Green Oil
Energy Sciences (Pvt) Ltd
HELPING HEAL THE EARTH

Request for Proposals	RFP/Digester/Phase I/03Oct2010
Component:	High Efficiency Anaerobic Digester
Project:	Phase I – 0.5 Megawatt bio-methanation based Renewable Energy Power Plant
Location:	Jaipur, Rajasthan, India (coordinates 26 41 06.78 N, 75 43 22.32 E)
RfP Due Date:	EoD Thursday 8th October 2010, Bid validity – 6 months
Last date for clarifications:	EoD Wednesday 7th October 2010. Clarifications to be addressed to **Mr S K Bhatnagar bhatnagarsubodh@gmail.com ; and Mr Anupam Jalote ajalote@greenoil.in** (addressed to both)
Send response to:	psoni@greenoil.in ; bhatnagarsubodh@gmail.com ; ajalote@greenoil.in (addressed to all three)

Project Overview:

GreenOil Energy Sciences (Pvt.) Ltd. is establishing a chain of a grid connected anaerobic digestion based power plants totalling 10 Megawatts. The first pilot plant of one megawatt is being established in two phases. Phase I, commencing now will establish a 500 kW generation facility. Phase II will follow after the satisfactory establishment of Phase I, and is expected to come up about 8 to 10 months later. Successive plants will be commissioned over the next 5 years.

One 3500 m^3 capacity digester will be constructed and two 315 kW generators will be installed in Phase I.

The input feed for Phase I will be 60 tons per day of a mixture of Fruit and Vegetable waste, cattle dung and other high energy agricultural by-products.

Caveats:

- This project is being designed with huge focus on being EROI (energy return on investment) positive, so the minimum amount of energy consumption is provided for internal processes (auxiliary power consumption). Permissible auxiliary consumption – 40 to 50 kW. Therefore utilising waste energy within the system is critical, along with the use of solar and other renewables so as to have maximum energy available for export to the Grid
- Capital expense has to be kept at the very lowest. This plant is a pilot for low capex – high productivity gas and energy production and will be replicated to scale up to 10 MW in modules of 1 and 2 MW each in various locations in North India over the coming 5 years

- Fresh water requirement has to be kept at a minimum and maximum possible water should be recycled
- High technology will be used to maximise process efficiency at each step, and tight process controls will be deployed to ensure that the overall processes run continuously at a very high level of efficiency and productivity
- There is also a focus on high usage of indigenous components and low level of imports.
- We are looking for partners with an open mind, willing to offer innovative, high efficiency technology, with a proven track record in supplying to similar plants or similar processes
- GreenOil is focussed on being the first in India to bring low cost, high productivity bio-methanation into the mainstream of Renewable Energy and offers its partners a high growth path in the country

Technical Specifications:

	Section	Element	Action	Remarks	Link 1	Link 2
A	**Material Handling**					
A1		Unloading of incoming organic raw material (RM)	Unloading from trucks / dumpers, conveying to temporary storage. Total RM about 60 tons per day. Use gravity feed as far as possible	Waste Fruit & Vegetables (F&V); Cattle Dung (CD); Oil cake (OC); Other Organic Matter like mustard stems etc (OM)		
A2		Segregation	F&V Waste segregated into two parts - direct feed to processor and pre-processing, other RM stored separately			
A3		Temporary storage	RM conveyed to storage area	Oil cake and farm waste stored for 15 days, Cattle dung stored for 5 days, F&V waste for 1 day		
A4		Pre-processing - a)Shredding	Shredding incoming F&V waste and organic matter such as plant stems, banana leaves etc	Size reduction to 2 to 5 mm range		

A5		Pre-processing - b) cooking F&V	Cooking for 24 hours at temperatures 50-75°C in a closed space, only for the segregated part of F&V waste and organic matter	Conveyed to homogenisation tanks post cooking. Solar heat as well as engine exhaust heat to be used		
A6		Fresh and recycled water added to homogenisation tanks	Recovered water from output sludge and fresh water from bore well / storage tanks. This water is temperature controlled. Tank to be sized suitably	Plumbing, control valves, level / flow sensors, temperature sensors	C3	
A7		Warm water storage tank (s)	Low cost, insulated, capacity of about 80 to 100 cu mtr - perhaps two small tanks	Heat recovery from engines, solar heat and burning gas to heat - for digester temperature control	C2	
A8		Pre-processing - c) Homogenisation to make Input Slurry	All inputs (F&V, CD, OC, OM), has to be conveyed to the homogenisation tank and mixed with temperature controlled water and blended to make a homogenous mixture. Amount of water depending on choice of digester design as in B2	Calculated amt of water at appropriate temperature to be added, proportionate to solid input - so water metering system is needed. Output to be conveyed to digesters after homogenisation	B1	B2
A9		Transport input slurry into digesters	Input slurry conveyed to the Digester	Slurry pumps and pneumatic valves to control movement of input slurry from homogenisation tanks to digesters		
A10		Transport post digestion sludge to de-watering station	Water recovery presses / filters to recover excess water from sludge	Should consume low energy		

