Hartalega
sdn bhd (75398-K)

UNFCCC Secretariat
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Germany

Attn: CDM Executive Board

Your ref.:	Our ref.:	Date:
CDM Ref. 1186	EB-RFR-KML01	10th October 2007

Subject: **Response to request for review**
Biomass thermal energy plant – Hartalega Sdn.Bhd, Malaysia

Dear Members of the CDM executive Board,

We refer to the request for review raised by three Board members on 27th September 2007 concerning our request for registration of project activity 1186 entitled "Biomass thermal energy plant – Hartalega Sdn.Bhd, Malaysia" and would like to provide the attached reply and support documents to clarify each point.

We trust that this complementary information will be useful to clarify the various points raised by the Board members. In the meantime we remain at your disposal for further clarifications if required.

Yours truly,

Kuan Mun Leong

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List of attachments:

SD_1a_1: Gas cost comparison
SD_1a_2: Capital cost comparison gas boiler/diesel oil boiler
SD_1a_3: Evolution of PKS cost
SD_1a_4: PIPOC 2006 article from Lafarge
SD_1a_5: Reference list of Vyncke
SD_1a_6: Vyncke proposal
SD_1a_7: Contract between Hartalega and Vyncke
SD_1a_8: Proof of downpayment to Vyncke
SD_1a_9: Example of Director Resolution
SD_1a_10: Example of Director Resolution
SD_1a_11: Gas historic
SD_1a_12: Capital cost comparison between steam boiler and thermal oil heaters
SD_1a_13: Certificate of end of boiler erection
SD_1a_14: Boilers 1 and 2 certification of commissioning
SD_1a_15: Cerificate boiler 3 end of erection
SD_1c_1: Capital cost comparison between gas biomass boiler and biomass boiler
SD_1c_2: Layout
SD_1d_1: Operational challenges
SD_1d_2: Contract between Hartalega and Vyncke for supply of boiler 3
SD_1d_3: Vyncke’s declaration of plant capacity
SD_1d_4: Information from Supermax about their biomass boiler
SD_1d_5: Reference list of MECHMAR
SD_1e_1: EFB plants in the CDM pipeline
SD_1e_2: Info sheet about TSH by EC-Cogen
SD_1e_3: Letter from Bank Hong Leong
SD_2_1: Vyncke’s opinion about gas boiler lifetime
SD_2_2: MECHMAR’s opinion about gas boiler lifetime

1 The PP shall further demonstrate the additionality of the project activity:
a. The work of Phase1 of the project activity began in February 2002 before the Board of Directors for Hartalega considered CDM revenues as important to improve the viability of the project as was demonstrated through a " Directors' Circular Resolution" regarding the project which was dated of 28 January 2002. Hence the starting date is prior to CDM consideration and the project would be business as usual project.

Information on CDM consideration by project participant

CDM consideration has been the main driver for this project activity development and success. Several combining factors explain that carbon credits were required for the implementation and long-term operation of the project activity:

1) **The project site has access to natural gas, a very competitive source of energy compared to conventional biomass such as wood waste and shells / mesocarp fibers (palm oil residues)**

   In Malaysia, the market for biomass boilers is limited by the fierce competition of heavily subsidized natural gas which ranks amongst the cheapest in the world (world average natural gas price basing on quoted 2006 figures is 139% higher than Malaysia subsidized natural gas price (See SD_1a_1). For example just across the border, gas energy costs in Singapore is 32.3 RM/GJ compared to 13.9 RM/GJ in Malaysia (see SD_1a_2, pages 7 & 8).
   In the years 2000, the benefit for an industry to switch from fossil fuel to biomass was attractive only when fuel oil was the baseline scenario. Indeed fuel oil cost per GJ is 2.438 time the cost of gas (natural gas: 13.96 RM/GJ; LFO: 34.03 RM/GJ; see SD_1a_2). Nowadays this statement is less obvious because of the rapidly rising biomass cost which recently changed the situation drastically. It leads to projects to switch back to natural gas when available (the expansion of the gas distribution network is ongoing). CDM incentives create leakage issues for boiler operating on shells from the palm oil industry (shells costs have raised from 32RM/ton in 2002 to 120 RM/ton at this present date (see SD_1a_3), doubling in the past 12 months only!). This point has been publicly presented by the group Lafarge in the PIPOC presentation [1]on 30/08/2007 in Kuala Lumpur. The project activity consisting of fuel switch has been severely reverted to fossil fuel under the pressure of sharp price increase of shells in Malaysia.
   In 2001, Hartalega had decided to implement a switch from fuel oil to natural gas which is the baseline applied for the project activity, excluding biomass boilers as an alternative solution (non-viable).

