CHALLENGE TO IMPLEMENTATION: WASTE ENERGY FROM PALM OIL IN INDONESIA GRID

POLICIES AND STRATEGIES TO MITIGATE CLIMATE CHANGE AND ENERGY POVERTY IN SOUTH EAST ASIA AND CHINA - HANOI AND HALONG BAY, VIETNAM 5-9 OCTOBER 2009

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The Government of Indonesia has a substantial potential for development of renewable energy resources, and particularly in rural areas of the country that have not been electrified. The government policy is therefore to achieve the goal of rural electrification based on the utilization of renewable energy resources. This policy is considered cost efficient, it achieves the goals of energy diversification, it is consistent with the national environmental policies of sustainable development, and it promotes greater community participation in the management of their basic services.Indonesian palm oil production is the first largest in the world and the second place is Malaysia. With total planted area of over 6.074 million ha, the annual production of crude palm oil in 2006 was 13.39 million tons processed in 340 palm oil mills (POMs). New POMs are being planned to meet milling shortages. The number of POMs and volume of fresh fruit bunches (FFB) being processed gives rise to large quantities of solid and liquid waste. When properly managed the wastes can be a viable energy source, providing a sustainable economic benefit while managing the adverse environmental impacts typically associated with POMs. and other opportunities for renewable energy (RE) projects utilizing POM waste.The long term sustainability of the waste management and energy capture projects from the POM has immense potential to become the backbone of rural electrification initiatives in Indonesia. The high cost of rural electricity production which is normally isolated systems with diesel generators can be displaced using excess power from the POM. The implementation of such widespread rural electrification initiatives requires some support in the initial stages, particularly to prove the technical, commercial and economic viability to the investing organizations and to prepare the guidelines to effectively tap the inherent potential on a nationwide basis.The waste management and energy capture initiatives have good long term potential for Indonesia. Loan assistance to realize the application of the technology and adoption of the country-wide commercialization strategies may be necessary. Implementation support for the development of practical integration guidelines for incorporation of POM waste management and energy capture as part of the provincial energy services to encourage the sustainability aspect of the initiatives identified.

Keyword: Potential POM, Biomass Power Plant, Cluster system,Interconnection Implementation renewable energy.

1, BACKGROUND

The government Indonesia has taken steps to gradually accelerate schemes for removal of subsidies prices for oil products and electricity. One of the main objectives in the development strategy for energy is to intensify the energy diversification activities by developing the use of new and renewable energy. Priority is given to the use and development of non oil energy. Indonesia has a substantial potential for development of renewable energy resources, and particularly in rural areas of the country that have not been electrified. The government policy is therefore to achieve the goal of rural electrification based on the utilization of renewable energy resources. This policy is considered cost efficient, it achieves the goals of energy diversification, it is consistent with the national environmental policies of sustainable development, and it promotes greater community participation in the management of their basic services

The present study recommends that PLN incorporate a biomass power plant as one of its RE investment initiatives. Such a PLN-led initiative would minimize or dispense with the role of the PPA as a major security document. As PLN requires the additional power to supply the current demand and biomass power is much more cost competitive than diesel generated power, the investment by PLN in a biomass power plant would be feasible and attractive.

The obvious solution is to connect the excess power in the Palm Oil Mills (POMs) to the distribution grid which will allow the installed RE capacities to be optimally shared between POM and PLN. The generation capacity sharing concept requires a framework that can facilitate the technical power evacuation and the appropriate commercial scheme to compensate the relevant participating parties. This is the crux of the barriers and constraints to enable independent power projects (IPP) to export power to the grid.

II *SITUATION AND KONDITION WASTE FROM PALM OIL MILLS*

The baseline energy practice in the POMs is developed on a totally independent concept where the POM complex and its housing estate are ensured of energy from its own energy generating assets. The POM is designed with a diesel black start system and steam turbo alternators driven by steam generated from biomass boilers. Most of the energy infrastructures are designed with redundancies.The baseline energy designs also use the energy assets, such as boilers, as a biomass waste reduction system. All the mesocarp fibers and part of the palm kernel shells are disposed in the boilers. Currently, the efficiencies of the energy generating assets are intentionally designed to maximise the incineration of the biomass. The boilers are generally low pressure (20 – 25 bar.g) while the steam turbo alternators have specific steam consumption in the region of 17 – 22 kg/kWh.

The baseline waste management practices in POMs in Sumatera are as follows:
i. Solid wastes are used for in-house energy generation i.e. palm kernel shells (PKS) and mesocarp fibres;

a. EFB is applied to plantation land as wet empty fruit bunches (EFB)
b. Alternatively, EFB is incinerated and EFB ash is applied to plantation land;
c. The liquid waste as palm oil mill effluent (POME) is digested in open lagoons and thereafter applied to the plantation fields as fertiliser at BOD of 1,000 - 3,500 mg/l.

