Response to request for review
"Shri Chamundi Captive Energy Private Limited", 16MW biomass fired cogeneration plant for supply of power and steam to an industrial facility in Karnataka (CDM Ref. 1350)

Dear Members of the CDM Executive Board,

We refer to the requests for review raised by three Board members concerning the request for registration of the "Shri Chamundi Captive Energy Private Limited", 16MW biomass fired cogeneration plant for supply of power and steam to an industrial facility in Karnataka. (CDM Ref. 1350) and would like to provide an initial response to these requests for review.

Comment 1:

"The DOE is required to further justify with relevant evidences how it has validated the investment and technological barriers to demonstrate additionality."

Answer by PPs:

I. Summary of investment and technology barriers

The project activity is based on biomass boilers firing low density crop residues (mainly coconut fronds and cane trash (just the leaves, not bagasse) followed by cashew shell residues, tobacco waste, corn cobs and eucalyptus branches) as primary fuel, which are abundantly available in the region. As compared to solid fossil fuels like coal, low density crop residues have a higher alkali content, which results in increased slagging and corrosion. In order to overcome this technical challenge, a special boiler design is required, leading to higher investment and operational costs (due to lower efficiency of the plant). Furthermore, there are higher management costs and risks related to the supply chain of multiple biomass residues as compared to combustion of coal. Due to high investment costs and technology risks associated with the utilization of inhomogeneous and non-conventional fuel, it was not possible to attract equity investors other than investors with an interest in CERs. Since the beginning of the CDM development process with the CDM Gold Standard initial stakeholder consultation in December 2005, the project has not been able to reach financial closure due to lack of equity investment, which would also trigger the required debt finance portion. The project is currently waiting for CDM registration in order to conclude negotiations with potential CDM investors.

II. Validation of investment barriers

PDD statement: "Due to the pioneering aspect of the project in respect to technological innovations in handling low density crop residues as fuel for a captive power plant, it has been impossible to attract equity investors other than investors with an interest in CERs."

Available evidence:

- A certificate from Nagarajan & Co., Chartered Accountants of MPPL Renewable Energy Pvt. Ltd. has been provided to the DOE in order to confirm that the project activity has not reached financial closure, which is contingent to the project achieving CDM registration.
- Contracts and intention letters with CER buyers confirming the intention of the project promoters to raise Euro 2.5 million as advance CDM funds against delivery of CERs have been provided to the DOE confirming the interest of CER buyers to co-finance the project.

PDD statement: "JK Industries (the consumer of heat and electricity produced by the captive cogeneration plant) was not willing to take all the risks and invest in a biomass based power plant. Instead, JKI was assessing the option of implementing a coal based cogeneration plant, which would be more cost effective and less risky than a biomass based plant. For the purpose of installing a coal based cogeneration plant, JKI had already received the required coal linkage from the Government owned collieries in 2003. Later, MPPL and JK created a special purpose vehicle (74% owned by MPPL and 26% by JKI) with the purpose to build a biomass based cogeneration plant based on CDM revenues and investors. Therefore, the project would not be possible without CDM."

Available evidence:

- A copy of the coal linkage issued to JK industries has been submitted to the DOE.
- Contracts between MPPL and JKI were also provided

Further evidence to justify the existence of an investment barrier:

1. The scientific publication "CDM potential of bagasse cogeneration in India" by P. Purohit and A. Michaelowa from May 2007 states that the cumulative capacity of renewable energy systems such as bagasse cogeneration in India is far below their theoretical potential despite government subsidy programs. The study confirms that "high upfront cost, lack of easy and long-term financing, project cash flows, etc. are the known barriers to the bagasse cogeneration projects. […] An analysis of the bagasse cogeneration projects approved by the Indian DNA and registered by the EB indicates that high investment costs is the major barrier for bagasse cogeneration projects."

   Considering the technical challenges and additional costs related to low-density crop residues described in the summary of investment and technology barriers provided above, it is clear that the proposed project is even more exposed to investment barriers than bagasse based projects.

2. According to the Karnataka Renewable Energy Development Ltd. (KREDL) Nodal Agency for Renewable Energy Development in Karnataka, 50 bagasse based cogeneration projects have been sanctioned since 1998, out of which only 18 projects with a total installed capacity of 339.9 MW have been commissioned so far. The situation for biomass projects using other types of biomass for power generation, such as the proposed project activity, is even worse. Out of 65 sanctioned biomass power projects in Karnataka since 1999, only 11 projects with a total cumulative installed capacity of 81 MW have been installed[1]. It is pertinent to note that out the 11 commissioned biomass power projects, only one has been commissioned in the past two years[2].