[1] Reference document: SD_1a_4: Palm Kernel Shell (PKS) is more than biomass for alternative fuel after 2005, by Mohammad Dit; page 283, section 3.4.2

2) **Hartalega uses more capital intensive thermal oil heaters instead of conventional steam boilers**

   Another barrier arises from the production process of Hartalega which requires thermal oil instead of steam as heating media. It implies the use thermal oil heaters instead of conventional steam boilers. Because such heaters work at low pressure, the heat exchanger (thermal oil coil) is substantially bigger and leads to an investment 2.89 time bigger than a conventional steam boiler (see SD_1a_12).

3) **Empty Fruit Bunch (EFB), a biomass residues without application, was selected as fuel for its wide availability despite its bad fuel characteristics**

   At that time, one supplier (Vyncke) was promoting a new biomass boiler concept capable of burning empty fruit bunch which has poor fuel characteristics but is widely available (unused waste from palm oil mills) and affordable as its price is mainly conditioned by its preparation (shredding) and transport costs.
   However severe technical challenges, leading to additional costs and operational issues, needed to be solved in order to demonstrate the feasibility of this concept. No other biomass boiler manufacturers had the technology in 2002 to burn 100% EFB (and still now). With their international experience, Vyncke had been exposed already to the Clean Development Mechanism and brought forward the eligibility of their EFB biomass boiler to earn carbon credits to overcome the "barriers". Vyncke (like most technology suppliers e.g. ENCO) have been disseminating the CDM concept to their clients which is demonstrated by the fact that all their references using EFB are applying for CDM (see SD_1a_5 and SD_1e_1).
   Hartalega was the first project in Malaysia and in the world to implement the technology developed by Vyncke taking into consideration that carbon revenues will be an additional income stream available at the time of the commercial operation date.
   CDM was considered from the very beginning of the project development phase as an argument to convince the project proponent to embark into EFB biomass.

Summary of major project milestones

We confirm that CDM consideration has started earlier than the Board Resolution the date (28th January 2002), which was one of the major milestones in the project activity development. The major milestones are listed here below:

Year	Period	Milestone	Reference documents
2001	-	Fuel switch decided for all existing diesel oil boilers to natural gas which was done gradually and completed by early 2005 (the gas pipeline installation to the project site activity too longer than expected)	SD_1a_11: Chronology of gas supply
2001	Second quarter	Supplier Vyncke approaches Hartalega, promoting their new EFB concept and carbon credits. An ongoing discussion is initiated which leads to the preparation of a commercial proposal to replace the existing boilers (15 GCal/h).	
2002:	January	The supplier finalizes his specifications and commercial terms and confirms that the project is eligible as small-scale project (< 45 MW thermal) and provides an estimate of the emission reductions. The letter clearly refers to earlier meetings that took place in 2001 where carbon credits have been discussed, the ratification of Malaysia to the protocol in September 2001 and the intention of the Malaysian Government to implement the CDM mechanism.	SD_1a_6: Vyncke's letter from 20.01.2002 to Hartalega with enclosed revised proposal referring to CDM eligibility
2002	28th January	Board resolution is passed for investment in biomass thermal oil heaters (Vyncke was the only supplier of biomass thermal oil heater in Malaysia proposing EFB as fuel)	
2002	8th February	Purchasing agreement is signed with supplier	SD_1a_7: Agreement between Vyncke and Hartalega
2002	27th February	First down-payment is made to supplier to enforce the agreement	SD_1a_8: Hartalega's letter from 27.02.2002 with enclosed TT transfer proof
2002	31st May	Malaysia puts in place the institutions to process CDM	