II. POTENTIAL BIOMAS IN INDONESIA

Indonesian palm oil production is the first largest in the world and the second place is Malaysia. With atotal planted area of over 5.4 million ha, the annual production of crude palm oil in 2005 was 13.8 million tons processed in 340 palm oil mills (POMs). New POMs are being planned to meet milling shortages. The number of POMs and volume of fresh fruit bunches (FFB) being processed gives rise to large quantities of solid and liquid waste. When properly managed the wastes can be a viable energy source, providing a sustainable economic benefit while managing the adverse environmental impacts typically associated with POMs. and other opportunities for renewable energy (RE) projects utilizing POM waste.

The Potential Area of Indonesia Palm Oil 1997 – 2006 is increase every years shows in table 2.1

Table 2.1
Area of Indonesian Palm Oil
1997 – 2006

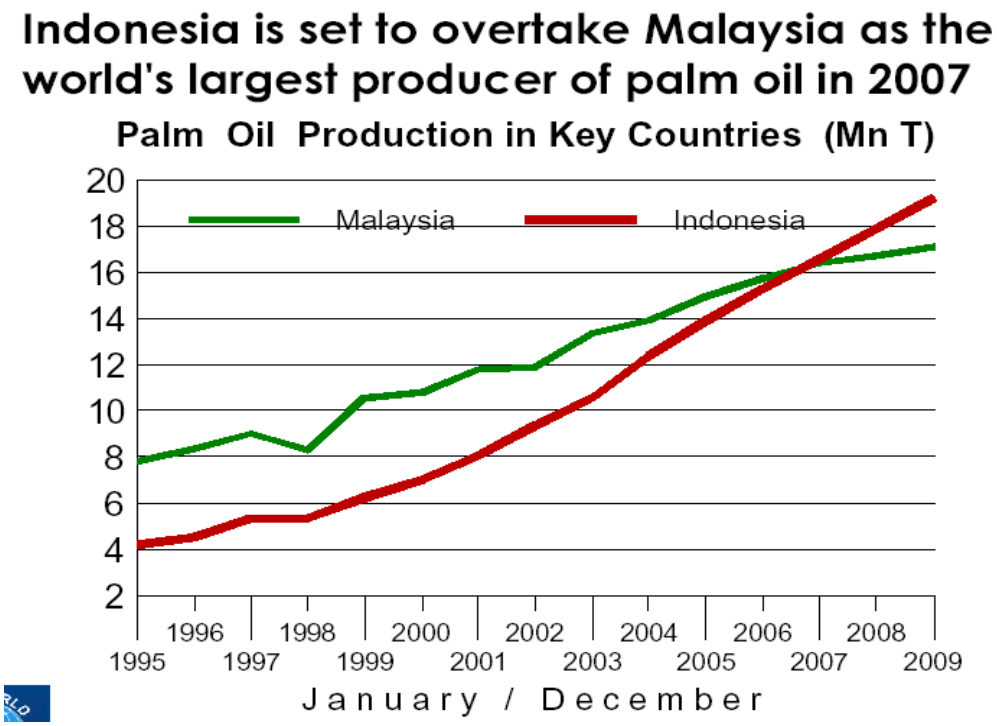
Year	Area (Ha)			
	Smallholders	Government	Private	Total
2000	1,166,758	588,125	2,403,194	4,158,076
2001	1,561,031	609,943	2,542,457	4,713,431
2002	1,808,424	631,566	2,627,068	5,067,058
2003	1,854,394	662,803	2,766,360	5,283,557
2004	1,904,943	674,983	2,821,655	5,401,581
2005	1,971,038	676,408	2,914,773	5,508,219
2006*	2,636,425	696,699	2,741,802	6,074,926

*: preliminary

Sources: Indonesian Palm Oil Statistics (2005), BPS-Statistics Indonesia,

Directorate of Estate Crops (Department of Agriculture)

Indonesia is set to overtake Malaysia as the world's largest producer of Palm oil in 2007, Picture 2.1 is explained prediction producer of Palm Oil until 2009



IV STARTEGY TO DEVELOPMENT PONTIAL WASTE FROM POMS

The independent systems designed with redundancies to cater to POMs that are remotely located from existing utilities. adjacent to roads or navigable waterways and he PT Perusahaan Listrik Negara (Persero) (PLN)'s 20 kV distribution line is within reach of the POMs. The close proximity to the PLN's grid coupled with the fact that additional generating capacity is required immediately, presents an opportunity to optimise the energy assets in waste biomass and connecting the POM energy assets to the energy demand pool. The industry concepts of the POM energy system needs to be modified from totally independent systems, to partially integrated systems. Waste management practices can be improved by the following technology interventions:

- Utilize the heat energy in EFB for electric power generation, rather than unproductive combustion;
- EFB must be dewatered. This can be achieved with presses and also recovers remnant oil before disposal;
- Alternatively, utilize the dewatered EFB as feedstock for catalytic conversion to organic diesel; and,
- Digested POME in a controlled high rate system and combustible methane greatly reduce GHG emissions.

