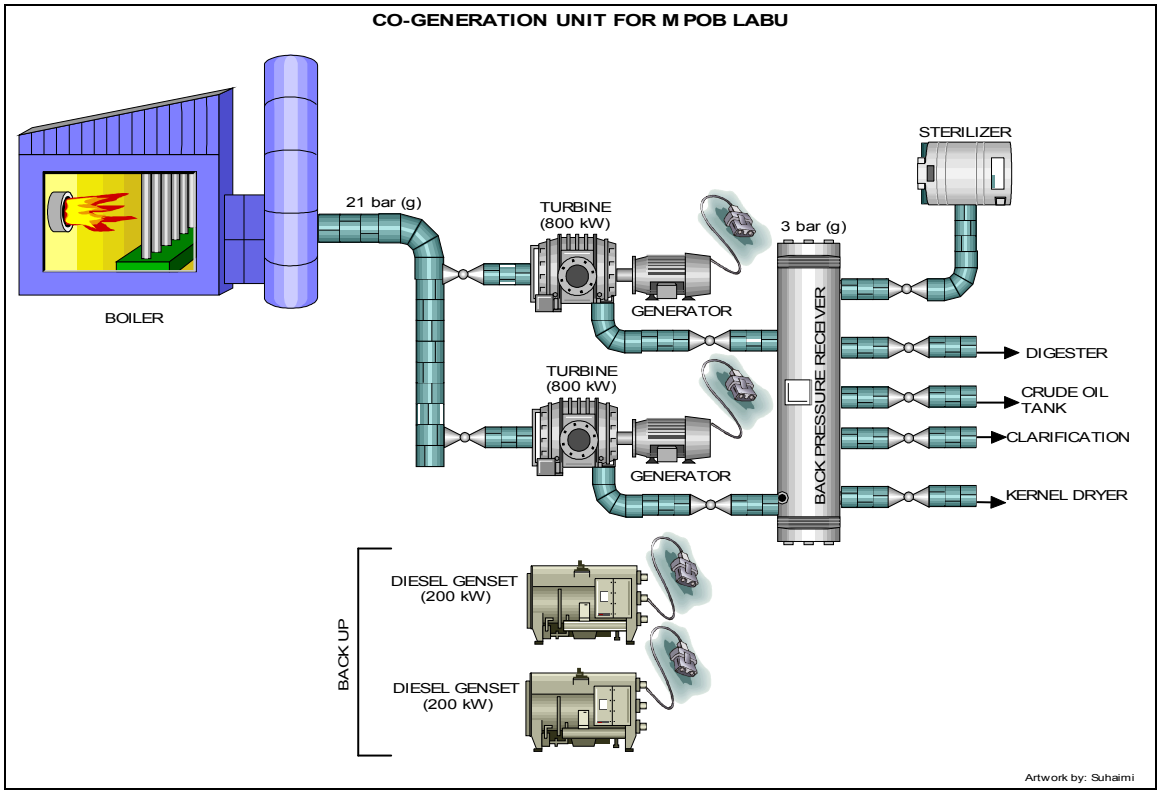
Background of MPOB Experimental Mill

The MPOB Experimental Mill is located at Labu, Negeri Sembilan, about 70 km from Kuala Lumpur. It is owned by MPOB but built on Ladang Labu belonging to Guthrie plantation. The mill is leased to Kumpulan Guthrie Berhad (KGB) for a period of 20 years after which the mill ownership will be transferred to KGB. During period of lease MPOB will have all the rights to make use of the mill to conduct any research it wants to do. Some research work are currently undergoing at the mill. One such research project is the continuous sterilization plant which is intended to replace the current batch sterilization system considered to be a major breakthrough in milling technology. Another project is the complete automation of mill operation using STRADA system and cameras. The idea is to minimize labour in a mill.

The designed mill capacity is 20 tonnes FFB per hour but is capable of processing 30 tonnes FFB per hour. The mill can process 500 tonnes to a maximum of 600 tonnes per day. The mill has a modern Combi boiler (Vyncke) which is considered to be a high tech boiler using water-cooled grates and moving floor auto fuel feeding system capable of high efficiency. The boiler also incorporates continuous ash removal system making the boiler capable of 24 hours operation without the need for shutting down for ash removal.