2002	August	Start of construction works onsite	
2002	December	Completion of erection of boilers 1 and 2	SD_1a_13: Certificate of end of erection
2003	January	End of commissioning	SD_1a_14: Vyncke 1 - certificate of end of commissioning).
2003-2004	-	Commissioning was carried out using mesocarp fibers. After signing of the certificate of end of commissioning, EFB fibers were used and encountered numerous operational challenges	SD_1d_1
2004	6 October.	Vyncke admitted non-performance of boilers 1 and 2 and initiated negotiation for a 3rd unit < > Settlement reached for a 3rd unit – agreement signed dated <vynkce 2 agreement.doc>. Page 4 of the agreement provides a brief description of the settlement.	SD_1d_2: contract for boiler 3 and; SD_1d_3: email from Vyncke
2005	Third quarter	CDM expertise becomes in Malaysia and Vyncke recommends a carbon advisor to the project proponent	SD_1d_6: Vyncke's email by Jef Mestdagh dated of 13.11.2005
2006	24th February	First CDM project is registered in Malaysia	www.unfccc.int Biomass energy plant-Lumut, project reference 0249
2006	First quarter	Hartalega initiates contacts with KYOTOenergy to provide carbon advisory services that recommended to use AMS-III.E (version 08)	
2006	1st September	Agreement is signed with carbon advisor KYOTOenergy Pte Ltd	
2006	12th May	Change of applicability of methodology: the 25,000 CER CAP imposed on AMS-III.E (version 09) forced the project participant to delay the validation and submission of PDD and to switch from a small-scale project to a large scale methodology when AM0036 became available in 29th September 2006. This has delayed the submission of the project by at least a year due to the substantial	

		amount of work required by large-scale methodologies!	
2006	October	Boiler 3 (phase 1) is commissioned but not operating at rated capacity	SD_1a_15 Certification boiler 3
2006-2007	October to July	Resolution of teething problems of boiler 3	
2007	July	Completion of phase 1- boilers 1, 2 and 3 (after a long phase of technological improvements)	
2007	October	The construction of phase 2 (boiler no 4) which is the largest of the project activity, is "on hold" till CDM registration is achieved. Phase 2 will supply 18MW thermal energy to 2 new glove production plants no 4 and 5. As the productions plant no 4 is under construction and will be operation by December 2007, natural gas burners are installed instead of biomass heaters. The fuel switch will occur once CDM registration is achieved and revenues from carbon credits are being generated. **CDM registration is critical for the project participant's decision to invest further in renewable energy!**	

Director's resolution to invest in the project activity:

The common practice at Hartalega relating to confirmation of investment decisions is that a Director's Resolution is usually issued very close to agreement signing date or sometime even on the same day.
Hartalega is a medium size enterprise founded by Mr. Kuan Kam Hon, who is also the Managing Director. He is entrusted by his Board to take business decisions and to steer and manage the entire organization.
Attached are two examples of purchases of land with quantum of no less than RM 3 million where:

i. Directors resolution was issued 7 days before signing of Sales and Purchase Agreement for the 1st land (see SD_1a_9: Director's resolution signed on 14 March 2007 and S&P signed on 20 March 2007)
ii. Directors resolution was issued on the same day of signing of Sales and Purchase Agreement for the 2nd land (see SD_1a_10: Director's resolution signed on 16 November 2006 and S&P signed on 16 November 2006)

Summary

The project participant is in a worst case scenario for a fuel switch to renewable energy:

- Natural is available at the project site: low operating costs (cheap source of energy and little manpower required) and lowest capital cost
- The manufacturing process requires thermal oil heaters instead of biomass boilers (more expensive than steam boiler and very few manufacturers of biomass thermal oil heaters)
- EFB is the predominant biomass source selected for the project activity which is a first of its kind in Malaysia

1.b: As stated in the Validation report, the predominant use of biomass residues in the country is for energy purposes. Further clarification and evidences on the analysis of alternatives to the project activity are required to substantiate the selection of the project activity.