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A11		Transport dewatered sludge to composting section	Composting section uses dewatered sludge and vermi-composts it to produce bio-fertiliser	Low energy, automated transport, either conveyor or gravity assisted	E1	
A12		Storage tanks for acidic and basic compounds	These are dozed into water fed into the Digesters for maintaining required pH levels	Pneumatic valves as well as controlled dozing system	C4	
A13						
B	**Digesters**					
B1		Input slurry homogenisation tanks	One tank of capacity about 50 to 60 cu mtr, or as deemed suitable for specific digester design	Twice a day loading of each digester	A8	
B2		Anaerobic Digester CSTR / BIMA / UASB / other suitable design	Airtight structure of 3500 cu mtr with inlet for slurry and outlet for sludge. For Input slurry as defined in A8	Cylindrical design, low cost construction with a design life of 30 years, 66% underground, flexible membrane roof	A8	
B3		Digestate slurry agitation system (Only if needed in the design selected in B2)	Mechanical and/or Pneumatic agitation of digestate slurry, needed in the digester	Continuous low intensity agitation at the digester base, twice a day, Medium intensity agitation throughout the day		
B4		Digestate slurry temperature control system	Digestate temperature maintained in the Mesophilic band of 25°C to 35°C range with minimum temp at 20°C and max at 40°C	Re-use of waste process heat and renewable sources recommended to minimise extra energy requirement	C1	

B5		Digestate slurry pH control system	Digestate pH to be maintained in a range of 6.5 to 7.5	By addition of permitted acidic / basic materials in specified concentrations. This addition can be either automated or manual	C4	
B6		Digestate Viscosity / fluidity monitoring	Viscosity to be maintained to achieve:a) Free flowing in the transmission pipes and pumpsb) Best suited for digester process selected in B2	Viscosity maintained by addition of water to Homogenisation Tank	C3	
B7		Digester Air Pressure monitoring	Alarm annunciation when it crosses specified threshold	Threshold to be set as per design selected in B2		
B8		Effluent sludge de-watering tanks	Capable of handling total sludge discharge of up to 100 to 120 cu mtr per day	Focus on low energy consumption rather than on high water recovery. Water to recycle back to homogenisers		
B9		Gas Scrubbing Tanks	Essentially for reducing CO_2 , H_2S and moisture content	Water / calcium carbonate spray based scrubbers / any other low cost, low energy technology	C5	
B10		Gas storage chambers	About 7,200 cu mtr gas produced daily. Storage needed for 4 hours of pre-scrubbed production or about 1250 cu mtr	Very low cost, lightweight storage, however, safety not to be compromised	C6	
B11		Surplus gas flaring system	When storage is full, surplus gas to be flared off		C7	
B12						
B13						

C	**PROCESS CONTROLS / SCADA**					
C0	**Guideline**		Various parameters being metered will have the following treatment: 1. Display on a central control panel at the plant control room 2. Feed into a PLC based control system for alarms as well as automatic process controls 3. Feed into a computer that will place this information on a web site for remote monitoring and control	Computer at Main Control room to display , record and store process and its data for 4 week period - after that backups to be taken Main logging computer to be firewalled, and the critical control data put on the web through a special mirrored PC connected to the net		
C1		Temperature control of digestate in the Digester	Multiple sensors to give the average temperature of the digestateTemp to be controlled by a) warm water added to input slurryb) produced bio-gas recycled heated and back into digesters for agitation as well as temp control	Sensors installed in a way that facilitates servicing / replacement	B5	
C2		Temperature control of water in warm water storage tanks	Water heated by waste heat from Generators Also heated by burning produced biogas, if needed	Temperature to be monitored and displayed as per guidelines	A7	
C3		Input Slurry and Digestate Viscosity Control	Monitoring and maintaining viscosity in a) the homogenising tanks b) the digesters	Values displayed, as well as pumps activated to add water to maintain desired viscosity	A6	B6