Power Generation

The MPOB Mill adopted a cogeneration concept to sustain its operational requirement of steam and electricity. The electrical installed capacity is 2 x 800 kW but the current load is only about 600 kW for mill operation as well as domestic consumption. The turbine is noncondensing type with a back pressure of 3 barg, the exhaust being used for mill processing. The steam consumption is about 18 kwh per tonne FFB processed.



Major components for its cogeneration unit are made up of a boiler, two steam turbines (800 kW each) and generator. In addition, its power generation capacity is also supplemented by two diesel gensets (200 kW each). The mill utilizes a mixture of shells and fibre as fuel of its boiler. The diagram below depicts the power generation setup of the mill.

Findings

The quantity or capacity of FFB per hours is in between 20 to 25 tonnes. Whiles, the quantity of EFB is 23% of the quantity or capacity of FFB. 1 tonne of FFB will produce 0.65 tonne of POME.

MONTHS	(tonne)
January	6179
February	6025
March	7149
April	7366
May	6426
June	5839
July	5306
August	4961
September	5378
October	5515
November	5513
December	5010
Total	70667

Table 1: Monthly crop projection (2003) for the Labu Experimental Mill (Given by Mill's Manager)

Fiber, Dry Shell and Wet Shell

According to the table 1, FFB projection for year 2003 is 70667 tonnes. Therefore:

Fuel type	% to FFB	Lower calorific value KJ/kg	Energy in MJ	MJ at 10% energy conversion	Total MWh	Total MW
Fiber	12	11,344 moisture-40%, oily	96197574	9619757	2672	0.305
Dry shell	4.2	20,720 moisture-0%, pure	61497250	6149725	1708	0.195
Wet Shell	1.8	18,836 moisture-10%, oily	23959505	2395951	666	0.076

Table 2. Total potential for fiber, dry shell and wet shell.

Total potential energy from these fuels :

(0.305-0.013) + (0.195 + 0.076 = 0.576 MW.

As this is obtained based on 10% thermal efficiency, at 25% thermal efficiency the power potential by proportioning will be

0.576 x 2.5 = **1.44 MW.**

Empty Fruit Bunch

Assumptions

EFB condition	= oily with 36% moisture
FFB processed by the mill	= 70667 tonnes (from the monthly crop projection)
EFB produced at 23%	= 16253 tonnes = 16253 x 10^3 kg
Lower (nett) calorific value	= 11000 kJ/kg
Energy available	= 16253 x 10^3 x 11000 kJ = 178783000 MJ
At 25% thermal efficiency	= 44695750 MJ
	= 12416 MWh
Power plant capacity	= **1.417 MW**

Biogas Harnessing and Utilization

It is estimated that 28 M^3 of biogas can be generated from every 1 M^3 of Palm oil mill effluent in effluent digestion pond.

POME production rate at 65% to FFB = 45934 tonnes of POME

Taking that 1 m^3 POME equal to 1 tonne of POME (as POME is a waste water)

Biogas production rate at 28 ^{3} / 1 M^3 POME = 1286152 M^3

The biogas calorific value (Lower CV) varies from 17 829 to 23 130 KJ/ $M^{3,}$ giving an average value of 20 000 kJ/M^3.

Energy available as input to boiler = 25723040 MJ

Electrical output at 25% efficiency = 6430760 MJ

= 1786 MWh

Therefore power plant capacity is **0.2 MW**

Total power potential

Total power potential (based on the monthly crop projection of the year 2003)

= 1.44 + 1.42 + 0.2 **= 3.06 MW**

(Not included the capacity needed for the mill's consumption, which is 1.25 MW)

Conclusion

It is concluded that MPOB Experimental Mill has a good potential to be the biomass power plant capable of generating 2 MW from EFB and biogas. The TNB sub-station is also located near the mill with the distance around 3 km. We are expected that the mill will take the initiative to be involved either in SREP Programme or BioGen Project.