The boilers are designed to burn 100% EFB. When EFB's moisture is higher than design value, shells are added in small quantity to compensate the loss of calorific value. <u>The boilers are predominantly burning EFB as fuel</u>.

Because PKS is used in the project activity in small proportion (max. 30% for boiler 1 and 2; none for boilers 3 and to be built no 4), the methodology AM0036 requests the project proponent to determine the most plausible baseline scenario for each types and source of biomass separately. It is understood that Empty Fruit Bunch is the main fuel utilized at the project activity site.

As well we would like to clarify the <u>three different types of biomass residues generated by a palm oil mill and their uses:</u>

- Palm Kernel Shells (PKS) and Mesocarp Fibres are the two principal biomass residues being currently used as fuel in boilers. However the palm oil milling industry consumes almost all of its mesocarp fibres and at least 50% of PKS for its own energy production; therefore these are <u>not available on the market</u>. PKS excess available for the market is estimated to 30% of the total production only (see SD_1a_4: page 281, section 3.3.2[2]. Biomass boiler burning fibers and shells is the common practice in the palm oil industry and is clearly limited to that industry. Mills are usually located in very remote areas and rely on their own biomass to produce energy.
- Common biomass boilers, often based on locally available technology, are burning shells (because of its excellent fuel characteristics) eventually mixed with wood chips or small proportion of mesocarp fibers if available in the local market.
- On the contrary Empty Fruit Bunches (EFB) have no (economical) application and are left to decay in landfill, especially for mills who do not own plantations referred as " independent mills" (incineration has been banned). It is the case of Jugra Palm Oil mill that supplies EFB to the project activity. A site survey of their landfills has been performed by a third-party licensed surveyor and shows that the height of the landfill is above 5 meters as confirmed during the site visit The site has sufficient storage capacity at least for the next 10 years (as detailed in annex 3.e of PDD).

This substantiate the selection of

- B2 for the predominant biomass (EFB) which is dumped or left to decay under clearly anaerobic conditions in landfills and;
- B4 for the secondary biomass fuel (PKS) which is sold by the palm oil mills to other consumers in the market and the predominant use of the biomass residues in the region/country is for energy purposes due to its high calorific value (most being used within the palm oil industry).

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1.c Clarifications are required in relation to the investment and financial barriers. In the validation report (page 15 of 92) the DOE states that "The cost of installing and operating biomass fuelled boilers was demonstrated to be higher than that of fossil fuel boilers. The extra costs are associated with the additional manpower requirements, the need for a large storage area for the biomass and the variable price of EFB and PKS. The costs mentioned are mainly operational rather than capital costs.

In sub-step 3a, the PDD elaborates in details the "Investment & financial barriers" raised by the project proponent. The main emphasis is made on the operating risks while the capital cost has been (too) briefly mentioned at the end of this section: "At last the capital cost involved with biomass boiler is not to compare with fossil fuel boilers" (see page 16 of PDD). Therefore we would like to elaborate further on the capital cost.

A cost analysis has been performed to compare the investment cost required for phase 1 (25.6 MW thermal) of the project activity compare with package gas fired boilers with an equivalent capacity. Phase 1 being completed, accurate data are available for the comparison.

For fossil fuel boilers, the capital cost is based on the following information (see SD_1c_1):

1. Price of existing installed gas boilers (present value)
2. Price of new equipment from MechMar (recent proposal)

For the comparison, we used the highest capital cost (conservative approach) for the fossil fuel boilers.
For the biomass boilers, the information on the various components has been retrieved from the invoices and includes the biomass boilers, auxiliary equipment and building works.

Please note that the additional land cost has been omitted in this comparison despite that biomass boilers 1 and 2 occupy a land area of 7,716 sqm, compare to 512 sqm for the natural gas boilers at equivalent capacity. The biomass boilers requires fifteen time more land than gas boilers (see SD_1c_2).

We can conclude that at equivalent thermal capacity, the capital cost for a biomass boiler is at least four times larger than for fossil fuel boilers (not taking into consideration the large land area required for biomass boilers).