C4		Digestate pH Control	a) Monitoring and displaying values of pH in the Digester b) Maintaining pH between desired band	System for automatically dozing calculated quantities of acidic / basic substances to bring pH into desired range	A12	B5
C5		Monitoring of CO_2 : CH_4 ratio and H_2S levels in the biogas produced	Sensors to monitor levels in a) Digester outlet b) post scrubbing gas storage	Display the levels pre and post scrubbing	B9	
C6		Gas Pressure monitoring in the Digester	Pressure levels to be monitored and announced Fault tolerant pressure release mechanisms to be placed in case of excessive pressure build-up	Criticality would arise when the gas storage tanks are full and the digester air pressure exceeds upper set point	B10	
C7		Gas Pressure monitoring in Biogas Storage Tank	Pressure levels to be monitored and announced Fault tolerant excess gas flaring system backed up by pressure release mechanisms	CRITICAL SAFETY COMPONENT	B11	

Specific Requirements

Following is a detailing of the input raw material feedstock

Input Feedstock	INPUT Availability - Tons Per Day	Total Solids %	Volatile Solids (as a % of TS)
Fruit & Vegetable Waste	20	10%	75%
Fresh Cattle Dung	30	15%	75%
Oil Cake of Castor (*Ricinus communis*)	10	85%	85%

Following are the specific details that you need to provide answers to:

1. Please give a detailed process flow of your digester design in line with the above technical specifications
    a. Please do not treat the above technical specifications as exhaustive – they are only meant to be a guide to your thought
    b. You are the specialist and will have a superior level of detailing than the one above
2. Please specify with which of the above mentioned input feed stocks you have direct experience with
    a. The number of installations, operational since when, in production or defunct
    b. cu mtrs of gas under production currently (NOT cu mtrs of installed digester capacity)
3. Please specify the technology that your digester design is based on (CSTR or BIMA or UASB or some other)
4. Is yours a single stage or two stage digestion process?
5. Is Hydrolysis a part of your input feed preparation?
6. Please specify whether your process is mesophilic or thermophilic
7. In your proposed digester design, what is the:
    a. Hydraulic Retention Time (HRT)
    b. Solid Retention Time (SRT) - any special measures to keep SRT>HRT? *Please note that this is an important parameter as it reduces digester size*
    c. Any bacterial supplements added?
    d. Ideal C:N Ration in the input feedstock
    e. Cubic meter capacity of digester per cubic meter of biogas produced
    f. Cubic meter capacity of digester per ton of input feedstock
8. Please specify which parameters will be controlled in your design
    a. Parameters like temperature and pH of the digestate, the ratio of CO_2 to CH_4 in the biogas produced, the viscosity of the homogenised input slurry etc
    b. Also specify the operational measures needed to maintain the controlled parameters
    c. Are any automated systems proposed to maintain these parameters?
    d. Any control systems in built to parametric maintenance?
    e. If external control systems are needed, please specify the protocols in which the outputs from your systems will be provided
9. Please specify the periodic maintenance downtime of your digester (the days for which the digester will be non serviceable, and the frequency of such planned maintenance activity) and the cost of the same
    a. Please specify the annual / periodic maintenance schedule of the subcomponents (like conveyors, mixers, pumps, other moving parts)
10. Please specify the amount of fresh water in litres per ton of input feedstock that your process will require
11. Please specify in kW the auxiliary power consumption needed for full load continuous operation of your digester

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   a. Please provide the specifications and list of the plant auxiliaries that will be used, with details of their connected load in kW

12. Please specify the assured quantity (yield) of biogas produced by your digester as per following:
    a. Production figures should be average round the year, as well as peak values (please provide both figures)
    b. Litres of biogas per kg of input feedstock (NOT per kg of TS)
    c. Cu mtrs of biogas produced per day, and per year
13. Please specify the High Heat Value and the Low Heat Value of the un-scrubbed as well as the scrubbed biogas
14. Please specify the composition of the biogas produced, un-scrubbed as well as scrubbed
    a. % of CH_4
    b. % of CO_2
    c. % of H_2S
    d. Moisture
    e. Other gasses
15. