Cover Note

Project Title: Malaysia: Malaysia: Biomass-based Power Generation and Cogeneration in the Palm Oil Industry
Date: 8 January 2001

	Work Program Inclusion	Reference/Note:
1. Country Ownership		
• Country Eligibility		• Cover Sheet Page 1 (Ratified UNFCCC 17 July 1994)
• Country Drivenness	Clear description of project' s fit within: • National reports/communications to Conventions • National or sector development plans • Recommendations of appropriate regional intergovernmental meetings or agreements.	• Paragraphs 1-19 address national priorities in this sector • Paragraph 20-21 addresses specific in-country institutional support and project ownership.
• Endorsement	• Endorsement by national operational focal point.	• OFP endorsement letter for this project is on file.
2. Program & Policy Conformity		
• Program Designation & Conformity	• Describe how project objectives are consistent with Operational Program objectives or operational criteria.	• Cover Sheet Page 1 Section 2
• Project Design	• Describe: • sector issues, root causes, threats, barriers, etc, affecting global environment. • Project logical framework, including a consistent strategy, goals, objectives, outputs, inputs/activities, measurable performance indicators, risks and assumptions. • Detailed description of goals, objectives, outputs, and related assumptions, risks and performance indicators. • Brief description of proposed project activities, including an explanation how the activities would result in project outputs (in no more than 2 pages). 1	• Sector issues are described in paragraphs 23-24). Root causes, threats, and barriers are addressed in paragraph 25-26. • The logistical framework is included in Annex 2. • The project objectives are described in paragraphs 32-34. Risks are addressed in paragraph 53, and indicators are addressed in Annex 2, Project Planning Matrix The project rationale is summarized in

[1] A project/program could undertake detailed design (specification of project outputs) during the first phase of implementation, with clear benchmarks for approval of the subsequent phase. A project could also be an adaptable program loan with several phases, where achievement of the clear benchmarks

	Work Program Inclusion	Reference/Note:
	• Global environmental benefits of project. • Incremental Cost Estimation based on the project logical framework. • Describe project outputs(and related activities and costs) that result in global environmental benefits • Describe project outputs (and related activities and costs) that result in joint global and national environmental benefits. • Describe project outputs (and related activities and costs) that result in national environmental benefits. • Describe the process used to jointly estimate incremental cost with in-country project partner. • Present the incremental cost estimate. If presented as a range, then a brief explanation of challenges and constraints and how these would be addressed by the time of CEO endorsement.	paragraphs 27-31). • Project activities are described briefly in paragraphs 38-49). • Global environmental benefits of the project are summarized on the first page of the project cover sheet in "2. Summary." • Annex 1 provides an estimation of incremental costs. • Paragraphs 32-34 provide a description of the global and national benefits of the project. Annex 1, the Incremental Cost Estimate Annex, also provides information on the distinction between global and national benefits. • Incremental costs were calculated by cooperating with project stakeholders in estimating a baseline and the project increment. The commitment of other agencies to the project is reflected in the strong baseline co-financing. A description of the modality of work with the project stakeholders is provided in paragraph57. • The incremental cost is presented in Annex A of the brief and itemized in Table A-1.
• Sustainability (including financial sustainability)	• Describe proposed approach to address factors influencing sustainability, within and/or outside the project to deal with these factors.	• Sustainability is discussed in paragraphs 54-56, and and as an integral element of all project activities, which were redesigned to replace subsidy by risk guarantee funding
• Replicability	• Describe the proposed approach to replication,(for e.g., dissemination of lessons, training workshops, information exchange, national and regional forum, etc) (could be within project description).	• Throughout project/project design: especially capacity strengthening, information dissemination and risk guarantee mechanism,
• Stakeholder Involvement	• Describe how stakeholders have been involved in project	• Paragraph 57-61 address these points.

at the end of each phase is a necessary condition for approval of the next phase. In such projects, describe in detail the project output for the first phase and describe briefly the project activities for that phase.

	Work Program Inclusion	Reference/Note:
	development. • Describe the approach for stakeholder involvement in further project development and implementation.	
• Monitoring & Evaluation	• Describe how the project design has incorporated lessons from similar projects in the past. • Describe approach for project M&E system, based on the project logical framework, including the following elements: • Specification of indicators for objectives and ouptus, including intermediate benchmarks, and means of measurement. • Outline organizational arrangement for implementing M&E. • Indicative total cost of M&E (maybe reflected in total project cost).	• Paragraphs 19 and 22 describes findings that have influenced project design. • Indicators for objectives and outputs are listed in Annex 2, Project Planning Matrix. • The monitoring and evaluation approach proposed and the organizational approach for implementation is described in paragraphs 67-71. • The indicative total cost of M&E is listed in Table 7.
3. Financing		
• Financing Plan	• Estimate total project cost • Estimate contribution by financing partners. • Propose type of financing instrument	• Cover page, section 3; Costs, contributions and financing arrangements are covered in Table 7 and paragraphs 37 (risk guarantee mechanism during Phase II of the project) and paragraphs 64-66.
• Implementing Agency Fees	• Propose IA fee	• Fees are assumed to be the standard fees for Full Projects according to the new guidelines. This is not stated explicitly in the document.
• Cost-effectiveness	• Estimate cost effectiveness, if feasible. • Describe alternate project approaches considered and discarded.	• Alternate modalities of contingent financing, risk guarantee mechanism, varying debt : equity ratio models were explored extensively during PDF A activities and preparatory activities of the full brief.
4. Institutional Coordination & Support		

	Work Program Inclusion	Reference/Note:
IA Coordination and Support • Core commitments & Linkages	Describe how the proposed project is located within the IA's: • Country/regional/global/sector programs. • GEF activities with potential influence on the proposed project (design and implementation).	• Paragraphs 19 and 22 addressthis issue.
• Consultation, Coordination and Collaboration between IAs, and IAs and EAs, if appropriate.	• Describe how the proposed project relates to activities of other IAs (and 4 RDBs) in the country/region. • Describe planned/agreed coordination, collaboration between IAs in project implementation.	• Paragraphs 57-63) address this issue.
5. Response to Reviews		
Council	Respond to Council Comments at pipeline entry.	Country driveness (paragraphs 1-19), Operational programme/project design (throughout document), Sustainability (paragraphs 54-56, project redesigned to replace subsidy by risk guarantee funding), Replication (throughout project/project design: especially capacity strengthening, information dissemination and risk guarantee mechanism), Monitoring and Evaluation (Project Planning Matrix), Financing (paragraphs 64-66), Institutional Coordination and support (paragraph 68)
Convention Secretariat	Respond to comments from Convention Secretariats .	
GEF Secretariat	Respond to comments from GEFSEC on draft project brief.	
Other IAs and 4 RDBs	Respond to comments from other IAs, 4RDBss on draft project brief.	

	Work Program Inclusion	Reference/Note:
STAP	Respond to comments by STAP at work program inclusion	
Review by expert from STAP Roster	Respond to review by expert from STAP roster.[2]	Annex 3-1 addresses the STAP reviewer's comments.

[2] STAP Roster Review, and IA response, is a required annex of the project brief.

PROJECT BRIEF

1. IDENTIFIERS

PROJECT NUMBER	**MAL/00/G3X**
PROJECT NAME	**Malaysia: Biomass-based Power Generation and Cogeneration in the Palm Oil Industry, Phase I**
DURATION	Five years, in two implementation phases of 2 and 3 years duration (01 June 2001 – 31 May 2006)
IMPLEMENTING AGENCY	United Nations Development Programme
EXECUTING AGENCY	Ministry of Energy, Communications and Multimedia
REQUESTING COUNTRY	Malaysia
ELIGIBILITY	Malaysia ratified the UNFCCC on July 17, 1994
GEF FOCAL AREA	Climate Change
GEF PROGRAMMING FRAMEWORK	Operational Programme No. 6: Promoting the Adoption of Renewable Energy by Removing Barriers and Reducing Implementation Costs

2. SUMMARY

The goal of this project is the reduction of the growth rate of GHG emissions from fossil fuel fired combustion processes and unutilized biomass waste through the acceleration of the growth of biomass-based power generation and combined heat and power (CHP). The main idea is to supplant part of the current fossil fuel consumption for power generation in Malaysia using biomass resources from the country's palm oil industry. The project purpose is to develop and exploit the energy potentials of biomass waste resources in the country through biomass-based power generation and CHP. This objective is expected to be realized through the successful implementation of programs dealing with: (1) information services and awareness enhancement on biomass energy technology; (2) policy studies and institutional capacity building in the area of biomass energy technology; (3) financial assistance for biomass energy projects; (4) demonstration schemes for biomass-based power generation and CHP; and, (5) biomass energy technology development. The 5-year project, which will be implemented in two phases, will build on the initial policy work on renewable energy done by the Danish Cooperation for Environment and Development (DANCED) with the Ministry of Energy, Communications and Multimedia (MECM).

3. COSTS AND FINANCING (MILLION US$)

GEF:	PDF A	0.025
	Phase 1	4.000
	Phase 2	4.032
	Sub-Total	**8.057**
CO-FINANCING:		
	Phase 1	
	GoM (Cash):	3.081
	GoM (in-kind):	0.804
	Private Sector (Cash):	6.518
	Private Sector (in-kind):	0.412

	Phase 2	
	GoM (Cash):	6.606
	GoM (in-kind):	0.189
	Private Sector (Cash):	15.370
	Private Sector (in-kind):	0.162
	Sub-Total	**33.146**
TOTAL PROJECT COSTS:		**41.203**

4. OPERATIONAL FOCAL POINT ENDORSEMENT

Endorsement Letter dated 5 January 2001 submitted to and received at UNDP-GEF on 5 January 2001.

Mr. Nasaruddin bin Che Abu, GEF National Focal Point
Ministry of Science, Technology and Environment
Tel: 60-3-2938955
Fax: 60-3-2936006

5. IMPLEMENTING AGENCY CONTACT

Dr. Nandita Mongia, GEF Regional Coordinator for Climate Change (Asia-Pacific)
Tel: 1-212-9065833
Fax: 1-212-9065825
E-mail: nandita.mongia@undp.org

ACRONYMS

BOD	Biological Oxygen Demand
BPGCP	Biomass Power Generation and Cogeneration Project
CETDEM	Centre for Environment, Technology and Development Malaysia
CHP	Combined Heat and Power
CH_4	Methane
CIDA	Canadian International Development Agency
CO_2	Carbon Dioxide
COGEN	Cogeneration
DANCED	Danish Cooperation for Environment and Development
DOE	Department of Environment
DSM	Demand Side Management
EE	Energy Efficiency
EFB	Empty Fruit Bunches
EPU	Economic Planning Unit
FRIM	Forest Research Institute of Malaysia
GDP	Gross Domestic Product
GEF	Global Environmental Facility
GHG	Green House Gases
GoM	Government of Malaysia
GW; Gwh	Gigawatt;Gigawatt-hour
IAPG	Inter Agency Planning Group
IPP	Independent Power Producer
JBEG	Department of Electricity and Gas Supply
kTOE	KiloTon of Oil Equivalent
kW	Kilowatt
LPAC	Local Project Appraisal Committee
MECM	Ministry of Energy Communication and Multimedia
MESITA	Malaysian Electricity Supply Industry Trust Account
MIEEIP	Malaysian Industrial Energy Efficiency Industry Project
MITI	Ministry of International Trade and Industry
MoF	Ministry of Finance
MOSTE	Ministry of Science, Technology and Environment
MPI	Ministry of Primary Industry
MW; MWh	Megawatt; Megawatt-hour
NEDO	New Energy and Industrial Technology Development Organization
PMT	Project Management Team
POME	Palm Oil Mill Effluent
PPA	Power Purchase Agreement
PTM	Malaysian Energy Centre
RE	Renewable Energy
SEB	Sabah ElectricitySdn Bhd
SESCO	Sarawak Electricity Company
SIRIM	SIRIM Berhad
SPP	Small Power Producers
TNB	TenagaNasionalBerhad
UNDP	United Nation Development Program
UNFCCC	United Nations Framework Convention on Climate Changes

BACKGROUND AND CONTEXT

ENERGY AND ELECTRICITY SECTOR

1. Electricity accounts for about 18% of the total final energy consumption in Malaysia. Presently, this form of energy is generated using natural gas (70%), diesel oil (1%), fuel oil (7%), hydro (12%) and coal (10%). The reported electricity generation in the country does not account for the electricity that is self-generated by industries.

2. In 1998, the total installed power generation capacity in all of Malaysia was 13.393 GW (12.079 GW in Peninsular Malaysia and 1.214 GW in Eastern Malaysia). The power demand in Peninsular Malaysia was 8.47 GW while in Eastern Malaysia it was 0.834 GW. Projections show that electricity demand in the country will grow by 6-10% annually during the next 5 years, and it will be necessary to plan new generation capacity.

3. The country's electricity supply industry is in the process of being restructured and the current vertically integrated activities of TNB will be unbundled. TNB is now divesting its share of power generation, and eventually its monopoly in distribution will be broken but it intends to retain control of transmission. With the recent introduction of a grid system operator and a future power market pool, there will be significant changes in the electricity supply industry. This is a long-term strategy being envisaged for the power industry, but with no specific time frame set at the moment. However, the Ministry of Energy, Communications and Multimedia is responsible for ensuring a level playing field is established for renewable energy when the need arises. Hence, this project will play an important role in providing the learning curve for pragmatic policy support to be instituted by the Ministry.

BIOMASS ENERGY IN MALAYSIA

Biomass Resources and Biomass Industry Profile

4. Malaysia has abundant biomass waste resources coming mainly from its palm oil, wood and agro-industries. A total of about 665 MW capacity can be expected if the estimated overall potential of about 20.8 million tons of biomass residues from these main sources in addition to 31.5 million m^3 of palm oil mill effluents (POME) is used for power generation and cogeneration. In addition, there is a substantial amount of unexploited biomass waste resources in the form of logging wood residues, rice straw, palm tree trunks and other residues. These biomass residues could further supplement future biomass-based power generation in the country if necessary.

5. Table 1 lists the typical biomass sources, amount, and the potential biomass-based power generation and power capacity in Malaysia as of 1999. It also lists the number of mills above minimum threshold for which energy systems are appropriate for each biomass stream.

6. As shown in Table 1, the palm oil industry accounts for the largest biomass waste production in Malaysia. Palm oil industry waste (including POME) represents the biggest potential for

biomass energy utilization in the country, inasmuch as these are easily available and are presently requiring cost effective means of disposal. Currently, most of these residues are disposed of through incineration and dumping. A small portion is used as fuel for the mills' heat and power requirements in a very inefficient manner.

Table 1. Biomass Resources Potential (1999)

Sector	Quantity kton/yr	Potential Annual Generation GWh	Potential Capacity (MW)
Rice mills	424	263	30
Wood industry	2,177	598	68
Palm oil mills	17,980	3,197	365
Bagasse	300	218	25
POME	31,500	1,587	177
Total	72,962	5,863	665

NOTE: *Biomass from rice mills is mainly rice husks; palm oil mill waste includes EFB (54%), fibers (33%), and shells (13%); woodwaste includes those from sawmills, plywood mills and wood moldings. Not accounted for are rice straws and palm trunk and fronds, as well as logging waste left in the forests. The potential annual electricity production and power generation capacity are computed assuming all the available biomass resources are utilized. Source: MPOB, SIRIM, FRIM, Forestry Department and Ministry of agriculture.*

7. Biomass fuels currently account for about 16% of the energy consumption in the country, of which about 51% is palm oil biomass waste and about 22% is wood waste. The present installed biomass-based power generation capacity in the country is 138 MW, about 100 MW of which are in the palm oil industry.

8. The palm oil industry in Malaysia contributes significantly to the country's GDP. The country is a world leader in the production and supply of crude palm oil. In 1999, a total of 3.22 million hectares of land is planted with palm oil trees supplying 370 palm oil mills all over the country. About 74% of these mills are in Peninsular Malaysia but more palm oil plantations and mills in Eastern Malaysia will be opened up. Since the 60s, all of the palm oil mills have depended on their own biomass wastes for fuel, mainly the palm kernel shells and mesocarp fibers.

9. The Malaysian palm oil industry is projected to steadily grow and to continue contributing significantly to the national GDP. This would mean more oil palm trees being planted and more oil palm fresh fruit bunches (FFB) being processed. At the same time, the volume of palm oil industry biomass and biomass-derived wastes generated will also increase accordingly. Typically the quantities of waste products generated in the manufacture of crude palm oil per ton FFB are shown in Table 2:

Table 2: Typical Quantities and Uses of Waste Products from the Palm Oil Industry

Waste Product	Form	Quantity (ton per ton FFB)	Current Uses in Palm Oil Industry	
			Mills w/ Plantation	Mills w/o Plantation
Empty fruit bunches	Solid	0.23	Soil mulching	None

(EFB)				
Mesocarp fibers	Solid	0.12	Boiler fuel	Boiler fuel
Shells	Solid	0.07	Boiler fuel	Boiler fuel
Palm oil mill effluents (POME)[3]	Liquid	0.67	Soil fertilizer	None
POME-derived biogas[4]	Gas		None	None

10. Based on forecast of crude palm oil (CPO) production during the period 2000-2005, the following are the potential annual supply of solid and liquid (in million tons, Mt) and gaseous waste products (in million cubic meters, Mm^3) that can be used for biomass-based grid-connected power generation and CHP:

Table 3: Forecast Generation of Biomass Waste Products from the Palm Oil Industry

Year	FFB, Mt	EFB, Mt	Fiber, Mt	Shell, Mt	POME, Mt
2000	49.8	11.5	6.0	3.5	33.4
2003	54.9	12.6	6.6	3.8	36.8
2005	58.3	13.4	7.0	4.1	39.1

11. If the palm oil mills continue to use only the fibers and shells as fuel (at the present 65:35 fiber:shell ratio) for grid-connected power generation and CHP, the potential overall power generation capacity will be about 261 MW by 2005. The amount of electricity that can be sold to the grid will account for only 1.3% of the total country power generation by that year.

Table 4: Forecast Biomass-based Power Generation Capacity and Electricity Production

Year	Forecast Power Generation, GWh	Mill Gross Power Generation, GWh	Mill Net Power Generation, GWh	Mill Power Generation Capacity, MW	% of Total National Power Generation
2000	70553.3	1878.7	981.5	214.5	1.4%
2003	85784.1	2069.7	1081.3	236.3	1.3%
2005	95938.0	2197.0	1147.8	250.8	1.2%

12. Depending on the extent the EFBs[5] are used as fuel and whether POME-derived biogas is also used or not, the potential power generation capacity from the palm oil industry by year

[3] Palm oil mill effluents (POME) consist of steam condensates from the FFB sterilizer/cooker, water extracted during the sludge dewatering process, and water used in the hydrocyclones for separating shells and fibers. Typically, the total amount of POME generated is about 0.67 tons per ton of FFB.

[4] The amount of biogas (65% CH_4) generated from the POME treatment lagoons/ponds is about 28 Nm^3/m POME.

2005 would range from 270 MW to 665 MW. A 270 MW capacity is possible if only all of the mesocarp fibers and shells are used. The excess power generation in this case will account for 1.4% of the total national electricity production. If say 25% of the available EFBs is also used, a total of 312 MW power generation capacity can be expected, with the excess power generation accounting for 1.8% of the national electricity production (3.8% if POME-biogas is also used). The maximum capacity can be achieved if all EFBs, fibers and shells are used as fuel for power generation/CHP including all the available POME-derived biogas. The excess power generation from the palm oil industry in this case will account for 5% of the national electricity production in 2005.

13. The supply of palm oil biomass waste will also be sustained by the availability of biomass residues resulting from the annual replanting of palm oil trees. Annual replanting of palm oil trees usually involves about 100,000 hectares of plantation land.

Biomass Power Generation and Cogeneration Technologies

14. Since the palm oil mills have abundant biomass waste resources, their energy systems were designed to be cheap rather than efficient. Most of the existing biomass combustion systems in Malaysia utilize low efficiency low-pressure boilers. The average conversion efficiencies in process steam and electricity generation are 35% and 3%, respectively. The average overall cogeneration efficiency is 38%. An additional source of energy in palm oil mills is the biogas produced in the anaerobic decomposition (for wastewater treatment purposes) of POME. Presently, POME-derived biogas is not recovered and used. This rich (CH_4 65%) gas is just allowed to dissipate freely into the atmosphere.

15. Commercially proven technologies are available in the international market for efficient production of power and heat from major biomass resources - bagasse, wood waste, palm oil waste, straw, and rice husk. The state-of-the-art modern technologies utilize efficient high-pressure boilers. Some of these boilers are capable of dual fuel burning, utilizing either liquid (e.g., diesel oil) or gas (e.g., natural gas) fuel as supplementary energy source. Dual fired boilers will be used in palm oil waste-fired boilers to facilitate the use of POME-derived biogas as supplementary fuel.

16. Local manufacturing capacity of efficient high-pressure steam generators in Malaysia is presently low. Most of the equipment for a biomass-based power generation and CHP has to be imported, making the capital cost of a conventional biomass power plant or CHP facility in the country high (typically around US$ 1,500/kW). Assistance (technical and/or financial) to local steam and power generation equipment manufacturers is critical in motivating them to improve their equipment designs and manufacturing methods. Such assistance is provided in the current UNDP-GEF funded Malaysia Industrial Energy Efficiency Improvement Project (MIEEIP). Moreover, with the market potentials of biomass-based power projects

[5] The EFBs from palm oil mills with plantations are sent back to the plantations and used for soil mulching/conditioning. It is estimated that about 75% of the EFBs in the industry are being used in the oil palm plantations. The remaining EFBs are those from mills without plantations. Previously, these are incinerated.

and a suitable government policy on power pricing, the local boiler industry could possibly take up the manufacturing of high-pressure biomass boilers, when the market and demand for efficient biomass power technology takes off.

17. Technologies for the effective treatment and handling of POME have been applied in several palm oil mills in Malaysia. The present systems typically involve the anaerobic decomposition of the organic components of POME and are sufficient to meet the required final effluent BOD_3 limits imposed by the government. As to the biogas (65% CH_4, 35% CO_2 and traces of H_2S) produced during POME treatment, there are no government regulations yet requiring palm oil mills to prevent its release to the atmosphere.

18. In case the palm oil mills consider the recovery and energy use of POME-derived biogas, the biogas can be piped from the anaerobic digestion tanks and POME lagoons/ponds and collected in a central storage tank. The biogas can then be treated to remove the corrosive components prior to use. Typical piping system design and installation (including safety and controls) in fuel gas reticulation systems can be applied for this purpose.