   As summarized in the table provided in Attachment 1 to this letter, all 11 commissioned biomass projects in Karnataka using biomass residues other than bagasse are applying for CDM (6 projects registered, 5 projects under validation). Information extracted from the 11 PDDs of the commissioned biomass power projects in Karnataka shows that the additionality argumentation of four projects

[1] Source: http://kredl.kar.nic.in/ProgressReport.htm

[2] Source: http://kredl.kar.nic.in/Docs/Biomass%20-%20commissioned%20as%20on%20date.doc

are based on a financial analysis. The remaining seven projects apply the barrier test, whereas five of these seven projects claim both investment and technology barriers and the other two claim only an investment or a technology barrier. These figures support the existence of investment and technology barriers for all commissioned biomass power projects in Karnataka.

Both the scientific publication on bagasse cogeneration projects (point 1 above) and the analysis of commissioned biomass power projects in Karnataka (point 2 above) support the project specific investment barrier arguments described above, since it is evident from common practice that biomass projects are exposed to investment (and technology) barriers.

III. Validation of technology barriers

PDD statement: "The biomass residues used as primary fuel for the project activity are not typical biomass fuels normally used for energy purposes. The proposed project activity will fire low-density crop residues, which lead to technological challenges related to the combustion process (mainly due to increased slagging/corrosion problems). These technological issues require a special boiler design and special operation and maintenance procedures. The proposed project activity has significant technological risks which make it impossible to raise conventional equity without the support of CDM funds."

Available evidence:

- A written confirmation by an independent engineering & consultancy company (Ark Engineering & Consultancy) has been provided to the DOE. Ark Engineering & Consultancy confirmed that low-density crop residues have a higher alkali content, which results in increased slagging and corrosion. In order to overcome this technical challenge, a special boiler design is required (featuring generous volumetric loading of furnace, convective superheater design, generous grate area loading, over firing air system with higher secondary air pressure and wide pitching of primary/secondary superheater section), which leads to increased costs. Furthermore, it is necessary to limit the steam outlet temperature of boilers firing low density crop residues to 455/460° C in order to ensure that furnace temperatures do not exceed the reatively low ash fusion temperatures of the low density crop residues.

The technical adaptations described above, result in increased investment costs and higher risks as compared to proven technology for combustion of coal/wood. As a consequence of the lower steam outlet temperature, the cycle efficiency of the cogeneration plant is reduced, which leads to an increase in the overall operational cost (due to higher requirement of Kg Steam/KWh generated) as well as increase in fuel quantity.

Comment 2:

"Further justification is required to explain how exactly the DOE has validated that this project activity is first of its kind."

Answer by PPs:
MPPL commissioned in 2001 a 4.5 MW unit firing low-density crop residues (cane trash, coconut fronds, etc.) as primary fuel. The Boiler was a 22 TPH unit (over sizing

of around 7%, resulting in MCR of 23.5 TPH, to overcome issues of slagging/corrosion associated with firing cane trash/coconut fronds as primary fuel).

Post commissioning of MPPL's unit, there have been 10 more biomass power plants (based on agricultural residues other than bagasse) commissioned in the State of Karnataka[3]. However, as specified in the table above, all the other plants are based on firing rice husk/wood or woody biomass such as husks and stalks. None of the commissioned biomass plants, except MPPL's pilot project, uses coconut fronds and cane trash and as primary fuel, which clearly demonstrates the continuance of technological barriers related to the firing of coconut fronds/cane trash as primary fuel. This statement can be verified based on information contained in the PDDs of the commissioned biomass power plants, which are available under the links provided in the last column of the table above.

The SCCEL (Shri Chamundi Captive Energy Pvt. Ltd.) project incorporates 2 Nos 45 TPH Boilers firing cane trash/coconut fronds as primary fuel. The SCCEL project faces additional technological challenges, over that experienced by MPPL's operating 22 TPH Boiler, with respect to

- Higher capacity (45 TPH)
- Need for higher availability (to meet process steam/electricity needs of a Tyre Plant for 355 days a year)

In this context the proposed SCCEL project is a pioneering one.

Comment 3:

"Further justification is required for selecting the baseline alternatives for: (a) power (P3 & P4) and heat (H6) generation; and (b) biomass residues (B1 & B3) which should also be identified for each type of biomass used (ACM0006 v4, p5)."