The wastes management improvement strategies can be integrated with energy capture and optimisation. The incineration of EFB can be replaced by efficient

combustion in a biomass boiler while the biogas collected can be combustible fuel for the power plant. The identified immediate opportunities for waste management improvement technologies include the extraction of remnant oil from EFB as part of the EFB dewatering process, and controlled digestion of palm oil mill effluent (POME) in covered tanks. These technologies can be immediately considered as retrofits to improve the current wastes management practices without compromising the benefits from the present final application of the wastes to the plantation fields. By introducing these wastes management technologies, the POM wastes can be converted into a feedstock for value added activities of energy conversion. Sufficiently treated EFB is suitable for combustion in efficient and automated biomass boilers, either for generation of electric power or process steam or both. The biogas captured from POME digesters can be combusted in the boiler for additional energy. electrical energy using gas engines or delivered to the POM housing estate for domestic utilisation purposes. Invariably, the improved waste management practices conver

Based on the baseline wastes management and energy system designs of the POMs together with the wastes improvement practices, several energy conversion technologies are being considered. Brief descriptions of the technologies are as follows:

a. ***Interconnection to PLN 20 kV Grid*** Asynchronous electrical interconnection with the PLN's 20 kV distribution system is technically feasible as most of the POMs that are adjacent to PLN's 20 kV distribution grid that have excess installed capacity. The interconnection would assist the POM to reduce its black start diesel cost and may export between 100 to 300 kilowatt (electric) of power to the grid. PLN could reduce its diesel requirements for generation of electricity servicing subsidized domestic needs. The immediate potential of exporting power to the grid will also open up new opportunities to produce more energy by using the internally generated excess biomass and improving the efficiency of the power generation units.
b. ***Biomass Power Generation*** The EFB intended for incineration in the POMs can be sent to a biomass power station but needs to be dewatered first for efficient conversion of the energy from the biomass into heat and power. The power can be sold to PLN and reduce the diesel or fossil fuel requirement for electricity generation.
c. ***Conversion of EFB Remnant Oil into Biodiesel*** The EFB dewatering system produces liquor with remnant oil that can be recovered for feedstock to a biodiesel methylation plant. The biodiesel plant could also obtain supplemental feedstock from the fat pit. The 'waste' oil would become value-added biodiesel oil that can be added to mineral diesel.
d. ***Biogas Energy Generation*** The biogas captured from the controlled POME anaerobic digestion can be used for supplementary fuel for electricity generation using gas engines or micro turbines or simply injected to supplement existing biomass feedstock to steam boilers.
e. ***Biomass Gasification System to Generate Electricity*** The excess shells in the POMs can be utilised as the biomass to fuel gasification system for

isolated demands in the rural areas that are currently supplied by diesel-based power generation.

f. ***Organic Diesel Production from Biomass Conversion*** The dewatered EFB can also be used as biomass input into a catalytic conversion cycle (CCC) system that can convert biomass directly into organic biodiesel.

V. ENVIRONMENTAL IMPACT

Environmental impacts of the biomass power plant project will take place during preparation, operation and post-operation stage.

Preparation Stage

During preparation stage, the potential environmental impacts will come from site preparation and construction of facilities and infrastructure. The potential impact of site preparation is generation of dust/particulates especially if the construction is carried out during the dry season. The other impact is generation of ambient noise levels during construction.

Operation Stage

Potential impact of this stage as follows :
• Decrease in air quality
• Increase in nuisance and visible smoke
• Air Quality

The burning of biomass is environmentally more polluting than gas but less polluting than coal. The combustion of biomass produces almost no sulfur dioxide, but more particulates than fossil fuels based on energy content to weight. The level of stack emissions should be below the standard based on Decree of Indonesian State Ministry of Environmental no. 13 of 1995. Increase in noise level. The power plant results in nuisance impact such as noise and visible smoke. Operation of a power plant will increase noise levels. If the power plant is located closed to a settlement, the nuisance noise will negatively impact the human health. should refer to the Decree of Indonesian State Ministry of Environmental no 48 of 1996.4. Visible smoke comes from combustion of biomass will adversely impact human health if the location of the power plant is located near communities.

Environmental Benefit

The environmental benefit of the biomass power plant is displacement of fossil fuel diesel. Utilization of mineral diesel result in generation of CO2 emissions that will be replaced by CO2 emissions from RE. The utilization of biomass power plant will decrease utilization of fossil fuel diesel and therefore overall gas emission will decline.