Regulatory Framework Relevant to Biomass-based Power Generation and Cogeneration

19. Presently, there are no government policies regarding the development and use of biomass resources for power generation and CHP. Aside from the serious interest of the palm oil industry in implementing biomass-based power generation and CHP projects, there are various issues that prompted the move to come up with policies and policy support programs on biomass energy. These include:

    (a) Climate Change Initiatives - *Malaysia's commitment to the UNFCCC, among others, the preparation of a GHG inventory, and a review and update of the assessment of vulnerability to climate change and adaptation needs.*
    (b) Fifth Fuel Policy - *In line with its commitment towards safeguarding the environment, the government is increasing the emphasis on renewable energy and energy efficiency and is presently considering to fully include them in the energy planning process.*
    (c) Ban on Open Burning - *The government has taken a strong stand on open burning particularly in the palm oil industry. The burning of EFB in existing incinerators cannot meet with the environmental regulations and DOE has stopped issuing new licenses.*
    (d) Drafting of Energy Efficiency Regulations - *The JBEG has drafted regulations on energy efficiency in large energy consuming enterprises and are expected to be enforced with the new Electricity Supply Act 2000.*
    (e) Malaysian Electricity Supply Industries Trust Account (MESITA) - *This was created to involve the country's power generating companies in contributing towards rural electrification and finance energy efficiency and renewable energy projects.*

Institutional Framework

20. This project is intended to be executed by the MECM, which is the implementing agency for the GoM' s energy policies, and the implementation and promotion of RE and EE activities. It will be implemented through coordinated efforts and close working relationships with the

relevant institutions involved in the energy sector, such as the JBEG and PTM and the power utilities (TNB, SESCO, and SEB). Their specific roles in the project development and implementation are described later towards the end of this Project Brief.

21. Institutional support will also come from several government ministries that are also involved in the formulation of energy-related policies and programs and for this project, those that are involved in the palm oil industry. This includes MoSTE, MITI, MoF, MPI, and PORIM, and their specific roles as stakeholders are described later.

Previous and Ongoing Projects

22. The complete project package (i.e., baseline activities and GEF-supported interventions) will focus on the utilization of palm oil waste materials (including POME-derived biogas) in power generation and CHP in the Malaysian palm oil industry. The project would definitely benefit from other programs and measures undertaken by the GoM and other relevant government and private institutions in the area of renewable (and in particular, biomass) energy. The projects that can either be influenced and benefited by, or be contributing to the objectives of, the proposed GEF-supported project are:

(a) World Solar Programme - *Malaysia is committed to the World Solar Programme, and has made education and training in RE and EE a high priority national project.*
(b) DANCED-supported RE Projects:
- *Blowing in the Wind: Malaysia's Renewable Energy Scene (CETDEM - 1996)*
- *Support to the Development of an Energy Efficiency Strategy (MECM - 1999)*
- *Renewable Energy as the Fifth Fuel (EPU - 1999)*
- *Center of Education and Training in Renewable Energy and Energy Efficiency (MECM - 2000 to 2002)*
- *Capacity Building in Government & Related Agencies (MECM - 2000 to 2002)*

(c) Partnership Facility Programs -*This Danish assistance project supported the establishment of the following commercial partnerships:*
- *COGEN plant for combustion of waste products from the palm oil production in Malaysia" (Enco Engineering Sdn. Bhd. and Ansaldo Volund)*
- *Wood waste cogeneration (Visdamax (M) Sdn. Bhd. and Euro Therm Ltd.)*

(d) ASEAN-EC Cogen Programme - *Since 1990, this has encouraged the transfer of European technology biomass-based heat and/or power generation through the establishment of demonstration projects on a full industrial scale basis. A total of 16 demonstration projects have been installed in the ASEAN countries, out of which 8 are in the Malaysian wood and oil palm sectors. The soon-to-be-implemented Phase 3 of this program will support CHP projects in ASEAN countries.*
(e) UNDP-GEF - *The present MIEEIP is comprised of project components that can also contribute to the implementation of some of the activities of the BPGCP.*
(f) Canadian Assistance-*Project collaboration on utility-led DSM with funding from CIDA.*
(g) Australian Assistance-*ASEAN-AusAid Energy Study using MARKAL model.*

Barriers to Biomass-based Power Generation and CHP in Malaysia

23. The palm oil industry in Malaysia is well suited for CHP operation. It has the energy resources (in the form of palm oil waste and biogas) that it can utilize to meet its electricity and process heating requirements. However, the industry generates biomass wastes that are more than enough for its power and heating needs and the excess volume of biomass waste is in fact causing disposal problems for the industry. The government has banned the incineration of solid biomass waste (mainly EFB) in line with the Clean Air Act. Due to this, the palm oil mills have to find other means of disposing their solid biomass waste, which are in excess of what they need for their present CHP operations. Other value-added uses of the solid biomass waste have been investigated with varying success and while there are some uses that are promising, commercialization could not be expected in the near future. While palm oil mills with plantations can use their solid biomass waste for mulching and soil conditioning or fertilizer, those without plantations are considering the utilization of their excess biomass waste for generating electricity that they can sell to the utility grid. Palm oil mills are aware of the biogas (60-70% CH_4) that is generated from the biodegradation of POME, but they are currently not doing anything about collecting this gas because they are not obligated to do so and there is presently not much local experience in this area.

24. While the idea of biomass-based power generation/CHP for selling electricity to the grid or other electricity consumers is well accepted, there are various technical, information, financial, institutional and regulatory barriers that hinder its development, implementation and replication, at least in the country's palm oil industry.

25. To date, there is no experience with efficient biomass power generation/CHP systems that sell surplus power to the grid or that sell electricity and/or steam to another facility under a power purchase contract. The existing palm oil waste-fired power generation/CHP facilities are all not grid-connected, and are mainly on-site facilities operating on "island" mode, with a few serving integrated mills. Key barriers seen as critical hindrances to the development and implementation of biomass-based power generation/CHP in Malaysia are as follows:

(a) *Lack of Information Services to Promote Biomass Energy Development and Applications*

There is a general misconception that biomass-based grid connected power generation and CHP is an unproven technology and business venture, and that the use of biomass fuels goes against the industrialization goals of the country. With reference to the palm oil industry, while it accounts for the biggest potential for biomass-based power generation/CHP, there is the common notion that the industry lacks the technical capability and experience in this particular field of biomass energy technology. The potential biomass energy project developers do not know where to obtain sufficient information as well as competent advise in matters related to the choice of technology, legal issues, preparation of agreements/contracts, financing, and etc. Since biomass-based power generation and sales is new to, and not within, the core business of the palm oil industry, the palm oil mills and potential investors usually do not have enough information related to the implementation of such kind of projects.

(b) *Absence of Policies on Biomass Energy Technology Development and Applications*

Presently, there is no official government policy concerning the development and utilization of biomass energy. While there is an existing policy regarding IPPs selling power to TNB, there is no basic regulatory framework for biomass power projects to sell excess power to the utility grid. The Ministry of Energy, Communications and Multimedia has set up a Special Committee on Renewable Energy (SCORE) that will be responsible for policy and institutional arrangements to promote the development of renewable energy resources in the country. SCORE includes TNB Distribution, EPU, DEGS and the Ministry of Finance. This project will be useful in helping SCORE in developing an appropriate regulatory frame work.

(c) *Lack of Accessible and Favorable Financing Schemes*

In view of the lack of support policies and information, it is difficult to obtain financing for biomass-based power generation/CHP projects in Malaysia. This is further aggravated by the fact that financial/banking institutions in the country are not familiar with the financing of such business ventures. Due to the perceived high risks, these institutions are cautious in providing financial assistance for such kind of projects. Only a few of the existing technology financing schemes in the country include renewable energy in their portfolios. Base on past experience, such schemes usually require a long application and approval process.

(d) Uncertain Financial Viability

Biomass-based power generation/CHP in the palm oil industry has long been practiced but power sales to the grid has not been done due to poor economics arising mainly from the inability to sell to the grid and to sell at favorable rates. Unless a "level playing field" price is mutually arrived at between the relevant stakeholders (including ESCOs), aside from the pertinent government support policies and regulations, biomass-based power generation/CHP will not be an attractive business venture. Negotiations have been ongoing amongst concerned stakeholders to arrive at a final level playing field.

(e) Lack of Successful Models to Demonstrate the Viability of Biomass-based Grid Connected Power Generation/CHP Systems

The experience so far in the country is limited to the existing inefficient biomass-fired CHP systems in the palm oil and wood industries. There have been no successful experience utilizing efficient biomass-based power generation and/or CHP systems that sells excess electricity to the grid or to other electricity user. Generating and selling electricity is beyond the scope of the palm oil mills' core business and is not within their area of competence. Moreover, while some of the palm oil millers are interested in the technology, they are reluctant to take the risks of being the first to implement this commonly regarded "new" technology.

26. The above barriers will hinder the replication of any biomass-based power generation and CHP initiatives that palm oil industry may be interested to invest in. Even planned demonstration programs in Malaysia that aims to showcase technologies on power

generation/CHP using biomass and/or biomass-derived energy forms have to contend with several barriers. The following are the barriers referred to:

(a) *Uncertainties of Biomass Fuel Supply*

Overall, the potential for biomass-based power generation/CHP looks good. There is presently the general perception that with the overall amount of palm oil industry waste resources, it would be possible to achieve the target %share (i.e., 4%) of renewable energy resources in the national power generation mix by year 2005. In the case of the demo schemes, the EFB supply at the demonstration sites is limited. The EFB supply to the demonstration sites will be augmented by EFB supplied by the nearby mills. In this regard, the design capacity of each demo power generation/CHP facility will be based on the available EFBs, mesocarp fibers, shells and POME-biogas at site including EFBs that will be supplied from nearby mills.

In this regard, the reliability of continuous supply of biomass waste (particularly solid waste) fuels from the nearby mills is critical to the full operation of the power generation/CHP facility in each demo site. The mills, particularly those without plantations and are near to the demo sites, seem certain that enough EFBs will be available for the demo schemes. Transporting their EFBs to the demo sites would be an alternative way of disposing their waste and at the same time getting additional revenues out of them.

On the other hand, the national utility (TNB), which is expected to purchase the electricity generated at each demo site, perceives that the supply of additional EFB to the demo sites would be unreliable. Among the reasons cited for this concern are: (1) Uncertainty in the actual volume and quality of the EFBs from the nearby mills; (2) Seasonal nature of the palm oil milling operations; and, (3) Absence of standard contract procedures concerning the supply and pricing of EFBs. The uncertainty of long-term supplies of additional EFB to the demo sites and to future replication sites is one of the main concerns of TNB considering the seasonal nature of its availability. It could also be costly to transport biomass waste residues from various palm oil mills to the biomass-based power generation/CHP facility. The price of biomass residues might also increase in the future, as other value added uses and opportunities are identified.

(b) *Uncertainties of Meeting Minimum Energy Off Take*

Solid-fuel fired power plants would usually be base loaded. These would generally have an availability factor of 90%. Spare capacity would normally be provided to ensure meeting minimum energy off-take (MEOT) requirements as stipulated in purchase power agreements (PPA), and to allow for maintenance and force outages. Considering the uncertainty in the long-term supply of the EFBs from other mills, the demo sites may not be able to operate at levels that would meet MEOT requirements of TNB. The seasonal availability of biomass residues is a major risk for grid-connected biomass-based IPP, operating under a PPA with TNB.

(c) *Uncertainties in the Implementation of Biomass-based Energy Technology*

There is a general apprehension that should palm oil mills be allowed to sell electricity to the grid, the power supply from these sites is unreliable judging from the way they presently operate their CHP facilities. The common knowledge that the mills deliberately operate their CHP facilities inefficiently in order to get rid of their biomass waste gives the impression that the mills are not up to the stringent reliability and efficiency requirements in the operation of grid-connected power plants. Like in the wood and agro-based industries, which also use biomass waste for energy purposes, biomass combustion in the palm oil industry needs to be improved towards best practice. Power sales to the grid require more efficient power and steam generation equipment, reliable interconnection safety and synchronization devices, as well as more sophisticated power project development skills to deal with broader technical and contractual issues. Moreover, there are limited manpower skills in the palm oil industry to operate and maintain the modern efficient biomass fuel-fired power equipment. Although the palm oil mill operators have good knowledge of power generation at the 500 kW levels, grid connection knowledge and expertise are lacking.

(d) *Power Generation and Sales are Beyond Scope of Core Business*

Biomass-based power generation/CHP systems that sell excess electricity to the grid or to other electricity user are yet to be found in Malaysia. Palm oil mills are presently CHP facilities, but generating and selling electricity is beyond the scope of their core business and is not within their area of competence.

(e) No Incentive to Recover and Use POME-Biogas for Power Generation

While the palm oil millers know and are interested in the technology of generating biogas (mesophilic or thermophilic) from POME, then capturing, storing, treating and using it as supplementary fuel, they are not doing it simply because there' s no incentive for them to do so. Presently, there is no restriction to the release of biogas to the atmosphere.

(f) *Uncertainty of Power Purchase by TNB Distribution*

(g) The realization of the demo schemes is very much dependent on the purchase of the generated electricity by TNB *Distribution* . The issue here is the return on investment and the ease with which the grid connection will be made between TNB *Distribution* and the host companies. Presently, there is no framework to accommodate this business relationship. TNB *Distribution* will most likely exercise its right to insist on due diligence on host company's proposal on the interconnection. This is to at least satisfy TNB *Distribution* that the link between power plant and its distribution system will be adequately and suitably protected from frequency and voltage variations, etc.

RATIONALE AND OBJECTIVES

PROJECT RATIONALE

27. The increasing demand and consumption of fossil fuels in Malaysia, which in the near future could lead to a growing dependence on fuel imports, poses one of the major challenges for

the Malaysian Government. An increasing dependence on fossil fuels, particularly in the power sector, will result in rapid increase in GHG emissions in the country since this sector is a major source of GHG emissions in the country.

28. The UNDP-GEF funded MIEEIP is one of the clear manifestations of Malaysia's commitment to reduce GHG emissions from energy-related development and economic activities. In this proposed project, Malaysia aims to further reduce GHG emissions, this time from its power sector through the replacement of the fossil fuels used in power generation with renewable energy (RE) resources, particularly biomass. This project will emphasize the energy potentials of biomass resources in electricity production, their significant contribution to the reduction of future GHG emissions in Malaysia, and therefore the need to accelerate the use of renewable energy sources in the country.

29. The biomass residues that are of particular concern in this project are those from the palm oil industry. The biomass production from this industry accounts for about half of the total biomass energy resources in the country with empty fruit bunches (EFB) accounting for about 54%. Table 5 summarizes the typical annual quantities and energy content of solid biomass wastes from the Malaysian palm oil industry.

30. During the period 2000-2005, the forecast annual average electricity generation growth rate is about 6.3%. The forecast annual average power generation growth rate in the palm oil industry, assuming biomass-based grid connected power generation is widely practiced, is about 3.2%. The estimated potential annual power generation in 2000 if all of the palm oil mill solid biomass waste is used as fuel is about 2,341 GWh. This corresponds to about 267 MW power generation capacity, which translates to a reduction of fossil fuel consumption for power generation of about 124.2 kTOE. Hence, using all the solid biomass waste to supplant part of the fuel requirements of existing and planned fossil fuel fired power plants could potentially reduce GHG emissions by 500 ktons of CO_2 per year.

Table 5: Palm Oil Industry Solid Biomass Wastes

Biomass Residue	Annual Quantity, million MT	Approx. Moisture Content, %	Energy Content MJ/kg
Empty Fruit Bunches	9.65	55	6.33
Mesocarp Fibers	5.92	40	10.64
Palm Kernel Shells	2.41	10	15.26
Palm Tree Trunks	6.36	Dry basis	18.50
Fronds	30.48	Dry basis	19.81
Total	54.82		

Sources: *PORIM, FRIM, Singh, G. et.al., Oil Palm and the Environment: A Malaysian Perspective, Nov. 1999.*

31. It must be emphasized that the biogas generated from the POME can also be recovered and used as supplemental fuel for power generation and CHP systems. The palm oil industry generates about 31.5 million MT of POME annually, which can produce about 882 million m^3 of biogas. If this is utilized for power generation, an additional 1,587 GWh can be

generated each year. This is practically adding a third of the power generation from the solid biomass waste and should be seriously considered. If this gas is not recovered and used, it will just dissipate into the atmosphere and contribute to GHG emissions.

PROJECT OBJECTIVES

32. The project's global environmental objective is to mitigate GHG emissions from the power sector of Malaysia, which presently accounts for a large share of the country's total GHG emissions. The sector is forecast, based on a "business as usual scenario" to produce GHG emissions 30% higher than its 1995 level by end of year 2005.

33. The main goal of this project is the reduction of the growth rate of GHG emissions from fossil fuel fired combustion processes and unutilized biomass waste through the acceleration of the growth of biomass-based power generation and CHP. The project would help catalyze the implementation of this technology in the palm oil industry to help reduce GHG emissions from the power sector by 3-4% or equivalent 1,300 ktons by the year 2005. The main strategy is to indirectly supplant part of the current fossil fuel consumption of power utilities in Malaysia with the biomass waste and POME-derived biogas in the country's palm oil industry. The immediate objectives of this project are:

    (a) Design and implementation of a biomass energy technology information services and awareness enhancement program covering the energy applications of biomass and biomass-derived waste materials, particularly biogas;
    (b) Conduct and implementation of policy studies and institutional capacity building in the area of biomass energy technology development and application;
    (c) Design and implementation of financing assistance program for projects on biomass energy technology applications;
    (d) Development and implementation of demonstration schemes for grid-connected power generation and CHP using palm oil biomass and POME-derived biogas; and,
    (e) Implementation of a biomass energy technology development program.

34. The project is expected to help catalyze the wider adoption of grid-connected biomass-based power generation and CHP not only in the country but also possibly in the other ASEAN countries where Malaysian financial and industrial interests are increasing.

PROJECT STRATEGY

35. The project strategy involves the implementation of barrier-removal activities, including the implementation of demonstration schemes showcasing the implementation of biomass-based grid connected power generation and CHP in Malaysia. The monitoring and evaluation of the implementation of the various program activities will follow these. Finally, activities for the dissemination of the results and recommendations of the programs will be carried out.

36. The various project components are designed specifically to address the identified barriers to biomass-based grid connected power generation and CHP in Malaysia. These are designed to draw and build on the existing capacity already available in Malaysia in a number of

government and private sector institutions. The combined effect of the activities in all project components is expected to "jump-start" biomass power generation/CHP in the country.

37. The project will be implemented in two phases. Phase 1 will begin with activities that are considered technical assistance to the removal of primary barriers that hinder the expansion of palm oil waste based power generation from both biomass and biogas sources. This phase will involve extensive capacity building efforts from GEF resources and supplementary baseline funding. It will also support the incremental cost incurred by a small experimental demonstration scheme (2MW capacity) – the only case in the current GEF initiative with a low positive incremental cost. At the end of Phase 1, once most of the instruments addressing removal of the institutional barriers are in place, Phase 2 will move to support an innovative loan /grant mechanism that will be worked through the Malaysian banking sector. The GEF funds will be used to support a risk guarantee mechanism for 3 additional demonstration sites with higher power generation capacity than the experimental mill, each with a different mix of parameters that make them a special case, demonstrating the technical viability of new and retrofitted technologies. The combination will consist of mills with and without plantations and with Greenfield technologies /retrofitted technologies that may or may not have any connection to the grid . It is interesting to note that these mills have negative incremental costs and attractive IRRs when pure financial analysis is conducted, but will never venture out to try boimass/gas based power generation in the real world because of perceived risk, irreversibility of investment required and uncertainties related to cost recovery. The mills chosen for the Phase 2 exercise will further make a showcase of how best to link with the TNB/any other utility over time for grid connected power supply. While the experimental plant in phase one is already grid connected, the three larger ones chosen for Phase 2 be working out institutional and technical linkages needed for grid connected power system to work for biomass based power generation/cogeneration.

PROJECT COMPONENTS AND EXPECTED RESULTS

38. The project is designed to address the barriers in the development and implementation of biomass-based grid connected power generation and CHP specifically in the Malaysian palm oil industry. To achieve this objective, the project is organized into five (5) components. Component No. 1 is designed to address the existing information-related barriers in developing biomass-based power generation/CHP projects. Component No. 2 is designed to address the institutional and regulatory barriers. Component No. 3 is intended to provide financial support to biomass-based grid connected biomass power generation and CHP projects. Component No. 4 is designed to demonstrate not only the techno-economic viability of biomass-based power generation projects but also how such projects are designed, financed and implemented. Lastly, Component No. 5 is designed to address the present technology barriers to biomass energy technology applications in the country. Each component is briefly described below.

COMPONENT 1: BIOMASS INFORMATION SERVICES AND AWARENESS ENHANCEMENT PROGRAM

39. This program will address the information barriers that hinder the development and implementation of biomass-based grid connected power generation/CHP in relevant

industries such as the palm oil industry. It will involve the implementation of capacity building activities and information dissemination services to ensure information on biomass energy technology are widely and freely available. Such activities will include those related to: (a) Biomass energy technologies database; (b) Biomass energy technology training courses; (c) Biomass energy technology information exchange service; (d) RE consultancy service industry development; and, (e) Biomass industry rating program. The program will build on the existing information dissemination activities of MECM and PTM.

(a) Comprehensive Biomass Energy Resource Inventory – *This will involve the conduct of a comprehensive biomass resource survey in the country covering all forms of biomass.*
(b) Biomass Energy Technologies Database – *This will involve the design and development of a database of biomass energy technologies and technology applications in Malaysia and in tropical countries for use in biomass energy research.*
(c) Biomass Energy Technology Training Courses – *This will involve the conduct of training courses on biomass energy technology for PTM staff, palm oil mill personnel, and local engineering consultants to equip them with the necessary technical capability to design and evaluate biomass energy related technology applications. It will also include the design and implementation of RE technology courses for engineering students as well as RE awareness programs incorporated in high school and elementary school curricula.*
(d) Integrated Information Dissemination Program – *This will involve the development and implementation of an integrated information dissemination program for MECM, including private and government institutions involved in biomass energy development.*
(e) Biomass Energy Technology Information Exchange Service – *This will involve the design and development of a biomass energy technology information exchange services program to be operated by PTM.*
(f) RE Consultancy Service Industry Development – *This activity will address the lack of local expertise in the area of biomass energy technology, and include capacity building for energy consultants in providing consultancy service on biomass energy technology.*
(g) Biomass Industry Rating Program – *This is intended as a promotional activity to encourage relevant industries to make use of their biomass energy resources for power generation/CHP. It will involve the design of an environmental rating scheme based on the magnitude of realizing the potentials for using biomass energy.*

COMPONENT 2: BIOMASS POLICY STUDY AND INSTITUTIONAL CAPACITY BUILDING

40. This component will build on the existing policy studies regarding renewable energy as the "Fifth Fuel" for power generation, and aims to remove the institutional and price-related barriers to the development and implementation of biomass-based power generation and CHP. The program will involve the provision of technical assistance in the formulation of policies and support activities that will facilitate the widespread application of biomass energy technology applications in the country. In particular, the provision of assistance in resolving the "level playing field" issue concerning the pricing and off-take of RE electricity generated from biomass-based power generation and CHP facilities will be covered. The specific activities will include those related to: (a) Biomass policy analysis; (b) Renewable energy (RE) electricity policy study; (c) RE electricity pricing study; and, (d) Biomass-based power generation market strategy.