In addition to the increased capital costs, the project proponent has to face the large amount of staff required for the operation, maintenance, handling and transport of biomass (37 people for the first phase of the project as described at page 3 of the PDD, compared 7 people for the maintenance of gas boilers (none are required for operation of gas boilers).

1.d Both technological barriers and prevailing practices barriers analysis is generic and vague. Further demonstration is required.
In addition, there are two other large manufacturing plants in Malaysia utilizing oil palm waste for thermal energy production.

Technological barriers

We would like to complement the information given at page 17 of the PDD (and reference documents) by the attached documents reference "Chronology of operational challenges" prepared by the project proponent (see CL_1d_1) and CL-C5 prepared by the supplier. We present here below the summary of these documents:

Empty fruit bunch has poor fuel characteristics (low ash melting point, low calorific, high abrasive property, low density/entanglement, high impermeability) rendering this biomass a difficult fuel to handle and burn. If those issues were properly identified by the supplier prior design, tremendous improvements were required after implementation of the first boilers in order to solve numerous operational issues.

Despite extensive improvements made during the initial development period (2004-2006), these technical barriers have resulted in high wear and tear of equipment and a severely <u>reduced boiler capacity by as much as 30%!</u>

The effective boiler(s) capacity were finally measured as 10 GCal/h instead of the 15 GCal/h as per agreement between project owner and supplier (see CL_1d_2 and SD_1d_3). This was a major set back for both supplier and project participant.

In order to complete phase 1, a third boiler had to be constructed (see SD_1d_3 and SD_1a_15) to compensate the reduced capacity of boilers 1 & 2 that was finally in commercial operation by July 2007. See also SD_1d_2, point1: Settlement. The fist phase of the project activity has been completed with 3 years delay!

At that stage, reverting to natural gas has been seriously considered by the project proponent.

Summary of technical challenges to use EFB as fuel in a biomass boiler

Fuel characteristic	**Origin of problems**	**Design/technological issues**	**Operational issues**
Low ash melting point of EFB	Formation of soft and sticky ash in the convection section	• Accumulation of ashes inside the boiler section and dust collection system resulting in reduced draft in the combustion chamber • It limits the operating temperature of the combustion chamber→ boiler capacity is reduced	Need to monitor the under pressure in the combustion chamber to regulate the ID draft Frequent shutdown for boiler cleaning
	Formation of eutectics in the furnace section	Depot of clinkers on the refractory walls, furnace step grate and furnace ceiling	Rapid damage to refractory and step-grate
Low calorific value of EFB	Exchange surfaces and combustion loading of the chamber	Thermal oil coil and combustion chamber need to be oversized	Need to operate at higher temperature which results in faster wear and tear of equipment (however limited by ash melting point)
Low density of shredded EFB and entanglement	Feeding of biomass	Feeding/mixing systems to achieve appropriate feeding rate to maintain combustion	Operate at higher speed than design resulting in high wear and tear
High abrasive property	Erosion of material	Erosion of feeding systems, convection areas, dust removal cyclones, draft-fan, step-grate	Frequent break-down of equipment, replacement of moving floor feeding system with improved design
Impermeability property	Air distribution on the grate	Create sufficient counter-pressure to obtain a homogenous air distribution inside the combustion chamber	Need to increase the draft by increasing the speed of the draft fan which increased its erosion, but limited by the erosion of the draft fan

Prevailing practice in the glove manufacturing industry

They are over 100 glove manufacturing plants in Malaysia [3]. Only the top two Groups of companies (including their subsidiaries) Top Glove and SuperMax installed biomass boilers which illustrates well that the use of biomass is not a common practice in that industry. One major barriers that biomass is facing in the glove manufacturing industry is the "messy" perception associated with operational aspects of biomass boilers and the inherent risk of contamination of the production process which is done in a rather " clean " environment.

Additionally several **major differences** with Hartalega reinforce the additionality barriers of this project activity:

1) Hartalega's production process uses thermal oil as heating media instead of steam. To achieve a high quality product, Hartalega opted for a maximal stability of the thermal process which could be only achieved by the use of thermal oil. As well it represents less hazards than pressurized steam.