Answer by PPs:
The selection of baseline alternatives for (a) power and (b) heat generation as well as for (c) the use of biomass residues is explained under section B.4 of the PDD based on the proposed procedure for selection of the most plausible baseline scenario as defined in methodology ACM0006, Version 04.

a) Selection of power generation baseline alternatives

Among the six proposed alternatives under ACM0006, alternatives P1, P3 and P4 and one additional scenario based on a new coal fired cogeneration plant have been considered and discussed under Section B.4 and B.5. P2 was not considered because the technical design of the proposed cogeneration plant is based on the technical requirements for firing low density crop residues (see explanation of technology barrier above) and specifically designed for the power and heat requirements of JKI industries. The alternatives P5 and P6 are considered to be irrelevant as baseline scenarios, since they are based on continuation of power generation in an existing power plant, fired with the same type of biomass residues as fired in the project activity, which does not apply to the project situation.

Alternative P1 (the proposed project without consideration of CDM revenues), is

[3] Source:
http://kredl.kar.nic.in/Docs/Biomass%20-%20commissioned%20as%20on%20date.doc

excluded under Section B.5 of the PDD due the existence of investment and technology barriers.

As explained in Section B.4 of the PDD, a combination of alternatives P3 and P4 reflecting the current situation, where JKI generates part of its electricity requirements through captive HFO generators and draws the balance from the electricity grid, does represent a plausible scenario because the existing HFO generators have a residual life time of at least 15 years and it does not require any investment. The current situation also allows for a certain flexibility to switch from captive HFO based electricity and grid electricity according to price fluctuations and security of supply. As compared to other alternatives with a need for investment, the current situation at JKI (combination of P3 and P4) represents the most convenient power generation scenario.

The additional power generation alternative based on a new coal fired cogeneration plant, represents a plausible baseline scenario, because it reflects the economically most attractive and less risky alternative and is in line with the plans of JKI prior to consideration of the proposed project activity (see explanation on investment barrier above).

b) Selection of heat generation baseline alternatives

Among the eight proposed alternatives under ACM0006, alternatives H1, H6 and one additional scenario based on a new coal fired cogeneration plant have been considered and discussed under Section B.4 and B.5. Alternative H2 and H5 have been excluded from further analysis due to the same above-mentioned reasons as for alternatives P2 and P5/P6 respectively. Alternatives H3 and H7 are considered to be irrelevant since there is no existing fossil fuel based cogeneration plant at the project site or nearby (there are only fossil fuel fired boilers for heat generation at the site) and no access to other sources of heat (such as district heating). Alternative H4 is excluded from further analysis since the generation of only heat using the same biomass residues as fuel instead of electricity and heat in a cogeneration plant, would represent an economically less attractive scenario than the proposed project activity. Alternative H8, based on other heat generation alternatives, such as solar thermal energy or heat pumps, is considered to be economically less attractive and technically less adequate than the proposed project due to large capacity and high temperature of heat generation required for the tyre manufacturing process at JKI.

Out of the further analyzed alternatives H1, H6 and the additional scenario based on a new coal based cogeneration plant, alternative H1 is excluded in Section B.5 of the PDD on the same basis as alternative P1 (see explanation above).

Alternative H6 represents the continuation of the existing situation, where JKI covers its process heat requirements through HFO fired boilers. This is a plausible scenario since it does not generate any additional investments for JKI (considering the fact that the existing HFO boilers have a remaining life time of at least 10 years).

Analog to the power generation baseline determination explained above, the additional heat generation alternative based on a new coal fired cogeneration plant, represents a plausible baseline scenario, because it reflects the economically most attractive and less risky alternative and is in line with the plans of JKI prior to consideration of the proposed project activity.

<u>Conclusion of power and heat baseline selection:</u>
When looking at the remaining power (P3/P4 and “coal based cogeneration”) and

heat (H6 and “coal based cogeneration”) generation alternatives, it becomes evident that the current situation (reflected by P3/P4 and H6) represents the most convenient baseline scenario for JKI since it does not require any investments. The additional coal based cogeneration scenario represents the most economical and less risky alternative due to lower investment costs, low fuel prices of coal and its supply security. Since both scenarios are plausible, the baseline option with the lowest baseline emissions is used as the most likely baseline scenario. As explained in Section B.4, the continuation of the current situation (represented by the combination P3/P4 and H6) results in lower baseline emissions and is selected as baseline scenario for calculation of emission reductions, which is conservative.

c) *Selection of biomass use baseline alternatives*

As outlined in Annex 3 of the PDD, the proposed project activity will consume low density agricultural residues, such as coconut fronds, cane trash (cane leaves normally burnt on the fields), corn cobs, eucalyptus branches (just residues, not the wood) and tobacco waste as primary fuel. Cashew shell residues, rice husk and wood chips will be used as secondary fuel. Among all these biomass residues to be used for power and heat generation by the project activity, all residues except cane trash, which is burnt on the fields (see table below), are expected to decay aerobically since the project plans to use only surplus biomass, which is not used for energy generation or other purposes.