(a) Biomass Policy Analysis – *This will involve the review of existing policies and regulations in Malaysia, as well as those from other countries, regarding energy resource development and utilization, with the aim at promoting and supporting biomass energy development and utilization. It will also evaluate possible policy support activities and strategies that can be considered for biomass energy project developers/investors.*
(b) Renewable Energy (RE) Electricity Policy Study – *This activity will involve the evaluation and formulation of policies and regulations on the production and sales of RE electricity in Malaysia, along with the policy support activities.*
(c) RE Electricity Pricing Study – *This activity will involve the conduct of an electricity tariff pricing study for electricity generated using renewable energy such as biomass waste. It will further investigate and evaluate various options for financial incentives to encourage biomass-based power projects, including capacity and energy payment and investment incentives. After evaluating each option, this task will propose specific recommendations for the levels of each incentive measure.*
(d) Biomass-based Power Generation Market Strategy – *This activity will involve the evaluation and development of strategies for biomass-based power producers, to assist them compete in an open electricity market. It will include evaluating possible incentives for prospective investors, and appropriate terms and conditions for grid connection.*
(e) Malaysia Power Market Simulation Model – *In conjunction with the market strategy study, this activity will entail the development of an electricity market simulation model, and the assessment of the Malaysia Power Market with the aim of assisting biomass-based power producers in competing in an open electricity market.*
(f) RE Electricity Policy Implementation Monitoring and Evaluation – *This activity entails the monitoring and evaluation of the impacts of the enforcement of policy; pricing and regulatory measures that are recommended and implemented in order to promote the use of biomass and biomass-derived energy forms for power generation.*

41. The activities that were recently carried out, as well as those presently being implemented, by EPU-DANCED in line with the Renewable Energy as Fifth Fuel Policy are similar to some of the proposed activities under Component No. 2. The proposed activities are meant to complement and build on the completed and ongoing projects of EPU-DANCED.

COMPONENT 3: BIOMASS INITIATIVES FINANCING ASSISTANCE PROGRAM

42. This project component will address the lack of an appropriate financing mechanism for biomass-based power generation/CHP projects. It will facilitate future financing of biomass-based power projects, and is crucial to ensure replication and sustainability of future biomass-based power generation and CHP in Malaysia. It will include activities designed to: (1) strengthen the technical capability of financial/banking institutions to evaluate financing for RE (e.g., biomass) power projects; (2) encourage the implementation biomass-based power projects for financing; and, (3) establish a financing schemes to provide financing for the potential biomass-based power project proponents/developers. This component is primarily designed to contribute to the removal of the financing barriers and to facilitate future replication of biomass-based power generation/CHP in Malaysia. The activities under this project component are:

(a) Training Course on RE Projects Financing – *This will entail the conduct of a training course for local banking and financial institutions on financing RE projects in industries.*
(b) RE Fund Establishment – *This will involve the development and establishment of a RE Fund (or Energy Business Fund) that will support RE initiatives of prospective biomass energy users.*
(c) Financing Schemes Mechanics Development – *This activity will entail the design of applicable financing schemes for prospective biomass-based power project applicants that will be implemented by the relevant government, banking and financing institutions.*
(d) Financing Eligibility Criteria – *In conjunction with the Financing Schemes Mechanics Development, the selection criteria for fund applicants who may be eligible for RE project financing assistance will be developed.*
(e) Assistance Services to Financing Applicants – *This will entail the provision of assistance to the companies that will host the demonstration projects, including assistance in the procurement of required hardware.*
(f) RE Projects Financing Assistance Program Evaluation – *This activity is mainly for the evaluation of the RE projects financing assistance program.*

COMPONENT 4: BIOMASS-BASED POWER GENERATION AND CHP DEMONSTRATION

43. This project component will address the barrier concerning the need to showcase the major aspects of the application of biomass-based grid connected power generation and CHP technology, and the limited biomass energy demonstration programs of the government. The program will build on similar demonstration projects proposed by various foreign institutions (e.g., DANCED, NEDO, AusAid) for implementation in selected palm oil mills in Malaysia.

44. The major activities for each demonstration scheme will be similar to that in full project implementations, starting from the conceptual design, to feasibility study, engineering design, installation, operation, monitoring and evaluation. Appropriate power generation and CHP technologies will be selected for the palm oil mills that will be considered in the program. Taking into consideration the types of palm oil mills (with and without plantations) in the country and the possible options in applying biomass-based power generation/CHP, five (5) demonstration schemes will be implemented, which are as follows:

(a) Greenfield Biomass-based Grid Connected Power Generation Facility with Supplementary POME Biogas Firing - Palm Oil Mill with Plantation *(Sandau Mill, Phase 2)*
(b) Greenfield Biomass-based Grid Connected Power Generation Facility with Supplementary POME Biogas Firing - Palm Oil Mill w/o Plantation *(Serting Mill, Phase 2)*
(c) Retrofitted Biomass-based Grid Connected Power Generation Facility with Supplementary POME Biogas Firing - Palm Oil Mill with Plantation *(PORIM Mill, Phase 1)*
(d) Retrofitted Biomass-based Grid Connected Power Generation Facility with Supplementary POME Biogas Firing - Palm Oil Mill w/o Plantation *(Morib Mill, phase 2)*

(e) Centralized Biomass-based Power Plant operating as an IPP (*Perwantas Mill, phase 2, non GEF)*

45. The results and experiences derived from the demonstration schemes will be documented and disseminated. The success of the schemes will demonstrate the effective and feasible process of designing, developing, implementing, and particularly financing, of biomass-based grid connected power generation/CHP projects. Successful pilot plants would demonstrate the technical and commercial viability of biomass-based grid connected power plants in the country. It is expected to facilitate increased interest and enhanced investments in future biomass-based grid connected power generation/CHP projects in Malaysia.

46. The general activities that will be carried out include:

(a) Biomass-based Power Generation Demonstration Scheme Promotion – *This will involve the conduct of a seminar-workshop to promote the demonstration schemes, and the identification of prospective host demonstration companies.*
(b) Host Demonstration Companies Selection Criteria and Selection – *This activity will involve the development of selection criteria for host demonstration companies, and the actual selection of suitable project demonstration sites.*
(c) Financial Assistance Arrangements for Demonstration Sites – *This activity will involve the provision of assistance in the financing of each demonstration scheme through the commercial banking sector. As agreed with project proponents and the Infrastructure and Development Bank of Malaysia, the later will provide for risk guarantee funds(with an agreed upon debt: equity ratio) to demonstration plants with GEF funds as the back up guarantee resources. If any of the selected demonstration plant is found to have gone ahead with its own resources at the end of the phase 1, the project management will look for new candidate mill, to be selected on the basis of selection criterion to be developed under the project .*
(d) Demonstration Program Results Evaluation and Dissemination – *This will entail the conduct of an overall performance evaluation of the demonstration program, including the dissemination of program results and recommendations.*
(e) Sustainable Follow-up Program Design – *This activity will involve the design of a sustainable follow-up program for financially supporting the biomass energy utilization in other relevant industry sectors.*

47. The following activities that will be carried in each demonstration site are the responsibility of the host companies. Apart from the incremental cost financing, technical assistance (in the plant design, commissioning and operation) will be provided for each site by the BPGCP.

(a) Baseline Data Establishment for Demonstration Sites – *This will entail the conduct of energy audits in each host demonstration company to establish the baseline data that will be used as bases for evaluating the impacts of the demonstration schemes.*
(b) Installation and Implementation Designs/Plans for the Demonstration Schemes – *This major activity will entail the preparation of installation and implementation plans for each demonstration scheme and will be carried out by the respective host companies.*

(c) Hardware Installation and Operation for each Demonstration Scheme - *This major activity will involve the engineering work related to the installation and operation of the required hardware for each demonstration scheme.*
(d) Monitoring and Evaluation of each Demonstration Scheme - *This activity will involve the monitoring and evaluation of the operating performance and economics of each demonstration scheme. It will also include a review of the initial RE and biomass energy development and utilization policies and policy support strategies and activities.*

48. In addition to the above, this program will involve barrier removal activities that will help ensure the implementation of the demonstration schemes and future replications of the biomass energy technologies that will be showcased in this programme. Some of these barriers are also addressed in general in the project specifically in Component Nos. 1, 2 and 3.

COMPONENT 5: BIOMASS ENERGY TECHNOLOGY DEVELOPMENT PROGRAM

49. This project component will address the identified technical barriers that hinder the promotion and implementation of projects that utilizes biomass waste resources for energy purposes. In this program, technical assistance will be provided in evaluating the energy utilization performance in all areas of operation (including CHP) in the palm oil mills. This will provide useful inputs in the design of new biomass-based power generation and CHP facilities or expansions in the palm oil mills, as well as identify potential improvements in the design and operation of the existing CHP systems. The program activities include:

(a) Assessment of Other Energy and Non-Energy Uses of Palm Oil Biomass Waste - *This will involve the conduct of studies aimed at assessing the feasibility and applicability of other uses (energy and non-energy) of biomass waste from the palm oil industry.*
(b) Evaluation of Energy Utilization Performance of Palm Oil Mills - *This activity is designed to evaluate the present energy utilization performance in all areas of operation in local palm oil mills. This will provide useful inputs in the design of new biomass-based power generation and CHP facilities or expansions in the palm oil mills, as well as identify potential improvements in the operation of existing CHP systems in these mills.*
(c) Skills Upgrading for Palm Oil Mill Power Plant Engineers & Operators - *This will involve training palm oil mill personnel on the safe, efficient and environment-friendly operation of biomass-based power generation/CHP systems, including certification of mill engineers to operate high pressure and high voltage power and CHP systems.*
(d) Assessment of Manufacturing Capability for Steam and Power Generation Equipment - *This will entail the evaluation of the manufacturing capabilities of the local steam and power generation equipment manufacturers supplying the palm oil industry in Malaysia.*
(e) Performance Evaluation of Locally Produced Steam & Power Generation Equipment – *This will involve the evaluation of the energy performance of locally produced steam & power generation equipment, followed by the identification of potential improvements and new designs for locally produced steam and power generation equipment.*
(f) Training Course of High Efficiency Equipment Designs and Production Technologies - *This will entail the conduct of a training course for local steam and power generation equipment manufacturers on high efficiency designs and production technologies.*

(g) Financial Assistance to Local Steam and Power Generation Equipment Manufacturers - *This activity will be carried out in conjunction with the financing assistance program of the BPGCP and is intended for local steam and power generation equipment producers.*
(h) Sustainable Biomass Energy R&D Program *This activity will involve the design and development of sustainable biomass energy R&D program supported by biomass-based power producers.*

PROJECT IMPLEMENTATION SCHEDULE

50. Annex 3 shows the schedule of activities of the project. Bulk of the project activities is in Component No. 4, which is mainly for demonstrating the process of designing, developing, implementing, and financing, of biomass-based grid connected power generation and CHP projects. The other components are mainly comprised of activities that are mainly for facilitating the removal of information, institutional, policy, financial, and technical barriers to the implementation of such projects. The project duration will be for five years. Of the two phases, Phase 1 will be during the first two years and Phase 2 activities will be carried out till the end of the project

51. Phase 1 will cover all the activities in Component Nos. 1, 2 and 3. Also included in Phase 1 are activities in Component No. 4 that are aimed at removing barriers in the implementation of the demonstration schemes. The first demonstration scheme of the project, which will be in the PORIM Experimental Mill, will be carried out in Phase 1. Preparations for the demonstration scheme in the Kwantas Mill, which will be financed and implemented entirely by the private sector, is, also expected to start in Phase 1. Moreover, the technical capacity building activities in Component No. 5 will also be implemented in the project's first phase.

52. Phase 2 of the BPGCP will mostly be activities related to the design, engineering, and operation of the other 3 demonstration schemes. The rest of the technical extension activities in Component No. 5 will also be implemented in this phase of the project.

RISKS AND SUSTAINABILITY

RISKS

53. A number of issues related to promoting biomass-based grid connected power generation and CHP should be considered in the BPGCP design and implementation. The primary issue is the present lack of support policies regarding the development and use of biomass energy and the pricing of biomass generated electricity sold to the grid. However, the GoM is currently working on this in conjunction with the proposal to make renewable energy as the fifth fuel for Malaysia under the 8th Malaysia Plan. The major risks that must be looked into in this project are described below. Most of these have been discussed previously (Nos. 25 & 26). While some of these are internal to the project design, others are affected by external factors.

(a) *Uncertainties of Meeting Minimum Energy Off Take*: Biomass-based power grid connected power plants/CHP facilities are supposed to operate reliably to meet MEOT requirements.

(b) *Uncertainties of Biomass Fuel Supply*: There is a looming prospect of oil palm plantations will be converted to real estate developments in Peninsular Malaysia. Nevertheless, the industry's growth in Eastern Malaysia will sustain the continuous operation of biomass-based power generation and CHP. The supply of biomass fuel will also be sustained by the availability of biomass residues resulting from the annual replanting of palm oil trees, which typically involve about 100,000 hectares of plantation land. The availability of POME-biogas will also ensure the availability of supplementary fuel for power generation/CHP in the palm oil industry.

(c) *Uncertainties of Power Purchase by TNB*: The planned open electricity market in Malaysia will bring about the risks of power purchase by TNB. In case of an open market, TNB Distribution is still expected to honor its PPA arrangements with IPPs. For the demonstration schemes, an agreement will be secured to ensure TNB Distribution's purchase of the electricity produced. For future projects, this potential risk will have to be carefully evaluated and mitigated by a relevant government policy. The Ministry of Energy, Communications and Multimedia's SCORE will be responsible for ensuring the promotion of grid-connection power generation from renewable energy resources. The Ministry has assured special attention will be given for power purchase from biomass power plants.

(d) *Uncertainties in the Malaysian Financial Sector*: Malaysia is currently well on its way to full recovery from the recent regional economic crisis. Despite this, the financial/banking institution sector in the country somehow is still wary about their financing deals with industries. With the enforcement of the relevant policies concerning the use of biomass energy, the implementation of attractive RE electricity tariffs, granting of financial incentives, issuance of PPAs to biomass-based power generators, it is expected that anxieties of the sector will be eliminated/eased.

(e) *Operating Risks*: There are limited manpower skills in the palm oil industry to operate and maintain the modern efficient biomass fuel-fired power equipment. This can however be easily addressed by the capacity building component of the project, which will include supplementary training to be provided by the power and steam generation equipment suppliers that will involved in the demonstration schemes.

SUSTAINABILITY

54. Biomass-based power generation/CHP is a proven reliable and cost-effective technology in the international market. In order to encourage, and sustain interest in, the application of this technology, this project will build capacity to provide technical information and advisory services to potential biomass-based power project developers/investors. It will also help create a sustainable demand for and supply of biomass power systems through disseminating information, supporting the demonstration schemes and carrying out barrier removal activities to ensure their successful implementation and subsequent replications. These efforts should ensure the long-term sustainability of biomass-based power generation and CHP technology in Malaysia.

55. The BPGCP will facilitate the formulation and enforcement of policies and regulations regarding the use of RE (including biomass energy) as the "Fifth Fuel" for power generation in Malaysia. It will facilitate the review and improvement of electricity pricing policies, particularly concerning biomass-generated electricity or RE electricity and facilitate policy dialogue for smooth adoption and implementation of the pricing policy and incentives, which will ensure the commercial viability of future biomass-based power projects. This proposed project is fully consistent with national policies and has been endorsed by the Government To sustain the momentum that will be generated by the initial project activities, the project will set up a financing mechanism for RE-based power projects by providing financial assistance for the replication of the technologies that will be showcased by the demonstration schemes. It will also train the financial/banking institutions in financing biomass power projects to ensure continuity in the financing of future projects, as well as promote investment opportunities for potential investors in Malaysia. Furthermore, follow-up programs will be included in each project component with the primary intention of sustaining the impacts of the project. These efforts will ensure the financial sustainability and viability of the biomass-based power generation/CHP projects even after the completion of the GEF assistance.

56. The government policies and regulations that will be put in place and implemented through this project will influence growing interest not only in the palm oil industry, but also in other biomass-related industries (e.g., wood, and agriculture) in developing and implementing biomass-based power generation and CHP. These and all other related efforts will ensure the institutional sustainability of this project.

STAKEHOLDER PARTICIPATION AND IMPLEMENTATION ARRANGEMENTS

57. The proposed BPGCP project is fully consistent with national policies and has been endorsed by the Government of Malaysia. Through the PDF A implementation phase over the past 8-10 months, a large number of stakeholders have been consulted in the formulation of this proposal through participation in workshops, etc. These stakeholders include government agencies, utilities, several private engineering firms, semi-autonomous research institutions, and project developers working with energy efficiency, private mill owners and ESCOs, and some NGOs. To continue with broad consulting, the project will draw upon an Advisory Board consisting of representatives from relevant government agencies, NGOs, the EE industry, and other stakeholders. The BPGCP will be executed by MECM. The UNDP Resident Mission in Kuala Lumpur will undertake the GEF oversight. The day-to-day operational management of the BPGCP will be the responsibility of the MECM. A Local Project Appraisal Committee (LPAC) will be established to provide overall guidance and approval of key BPGCP program activities including fund commitments and co-financing arrangements. The LPAC will consist of the Secretary General of MECM, senior representatives from the EPU, MOSTE, and MPI, the power utilities, R&D institutions in palm oil industry and the palm oil industry associations.

58. Successful project execution will require close cooperation of the abovementioned stakeholders. The MECM is a member of the Inter-Agency Planning Group (IAPG) and is

responsible for the approval of electricity tariffs, issuance of electricity supply licenses, and for the development of programs in the areas of renewable energy and energy efficiency. There are a number of RE projects being supported by the Electricity Supply Industry Trust Account (MESITA), which is managed by the MECM. The JBEG, which is under the MECM, is the regulatory body for electricity supply in Malaysia. Another IAPG member, the EPU is responsible for the formulation of privatization policies, and evaluation, selection and approval of IPPs. It is responsible for the formulation of energy strategies and policies including national energy planning and policy development in renewable energy. The MoF, another IAPG member, is the agency that has the final say and approval of matters related to investment incentives and the GoM's share ownership of TNB rests in the MoF. IAPG member MoSTE is the agency mandated to implement science and technology R&D which can be commercialized and support environmental conservation activities such as projects on RE utilization. The MPI is tasked to promote specific commodities considered to be economically and socially strategic to national development and enhances Malaysia's competitive advantage in the global market. The palm oil industry is under this ministry.

59. The other stakeholders are PORIM, the power utilities, and the palm oil growers and millers associations. PORIM is the focal point for palm oil R&D activities and is supported by the palm oil mills. SIRIM Bhd is the national organization on quality standards and is the prime mover in research and development in the country. The power utilities currently monopolize the transmission and distribution of electricity in Peninsular (TNB) and East (SESCO and SESB) Malaysia. They have expressed interest and support in the development of technologies for using renewable energy resources as fuel for power generation as long as these are competitive. The palm oil growers and millers are interested in the project since they are concerned about their obligation to comply with environmental restrictions imposed on them by the government regarding the management of their biomass waste.

60. There are also certain groups that are either directly or indirectly concerned about the outcomes of the project. These are those who are at present utilizing the palm oil biomass resources either for energy or non-energy purposes.

61. A Project Manager along with core senior technical staff will make up a Project Management Team (PMT) that will oversee the project operations. The PMT will be supported with local and international experts as and when needed to undertake project activities. Support staff, services and facilities will be provided by MECM and other agencies.

62. A key activity in finalizing the project document will include the identification of a utility provider responsible for purchase of power/heat (as relevant) from the demonstration project(s), and negotiation to finalize the related financial and implementation arrangements. The final project document submitted will include details of the Financial arrangements in the form of a draft Memorandum of Understanding (MOU) with Pilot Plant(s) for Capital Grants for credit related activities (conforming to UNDP Programming Manual Standards) ready for signature upon GEF CEO and UNDP final clearance of the project document. Implementation arrangements will be elaborated under an annexed Subcontract Terms of Reference regarding Provision of Contingent Financing to the Pilot Plant(s).

63. Considering the typical gestation period for obtaining GEF funding commitment, actual project development, evaluation and approval, it is anticipated that project will kick-off by mid-2001. It will operate for a period of five years concluding on 30 June 2006. Implementation of the project will be structured to initially establish the BPGCP technical and institutional capacity and to subsequently target host companies for the planned biomass-based power generation and sales demonstration schemes. A detailed project implementation plan will be formulated after the GEF's approval of this Project Brief.

INCREMENTAL COSTS AND PROJECT FINANCING

64. The total estimated project cost is US$ 41,178,000 (US$ 41,203,000 inclusive of the PDF A grant). The total cost associated with the implementation of baseline activities in each of the project components is US$ 33,146,000. Out of this total amount, the GoM will provide US$ 10,682,000. The other funds for the baseline activities will come from the private sector (US$ 22,464,000).

65. The incremental costs for the incremental activities that will be carried out in each of the project component amounts to US$ 8,032,000. This is the amount to be provided by the GEF. Table 6 summarizes the project cost details. The incremental cost analysis is presented in Annex 1A. Details of the indicative project costs are in Annex 1B.

    Bulk of the GEF funds, amounting to US$ 6,342,000 is allocated for the demonstration schemes in Component 4.

Table 6. Project Budget (US Dollars)

Project Output	Baseline	Incremental	Total
1. Biomass Information Service and Awareness Enhancement Program	598,000	412,000	1,010,000
2. Biomass Policy Study and Institutional Capacity Building Program	394,000	299,000	693,000
3. Biomass Initiatives Financing Assistance Program	320,000	266,000	586,000
4. Biomass-based Power Generation and CHP Demonstration Program	31,518,000	6,342,000	37,860,000
5. Biomass Energy Technology Development Program	316,000	713,000	1,029,000
TOTAL COSTS	33,146,000	8,032,000	41,178,000

See also Annex 6 for the detailed project budget.