   At equivalent capacity, the investment cost for thermal oil boilers is 2.89 time higher than a steam boiler (see SD_1a_12). This comes from the greater heat exchanger required. As well very few suppliers have the experience to manufacture such "thermal oil biomass heaters".

2) The 2 other glove manufacturing groups have major differences with the project activity:
   1. Produce steam instead of thermal oil (see SD_1d_5 which is the reference list of MECHMAR steam boilers)
   2. Use mainly PKS (see SD_1d_5 which is the reference list of MECHMAR) and some wood waste, and mesocarp fibers (see SD_1D_4 which is an email from Supermax with the description of their biomass utilized: points 1&2). No EFB is being used by any other glove manufacturers!!!
   3. Had no access to natural gas at the time of the investment (see SD_1D_4 which is an email from Supermax, see point 4) thus their baseline was diesel oil (which explains why the fuel switch was attractive and possible without the CDM support in early 2000), although as explained in our reply 1.a, most are facing today the problem of biomass costs!

SUMMARY of differences	**TopGlove /Supermax**	**Hartalega**
Baseline fuel	Diesel oil	Natural gas
Project activity biomass fuel	Wood waste, PKS and mesocarp fibers	Main fuel EFB:
Heat media produced	Saturated Steam	Thermal oil and hot water
Type of technology	Steam boiler	Thermal oil heaters[4]

[3] http://www.lgm.gov.my/latex_allergy/glovemanufac.html
[4] SD_1a_7: Agreement between project proponent and supplier Vyncke (dated of 08.02.2002)

1.e Regarding the impact of the CDM registration the DOE states that it would be essentially of a financial nature while the PP has chosen the use of barriers instead of financial analysis

We deeply regret the inconvenience caused by the way the barrier analysis was presented in the PDD.

We confirm, as stated at page 15 of the PDD that the project participant has chosen to use step 3 “Barrier analysis” and will not use step 2 “Investment analysis” in compliance with the “Tool for the demonstration and assessment of additionality (version 02)”

The PDD will be amended to better describe the barrier analysis as follow:

Prevailing practice barrier *(details given in 1.d here above)*

Hartalega is the “first of its kind” in Malaysia

- First renewable energy plant in commercial operation predominantly using EFB
- First and (still) only EFB biomass thermal oil heaters in commercial operation

Technological barriers *(details given in point 1.d here above)*

The use of empty fruit bunch as renewable source of energy was new and required tremendous technological developments.
The technology was not available in Malaysia and has been sourced from Belgium.
The project proponent and supplier faced serious risk of technical failure which has in fact resulted in a 30% under-performance of the plant and the need to construct an additional boiler to make good.
Some subsequent projects, e.g. TSH Bio-Energy, failed to burn predominantly EFB and reverted back to a mix of fibers/shells/EFB.

Investment barrier

In addition to the details given in point 1.c here above, the investment barrier is confirmed by the fact that all the other EFB plants are applying for CDM (see SD_1e_1: CDM pipeline for EFB projects) or have benefited from grants (cfr SD_1e_2: Press release from EC-Cogen and TSH-Bio Power).

Because of the high risk perceived by the financial institutions to invest in biomass technology, phase 1 has been financed entirely by the project proponent. Negotiations with Hong Leong bank are ongoing for the financing of phase 2. As stated in SD_1e_3 (Hong Leong Bank’s comments), the decision to grant the loan will be based on the capability of the project to cover its obligations. The CDM registration and additional revenues from carbon credits are a strong guarantee towards the bank

<u>Income from carbon credits will alleviate the project's barriers and render the biomass project activity attractive compare to natural gas scenario.</u>

2. The required documentation on the typical average technical lifetime of boilers in the country/sector should be provided.

There is not study available to confirm the lifetime of gas fired thermal oil heater in the glove manufacturing industry in Malaysia. If we limit this study to thermal oil heaters of similar capacity, such market study would entail an extensive market research resulting in excessive costs.

The project participant has requested opinion's from thermal oil heaters suppliers:

- VYNCKE confirms 25 to 30 years an average lifetime (see SD_2_1)
- MAXXTEC confirms 30 years lifespan (see SD_2_2)