Biomass residue type	**Baseline scenario**
Cane trash	Biomass residues are burnt on the fields
Coconut fronds	Biomass is left to decay aerobically
Corn cobs	Biomass is left to decay aerobically
Eucalyptus branches	Biomass is left to decay aerobically
Tobacco waste	Biomass is left to decay aerobically
Cashew shell residues	Biomass is left to decay aerobically
Rice husk	Biomass is left to decay aerobically
Wood chips	Biomass is left to decay aerobically

Among the eight proposed baseline alternatives for biomass use in ACM0006, Version 04, alternatives B1 (aerobic decay) and B3 (uncontrolled burning) represent the most plausible baseline alternatives for the biomass residue types mentioned above. In terms of baseline emissions, methodology ACM0006, Version 04 assumes, for both scenarios (natural decay and uncontrolled burning), that the biomass residues would be burnt in an uncontrolled manner. Hence, it is not relevant to specify (neither in the ex-ante calculation of baseline emissions nor in the ex-post calculations based on the monitoring report) which of the two alternatives B1 or B3 is the most likely baseline scenario.

Alternative B2 (anaerobic decay - in landfills for example) is excluded even though part of the residues might be disposed in nearby landfills (in theory). This decision to exclude the anaerobic decay alternative is a conscious decision by the project participants in order to avoid an overestimation of baseline emissions due to biomass decay.

Alternative B4 (biomass used for heat and/or electricity at the project site) is excluded, because it does not reflect the current situation at JK Industries.

Alternatives B5 and B6, where biomass residues would be used in existing or new power plants including cogeneration units (B5) or in existing or new boilers (B6) are possible but unlikely due to abundant availability of above mentioned biomass

residues in the region. These alternatives are subject to the leakage emission analysis to be conducted as part of the monitoring plan of the proposed project. Hence, it is not required to analyze these baseline alternatives in detail in the PDD. In case competing uses of above-mentioned biomass residues for power and/or heat generation are identified, resulting leakage effects shall be taken into account in the monitoring and verification phase of the project.

Alternative B7 (other energy purposes) is excluded because none of the above mentioned biomass residues is expected to be used for other energy purposes such as biofuels. None of them represents a typical feedstock for biofuel generation or other energy purposes.

Alternative B8 (other non-energy purposes) is also excluded because none of the above mentioned agricultural residues is used for non-energy purposes such as fertilizer or feedstock in processes (i.e. pulp and paper industry).

Comment 4:

"The PP/DOE are required to explain (in section B.7.2) how exactly each type of biomass delivered to the project site is going to be monitored according to ACM0006 v4 (p 48)."

Answer by PPs:
As per ACM0006, Version 04 and the monitoring procedures described in Section B.7 of the PDD, following monitoring parameters are linked to biomass residues delivered to the project site:

(i) biomass quantity of type *k* combusted in the plant;
(ii) moisture content of the biomass of type *k*;
(iii) average trip distance between biomass source of type *k* and plant and
(iv) average truck load for transportation of biomass of type *k*
(v) available surplus of biomass of type *k* (analysis of leakage emissions)

Among the different types of biomass residues to be used in the project activity, such as coconut fronds, cane trash, corn cobs, eucalyptus branches, tobacco waste, cashew shell residues, rice husk and wood chips, each type of biomass is generated in a different location and will be provided by a different supplier. Given the fact that biomass delivery to the cogeneration plant will occur in separate trucks for each type of biomass and that the source of biomass will be registered for each delivery (for leakage assessment purposes), above mentioned parameters will be monitored separately for each single type of biomass as outlined in Section B.7 of the PDD.

Sent on behalf of the Project Participants:

Mr. K. Krishan
Chairman
MPPL Pvt. Ltd.

and

Patrick Bürgi
Partner
South Pole Carbon Asset Management

Attachment 1

Analysis of Commissioned Biomass Power Plants in Karnataka

Source of first five columns in the table below:
http://kredl.kar.nic.in/Docs/Biomass%20-%20commissioned%20as%20on%20date.doc

Source of all other columns: UNFCCC and DOE project links (provided in the last column of the table below) and the PDDs available under these links.