MONITORING, EVALUATION AND DISSEMINATION

66. The Project Planning Matrix (Annex 2) states all the success indicators or objectively verifiable indicators for each activity that will be carried out under this project. These indicators are the parameters that have to be monitored by MECM under this project. The annual growth in installed biomass-based power generation and CHP capacity in the country provides a clear indication of the realization of the project's purpose. As such, this is one parameter that has to be monitored and evaluated during the course of project implementation. In addition, the actual amount of biomass-generated electricity that will be accounted for in the national electricity generation is also another indicator that has to be monitored and evaluated under this project. The extent by which the GEF developmental goal is achieved can be evaluated from the monitored results. The forecast trend in energy supply and electricity generation patterns can be evaluated based on the monitored and reported results of the project. By the time of project completion, at least the five biomass-based grid connected power generation and CHP demonstration facilities will be in operation. Based on the forecast, the estimated additional biomass-based power plants and CHP facilities can be determined in the short, medium and long terms.

67. This project has been designed taking into account the relevant lessons learned from previous UNDP/GEF sponsored biomass energy projects. One of the most important lessons learned from the projects implemented to date is that long-term biomass fuel-supply contracts is a critical issue that has to be resolved prior to project implementation. This is essential for project financing. The host demonstration companies should ensure a continuous and adequate supply of biomass fuels to the power generation and CHP plants. The second lesson is the importance of an appropriate level of power purchase price in the PPA to ensure the financial viability of the biomass-based power generation and CHP plants.

68. The project implementation will be monitored and evaluated in line with UNDP rules and procedures and the GEF guidelines for M&E. UNDP will undertake this activity with cooperation from the GEF focal point in Malaysia and the project's executing agency. UNDP's extensive experience in monitoring large programs will be drawn upon to ensure that the project activities are carefully documented. Data will be collected on the key performance indicators and results of the monitoring and evaluation survey will be used to implement changes to the project, if necessary and for future reference in the development of similar projects. Annual Performance Reports will be prepared and discussed with the project executing agency and the project staff. Annual Tri-partite Review meetings will be conducted to come up with specific recommendations (if necessary) to improve project impact and implementation. The project will be subject to at least one external evaluation.

69. The project team will undertake continuous, self-monitoring of project activities. They will also carefully monitor external conditions related to the critical assumptions listed in the Project Planning Matrix (Annex 2). At the outset, the project team in consultation with UNDP, SIRIM, and other concerned stakeholders will prepare detailed and measurable performance indicators for the overall project. These performance indicators will be assessed

every six months. The indicators will apply no only to project activities, but also progress made in the implementation of the pilot plants and other potential sites.

70. Based on the overall project objectives and these performance indicators, quarterly workplans will be prepared. These will indicate how the quarter's activities contribute to the overall objectives. Performance indicators will then be prepared for each quarter. This will be used to measure performance. In addition, this monitoring will be used to continuously refine the project approach and activities.

71. This project will have close linkages with the UNDP-GEF Thailand project in order to benefit from synergies gained through sharing of lessons learned. The Thailand project "Removal of Barriers to Biomass Power Generation and Co-generation" is similar to the proposed Malaysia project in that both seek to promote the expanded use of biomass power. However, in Thailand, the targeted feedstocks are primarily rice husks and sawmill wastes whereas in Malaysia, the feedstocks are wastes from the palm oil industry covering empty fruit bunches (EFBs) and palm oil mill effluent (POME). The technologies being used are different--the Thailand effort is relying on conventional boilers only, whereas the gasification process is critical to the success of the Malaysia project. Both projects target similar informational, financial, and risk barriers. In the case of the risk barriers, both projects propose to utilize partial risk guarantees. The Thailand project will support partial risk guarantees intended to reduce risks associated with the deployment of this new technology in Thailand. The GEF funds provide 50% of the risk guarantee needs for two initial pilot plants. The project will set up a risk/credit guarantee fund to provide fuel supply risk guarantees to share and reduce the risks to the financial institutions. The risk/credit guarantee will be offered to the biomass power developers at the initial stage, combined with the renewable energy tariff incentives. These will gradually be phased out.

72. In contrast, the Malaysian project proposes partial risk guarantees worth 25% of the risk guarantee needs of 4 different greenfield pilot plants as part of the demo schemes. Based on the demo scheme's investment cost (covering both biomass and biogas from POME components), the financing institution or bank will loan money to the host company at the agreed debt-equity ratio, loan interest rate and loan tenure. The host company will raise the equity portion either from its own resources, from MESITA, commercial loans, or other fund sources. Part of the amount that is loaned from the financing institution or bank will be subject to "low" interest rate. This is the part to be attributed to the GEF as cost of removing financial barriers. The other portion of the loan will be subject to the normal interest rate that financing institution or bank would charge the borrower. The loan repayments will be used as seed money for a separate fund that will be used for assisting replication projects. The interest rate on the GEF portion of the loan could be at a low rate (say 3%) at the start, can be reduced up to 0%, depending on the performance level achieved. For example, if the expected performance is exceeded (e.g., expected payback period is quickly reached), the interest on the GEF loan portion can become 0%. Penalties will be applied if the host company (i.e., borrower) is unable to pay back the non-GEF loan money within the agreed time frame.

73. As far as possible, the opportunities to share lessons learned between the two projects will be facilitated by the UNDP-GEF. Since Thailand is the more advanced project, the ongoing results of the Thailand project feasibility study will be communicated to the Malaysia project stakeholders.

Annexes:

Annex 1: Incremental Cost

- Annex 1A IC Text
- Annex 1B IC Matrix
- Annex 1C GHG Table (2 pages)

Annex 2: Project Planning Matrix

Annex 3: STAP Review and Annex 3.1 Response to STAP Review

Annex 4: Project Schedule (Phased)

Annex 5: OFP endorsement

Annex 6: Detailed project budget

(Optional Annexes available upon request: GHG replacement calculations for demonstration sites).

ANNEX 1 A: INCREMENTAL COSTS

BROAD DEVELOPMENT GOALS

1. In line with the Fifth Fuel objectives of the Government of Malaysia (GoM), the Biomass-based Power Generation and Cogeneration Project (BPGCP) was conceived with the primary aim of developing the energy potentials of biomass resources, particularly from the Malaysian palm oil industry, to meet national development needs and environmental conservation commitments. This project seeks GEF's support to ensure that the growth rate of emissions from the fossil fuel-fired power generation is reduced through the utilization of biomass resources as fuel.

BASELINE ACTIVITIES

2. The baseline conditions for this project consist of what GoM would do without GEF support. Under this baseline, several barriers exist to grid connected biomass-based power generation and cogeneration (CHP) in Malaysia. The proposed project aims to eliminate these barriers. The palm oil mills in the country operate small CHP facilities. However, because of the excess biomass waste that they generate, they tend to operate their CHP units inefficiently. Without this project, biomass-based power generation and CHP in the palm oil industry will remain inefficient and excess biomass waste disposal will remain a problem for many palm oil millers. Currently, the combined amount of electricity produced by the palm oil mills accounts only for a very small fraction of the national electricity supply mix.

Some of the present and planned activities of the MECM/PTM, EPU, research institutions like PORIM, SIRIM and FRIM, and international agencies like DANCED are actually complementing the activities of the proposed BPGCP. Hence these activities can be integrated with those of the proposed project. In the context of the BPGCP, the activities of these government agencies are regarded as baseline activities. Such activities will possibly be implemented even without the support of a funding institution like GEF. Private sector organizations with relevant ongoing RE-related activities can also be tapped by the BPGCP, and in that regard, their activities will form part of the baseline activities of the BPGCP. The budget for such activities is considered part of BPGCP's baseline cost.

GLOBAL ENVIRONMENTAL OBJECTIVES

The global environmental objective of the BPGCP is to reduce the growth rate of GHG emissions from fossil fuel-fired power generation by removing the major barriers to the development of biomass power generation/CHP. The proposed project's main strategy is to supplant part of the fossil fuel consumption for power generation in Malaysia. The BPGCP has been designed to be consistent with GEF Operational Program #6 on "Promoting the Adoption of Renewable Energy by Removing Barriers and Reducing Implementation Costs".

GEF ALTERNATIVE

3. Various studies carried out by and for, the GoM on the utilization of biomass resources from the country's palm oil industry for energy uses have indicated that Malaysia has a potential of 365 MW power capacity from biomass-based power generation. The private sector, particularly the palm oil millers, has expressed interest in advancing the development of biomass energy projects. However, due to various barriers that exist, these enormous potentials may not be realized. Presently, the GoM is conducting studies for purposes of developing and implementing policies and policy strategies to facilitate the development and utilization of biomass energy resources for fuel purposes and make way for biomass-based power producers to sell their RE electricity to the grid. But without the removal of the other barriers through the BPGCP, the widespread replication of biomass power generation/CHP is unlikely to take place. The GEF support for the proposed initiative will be instrumental in assisting Malaysia to fully tap the energy potentials of its biomass resource.

4. The project is designed for implementation in two phases. Phase 1 will concentrate on providing for barrier removal activities that are prerequisites for enhancing commercial use of palm oil mills' waste products (both biomass and biogas) for power generation. This first Phase will address the institutional building and capacity enhancement needs, which are impediments to use of palm oil mills' waste products for power generation and co–generation. In addition to the provision of technical assistance to capacity enhancement, Phase 1 will help retrofit an existing experimental mill for biomass based grid connected power generation scheme with a supplementary POME biogas firing facility. The immediate objectives of Phase 1 are:

   (f) Design and implementation of a biomass energy technology information services and awareness enhancement program covering the energy applications of biomass and biomass-derived waste materials, particularly biogas;

   (g) Implementation of policy studies and institutional capacity building in the area of biomass energy technology development and application;

   (h) Design and implementation of financing assistance program for projects on biomass energy technology applications;

   (i) Implementation of a biomass energy technology development program.

   (j) Strengthen and expand the capacity of an existing experimental mill for grid connected power generation and POME based biogas firing (PORIM Mill).

5. Component No.1, Phase 1 of the BPGCP will address the information barriers that hinder the development and implementation of biomass-based grid connected power generation and CHP in relevant industries such as the palm oil industry. The program activities include: (1) conduct of a comprehensive biomass energy resource survey in the country; (2) design and development of a database of biomass energy technologies and technology applications; (3) conduct of training courses on biomass energy technology for PTM staff, palm oil mill

personnel, and local engineering consultants; (4) development and implementation of an enhanced and integrated information dissemination program; (5) design and development of a biomass energy technology information exchange services program; (6) capacity building for local energy consultants in providing consultancy service on biomass energy technology; and, (7) design of an environmental rating scheme based on magnitude of realizing potentials for using biomass energy. The baseline funds will amount to $597,900 and GEF increment at $412,000.

6. Component No. 2, Phase 1 will build on the existing policy studies regarding renewable energy as the Fifth Fuel for power generation, and aims to remove the institutional and price-related barriers to the development and implementation of biomass-based power generation and CHP. This project component will include the following activities: (1) review of existing policies and regulations regarding energy resource development and utilization; (2) conduct of promotional workshops on biomass energy development and utilization; (3) evaluation and formulation of policies and regulations on the production and sales of RE electricity; (4) conduct of tariff pricing study for RE electricity; (5) development of a strategy for biomass-based power producers to assist them compete in an open electricity market; (6) development of an electricity market simulation model, and the assessment of the Malaysia Power Market; and (7) monitoring and evaluation of the impacts of the enforcement of policy, pricing and regulatory measures that are recommended and implemented.

7. Component No. 3, Phase 1, will address the lack of an appropriate financing mechanism for biomass-based power generation and CHP projects. It will facilitate future financing of biomass-based power projects, and is crucial to ensure replication and sustainability of future biomass-based power generation and CHP in Malaysia. It includes activities designed to: (1) strengthen the technical capability of financial/banking institutions to evaluate financing for RE power projects; (2) encourage the implementation biomass-based power projects for financing; and, (3) establish a financing schemes to provide financing for the potential biomass-based power project proponents/developers. This component is primarily designed to contribute to the removal of the financing barriers and to facilitate future replication of biomass-based power generation and CHP in Malaysia. A total of US$ 320,000 is required to support the baseline activities. Out of this, PTM will provide US$ 30,000 in-kind contribution for office space and supplies, as the "One Stop Shop" will be housed in PTM. Incremental costs, amounting to US$ 266,000 will come from GEF. This will mainly for generating a pipeline of sustainable follow-on activities and design of the financing mechanisms for funding the replication projects.

8. In addition to the provision of technical assistance to capacity enhancement, Component 4 under Phase 1 will help an existing experimental mill in green field technology application for biomass based grid connected power generation scheme. During the implementation of phased approach of support to demonstration schemes it is logical to begin with an existing experimental unit (PORIM), for several reasons. The unit is supported by the palm oil millers' association and is already grid connected for the purposes of meeting the existing researchcentre's requirement. Therefore, part of Component 4 conducted under Phase 1 will pay for the PORIM Mill's existing experimental unit's incremental cost of $1.25 million of

undertaking the initiative through the investment bank. The funds will be paid back to the Bank at a zero interest rate, under terms to be negotiated during the project development stage.

9. Building on the experience and results of Phase 1, Phase 2 will concentrate on working with mills of higher generation capacity with no prior experience in harvesting the biogas from POME or in grid connected power generation. This phase will develop and implement demonstration schemes for power generation and CHP using both palm oil biomass and POME-derived biogas. The demonstration schemes will cover application of greenfield as well as retrofitting technologies in 3 mills. The GEF will provide a risk guarantee for up to 25% of the investment costs. The GEF funds will therefore be placed in a risk guarantee fund that will be held and managed by a Malaysian investment bank.

10. Component No. 4, Phase 2 will also address the barrier concerning the need to showcase the application of biomass-based grid connected power generation and CHP technology, and the limited biomass energy demonstration programs of the government. The program will also build on similar demonstration projects proposed by various foreign institutions for implementation in selected palm oil mills in Malaysia. Under Phase 2, four (4) demonstration schemesshowcasing biomass-based power generation and cogeneration technology will be carried out in palm oil mills with (1) and without plantations (2) and in 1 site which will be a central biomass-fired power plant. All schemes, except for the central power plant, will include supplementary gas firing using the biogas derived and recovered from POME. The successful design, engineering, construction and operation of the pilot plants will demonstrate the feasible process of developing, financing, and implementation of a biomass-based grid connected power plants in the country. It is expected to facilitate the development and implementation of future biomass-based power generation and CHP projects in Malaysia.

11. Under Component 4, GEF will fund the barrier removal cost for the demonstration schemes that will involve supplementary firing with POME-derived biogas. Without the BPGCP, the GoM will not consider the recovery and utilization of POME-derived biogas in its biomass energy development and utilization activities. This is a very important aspect of the GHG emission reduction and biomass utilization objectives of this project, which is of significant interest to GEF. This particular aspect of the biomass-based power generation and CHP demonstration scheme is an incremental activity that will be covered by GEF funds. The GEF incremental cost funding will be provided to the host demonstration companies on a contingent finance basis. This will be carried out in partnership with a local financing institution, or bank of repute, that is willing to loan the host companies part of the funds needed for the demonstration schemes at an agreed debt-equity ratio, loan tenure and interest rate.

12. The financing institution or bank will receive the GEF resources to establish a loan fund for assisting the financing of the demo schemes. Based on the demo scheme's investment cost (covering both biomass and biogas components), the financing institution or bank will loan money to the host company at the agreed debt-equity ratio, loan interest rate and loan tenure. The host company will raise the equity portion either from its own resources, from MESITA, commercial loans, or other fund sources. The GEF resources contributed to the loan fund will

be managed and loaned from the financing institution or bank at a low interest rate that is to be negotiated before the loan is disbursed (see 15 below). These GEF funds will go towards the cost of removing the project's financial barriers. The remaining portion of the project loan will be offered by the financing institution and will therefore be subject to the normal interest rate and bank charges of the financing institution The GEF loan repayments will go back into the GEF loan fund, which will be maintained as a separate fund that will be used for assisting replication projects.

13. Depending on the level of performance achieved in the biogas portion of the demonstration scheme, the low interest rate offered on the GEF portion of the loan could be reduced to as low as zero percent. For example, if the expected performance is exceeded (e.g., expected payback period is quickly reached), the interest on the GEF loan portion could possibly become zero percent. Likewise, penalties will be applied if the host company (i.e., borrower) is unable to pay back the non-GEF loan money within the pre-agreed time frame, like paying additional charges or paying higher interest on the GEF portion of the loan. The terms for both the potential penalties and bonuses will be negotiated with the host company prior to loan disbursement.

14. The financing institution or bank will get an agreed fund management fee of 1.5% for this exercise. It will also earn interest on the non-GEF portion of the loan at the going rate and possibly also on the GEF portion in case a low interest rate will be charged on it. The baseline costs of Component 4 (both Phase 1 and 2) will be $31,518,000 and the incremental cost will be $6,342,000 (including the purely incremental costs for the PORIM Mill activities and the financial barrier removal costs associated with the remaining activities under Component 4).

15. It is expected that funds sourced by the consortium that will implement the fifth demonstration scheme (Centralized biomass-based Power Plant), plus from other sources like commercial banks, MESITA, etc. will be enough to cover the investment requirement of the demo scheme. Hence, GEF funds are not required for this particular scheme.

16. The plant capacities, estimated investment costs of the five (5) demonstration schemes are as follows:

No.	Demonstration Scheme	Demo Site	Capacity, MW	Investment Cost, US$
1	Greenfields BPGCF w/Gas Firing (Mill w/ Plantation)	Sandau	5	7.60 million
2	Greenfields BPGCF w/Gas Firing (Mill w/o Plantation)	Serting	5	7.11 million
3	Retrofitted BPGCF w/Gas	PORIM	2	3.16 million

	Firing (Mill w/ Plantation)			
4	Retrofitted BPGCF w/Gas Firing (Mill w/o Plantation)	Morib	4	4.97 million
5	Central Biomass Power Plant IPP	Kwantas	8	9.21 million

Insert Excel files:
Annex1b/
Annex 1c;
Annex 2(2 pages)

ANNEX 3: STAP REVIEW AND RESPONSE

STAP REVIEW OF UNDP/GEF PROPOSAL ENTITLED:

Malaysia: Biomass-based Power Generation and Cogeneration in the Palm Oil Industry

Dr. Jayant A. Sathaye, Lawrence Berkeley National Laboratory

Summary

I am satisfied that the project brief meets all the necessary criteria, and I believe it is a well conceived project and deserves to be funded. It has a balanced mix of activities to meet the stated objectives. The use of waste products from the palm oil industry is a sound idea. It has significant global benefits. As noted in the Brief, various barriers prevent the adoption of biomass conversion technology in Malaysia. The project design is well suited to the removal of barriers noted in the Brief, since it will address technical and institutional barriers, develop information on biomass conversion for the use of the palm oil industry, and come up with an action plan for the replication and sustainability of biomass conversion. The palm-oil industry, bilateral donors, the utility companies, and several government agencies are the primary stakeholders in the project. These stakeholders will provide two-thirds of the financial support to cover the baseline cost of the project. The involvement of multiple stakeholders, the significant baseline funding, the strong support of the palm-oil industry, and the significant GHG benefits provide a strong basis for GEF incremental support for the project.

Introduction

My overall impression of the proposed project is very good. The proposed project is to develop and exploit the energy potentials of biomass waste resources in Malaysia through biomass-based power generation and combined heat and power generation (CHP). This will be achieved through the construction and operation of demonstration plants in five locations. Two of these projects (Sandau and Serting) have plantations on site, two others (PORIM and Morib) will purchase the biomass from other plantations, and the fifth one (Kwantas) will operate as an independent power producer (IPP). The projects will have a baseline funding of about $33 million, $10.7 million of which will come from the government and the remaining amount from private industry.

The main intent of the project is to remove barriers to the spread of biomass combustion technology and the sale of power to Tenaga Nasional Berhad (TNB) or other entities. As the Project Brief notes, lack of information, absence of official government policies, lack of access to financing, uncertain financial viability, and lack of successful models to demonstrate the viability of biomass-based grid connected power generation are the key barriers to be addressed by the project.

Following is a review of the Project Brief covering the items noted in the STAP Terms of Reference for technical reviews of project proposals.

Scientific and technical soundness of the project, and identification of global environmental benefits

The project as proposed is technically sound. The use of biomass waste that otherwise would have decomposed and released methane is a sound idea. The conversion of this waste to electricity would offset the generation of electricity from fossil fired plants. This has two advantages. One is that the methane that would have been generated from decomposing waste will be removed, and replaced by carbon dioxide that has a lower Global Warming Potential (GWP). Secondly, the carbon dioxide released by the use of fossil fuels in the generation of electricity would be offset. The conversion of waste to electricity therefore will benefit the global environment, and also has the potential to reduce local water pollution, and to help produce cheaper electricity. The Project Brief needs to address several issues that are noted below in order to ensure that it can meet its stated goals.

The information provided in the Brief needs to be strengthened in order to justify the analysis of global environmental benefits. On page 12, paragraph 30, of the Brief, it notes that the project would offset 124.2 KTOE of fuel, and 500 ktons of CO2 per year. The offset fuel amount is too small, by a factor of three, even if one assumes that coal would be used to generate all offset electricity. Second, the project will offset electricity in both peninsular Malaysia and in other provinces. The fuel to be offset is most likely natural gas in peninsular Malaysia, and some combination of other fuels, including diesel, in the other provinces. The carbon offset needs to be based on these realities and not on the assumed use of coal for power generation.

Project fit to GEF goals and other guidance

The project is proposed as a barriers removal project under the appropriate Operational Programme No. 6. This programme is intended to reduce barriers for projects that are presumed to be cost-effective but whose implementation is hampered by information, institutional, social, contractual, etc. barriers. In order to establish a project's cost effectiveness, an incremental cost analysis is done from a national or societal perspective. The Project Brief provides such an analysis for the demonstration projects, and estimates that the incremental cost is negative, and that barriers are the main reason that the biomass projects in Malaysia are unlikely to go ahead. Hence, the project allocates about $1.9 million for the removal of barriers to the implementation of such projects. The remaining amount, about $6 million, will be provided as contingent financing to the government. The demonstration projects will collect revenue from the sale of electricity, which will be used to pay back the loan amount.

Project replicability and sustainability

In order to ensure project replicability and sustainability a successful demonstration of both the technical and institutional aspects of the project is needed. The Brief has highlighted how a technical demonstration of the project will be performed. It needs to provide more information on the institutional aspects. The Brief notes that the electricity generated by the biomass projects would be sold to TNB. However, TNB is in a transition phase whereby it is soon to become only a distribution utility. The Brief thus needs to note ways by which institutional arrangements for selling power would be established in both the presence and absence of TNB. Once the Brief is approved, prior to project implementation, the Project Document needs to include a contract with TNB, and/or other buyers, to demonstrate the institutional feasibility of the project.

In addition to the above, the Brief needs to include an activity for the development of an action plan that would detail ways by which the project demonstrations would be translated into a broader set of similar activities nationwide, and within the region. This will require the involvement of all stakeholders from the very beginning of the project in order to ensure that the responsibilities and risks to all concerned are understood and accepted by them.

The demonstration projects will have to be formulated such as to ensure the transparent and ready availability of data and project results to the biomass industry, including site visits by other palm oil producers. The information will have to include both financial and technical data so that other project developers can be convinced of the viability of the project's soundness. The Brief needs to explicitly note that demonstration project owners would be willing to share such information.

Other environmental effects

Palm oil projects in Malaysia have been noted to have deleterious impacts on local water quality and biodiversity. The Project Brief needs to note its effect on these impacts, if any. At first glance, it appears that the disposal of waste through combustion would reduce water pollutant releases. The Brief makes no mention of local environmental benefits and needs to address this topic.

Involvement of stakeholders

There are several international donors and local stakeholders who are working on more efficient utilization of biomass in Malaysia. The Brief notes ways in which GEF would collaborate with the major actors. Continued cooperation in this regard will be essential in order to ensure that the baseline funding identified by the project is secure, and remains in place as the project is implemented.

RESPONSE TO STAP REVIEW

The Reviewer's comments are very positive and have some constructive suggestions for strengthening the project.

Comment (3) in particular led to correcting the GHG offset calculations. The original calculations were corrected by a factor of three in the conversion of GWh to Ktoe in the CO2-Base sheet of PalmOil-GHGRed.xls. The generation of 70553 GWh requires about 215000 GWh of input energy. That translates using the formula in cell C48 to about 18500 ktoe, and correspondingly higher CO2.

The C02 displacement were originally calculated on the assumption of coal replacement. The calculations have now been revised to reflect the expected energy mix in the power generation sector if BAU scenario is to continue to continue till 2005. Coal based power generation represents approximately 31% of the power sector energy mix. The GHG tables (Annex 1C) have been corrected to be more representative of the expected fuel mix.

Comment 4: (response not needed)

Comment 5: Reply: Reference is made to para 48 of the Project Brief which mentions the implementation of activities intended to remove barriers to the implementation of the demo schemes and their future replications. Among these are the

Drafting and recommendation of standard biomass fuel supply agreements suited for the demo schemes and future replications.

Preparation and implementation of long-term biomass supply agreements for the replication projects considering the experience derived from the demo schemes.

Preparation and implementation of standard long-term biomass fuel supply agreements that will ensure EFBs from outside sources will be available.

Drafting of standard heat/steam off-take agreements for use in the demo schemes and in the replication projects.

Drafting of a standard PPA for electricity sales to TNB for use in the demo schemes and in the replication projects.

With regard to the STAP comment on the possible need to introduce a separate activity to develop an action plan Reference is made to Annex 3 (Project Schedule), wherein specific activities have been identified to disseminate the results/experiences derived from the demo schemes, and to promote their replication

4.10. Demonstration Program Results Evaluation and Dissemination

4.11. Sustainable Follow-up Program Design

These are in addition to the continued follow-up implementation of activities in Component No. 1(Biomass Information Services and Awareness Enhancement Program). Activity 4.11 refers to the formulation of a sustainable program (action plan) for the replication projects. The preparation of the detailed action plan could either be carried out in the writing of the Project Document or be an activity of the Project.

With regard to the STAP comment regarding transparency of the project demonstration initiatives and data, Component No. 1 will address the information aspects of the project, including the development and maintenance of a biomass energy database. The intention of the program is to assist potential project proponents and developers in evaluating and designing similar projects. One of the criteria in the selection of the demo sites is the willingness of the host company to share all relevant information related to the demo schemes. Moreover, this will also be one of the criteria for companies that may apply for assistance in replicating the technologies demonstrated under the Sustainable Follow-up Program.

Comment 6:

Other environmental impacts

The Project is intended to reduce GHG emissions by supplanting fossil fuels used in power generation with biomass resources from the palm oil industry. The utilization of biomass resources also prevents the dissipation of CH4 and other GHG gases from the decomposition of unused biomass and POME. Attachment A-3 summarizes the GHG emission reduction that can be realized from each of the 5 demo schemes under the project. The following are among the environmental impacts of the Project.

- Reduction of biomass waste disposal problems in the palm oil industry,
- additional revenues for mills in selling their wastes, EFBs, fibers and shells as fuel
- avoidance of illegal palm oil waste dumping in open spaces and bodies of water
- avoidance of EFB incineration
- Utilization of POME biogas for energy purpose
- Energy efficient (less pollution) operation of power generation/CHP facilities in palm oil mills.

People from the palm oil industry and the agricultural sector have indicated that there are no adverse environmental impacts that will result in the utilization of EFB for power generation if only about 25% is utilized. The rest of EFBs in industry will be sufficient enough to meet the soil mulching needs in oil palm plantations. Moreover,

sludges that will be produced in the anaerobic decomposition of POME (for biogas recovery and use in power generation) can still be used for land applications in the plantations. EFB ashes, which are rich in potash are also utilized as fertilizer in the plantations.

Local Water and Air Quality Improvement

The empty fruit bunches do contain a small amount of oil (less than 1%). It is estimated that 50,000 tonnes of oil contaminate the soil annually. This oil can contaminate underground water through rain water if empty fruit bunches are improperly disposed. Although the effect to water catchment areas is minimum, preventive action is necessary to maintain the good quality of local water supply. The extraction of oil from EFBs is not economical at the moment.

The proposed grid connection project will encourage proper disposal of EFBs by the palm oil industry. An efficient combustion system and the turbo-generator system will minimise underground water contamination. Cleaner emissions from the burning system will also reduce the SOx and Nox, and these will reduce the formation of acid rain. Acid rain formation can cause instability to the plants.

The mitigation of air pollution through a proper and efficient combustion process can be facilitated through the proposed grid connection project. The biogas utilisation also reduces the emission of methane, a GHG.

As to the effect to the water quality improvement, the disposal of the palm oil waste to the dump site as well as to the field has been found to have at times contributed to the leach from the waste to be washed into the underground water system at areas where the water table is high.

However the major problem from the disposal of the waste is in the incineration of it at low efficiency incinerators. The Volatile Organic Acids (VOC) and the high dust particulate emission has posed to be a major air polluter for the industry. The smell of the smoke due to the high VOC's as the EFB is untreated has made the location of such industries difficult to be located close to nearby dwellings. The white flume emitted when burning it in low temperature incinerators due to the high moisture content, is the cause of concern to the DOE, in the wake of the national haze problem.

Finally the problem faced by the planters is the explosion in the population of the rhinoceros beetle which being a pest is causing damage to the palms which in turn leads to the requirement of the use of pest control chemicals, hence the increasing use of the chemicals will lead to water contamination in areas close to the water source.

The project will help address all of the above local concerns.

COMMENT 7 : PROJECT BRIEF SECTION ON STAKE HOLDER PARTICIPATION , PARA 57.

Insert:

Annex 4 – Excel worksheet.

Annex 5 – PDF file

Annex 6 – Excel worksheet

Annexes:

Annex 1: Incremental Cost

- Annex 1A IC Text
- Annex 1B IC Matrix
- Annex 1C GHG Table (2 pages)

Annex 2: Project Planning Matrix

Annex 3: STAP Review and Annex 3.1 Response to STAP Review

Annex 4: Project Schedule (Phased)

Annex 5: OFP endorsement

Annex 6: Detailed project budget

(Optional Annexes available upon request: GHG replacement calculations for demonstration sites).

ANNEX 1 A: INCREMENTAL COSTS

BROAD DEVELOPMENT GOALS

1. In line with the Fifth Fuel objectives of the Government of Malaysia (GoM), the Biomass-based Power Generation and Cogeneration Project (BPGCP) was conceived with the primary aim of developing the energy potentials of biomass resources, particularly from the Malaysian palm oil industry, to meet national development needs and environmental conservation commitments. This project seeks GEF's support to ensure that the growth rate of emissions from the fossil fuel-fired power generation is reduced through the utilization of biomass resources as fuel.

BASELINE ACTIVITIES

2. The baseline conditions for this project consist of what the GoM would do without GEF support. Under this baseline, several barriers exist to grid connected biomass-based power generation and cogeneration (CHP) in Malaysia. The proposed project aims to eliminate these barriers. The palm oil mills in the country operate small CHP facilities. However, because of the excess biomass waste that they generate, they tend to operate their CHP units inefficiently. Without this project, biomass-based power generation and CHP in the palm oil industry will remain inefficient and excess biomass waste disposal will remain a problem for many palm oil millers. Currently, the combined amount of electricity produced by the palm oil mills accounts only for a very small fraction of the national electricity supply mix.

Some of the present and planned activities of the MECM/PTM, EPU, research institutions like PORIM, SIRIM and FRIM, and international agencies like DANCED are actually complementing the activities of the proposed BPGCP. Hence these activities can be integrated with those of the proposed project. In the context of the BPGCP, the activities of these government agencies are regarded as baseline activities. Such activities will possibly be implemented even without the support of a funding institution like GEF. Private sector organizations with relevant ongoing RE-related activities can also be tapped by the BPGCP, and in that regard, their activities will form part of the baseline activities of the BPGCP. The budget for such activities is considered part of the BPGCP's baseline cost.

GLOBAL ENVIRONMENTAL OBJECTIVES

The global environmental objective of the BPGCP is to reduce the growth rate of GHG emissions from fossil fuel-fired power generation by removing the major barriers to the development of biomass power generation/CHP. The proposed project's main strategy is to supplant part of the fossil fuel consumption for power generation in Malaysia. The BPGCP has been designed to be consistent with GEF Operational Program #6 on "Promoting the Adoption of Renewable Energy by Removing Barriers and Reducing Implementation Costs".

GEF ALTERNATIVE

3. Various studies carried out by and for, the GoM on the utilization of biomass resources from the country's palm oil industry for energy uses have indicated that Malaysia has a potential of 365 MW power capacity from biomass-based power generation. The private sector, particularly the palm oil millers, has expressed interest in advancing the development of biomass energy projects. However, due to various barriers that exist, these enormous potentials may not be realized. Presently, the GoM is conducting studies for purposes of developing and implementing policies and policy strategies to facilitate the development and utilization of biomass energy resources for fuel purposes and make way for biomass-based power producers to sell their RE electricity to the grid. But without the removal of the other barriers through the BPGCP, the widespread replication of biomass power generation/CHP is unlikely to take place. The GEF support for the proposed initiative will be instrumental in assisting Malaysia to fully tap the energy potentials of its biomass resource.

4. The project is designed for implementation in two phases. Phase 1 will concentrate on providing for barrier removal activities that are prerequisites for enhancing commercial use of palm oil mills' waste products (both biomass and biogas) for power generation. This first Phase will address the institutional building and capacity enhancement needs, which are impediments to use of palm oil mills' waste products for power generation and co–generation. In addition to the provision of technical assistance to capacity enhancement, Phase 1 will help retrofit an existing experimental mill for biomass based grid connected power generation scheme with a supplementary POME biogas firing facility. The immediate objectives of Phase 1 are:

   (f) Design and implementation of a biomass energy technology information services and awareness enhancement program covering the energy applications of biomass and biomass-derived waste materials, particularly biogas;

   (g) Implementation of policy studies and institutional capacity building in the area of biomass energy technology development and application;

   (h) Design and implementation of financing assistance program for projects on biomass energy technology applications;

   (i) Implementation of a biomass energy technology development program.

   (j) Strengthen and expand the capacity of an existing experimental mill for grid connected power generation and POME based biogas firing (PORIM Mill).

5. Component No.1, Phase 1 of the BPGCP will address the information barriers that hinder the development and implementation of biomass-based grid connected power generation and CHP in relevant industries such as the palm oil industry. The program activities include: (1) conduct of a comprehensive biomass energy resource survey in the country; (2) design and development of a database of biomass energy technologies and technology applications; (3) conduct of training courses on biomass energy technology for PTM staff, palm oil mill

personnel, and local engineering consultants; (4) development and implementation of an enhanced and integrated information dissemination program; (5) design and development of a biomass energy technology information exchange services program; (6) capacity building for local energy consultants in providing consultancy service on biomass energy technology; and, (7) design of an environmental rating scheme based on magnitude of realizing potentials for using biomass energy. The baseline funds will amount to $597,900 and GEF increment at $412,000.

6. Component No. 2, Phase 1 will build on the existing policy studies regarding renewable energy as the Fifth Fuel for power generation, and aims to remove the institutional and price-related barriers to the development and implementation of biomass-based power generation and CHP. This project component will include the following activities: (1) review of existing policies and regulations regarding energy resource development and utilization; (2) conduct of promotional workshops on biomass energy development and utilization; (3) evaluation and formulation of policies and regulations on the production and sales of RE electricity; (4) conduct of tariff pricing study for RE electricity; (5) development of a strategy for biomass-based power producers to assist them compete in an open electricity market; (6) development of an electricity market simulation model, and the assessment of the Malaysia Power Market; and (7) monitoring and evaluation of the impacts of the enforcement of policy, pricing and regulatory measures that are recommended and implemented.

7. Component No. 3, Phase 1, will address the lack of an appropriate financing mechanism for biomass-based power generation and CHP projects. It will facilitate future financing of biomass-based power projects, and is crucial to ensure replication and sustainability of future biomass-based power generation and CHP in Malaysia. It includes activities designed to: (1) strengthen the technical capability of financial/banking institutions to evaluate financing for RE power projects; (2) encourage the implementation biomass-based power projects for financing; and, (3) establish a financing schemes to provide financing for the potential biomass-based power project proponents/developers. This component is primarily designed to contribute to the removal of the financing barriers and to facilitate future replication of biomass-based power generation and CHP in Malaysia. A total of US$ 320,000 is required to support the baseline activities. Out of this, PTM will provide US$ 30,000 in-kind contribution for office space and supplies, as the "One Stop Shop" will be housed in PTM. Incremental costs, amounting to US$ 266,000 will come from GEF. This will mainly for generating a pipeline of sustainable follow-on activities and design of the financing mechanisms for funding the replication projects.

8. In addition to the provision of technical assistance to capacity enhancement, Component 4 under Phase 1 will help an existing experimental mill in green field technology application for biomass based grid connected power generation scheme. During the implementation of phased approach of support to demonstration schemes it is logical to begin with an existing experimental unit (PORIM), for several reasons. The unit is supported by the palm oil millers' association and is already grid connected for the purposes of meeting the existing research centre's requirement. Therefore, part of Component 4 conducted under Phase 1 will pay for the PORIM Mill's existing experimental unit's incremental cost of $1.25 million of

undertaking the initiative through the investment bank. The funds will be paid back to the Bank at a zero interest rate, under terms to be negotiated during the project development stage.

9. Building on the experience and results of Phase 1, Phase 2 will concentrate on working with mills of higher generation capacity with no prior experience in harvesting the biogas from POME or in grid connected power generation. This phase will develop and implement demonstration schemes for power generation and CHP using both palm oil biomass and POME-derived biogas. The demonstration schemes will cover application of both greenfield as well as retrofitting technologies in 3 mills. The GEF will provide a risk guarantee for up to 25% of the investment costs. The GEF funds will therefore be placed in a risk guarantee fund that will be held and managed by a Malaysian investment bank.

10. Component No. 4, Phase 2 will also address the barrier concerning the need to showcase the application of biomass-based grid connected power generation and CHP technology, and the limited biomass energy demonstration programs of the government. The program will also build on similar demonstration projects proposed by various foreign institutions for implementation in selected palm oil mills in Malaysia. Under Phase 2, four (4) demonstration schemesshowcasing biomass-based power generation and cogeneration technology will be carried out in palm oil mills with (1) and without plantations (2) and in 1 site which will be a central biomass-fired power plant. All schemes, except for the central power plant, will include supplementary gas firing using the biogas derived and recovered from POME. The successful design, engineering, construction and operation of the pilot plants will demonstrate the feasible process of developing, financing, and implementation of a biomass-based grid connected power plants in the country. It is expected to facilitate the development and implementation of future biomass-based power generation and CHP projects in Malaysia.

11. Under Component 4, GEF will fund the barrier removal cost for the demonstration schemes that will involve supplementary firing with POME-derived biogas. Without the BPGCP, the GoM will not consider the recovery and utilization of POME-derived biogas in its biomass energy development and utilization activities. This is a very important aspect of the GHG emission reduction and biomass utilization objectives of this project, which is of significant interest to GEF. This particular aspect of the biomass-based power generation and CHP demonstration scheme is an incremental activity that will be covered by GEF funds. The GEF incremental cost funding will be provided to the host demonstration companies on a contingent finance basis. This will be carried out in partnership with a local financing institution, or bank of repute, that is willing to loan the host companies part of the funds needed for the demonstration schemes at an agreed debt-equity ratio, loan tenure and interest rate.

12. The financing institution or bank will receive the GEF resources to establish a loan fund for assisting the financing of the demo schemes. Based on the demo scheme's investment cost (covering both biomass and biogas components), the financing institution or bank will loan money to the host company at the agreed debt-equity ratio, loan interest rate and loan tenure. The host company will raise the equity portion either from its own resources, from MESITA, commercial loans, or other fund sources. The GEF resources contributed to the loan fund will

be managed and loaned from the financing institution or bank at a low interest rate that is to be negotiated before the loan is disbursed (see 15 below). These GEF funds will go towards the cost of removing the project's financial barriers. The remaining portion of the project loan will be offered by the financing institution and will therefore be subject to the normal interest rate and bank charges of the the financing institution The GEF loan repayments will go back into the GEF loan fund, which will be maintained as a separate fund that will be used for assisting replication projects.

13. Depending on the level of performance achieved in the biogas portion of the demonstration scheme, the low interest rate offered on the GEF portion of the loan could be reduced to as low as zero percent. For example, if the expected performance is exceeded (e.g., expected payback period is quickly reached), the interest on the GEF loan portion could possibly become zero percent. Likewise, penalties will be applied if the host company (i.e., borrower) is unable to pay back the non-GEF loan money within the pre-agreed time frame, like paying additional charges or paying higher interest on the GEF portion of the loan. The terms for both the potential penalties and bonuses will be negotiated with the host company prior to loan disbursement.

14. The financing institution or bank will get an agreed fund management fee of 1.5% for this exercise. It will also earn interest on the non-GEF portion of the loan at the going rate and possibly also on the GEF portion in case a low interest rate will be charged on it. The baseline costs of Component 4 (both Phase 1 and 2) will be $31,518,000 and the incremental cost will be $6,342,000 (including the purely incremental costs for the PORIM Mill activities and the financial barrier removal costs associated with the remaining activities under Component 4).

15. It is expected that funds sourced by the consortium that will implement the fifth demonstration scheme (Centralized biomass-based Power Plant), plus from other sources like commercial banks, MESITA, etc. will be enough to cover the investment requirement of the demo scheme. Hence, GEF funds are not required for this particular scheme.

16. The plant capacities, estimated investment costs of the five (5) demonstration schemes are as follows:

No.	Demonstration Scheme	Demo Site	Capacity, MW	Investment Cost, US$
1	Greenfields BPGCF w/Gas Firing (Mill w/ Plantation)	Sandau	5	7.60 million
2	Greenfields BPGCF w/Gas Firing (Mill w/o Plantation)	Serting	5	7.11 million
3	Retrofitted BPGCF w/Gas	PORIM	2	3.16 million

	Firing (Mill w/ Plantation)			
4	Retrofitted BPGCF w/Gas Firing (Mill w/o Plantation)	Morib	4	4.97 million
5	Central Biomass Power Plant IPP	Kwantas	8	9.21 million

Annex 1B

PROJECT INCREMENTAL COST MATRIX

Components	Cost	Baseline	Alternative	Incremental
1. Biomass Information Service and Awareness Enhancement Program				
Total Baseline Funds	$598,000	**Business-as-Usual Scenario:** Biomass resource data gathering by various organizations. Some RE technology R&D projects but not including biomass. Palm oil mills are utilizing part of their biomass waste for mill heat and power requirements. Information Center of PTM catering to RE technology in general.	**Proposed Scenario:** Potential biomass-based power generation/CHP projects are backed up with information materials ranging from comprehensive biomass resource inventory to biomass energy technologies website and database. Enhanced and regular biomass energy promotional activities.	**New Features:** The new features include: (1) Biomass energy resource inventory system; (2) Biomass energy technology database and website; (3) Biomass Cell at PTM Information Center; (4) Development of a RE consultancy service industry; (5) Biomass Industry Rating system.
Funds Requested from GEF	$412,000	**Domestic Benefits:** Increased awareness on RE technology, but limited biomass energy technology information exchange.	**Domestic Benefits:** Increased confidence in the viability and cost-effectiveness of biomass-based power generation and CHP. Increased awareness on biomass energy technology applications.	**Domestic Benefits:** Enhanced availability of information on biomass energy technology. Increased capacity of local engineering/consultancy firms in biomass energy technology and increased environmental awareness in biomass-related industries.
		Global Benefits: *If information is put into good use:* Potential users of biomass-based energy are interested and encouraged to consider the utilization of biomass resources to meet their energy needs, thereby contributing to the reduction in use of GHG-emitting fossil	**Global Benefits:** *If information is put into good use:* Biomass supplants part of the fuel used for fossil fuel fired power plants. GHG emission reduction from fossil fuel fired power plants and from the utilization of POME-derived biogas.	**Global Benefits:** *If information is put into good use:* Biomass-related industries will have reduced their waste disposal problems & contribute to the reduction of GHG emissions from fossil fuel fired combustion systems.
Total Funds Required	$1,010,000	**Cost: $597,900**	**Cost: $1,001,000**	**Cost: $412,000**
2. Biomass Policy Study and Institutional Capacity Building Program				
Total Baseline Funds	$394,000	**Business-as-Usual Scenario:** Malaysia's energy policy objectives (supply, utilization, environmental conservation), Fifth fuel (i.e., RE) policy, Electricity Supply Act 2000, Climate Change Initiatives, ban on open burning and waste incineration.	**Proposed Scenario:** Government policies are in place to support biomass-based grid connected power generation and other energy uses of biomass. Incentives and supporting pricing policies are provided to biomass-based power generators.	**New Features:** Clear government policy on the development, sales and utilization of RE electricity, including RE electricity pricing, pricing policy tools for developing biomass-based power generation market strategy.
Funds Requested from GEF	$299,000	**Domestic Benefits:** Increased support for the energy uses of biomass resources. Increased potentials for biomass-based power generation/CHP and reduction of waste disposal problems in palm oil mills.	**Domestic Benefits:** The economic viability of biomass-based grid connected power generation/CHP projects are improved.	**Domestic Benefits:** Serious interest in the energy uses of biomass resources is enhanced among the biomass-related industries (e.g., palm oil industry).
		Global Benefits: *If relevant policies are issued and implemented:* Potential users of biomass-based energy (e.g., palm oil mills) are encouraged to utilize their excess biomass resources to displace fossil fuel consumption and contribute to the reduction of GHG emissions.	**Global Benefits:** *If relevant policies are issued and implemented:* Potential biomass-based power generation/CHP owners/operators are encouraged to go ahead with their power generation projects, resulting to significant reduction in GHG emissions from existing conventional fuel (i.e., coal, diesel) power generation systems.	**Global Benefits:** *If relevant policies are issued and implemented:* More biomass-based power generation/CHP projects will be developed and implemented, resulting to reduction of fossil fuel usage for power generation in the country, and contributing to GHG emissions reduction in the ASEAN region.
Total Funds Required	$693,000	**Cost: $394,000**	**Cost: $693,000**	**Cost: $299,000**