Sl. No	Name of the company	Location	Installed capacity in MW	Commissio-ned date and month	Fuel used	CDM Applicaion	Reference number	Financial analysis	Investment barrier	Technological barrier	Prevailing practice	Other	Source
								Barrier					
1	Malavalli Power Plant Private Limited	C M Koppalu, Malavalli Taluk, Mandya District	4.5	19th July 2001	Low density crop residues (pioneer project by MPPL)	Yes (registered)	Project 0298	no	yes	yes	yes	yes	http://cdm.unfccc.int/Projects/DB/DNV-CUK1141812568.71/view
2	Bhagyanagar Solvents & Extractions Private Limited	Hegasanahalli, Raichur	7.5	Sep-03	Rice husk and other agro residues	Yes (validation)		no	yes	yes	yes	yes (policy related)	http://cdm.unfccc.int/Projects/Validation/DB/KTFITRCN25WBSY940PFODM56SA0JMH/view.html
3	Samsons Distilleries Limited	Duggavati, Davanagere	2	Jul-03	Biogas with co-firing of rice husk	Yes (validation)		no	yes	yes	no	no	http://cdm.unfccc.int/Projects/Validation/DB/Q2206Q35RT2IMHULITQGL2HQ3JI7A2/view.html
4	R K Power Gen Private Limited	Chikkayanahalli, Babbur Panchyat, Hiriyur Taluk, Chiytradurga District	20	Jan-04	Prosopis Juliflora, Coconut Residues, bark, eucalyptus lops & tops, ground nut husk, paddy husk, fig stalk, betel nut husk, sunflower stalks, tamarind husk	Yes (registered)	Project 0694	no	no	yes	no	yes (policy / regulatory)	http://cdm.unfccc.int/Projects/DB/DNV-CUK1160632473.69
5	Indra Power Energies Limited	Chikkajantakal, Gangavati Taluk	6	Feb-04	Rice husk and bagasse as main fuel	Yes (registered)	Project 0849	no	yes	yes	yes	yes (institutional)	http://cdm.unfccc.int/Projects/DB/DNV-CUK1168331609.32/view
6	Koppal Green Power Limited	Karatagi, Gangavati Taluk	6	Jan-05	Mainly rice husk (rice husk, paddy straw and other biomass materials such as cotton stalk, sunflower stalk, etc available in the region)	Yes (validation)		yes	no	no	yes	yes (policy)	http://www.tuvdotcom.com/pi/web/TuvdotcomIdSearchResults.xml?TUVdotCOMID=9105038744
7	Konark Power Limited	Ballarapur, Talumkur Taluk & District	6	May-05	Rice husk	Yes (registered)	Project 0914	yes	no	no	yes	yes (policy related)	http://cdm.unfccc.int/Projects/DB/TUEV-RHEIN1170156110.38/view
8	Poweronicks Limited	Shiraguppa, Shirguppa Taluk, Bellary District	6	May-05	Mainly rice husk (coconut shell, groundnut shell, rice husk, paddy straw, cotton stlaks, sunflower stalks)	Yes (validation)		yes	no	no	yes	yes (policy)	http://cdm.unfccc.int/Projects/Validation/DB/0DGSCCKRW67WVKD4OM4ZWAPST94WJQ/view.html
9	Ravi Kiran Power Project Private Limited	Gangavati Taluk, Koppal District.	7.5	Commissioned on 01.06.05	Mainly rice husk	Yes (registered)	Project 0971	no	yes	no	yes	no	http://cdm.unfccc.int/Projects/DB/DNV-CUK1172824244.43
10	Koganti Power Limited.	Yapalaparivi, Sindhanur Taluk, Raichur District.	7.5	26th November 2005	Mainly rice husk	Yes (validation)		yes	no	no	yes	yes (policy related)	http://www.tuvdotcom.com/pi/web/TuvdotcomIdSearchResults.xml?TUVdotCOMID=9105038942&LanguageSelected=en-us&strLevel=-1&strUrlId=4&strUserId=
11	Hassan Biomass Power Company Pvt. Limited.	Hassan Industrial Area, Hassan	8	2006-07	Primarily woody biomass and coconut fronds	Yes (registered)	Project 0718	no	yes	yes	yes	yes (regulatory, business competency, information component)	http://cdm.unfccc.int/Projects/DB/TUEV-RHEIN1161352456.32
	Total		**81**			**6 reg/5 val**							