Annex 1B

PROJECT INCREMENTAL COST MATRIX

Components	Cost	Baseline	Alternative	Incremental
3. Biomass Initiatives Financing Assistance Program				
Total Baseline Funds	$320,000	**Business-as-Usual Scenario:** Some of the banking/financial institutions are funding technology projects. Some include RE, waste reduction, and environment projects in their portfolio. But very few projects have been undertaken.	**Proposed Scenario:** Financing mechanisms for RE projects (e.g., biomass-based power generation/CHP) is set up and the financing/banking institutions are educated in evaluating such projects.	**New Features:** RE Fund established for provision of financial assistance to prospective biomass-based power generation/CHP project developers. Increased access to financing for biomass energy projects.
Funds Requested from GEF	$266,000	**Domestic Benefits:** Some technology projects get financial assistance from the banking/financing sector. Unfortunately, no RE projects get financed so far.	**Domestic Benefits:** The banking/financial sector will be more open to providing affordable financial assistance to potential biomass energy project developers.	**Domestic Benefits:** Interest in RE electricity generation and use is enhanced and the share of biomass-generated electricity in the power generation mix is increased.
		Global Benefits: *If the program is effectively implemented:* The banking/financial institutions become familiar and confident about financing RE projects, thereby encouraging industries to make use of RE resources. This will consequently contribute to the reduction of GHG emissions from the use of conventional fossil fuels.	**Global Benefits:** *If the program is effectively implemented:* Prospective biomass energy project developers will avail of financial assistance. More biomass-based power generation projects will be developed and implemented. Malaysian experience in this area can be replicated in other ASEAN countries thereby contributing to wider global GHG emissions reduction.	**Global Benefits:** *If the program is effectively implemented:* More biomass-based power generation/CHP projects will be developed and implemented, resulting to reduction of fossil fuel consumption for power generation in the country, and potentially in other countries in the ASEAN region that may replicate the Malaysian experience in this area.
Total Funds Required	$586,000	**Cost: $320,000**	**Cost: $586,000**	**Cost: $266,000**
4. Biomass-based Power Generation and CHP Demonstration Program				
Total Baseline Funds	$31,518,000	**Business-as-Usual Scenario:** Research and information dissemination about RE and biomass energy technologies. Some palm oil millers are willing to implement biomass-based power generation/cogen using palm oil solid biomass waste only.	**Proposed Scenario:** Biomass-based grid connected power generation/CHP technologies, including the utilization of POME-derived biogas, are showcased as demonstration schemes.	**New Features:** Demonstrationof biomass-based grid connected power generation/CHP, including the utilization of POME-derived biogas.
Funds Requested from GEF	$6,342,000	**Domestic Benefits:** Demonstration schemes showcasing the technical and economic viability of biomass-based grid connected power generation/CHP improves the confidence of project developers.	**Domestic Benefits:** Improved awareness by the biomass-related industries about biomass energy technologies particularly in the aspects of design, implementation, operation, performance and benefits.	**Domestic Benefits:** Knowledge of all aspects of actual biomass-based power generation and power sales project implementation. Energy savings and GHG reduction from demonstration projects.
		Global Benefits: *If technology applications are replicated:* Documented results of the demo schemes can influence other countries in adopting the Malaysian experience. This will result in further reduction in biomass waste disposal problems in the palm oil industry and the displacement of fossil fuels used in conventional power	**Global Benefits:** *If technology applications are replicated:* Biomass energy utilization will supplant fossil fuel consumption in the power industry, and this translates to reduced GHG reductions. Technology can be replicated by the palm oil mills in Malaysia and in other countries.	**Global Benefits:** *If technology applications are replicated:* Reduced waste disposal problems & GHG emissions reduction from fossil fuel fired power plants. Replicable demonstration schemes used as models by other biomass-related industries in Malaysia and in other countries.
Total Funds Required	$37,860,000	**Cost: $31,518,000**	**$37,860,000**	**$6,342,000**

Annex 1B

PROJECT INCREMENTAL COST MATRIX

Components	Cost	Baseline	Alternative	Incremental
5. Biomass Energy Technology Development Program				
Total Baseline Funds	$316,000	**Business-as-Usual Scenario:** R&D activities carried out by government research institutions which include both energy and non-energy uses of biomass resources.	**Proposed Scenario:** Plant scale R&D projects on all possible energy uses of biomass are implemented. Moreover, activities to improve energy utilization efficiency in palm oil mills, as well as in the local manufacture of energy efficient steam and power generation equipment are carried out.	**New Features:** Information on various energy applications of biomass resources. Energy performance evaluation of palm oil mills, and improvements in the design and manufacturing of local steam and power generation equipment.
Funds Requested from GEF	$713,000	**Domestic Benefits:** Awareness about the benefits and uses of RE and biomass energy is enhanced.	**Domestic Benefits:** Improved awareness and confidence by prospective users about the actual benefits that can be derived from various energy uses of biomass. Increased interest in the improved design and manufacture of locally made steam and power generation equipment.	**Domestic Benefits:** Increased knowledge about, and confidence on, the various options for utilizing biomass resources for energy purposes (thermal or electrical). Replication of energy efficient equipment designs and manufacturing processes.
		Global Benefits: *If extensive R&D activities are implemented:* Actual potentials of biomass energy uses are verified and made known to prospective users. This will enhance further the confidence in biomass energy technology applications.	**Global Benefits:** *If technology applications are replicated:* Biomass resources are utilized for thermal and electrical energy production not only in biomass-related industries but in other industries where possible in Malaysia and in other countries. Wider use of biomass energy promotes the energy efficient design and manufacturing of local energy equipment.	**Global Benefits:** *If technology applications are replicated:* Increased utilization of biomass energy resources. Reduced biomass waste disposal problems, and GHG emissions from fossil fuel fired combustion processes in the power sector and industries. Replicable demonstration schemes used as models by other Malaysian industries and those in other countries.
Total Funds Required	$1,029,000	**Cost: $316,000**	**Cost: $1,029,000**	**Cost: $713,000**

SUMMARY

Project Component	Baseline Cost	Alternative Cost	Incremental Cost
1. Biomass Information Service and Awareness Enhancement	$598,000	$1,010,000	$412,000
2. Biomass Policy Study and Institutional Capacity Building	$394,000	$693,000	$299,000
3. Biomass Initiatives Financing Assistance Program	$320,000	$586,000	$266,000
4. Biomass-based Power Generation and CHP	$31,518,000	$37,860,000	$6,342,000
5. Biomass Energy Technology Development Program	$316,000	$1,029,000	$713,000
TOTAL	**$33,146,000**	**$41,178,000**	**$8,032,000**

Annex 1 C: Malaysia Biomass Project: GHG Reduction (page 1)

(mainly CO_2 and CH_4 emissions but expressed in equivalent CO_2)

Case: EFB-25%, Fiber -100%, Shells - 100%, Biogas - 100%

Biomass Resources

Production

Year	EFB, Mt	Fiber, Mt	Shell, Mt	POME, Mt	Biogas, Mm3
2000	11.464	5.981	3.489	33.394	935.036
2001	11.852	6.184	3.607	34.526	966.726
2002	12.241	6.386	3.725	35.658	998.415
2003	12.629	6.589	3.844	36.789	1030.105
2004	13.018	6.792	3.962	37.921	1061.795
2005	13.406	6.995	4.080	39.053	1093.485

Utilization for Power Generation

Year	EFB, Mt	Fiber, Mt	Shell, Mt	POME, Mt	Biogas, Mm3
2000	2.866	5.981	3.489	33.394	935.036
2001	2.963	6.184	3.607	34.526	966.726
2002	3.060	6.386	3.725	35.658	998.415
2003	3.157	6.589	3.844	36.789	1030.105
2004	3.254	6.792	3.962	37.921	1061.795
2005	3.352	6.995	4.080	39.053	1093.485

Residual Biomass Resources

	EFB	Fiber	Shell	POME-biogas
	Mton	Mton	Mton	Mm3
Year	6.5 TJ/kton	11.3 TJ/kto	14.8 TJ/kto	24.22 MJ/m3
2000.000	8.598	0.000	0.000	0
2001.000	8.889	0.000	0.000	0
2002.000	9.181	0.000	0.000	0
2003.000	9.472	0.000	0.000	0
2004.000	9.763	0.000	0.000	0
2005	10.0547	0	0	0

Power Generation

Year	Power Generation, GWh					Mill Power	Excess
	ex EFB	ex Fiber	ex Shell	ex Biogas	Total	Use, GWh	Electricity
2000	318.4	1150.2	872.2	1683.1	4023.9	897.2	3126.8
2001	329.2	1189.2	901.8	1740.1	4160.3	927.6	3232.7
2002	340.0	1228.2	931.4	1797.1	4296.7	958.0	3338.7
2003	350.8	1267.1	960.9	1854.2	4433.1	988.4	3444.7
2004	361.6	1306.1	990.5	1911.2	4569.4	1018.8	3550.7
2005	372.4	1345.1	1020.0	1968.3	4705.8	1049.2	3656.6

CH4 Emissions (ex biodegradation), in equiv. CO2, kTons

Year				
2000.0	2151.6	0.0	0.0	0
2001.0	2224.5	0.0	0.0	0
2002.0	2297.4	0.0	0.0	0
2003.0	2370.3	0.0	0.0	0
2004	2443.267	0	0	0
2005	2516.188	0	0	0

CO2 Emissions from Palm Oil Industry (excluding CO2 from biomass combustion)

Year	Unused Biomass			POME	Total, ktons
	EFB	Fiber	Shell	Biogas	
2000	2151.6	0.0	0.0	657.1	2808.6
2001	2224.5	0.0	0.0	679.3	2903.8
2002	2297.4	0.0	0.0	701.6	2999.0
2003	2370.3	0.0	0.0	723.9	3094.2
2004	2443.3	0.0	0.0	746.1	3189.4
2005	2516.2	0.0	0.0	768.4	3284.6

Notes: *Equivalent CO2 values for CH4 emissions.from bio-degradation*
CO2 from biogas is accounted for
CO2 from combustion of CH4 in biogas is accounted for

CO2 Emissions Reduction

Year	X's Power Gen, GWh	CO2 Emission Reduction Displaced Fuel	Biomass Usage	Total CO2 Emiss. Red	%Reduction
2000	3126.8	1971.3	3424.5	5395.8	10.6%
2001	3232.7	2086.4	3540.6	5627.0	10.2%
2002	3338.7	2147.9	3656.7	5804.6	9.9%
2003	3444.7	2298.6	3772.7	6071.3	9.5%
2004	3550.7	2444.8	3888.8	6333.6	9.1%
2005	3656.6	2587.3	4004.9	6592.2	8.8%

Notes: *Displaced fuel - equivalent CO2 emissions based on average energy mix in power generation*
Biomass usage - equivalent CO2 values of CH4 emissions from bio-degradation

Base CO2 Emissions from Palm Oil Industry (excluding CO2 from biomass combustion)

Year	Unused Biomass EFB	Fiber	Shell	POME Biogas	Total CO2
2000	**2868.8**	**1408.0**	**1145.9**	**810.5**	**6233.2**
2001	**2966.0**	**1455.7**	**1184.8**	**838.0**	**6444.4**
2002	**3063.2**	**1503.4**	**1223.6**	**865.4**	**6655.7**
2003	**3160.5**	**1551.1**	**1262.5**	**892.9**	**6866.9**
2004	**3257.7**	**1598.8**	**1301.3**	**920.4**	**7078.2**
2005	**3354.9**	**1646.6**	**1340.1**	**947.8**	**7289.4**

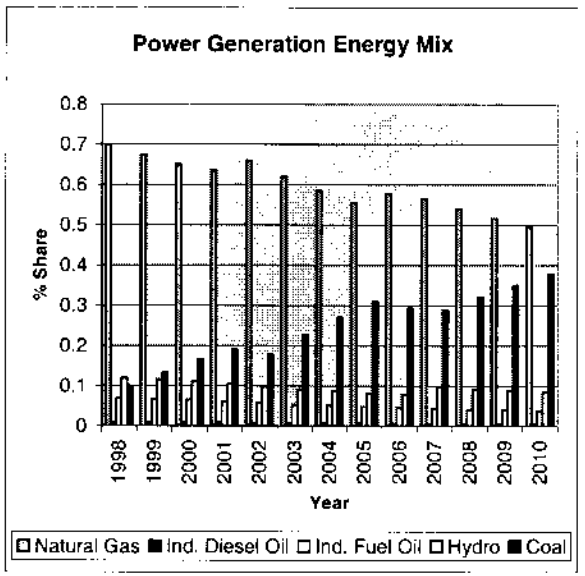
Note: Equivalent CO2 values for CH4 emissions.from bio-degradation

Base CO2 Emissions from National Electricity Generation

Year	Forecast Power Gen, GWh	CO2 emissions ktons
2000	**70553.3**	**44480.4**
2001	**75630.3**	**48812.2**
2002	**80707.2**	**51921.3**
2003	**85784.1**	**57241.9**
2004	**90861.0**	**62562.4**
2005	**95938.0**	**67883.0**

Note: Equivalent CO2 values based on average energy mix in power generation

Annex 1 C: Malaysia: Power Generation Energy Mix & Equiv. CO2 Emission Factors (page 2)



Power Generation Mix (GWh)

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Natural Gas	45833.5	45833.5	48103.3	53180.2	53180.2	53180.2	53180.2	58257.1	59991.6	59991.6	59991.6	59991.6
Ind. Diesel Oil	654.8	654.8	654.8	654.8	654.8	654.8	654.8	654.8	654.8	654.8	654.8	654.8
Ind. Fuel Oil	4583.3	4583.3	4583.3	4583.3	4583.3	4583.3	4583.3	4583.3	4583.3	4583.3	4583.3	4583.3
Hydro	7857.2	7857.2	7857.2	7857.2	7857.2	7857.2	7857.2	7857.2	10222.4	10222.4	10222.4	10222.4
Coal	6547.6	11624.5	14431.6	14431.6	19508.5	24585.4	29662.3	29662.3	30639.5	35716.4	40793.3	45870.2
	65476.4	70553.3	75630.2	80707.1	85784.0	90860.9	95937.8	101014.7	106091.6	111168.5	116245.4	121322.3

Power Generation Energy Mix

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Natural Gas	67.5%	65.0%	63.6%	65.9%	62.0%	58.5%	55.4%	57.7%	56.5%	54.0%	51.6%	49.4%
Ind. Diesel Oil	1.0%	0.9%	0.9%	0.8%	0.8%	0.7%	0.7%	0.6%	0.6%	0.6%	0.6%	0.5%
Ind. Fuel Oil	6.7%	6.5%	6.1%	5.7%	5.3%	5.0%	4.8%	4.5%	4.3%	4.1%	3.9%	3.8%
Hydro	11.6%	11.1%	10.4%	9.7%	9.2%	8.6%	8.2%	7.8%	9.6%	9.2%	8.8%	8.4%
Coal	13.2%	16.5%	19.1%	17.9%	22.7%	27.1%	30.9%	29.4%	28.9%	32.1%	35.1%	37.8%

ktons CO2 @ 33% thermal efficiency in power generation

Natural Gas	15.31 tC/T	28068.2	29458.2	32567.3	32567.3	32567.3	32567.3	35676.3	36738.5	36738.5	36738.5	36738.5
Ind. Diesel Oil	18.91 tC/T	495.3	495.3	495.3	495.3	495.3	495.3	495.3	495.3	495.3	495.3	495.3
Ind. Fuel Oil	20.37 tC/T	3734.5	3734.5	3734.5	3734.5	3734.5	3734.5	3734.5	3734.5	3734.5	3734.5	3734.5
Hydro		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Coal	26.2 tC/TJ	12182.4	15124.2	15124.2	20444.8	25765.3	31085.9	31085.9	32110.0	37430.5	42751.1	48071.6
		44480.4	48812.2	51921.3	57241.8	62562.3	67882.9	70992.0	73078.2	78398.8	83719.3	89039.9
ktons CO2/GWh		**0.630**	**0.645**	**0.643**	**0.667**	**0.689**	**0.708**	**0.703**	**0.689**	**0.705**	**0.720**	**0.734**
ktons C/GWh		**0.172**	**0.176**	**0.175**	**0.182**	**0.188**	**0.193**	**0.192**	**0.188**	**0.192**	**0.196**	**0.200**

1 GWh = 10.909 TJ

ANNEX 2

Project Planning Matrix

Project Strategy	Success Indicators	Means of Gauging Success	Assumptions
1. Development Goal			
1. The growth rate of GHG emissions from fossil fuel fired activities and from the decomposition of unused biomass waste is reduced through the removal of the major barriers to the development of biomass-based combined heat and power (CHP) projects to supplant part of the current fossil fuel use in Malaysia.	1.1.1. The GHG emissions from power generation in the country are reduced by 3.8%, by the year 2005 compared to when no interventions are implemented.	1.2.1. Documentation of annual data on fossil fuel and biomass energy utilization for power generation and industrial process heating from MECM.	1.3.1. Biomass-based power producers comply with the documentation requirements under the project.
		1.2.2. Documentation of estimates of annual GHG emissions reduction from the replacement of fossil fuel by biomass energy in power generation and industrial process heating.	1.3.2. Reports of estimates of GHG emissions reduction from various sources are consistent.
2. Project Purpose			
2. The energy potentials of unutilized biomass resources are used through biomass-based power generation or cogeneration.	2.1.1. The annual growth in installed biomass-based power generation and/or cogeneration capacity in the country is about 3.2% by the end of the 8th Malaysia Plan.	2.2.1. Documentation of the annual inventory of power generation installed capacity (particularly biomass-based systems) from MECM.	2.3.1. Compliance of power generators (e.g., TNB, IPPs) to the reporting requirement to MECM.
		2.2.1a. Documentation of the number of palm oil mills that installed new steam and power generation facilities.	
	2.1.2. About 4% of the power generation mix in the country is accounted for by palm oil biomass energy by the end of the 8th Malaysia Plan (2005).	2.2.2. Annual energy balance report from the MECM.	
3. Project Outputs			
3.1. Biomass Information Services and Awareness Enhancement Program			
3.1.1. Comprehensive Biomass Energy Resource Inventory	3.1.1.1. A comprehensive biomass resource survey accounting for at least 90% of available biomass resources completed by the 1st quarter of 2002.	3.1.1.2. Document on the biomass resource survey at PTM.	3.1.1.3. Inter-agency cooperation in the sharing of data.
3.1.2. Biomass Energy Technologies Database	3.1.2.1. Comprehensive biomass resource database completed by 1st quarter 2002, and subsequently used by researchers and investors.	3.1.2.2. Comprehensive biomass resource database installed at PTM.	3.1.2.3. This will be part of Component No. 4 of the MIEEIP.

ANNEX 2

Project Planning Matrix

Project Strategy	Success Indicators	Means of Gauging Success	Assumptions
1. Development Goal			
3.1.3. Biomass Energy Technology Training Courses	3.1.3.1. Completion of in-house biomass energy technology training course for PTM staff by June 2001.	3.1.3.2. Documentation of training course materials as well as the individual training course evaluation reports (highlighting results, trainee comments and recommendations) submitted to MECM, PTM and MOEM.	
	3.1.3.1a. Completion of 2 training courses on biomass-based power generation and CHP for palm oil mill management and banking/financing institutions by end 2001.		This is in addition to the regular training courses that are provided by PORIM to the palm oil industry.
	3.1.3.1b. Completion of a comprehensive training course on biomass energy technology, including biomass-based power generation and CHP for local engineering consultants by mid-2002.		
	3.1.3.1c. Incorporation of RE Technology in the curriculum of engineering universities by 2nd quarter 2002.	3.1.3.2a. Documentation of the relevant school curricula, as well as the lecture materials.	This in conjunction with the ongoing DANCED-financed capacity building activities in the field of RE.
	3.1.3.1d. Incorporation of RE within the science curricula of high schools and elementary schools by 2nd quarter 2002.		
3.1.4. Integrated Information Dissemination Program	3.1.4.1. Creation and operation of a Biomass Cell in the Information Center that will be set up at PTM by 3rd quarter 2001.	3.1.4.2. Documentation of the official inauguration, charter and program activities of the Information Center.	3.1.4.3. UNDP-GEF to supplement baseline activities of DANCED and PTM.
	3.1.4.1a. A minimum number of 200 satisfied customers serviced by the center by end 2001.	3.1.4.2a. Documentation of survey results conducted among customers served by the Information Center.	3.1.4.3a. DANCED and PTM to implement through ongoing related projects.
	3.1.4.1b. Information materials on biomass energy technology included in PTM website by 4th quarter 2001.	3.1.4.2b. Actual website contents and number of visits as indicated in the website.	3.1.4.3b. UNDP-GEF to supplement activities of PTM and DANCED with the provision of biomass energy technology information materials to PTM's website.

ANNEX 2

Project Planning Matrix

Project Strategy	Success Indicators	Means of Gauging Success	Assumptions
1. Development Goal			
3.1.5. Biomass Energy Technology Information Exchange Service	3.1.5.1. A fully functioning information exchange services program operated by PTM by end 2001.	3.1.5.2. Documentation on the mechanics of the information exchange services program as well as the data/information that have been circulated among the parties involve in the program.	3.1.5.3. UNDP-GEF to supplement baseline activities of PTM on this area.
	3.1.5.1a. Publication of a newsletter containing information circulated through the information exchange service (local and regional) starting 2002.	3.1.5.2a. Copies of each issue of the newsletter published by PTM/MECM and circulated throughout the country and ASEAN.	3.1.5.3a. Expansion of the present newsletter of PTM. PORIM also to contribute information.
	3.1.5.1b. Around 10 RE projects in the country are monitored by PTM starting 2002.	3.1.5.2b. Updated summary lists of RE projects in each issue of the newsletter.	
	3.1.5.1c Profiles of monitored RE projects in the country are prepared and regularly updated starting 2002.	3.1.5.2c. Project profiles published by PTM and posted in the PTM website.	
3.1.6. RE Consultancy Service Industry Development	3.1.6.1. Local consultants are providing consultancy services on biomass-based power generation and CHP starting 2002.	3.1.6.2. Documentation of services provided by local consultants.	
	3.1.6.1a. PTM accredits local consultants who completed the required training course on biomass energy technology starting mid-2002.	3.1.6.2a. List of accredited local consultants from the PTM.	3.1.6.3. Could be part of Component No. 5 of the MIEEIP. UNDP-GEF to supplement planned activities in Component No. 5 of the MIEEIP.
3.1.7. Biomass Industry Rating Program	3.1.7.1 Developed scheme for rating companies that are prospective biomass energy (primary or derived) users based on the magnitude of realizing their potentials for using biomass energy by mid-2002.	3.1.7.2. Documentation of the rating program (includes scope, rating criteria and procedures, etc.), as well as the rankings of the relevant companies.	3.1.7.3. Supporting policies for "Green Certificates" or anything of the same nature are in place by 2001.
	3.1.7.1a The ratings are considered in the overall business ranking of biomass-related entities like palm oil mills by 2003.	3.1.7.2a. Documentation of the accreditation of the rating schemes in the ranking of business establishments in Malaysia.	3.1.7.3a. The Malaysian business community regards biomass energy as an environment-friendly energy resource and supports the government's Fifth Fuel Policy.
3.2. Biomass Policy Study and Institutional Capacity Building Program			

ANNEX 2

Project Planning Matrix

Project Strategy	Success Indicators	Means of Gauging Success	Assumptions
1. Development Goal			
3.2.1. Biomass Policy Analysis	3.2.1.1. A clear government policy on the promotion, development and utilization of biomass energy for power generation by end 2001.	3.2.1.2. Documentation of the policy statement and supporting policies and regulations from the MECM.	3.2.1.3. To be covered by DANCED's Capacity Building Project (EPU, MECM, DANCED).
	3.2.1.1a. Policy study concerning the provision of financial credits to prospective biomass energy project developers completed by end 2001.	3.2.1.2a. Documentation of appropriate incentive policy recommendations.	
3.2.2. Biomass Energy Utilization Workshop Series	3.2.2.1. Annual national workshops on biomass energy promotion completed each year till 2006.	3.2.2.2. Proceedings of the individual workshops highlighting the papers presented, issues discussed, and recommendations.	3.2.2.3. Incremental activity to be implemented by UNDP-GEF.
3.2.3. Biomass-based Power Generation Market Strategy	3.2.3.1. A marketing model for biomass-based power producers and CHP operators by mid-2002.	3.2.3.2. Documentation of the marketing model from the MECM.	3.2.3.3. Open electricity market in place by 2003.
	3.2.3.1a. Terms and conditions for biomass-based power generation sales to the utility grid is completed by 2002.	3.2.3.2a. Documentation of the terms and conditions for connection to the utility grid.	
	3.2.3.1b. Policy recommendations for the granting of appropriate incentives for biomass-based power generation and CHP by start of 2002.	3.2.3.2b. Documentation of the policy recommendations.	3.2.3.3a. Considers the plan for an open electricity market. To be implemented by DANCED/EPU/MECM.
3.2.4. RE Electricity Policy Study	3.2.4.1. Approved policy and regulations on the production and sales of RE electricity by 2002.	3.2.4.2. Documentation of the policy statement and supporting policies and regulations from the MECM.	3.2.4.3. Considers the plan for an open electricity market. To be implemented by DANCED/EPU/MECM.
3.2.5. RE Electricity Pricing Study	3.2.5.1. Favorable power tariff policy for biomass-based power generation and CHP projects approved and enforced by the government by mid-2002.	3.2.5.2. Documentation of the policy statement, supporting policies and regulations, and approved tariffs from the MECM.	3.2.5.3. Proposed tariffs are implemented. To be implemented by DANCED/EPU/MECM.
3.2.6. Malaysia Power Market Simulation Model	3.2.6.1. A market simulation model that will provide guidance in power sales bidding to biomass-based power producers and CHP operators by 1st quarter 2002.	3.2.6.2. Documentation and software of the market simulation model from the MECM.	3.2.6.3. Data on existing and planned power generation and T&D systems in Malaysia, as well as electricity demand forecasts are made available. Open electricity market in place by 2003
3.2.7. RE Policy Implementation Monitoring and Evaluation.	3.2.7.1. An evaluation report on annual production and sales of RE electricity and the %share of biomass energy in the national power mix by year 2005.	3.2.7.2. Documentation of financial reports submitted by the biomass-based power producers.	3.2.7.3. Supporting policies for "Environmental Certificates" or anything of the same nature are in place by 2001.

ANNEX 2

Project Planning Matrix

Project Strategy	Success Indicators	Means of Gauging Success	Assumptions
1. Development Goal			
3.3. Biomass Initiatives Financing Assistance Program			
3.3.1. Training Course on RE Projects Financing	3.3.1.1. Two training courses conducted for: (1) private and government financial institutions; and, (2) commercial banks by 1st quarter 2002.	3.3.1.2. Documentation of training course materials as well as the individual training course evaluation reports (highlighting results, trainee comments and recommendations) submitted to MECM.	3.3.1.3. Financial/banking institutions will cooperate and the bankers association will endorse this activity.
		3.3.1.2a. No. of trainees, no. of people from the financial sector, and no. of decision makers attending the training courses.	
3.3.2. RE Fund (or Energy Business Fund) Establishment	3.3.2.1. An RE Fund established by the government by end 2001.	3.3.2.2. Documentation of the official establishment of the RE Fund.	3.3.2.3. Malaysian financial services sector recovery will continue and they will be willing to provide financing for RE projects, including biomass-based power developers.
3.3.3. Financing Schemes Mechanics	3.3.3.1. Document presenting clearly the mechanics of the RE Fund financing schemes, including the criteria for financing eligibility, by 3rd quarter 2001.	3.3.3.2. Documentation of the RE Fund including the financing mechanics, rules and regulations, eligibility criteria, etc.	3.3.3.3. To be implemented by MECM/DANCED.
3.3.4. Financing Eligibility Criteria			
3.3.5. Assistance Services to Financing Applicants	3.3.5.1. A "One Stop Shop" setup for assisting applicants for financing is established by end 2001.	3.3.5.2. Documentation of the "One Stop Shop" service including the description of the services provided, procedures, recommendations, etc.	3.3.5.3. To be implemented by MECM/DANCED.
	3.3.5.1a. Approved financial assistance applications to eligible palm oil mills from financing companies based on the financing assistance package by mid-2002.	3.3.5.2a. Documentation of approved project financing applications.	3.3.5.3a. The target number of applicants is met.
3.3.6. RE Projects Financing Assistance Program Evaluation	3.3.6.1. About 50% of palm oil millers availed of the RE Fund financing by year 2005.	3.3.6.2. Documentation of approved project financing applications.	

ANNEX 2

Project Planning Matrix

Project Strategy	Success Indicators	Means of Gauging Success	Assumptions
1. Development Goal			
	3.3.6.1a. Attractive economic and financial performance of biomass projects, whereby about 50% of investment recovered half-way through the expected payback period of each project.	3.3.6.2a. Documentation of financial reports submitted by the biomass-based power producers.	
3.4. Biomass-based Power Generation and CHP Demonstration Program			
3.4.1. Biomass-based Power Generation Demonstration Scheme Promotion	3.4.1.1. Seminar-workshop attended by major stakeholders completed 3rd quarter 2001.	3.4.1.2. Proceedings of the workshop highlighting the papers presented, issues discussed, and recommendations.	
	3.4.1.1a. About 50% of the palm oil millers applied for hosting the demonstration schemes after the workshop.	3.4.1.2a. Documentation of results of survey of companies hosting the demonstration schemes.	
3.4.2. Selection of Host Demonstration Companies	3.4.2.1. Approved set of criteria for host demonstration companies completed by end 2001.	3.4.2.2. Documentation of the selection criteria.	3.4.2.3. The demonstration schemes are: 2 sites (mills w/ and w/o plantations) w/ new power generation/CHP facilities w/ supplemental POME-biogas firing; 2 sites (mills w/ and w/o plantations) w/ retrofitted power generation/CHP facilities w/ supplemental POME-biogas firing; and 1 site operating a centralized power plant/CHP facility as an IPP.
	3.4.2.1a. Evaluated all potential demonstration sites and selected five (5) companies for the demonstration schemes by 1st quarter 2002.	3.4.2.2a. Documentation of the site evaluation reports and the final selection of 5 host demonstration companies.	
	3.4.2.1b. MOAs signed with five host demonstration companies by 2nd quarter 2002.	3.4.2.2b. Signed MOAs between MECM and the five host demonstration companies.	
3.4.3. Specific Demo Scheme Implementation Barrier Removal Activities	3.4.3.1a. Verified and confirmed availability of biomass volumes to support demo schemes by end 2001.	3.4.3.2a. Documentation of biomass surveys in the demo sites (including in the mills that will supply EFB to the demo sites.	3.4.3.3a. Palm oil mills that will supply the EFBs are already identified and have prior agreement/interest in supplying EFB to the demo sites.
	3.4.3.1b. Long term biomass supply agreements for the demo plants are approved/signed by each host company and relevant palm oil mills supplying EFBs by end 1st quarter 2002.	3.4.3.2b. Documentation of standard biomass fuel supply agreement and the signed long term supply agreements between the host companies and EFB suppliers.	

ANNEX 2

Project Planning Matrix

Project Strategy	Success Indicators	Means of Gauging Success	Assumptions
1. Development Goal			
	3.4.3.1c. Standard heat/steam off-take and electricity purchase agreements are prepared and approved by relevant parties (i.e., TNB, host company, EFB suppliers) by end 2nd quarter 2002	3.4.3.2c. Documentation of standard heat/steam off-take, and electricity purchase agreements.	
	3.4.3.1d. Financing assistance mechanism for the demo schemes for financing investment involved in POME-biogas recovery and use is set-up and implemented by end 2nd quarter 2002.	3.4.3.2d. Documentation of the GEF financial assistance arrangement with a local bank (fund manager).	
	3.4.3.1e. Favorable purchase price of RE electricity produced from demo plants is confirmed and PPAs between TNB and host companies are secured by end 2002.	3.4.3.2e. Documentation of the signed PPAs between TNB and the host companies.	
3.4.4. Baseline Data Establishment for Demonstration Sites	3.4.4.1. Energy audits conducted at the five sites and baseline performance data established by 3rd quarter 2002.	3.4.4.2. Energy audit reports highlighting the baseline steam and power generation performance as well as the expected performance of the new or retrofitted biomass-based power generation or CHP unit.	3.4.4.3. Could be part of Component No. 2 of the MIEEIP. Other institutions involved are: DANCED, MECM, TNB, and host company.
	3.4.4.1a. Operating performance targets for the planned biomass-based power generation/CHP facilities are defined by end 3rd quarter 2002.	3.4.4.2a. Documentation of agreed performance targets and the procedures for monitoring and evaluating the actual operating performance.	3.4.4.3a. All parties involved agreed on the performance targets as well as the procedures that will be used and who will carry out the evaluation.
3.4.5. Installation and Implementation Designs/Plans for the Demonstration Schemes	3.4.5.1. Power plant (new and retrofit) basic design completed by Oct 2002. *Note: This is for sites where no previous designs have been proposed.*	3.4.5.2. Documentations of the approved basic engineering designs.	3.4.5.3. To be implemented by DANCED, MECM, TNB and host company (I.e., its own engineering staff or hired consultants/contractors).
	3.4.5.1a. Comprehensive technical and economic feasibility evaluations completed by Dec 2002. *Note: This is for sites where no previous feasibility studies have been done.*	3.4.5.2a. Documentations of the completed and reviewed technical and economic feasibility reports.	

ANNEX 2

Project Planning Matrix

Project Strategy	Success Indicators	Means of Gauging Success	Assumptions
1. Development Goal			
	3.4.5.1b. Detailed engineering designs completed and approved by 1st quarter 2003. *For the other sites which already have basic engineering design and feasibility evaluations - completion by mid-2002.*	3.4.5.2b. Documentations of the approved detailed engineering designs and equipment specifications..	
3.4.6. Financial Assistance Arrangements for Demonstration Sites	3.4.6.1. Approved financial assistance applications from financing companies based on the financing assistance package by end 2002.	3.4.6.2. Documentations of the approved financial assistance packages.	3.4.6.3. To be implemented by ASEAN-EU Cogen, MTDC, BIT, RE Fund and host company.
	3.4.6.1a. Equipment procurement and delivery at sight completed by 3rd quarter 2003. *For other sites - completion by end 2002.*	3.4.6.2a. Documentations of the equipment supply proposals, bids, approved bids, procurement, shipment, delivery and acceptance.	
3.4.7. Hardware Installation and Operation for each Demonstration Scheme	3.4.7.1. Civil engineering and support facilities construction completed by end 2003. *For other sites - 3rd quarter 2002.*	3.4.7.2. Documentations of the civil engineering designs and support facilities. Actual inspection and inspection report of erected facilities.	3.4.7.3. To be implemented by DANCED, MECM, TNB and host company (i.e., its own engineering staff and consultants/contractors).
	3.4.7.1a. Installation and commissioning of demonstration facilities by 1st quarter 2004. *For other sites - mid-2003.*	3.4.7.2a. Actual inspection and documentations of inspection reports, as well as the commissioning reports.	
	3.4.7.1b. Technical assistance provided to host demonstration sites during start-up of the facilities.	3.4.7.2b. Documentation of technical services provided during start-up and initial operations of facilities.	
3.4.8. Monitoring and Evaluation of each Demonstration Scheme	3.4.8.1. An evaluation report for each demonstration site highlighting the operating and economic performances by end 2005.	3.4.8.2. Documentation of each technical and economic performance evaluation report submitted to MECM.	
	3.4.8.1a. Attractive economic and financial performance of biomass projects, whereby about a third of the investment recovered by year 2005.		

ANNEX 2

Project Planning Matrix

Project Strategy	Success Indicators	Means of Gauging Success	Assumptions
1. Development Goal			
3.4.9. Review of the Biomass-based grid connected Power Generation and CHP policy	3.4.9.1. Revised policy and implementing guidelines covering pricing, incentives, etc. about biomass-based grid connected power generation & CHP issued and enforced by end 2005.	3.4.9.2. Documentation of the revised policy and implementing guidelines.	3.4.9.3. All demonstration schemes are implemented and monitored.
3.4.10. Demonstration Program Results Evaluation and Dissemination	3.4.10.1. A national workshop presenting the results of the demonstration program completed by mid-2006.	3.4.10.2. Proceedings of the workshop highlighting the papers presented, issues discussed, and recommendations.	
	3.4.10.1a. Successful operation of the demonstration schemes by end 2006.	3.4.10.2a. Documentation of each technical and economic performance evaluation report submitted to MECM.	
	3.4.10.1b. Increased installed capacity of biomass-based power and CHP systems in the country bringing up the total to 553 MW by mid-2006.	3.4.10.2b. Documentation of installed biomass-based power and CHP systems in the country at MECM.	
3.4.11. Sustainable Follow-up Program Design	3.4.11.1. Financing scheme is in place for supporting the follow up program by 3rd quarter 2006.	3.4.11.2. Project documents submitted to the MECM.	3.4.11.3. Sufficient biomass resources exist for large-scale development of biomass power. Long-term biomass supply contracts can be obtained and the attractiveness of biomass as fuel not undermined by cheap fossil fuels.
			3.4.11.3a. PTM, SIRIM, MESITA to be tapped to supplement available funds by 2006.
3.5. Biomass Energy Technology Development Program			
3.5.1. Assessment of Other Energy-and Non-Energy Uses of Palm Oil Industry Biomass Waste	3.5.1.1. Individual evaluation reports and project recommendations for each potential energy-related uses of palm oil biomass completed and submitted to the MECM by end 2002.	3.5.1.2. Documentation of each evaluation report submitted to MECM.	3.5.1.3. Palm oil millers are interested in other alternative uses of palm oil biomass waste, either for energy or non-energy purposes.
3.5.2. Evaluation of Energy Utilization Performance of Palm Oil Mills	3.5.2.1. Energy audit reports highlighting detailed findings and improvement recommendations, completed and	3.5.2.2. Energy audit reports submitted to the MECM.	3.5.2.3. Palm oil industry possibly considered in Component 2 of the MIEEIP (Other Industry Sectors).

ANNEX 2

Project Planning Matrix

Project Strategy	Success Indicators	Means of Gauging Success	Assumptions
1. Development Goal			
3.5.3. Potential Improvements CHP Design and Operations in Palm Oil Mills	submitted to the MECM by end 2002.		DANCED and PTM to carry out energy audits.
3.5.4. Skills Upgrading for Palm Oil Mill Power Plant Engineers & Operators.	3.5.4.1. Completion of 2 comprehensive training courses on biomass-based power generation and CHP for palm oil mill staff by end 2001. *(Same as Item 3.1.3.b.)*	3.5.4.2. Documentation of training course materials as well as the individual training course evaluation reports (highlighting results, trainee comments and recommendations) submitted to MECM.	3.5.4.3. Training course designed for subsequent certification of palm oil mill power plant engineers by the NIOSH.
	3.5.4.1a. Power plant engineers of palm oil mills are certified to operate high pressure, high voltage power and CHP systems by 2002.	3.5.4.2a. Certification documents from NIOSH.	
3.5.5. Assessment of Capabilities of Local Steam and Power Generation Equipment Manufacturers	3.5.5.1. Completion and submission of assessment reports highlighting findings and recommendations to MECM by mid-2002.	3.5.5.2. Documentation of each assessment report submitted to MECM.	3.5.5.5. Local steam and power generation equipment manufacturers could be covered under Component No. 7 of the MIEEIP.
3.5.6. Performance Evaluation of Locally Produced Steam & Power Generation Equipment	3.5.6.1. Completion and submission of assessment reports highlighting findings and recommendations to MECM by 3rd quarter 2002.	3.5.6.2. Documentation of each assessment report submitted to MECM.	
3.5.7. Potential Improvements and New Designs for Locally Produced Steam and Power Generation Equipment	3.5.7.1. Completion and submission of assessment reports highlighting findings and recommendations to MECM by end 2002.	3.5.7.2. Documentation of each assessment report submitted to MECM.	
3.5.8. Training Course of High Efficiency Equipment Designs and Production Technologies	3.5.8.1. Completion of comprehensive training courses on high efficiency design and production of steam and power generation equipment by 1st quarter 2003.	3.5.8.2. Documentation of training course materials as well as the individual training course evaluation reports (highlighting results, trainee comments and recommendations) submitted to MECM.	3.5.8.3. UNDP-GEF to supplement activities of Component No. 7 of the MIEEIP.
3.5.9. Financial Assistance to Local Steam and Power Generation Equipment Manufacturers	3.5.9.1. Qualified local steam and power generation equipment manufactures avail of the financial assistance provided under Component No. 7 of the MIEIP by 2004.	3.5.9.2. Documentation of financing assistance provided to eligible local equipment manufacturers.	

ANNEX 2

Project Planning Matrix

Project Strategy	Success Indicators	Means of Gauging Success	Assumptions
1. Development Goal			
3.5.10. Sustainable Biomass Energy R&D Program	3.5.10.1. By mid-2006, biomass-based power generators express support to a proposed biomass R&D program supporting the RE Fund.	3.5.10.2. MOA signed between biomass-based power generators and MECM regarding financial support for the biomass R&D program.	3.5.10.3. Successful demonstration schemes and profitable biomass-based power generation business.
	3.5.10.1a. Biomass-based power generators start contributing to the RE Fund by end 2006.	3.5.10.2a. Documentation of the contributions made by the biomass-based power generators.	

ANNEX 3: STAP REVIEW AND RESPONSE

STAP REVIEW OF UNDP/GEF PROPOSAL ENTITLED:

Malaysia: Biomass-based Power Generation and Cogeneration in the Palm Oil Industry

Dr. Jayant A. Sathaye, Lawrence Berkeley National Laboratory

Summary

I am satisfied that the project brief meets all the necessary criteria, and I believe it is a well conceived project and deserves to be funded. It has a balanced mix of activities to meet the stated objectives. The use of waste products from the palm oil industry is a sound idea. It has significant global benefits. As noted in the Brief, various barriers prevent the adoption of biomass conversion technology in Malaysia. The project design is well suited to the removal of barriers noted in the Brief, since it will address technical and institutional barriers, develop information on biomass conversion for the use of the palm oil industry, and come up with an action plan for the replication and sustainability of biomass conversion. The palm-oil industry, bilateral donors, the utility companies, and several government agencies are the primary stakeholders in the project. These stakeholders will provide two-thirds of the financial support to cover the baseline cost of the project. The involvement of multiple stakeholders, the significant baseline funding, the strong support of the palm-oil industry, and the significant GHG benefits provide a strong basis for GEF incremental support for the project.

Introduction

My overall impression of the proposed project is very good. The proposed project is to develop and exploit the energy potentials of biomass waste resources in Malaysia through biomass-based power generation and combined heat and power generation (CHP). This will be achieved through the construction and operation of demonstration plants in five locations. Two of these projects (Sandau and Serting) have plantations on site, two others (PORIM and Morib) will purchase the biomass from other plantations, and the fifth one (Kwantas) will operate as an independent power producer (IPP). The projects will have a baseline funding of about $33 million, $10.7 million of which will come from the government and the remaining amount from private industry.

The main intent of the project is to remove barriers to the spread of biomass combustion technology and the sale of power to Tenaga Nasional Berhad (TNB) or other entities. As the Project Brief notes, lack of information, absence of official government policies, lack of access to financing, uncertain financial viability, and lack of successful models to demonstrate the viability of biomass-based grid connected power generation are the key barriers to be addressed by the project.

Following is a review of the Project Brief covering the items noted in the STAP Terms of Reference for technical reviews of project proposals.

Scientific and technical soundness of the project, and identification of global environmental benefits

The project as proposed is technically sound. The use of biomass waste that otherwise would have decomposed and released methane is a sound idea. The conversion of this waste to electricity would offset the generation of electricity from fossil fired plants. This has two advantages. One is that the methane that would have been generated from decomposing waste will be removed, and replaced by carbon dioxide that has a lower Global Warming Potential (GWP). Secondly, the carbon dioxide released by the use of fossil fuels in the generation of electricity would be offset. The conversion of waste to electricity therefore will benefit the global environment, and also has the potential to reduce local water pollution, and to help produce cheaper electricity. The Project Brief needs to address several issues that are noted below in order to ensure that it can meet its stated goals.

The information provided in the Brief needs to be strengthened in order to justify the analysis of global environmental benefits. On page 12, paragraph 30, of the Brief, it notes that the project would offset 124.2 kTOE of fuel, and 500 ktons of CO2 per year. The offset fuel amount is too small, by a factor of three, even if one assumes that coal would be used to generate all offset electricity. Second, the project will offset electricity in both peninsular Malaysia and in other provinces. The fuel to be offset is most likely natural gas in peninsular Malaysia, and some combination of other fuels, including diesel, in the other provinces. The carbon offset needs to be based on these realities and not on the assumed use of coal for power generation.

Project fit to GEF goals and other guidance

The project is proposed as a barriers removal project under the appropriate Operational Programme No. 6. This programme is intended to reduce barriers for projects that are presumed to be cost-effective but whose implementation is hampered by information, institutional, social, contractual, etc. barriers. In order to establish a project's cost effectiveness, an incremental cost analysis is done from a national or societal perspective. The Project Brief provides such an analysis for the demonstration projects, and estimates that the incremental cost is negative, and that barriers are the main reason that the biomass projects in Malaysia are unlikely to go ahead. Hence, the project allocates about $1.9 million for the removal of barriers to the implementation of such projects. The remaining amount, about $6 million, will be provided as contingent financing to the government. The demonstration projects will collect revenue from the sale of electricity, which will be used to pay back the loan amount.

Project replicability and sustainability

In order to ensure project replicability and sustainability a successful demonstration of both the technical and institutional aspects of the project is needed. The Brief has highlighted how a technical demonstration of the project will be performed. It needs to provide more information on the institutional aspects. The Brief notes that the electricity generated by the biomass projects would be sold to TNB. However, TNB is in a transition phase whereby it is soon to become only a distribution utility. The Brief thus needs to note ways by which institutional arrangements for selling power would be established in both the presence and absence of TNB. Once the Brief is approved, prior to project implementation, the Project Document needs to include a contract with TNB, and/or other buyers, to demonstrate the institutional feasibility of the project.

In addition to the above, the Brief needs to include an activity for the development of an action plan that would detail ways by which the project demonstrations would be translated into a broader set of similar activities nationwide, and within the region. This will require the involvement of all stakeholders from the very beginning of the project in order to ensure that the responsibilities and risks to all concerned are understood and accepted by them.

The demonstration projects will have to be formulated such as to ensure the transparent and ready availability of data and project results to the biomass industry, including site visits by other palm oil producers. The information will have to include both financial and technical data so that other project developers can be convinced of the viability of the project's soundness. The Brief needs to explicitly note that demonstration project owners would be willing to share such information.

Other environmental effects

Palm oil projects in Malaysia have been noted to have deleterious impacts on local water quality and biodiversity. The Project Brief needs to note its effect on these impacts, if any. At first glance, it appears that the disposal of waste through combustion would reduce water pollutant releases. The Brief makes no mention of local environmental benefits and needs to address this topic.

Involvement of stakeholders

There are several international donors and local stakeholders who are working on more efficient utilization of biomass in Malaysia. The Brief notes ways in which GEF would collaborate with the major actors. Continued cooperation in this regard will be essential in order to ensure that the baseline funding identified by the project is secure, and remains in place as the project is implemented.

RESPONSE TO STAP REVIEW

The Reviewer's comments are very positive and have some constructive suggestions for strengthening the project.

Comment (3) in particular led to correcting the GHG offset calculations. The original calculations were corrected by a factor of three in the conversion of GWh to Ktoe in the CO2-Base sheet of PalmOil-GHGRed.xls. The generation of 70553 GWh requires about 215000 GWh of input energy. That translates using the formula in cell C48 to about 18500 ktoe, and correspondingly higher CO2.

The C02 displacement were originally calculated on the assumption of coal replacement. The calculations have now been revised to reflect the expected energy mix in the power generation sector if BAU scenario is to continue to continue till 2005. Coal based power generation represents approximately 31% of the power sector energy mix. The GHG tables (Annex 1C) have been corrected to be more representative of the expected fuel mix.

Comment 4: (response not needed)

Comment 5: Reply: Reference is made to para 48 of the Project Brief which mentions the implementation of activities intended to remove barriers to the implementation of the demo schemes and their future replications. Among these are the

Drafting and recommendation of standard biomass fuel supply agreements suited for the demo schemes and future replications.

Preparation and implementation of long-term biomass supply agreements for the replication projects considering the experience derived from the demo schemes.

Preparation and implementation of standard long-term biomass fuel supply agreements that will ensure EFBs from outside sources will be available.

Drafting of standard heat/steam off-take agreements for use in the demo schemes and in the replication projects.

Drafting of a standard PPA for electricity sales to TNB for use in the demo schemes and in the replication projects.

With regard to the STAP comment on the possible need to introduce a separate activity to develop an action plan Reference is made to Annex 3 (Project Schedule), wherein specific activities have been identified to disseminate the results/experiences derived from the demo schemes, and to promote their replication

4.10. Demonstration Program Results Evaluation and Dissemination

4.11. Sustainable Follow-up Program Design

These are in addition to the continued follow-up implementation of activities in Component No. 1(Biomass Information Services and Awareness Enhancement Program). Activity 4.11 refers to the formulation of a sustainable program (action plan) for the replication projects. The preparation of the detailed action plan could either be carried out in the writing of the Project Document or be an activity of the Project.

With regard to the STAP comment regarding transparency of the project demonstration initiatives and data, Component No. 1 will address the information aspects of the project, including the development and maintenance of a biomass energy database. The intention of the program is to assist potential project proponents and developers in evaluating and designing similar projects. One of the criteria in the selection of the demo sites is the willingness of the host company to share all relevant information related to the demo schemes. Moreover, this will also be one of the criteria for companies that may apply for assistance in replicating the technologies demonstrated under the Sustainable Follow-up Program.

Comment 6:

Other environmental impacts:

The Project is intended to reduce GHG emissions by supplanting fossil fuels used in power generation with biomass resources from the palm oil industry. The utilization of biomass resources also prevents the dissipation of CH4 and other GHG gases from the decomposition of unused biomass and POME. Attachment A-3 summarizes the GHG emission reduction that can be realized from each of the 5 demo schemes under the project. The following are among the environmental impacts of the Project.

- Reduction of biomass waste disposal problems in the palm oil industry;
- additional revenues for mills in selling their waste EFBs, fibers and shells as fuel
- avoidance of illegal palm oil waste dumping in open spaces and bodies of water
- avoidance of EFB incineration
- Utilization of POME biogas for energy purpose
- Energy efficient (less pollution) operation of power generation/CHP facilities in palm oil mills.

People from the palm oil industry and the agricultural sector have indicated that there are no adverse environmental impacts that will result in the utilization of EFB for power generation if only about 25% is utilized. The rest of the EFBs in industry will be sufficient enough to meet the soil mulching needs in oil palm plantations. Moreover,

sludges that will be produced in the anaerobic decomposition of POME (for biogas recovery and use in power generation) can still be used for land applications in the plantations. EFB ashes, which are rich in potash are also utilized as fertilizer in the plantations.

Local Water and Air Quality Improvement

The empty fruit bunches do contain a small amount of oil (less than 1%). It is estimated that 50,000 tonnes of oil contaminate the soil annually. This oil can contaminate underground water through rain water if empty fruit bunches are improperly disposed. Although the effect to water catchment areas is minimum, preventive action is necessary to maintain the good quality of local water supply. The extraction of oil from EFBs is not economical at the moment.

The proposed grid connection project will encourage proper disposal of EFBs by the palm oil industry. An efficient combustion system and the turbo-generator system will minimise underground water contamination. Cleaner emissions from the burning system will also reduce the SOx and Nox, and these will reduce the formation of acid rain. Acid rain formation can cause instability to the plants.

The mitigation of air pollution through a proper and efficient combustion process can be facilitated through the proposed grid connection project. The biogas utilisation also reduces the emission of methane, a GHG.

As to the effect to the water quality improvement, the disposal of the palm oil waste to the dump site as well as to the field has been found to have at times contributed to the leach from the waste to be washed into the underground water system at areas where the water table is high.

However the major problem from the disposal of the waste is in the incineration of it at low efficiency incinerators. The Volatile Organic Acids (VOC) and the high dust particulate emission has posed to be a major air polluter for the industry. The smell of the smoke due to the high VOC's as the EFB is untreated has made the location of such industries difficult to be located close to nearby dwellings. The white flume emitted when burning it in low temperature incinerators due to the high moisture content, is the cause of concern to the DOE, in the wake of the national haze problem.

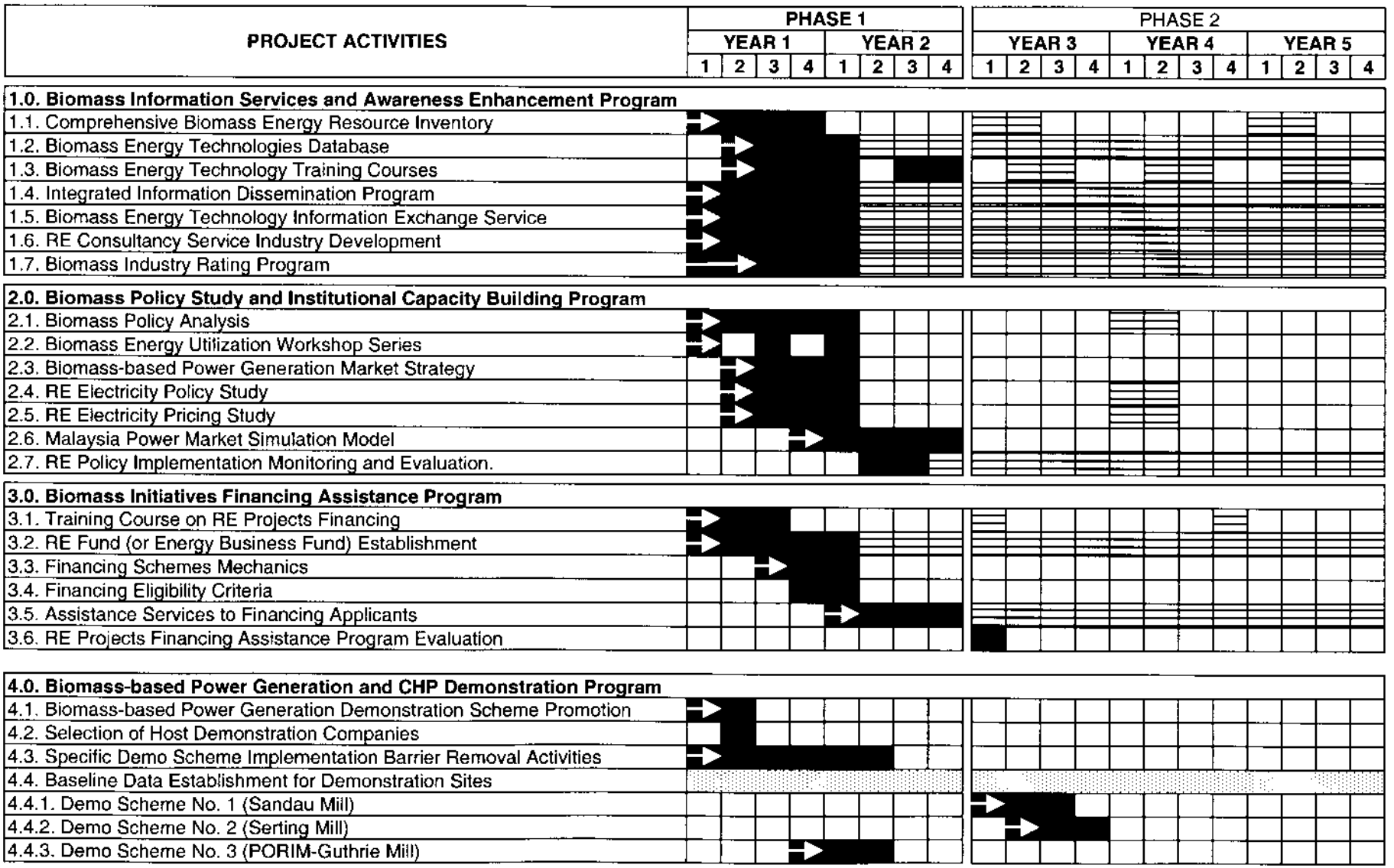
Finally the problem faced by the planters is the explosion in the population of the rhinoceros beetle which being a pest is causing damage to the palms which in turn leads to the requirement of the use of pest control chemicals, hence the increasing use of the chemicals will lead to water contamination in areas close to the water source.

The project will help address all of the above local concerns.

COMMENT 7 : PROJECT BRIEF SECTION ON STAKE HOLDER PARTICIPATION, PARA 57.

ANNEX 4

Project Schedule



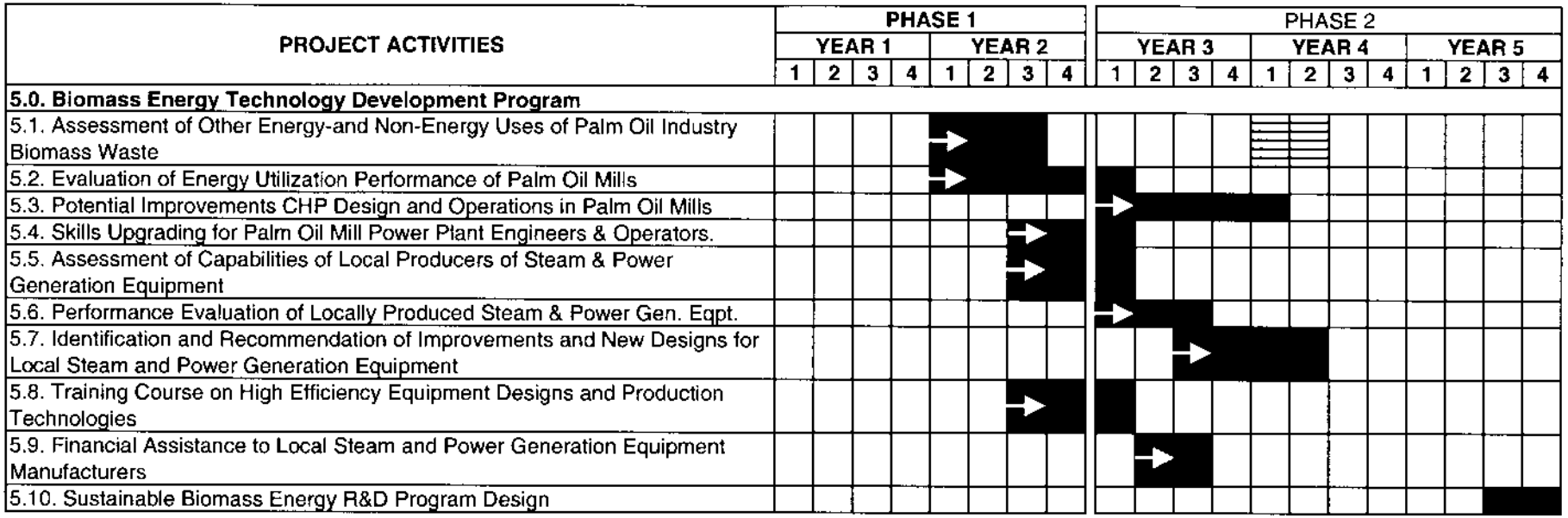
ANNEX 4

Project Schedule

PROJECT ACTIVITIES	PHASE 1								PHASE 2											
	YEAR 1				YEAR 2				YEAR 3				YEAR 4				YEAR 5			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
4.4.4. Demo Scheme No. 4 (Morib Mill)																				
4.4.5. Demo Scheme No. 5 (Kwantas Mill)																				
4.5. Installation and Implementation Designs/Plans for the Demo Schemes																				
4.5.1. Demo Scheme No. 1 (Sandau Mill)																				
4.5.2. Demo Scheme No. 2 (Serting Mill)																				
4.5.3. Demo Scheme No. 3 (PORIM-Guthrie Mill)																				
4.5.4. Demo Scheme No. 4 (Morib Mill)																				
4.5.5. Demo Scheme No. 5 (Kwantas Mill)																				
4.6. Financial Assistance Arrangements for Demonstration Sites																				
4.7. Hardware Installation and Operation for each Demonstration Scheme																				
4.7.1. Demo Scheme No. 1 (Sandau Mill)																				
4.7.2. Demo Scheme No. 2 (Serting Mill)																				
4.7.3. Demo Scheme No. 3 (PORIM-Guthrie Mill)																				
4.7.4. Demo Scheme No. 4 (Morib Mill)																				
4.7.5. Demo Scheme No. 5 (Kwantas Mill)																				
4.8. Monitoring and Evaluation of each Demonstration Scheme																				
4.9. Review of Biomass-based grid connected Power Generation policy																				
4.10. Demonstration Program Results Evaluation and Dissemination																				
4.11. Sustainable Follow-up Program Design																				

ANNEX 4

Project Schedule



MINISTRY OF SCIENCE, TECHNOLOGY
AND THE ENVIRONMENT, MALAYSIA,
14TH FLOOR, WISMA SIME DARBY,
JALAN RAJA LAUT,
50662 KUALA LUMPUR,
MALAYSIA

Telefon: 2938955
Telex: MOSTEC MA 28154
Telefax: 603-2936006

Our Ref:

Your Ref KSTAS(S)[illegible]

Date: P001/003(30)
5 January 2001

REC'D 5 JAN 2001	
RR	✓
DRR	
ADMIN.	
FINANCE	
OPN. SVC	
PROG. 1	✓
PROG. 2	
PROG. 3	
MAL/00/G41	

Mr. Philips Young
Resident Representative
United Nations Development Programme
Wisma UN, Blok C
Komplek Pejabat Damansara
Jalan Dungun
Damansara Heights
50490 Kuala Lumpur

Dear Sir,

PROJECT BRIEF
Malaysia: Biomass-based Power Generation and Cogeneration in the Palm Oil Industry (Project duration- 01 June 2001-31 May 2006)

I have the honour to refer to the proposal from Ministry of Energy, Communications and Multimedia to forward the project brief on the above matter for GEF support.

I am pleased to inform you that the Ministry of Science, Technology and the Environment, as the GEF national operational focal point hereby in principle endorses the said proposal for GEF support.

The project's main objective is to reduce the emission of greenhouse gases from fossil fuel as well as through the utilisation of the abundant biomass waste in the country's palm oil industry. We, therefore hope that the proposal will receive favourable consideration since it will contribute to the international efforts in reducing global warming.

Thank you

Yours sincerely

(NASARUDDIN CHE ABU)
For Secretary General
Ministry of Science, Technology and the Environment.

Annex 6: Detailed Project Budget

Project Budget Schedule

COMPONENT No. 1

Contributor	Year 1		Year 2		Year 3		Year 4		Year 5		Total	Total	TOTAL
	Cash	In-Kind	Cash	In-Kind	Cash	In-Kind	Cash	In-Kind	Cash	In-Kind	Cash	In-Kind	
Gov't of Malaysia	166630	252360	51270	77640	0	0	0	0	0	0	217900	330000	547900
Private Sector	0	38240	0	11760	0	0	0	0	0	0	0	50000	50000
GEF	315060	0	96940	0	0	0	0	0	0	0	412000	0	412000
TOTAL	**481690**	**290600**	**148210**	**89400**	**0**	**0**	**0**	**0**	**0**	**0**	**629900**	**380000**	**1009900**

COMPONENT No. 2

Contributor	Year 1		Year 2		Year 3		Year 4		Year 5		Total	Total	TOTAL
	Cash	In-Kind	Cash	In-Kind	Cash	In-Kind	Cash	In-Kind	Cash	In-Kind	Cash	In-Kind	
Gov't of Malaysia	23700	120910	16300	83140	0	0	0	0	0	0	40000	204050	244050
Private Sector	0	88890	0	61110	0	0	0	0	0	0	0	150000	150000
GEF	177190	0	121810	0	0	0	0	0	0	0	299000	0	299000
TOTAL	**200890**	**209800**	**138110**	**144250**	**0**	**0**	**0**	**0**	**0**	**0**	**339000**	**354050**	**693050**

COMPONENT No. 3

Contributor	Year 1		Year 2		Year 3		Year 4		Year 5		Total	Total	TOTAL
	Cash	In-Kind	Cash	In-Kind	Cash	In-Kind	Cash	In-Kind	Cash	In-Kind	Cash	In-Kind	
Gov't of Malaysia	6670	94440	5330	75560	0	0	0	0	0	0	12000	170000	182000
Private Sector	0	76890	0	61520	0	0	0	0	0	0	0	138410	138410
GEF	147780	0	118220	0	0	0	0	0	0	0	266000	0	266000
TOTAL	**154450**	**171330**	**123550**	**137080**	**0**	**0**	**0**	**0**	**0**	**0**	**278000**	**308410**	**586410**

COMPONENT No. 4

Contributor	Year 1		Year 2		Year 3		Year 4		Year 5		Total	Total	TOTAL
	Cash	In-Kind	Cash	In-Kind	Cash	In-Kind	Cash	In-Kind	Cash	In-Kind	Cash	In-Kind	
Gov't of Malaysia	888410	13330	1887870	28340	3331540	50010	2109970	31670	1110510	16660	9328300	140010	9468310
Private Sector	2080880	19040	4421860	40470	7803290	71430	4942080	45240	2601100	23810	21849210	199990	22049200
GEF	47120	0	2695000	0	2997500	0	468600	0	133780	0	6342000	0	6342000
TOTAL	**3016410**	**32370**	**9004730**	**68810**	**14132330**	**121440**	**7520650**	**76910**	**3845390**	**40470**	**37519510**	**340000**	**37859510**

COMPONENT No. 5

Contributor	Year 1		Year 2		Year 3		Year 4		Year 5		Total	Total	TOTAL
	Cash	In-Kind	Cash	In-Kind	Cash	In-Kind	Cash	In-Kind	Cash	In-Kind	Cash	In-Kind	
Gov't of Malaysia	0	0	35460	69100	40910	68180	8190	13640	5450	9090	90010	150010	240020
Private Sector	0	0	15760	14230	18180	16420	3640	3280	2420	2190	40000	36120	76120
GEF	0	0	280880	0	324090	0	64820	0	43210	0	713000	0	713000
TOTAL	**0**	**0**	**332100**	**73330**	**383180**	**84600**	**76650**	**16920**	**51080**	**11280**	**843010**	**186130**	**1029140**

OVERALL PROJECT

Contributor	Phase 1		Phase 2		Total	Total	GRAND	%Share
	Cash	In-Kind	Cash	In-Kind	Cash	In-Kind	TOTAL	
Gov't of Malaysia	3081640	804820	6606570	189250	9688210	994070	10682280	26%
Private Sector	6518500	412150	15370710	162370	21889210	574520	22463730	55%
GEF	4000000	0	4032000	0	8032000	0	8032000	20%
TOTAL	**13600140**	**1216970**	**26009280**	**351620**	**39609420**	**1568590**	**41178010**	100%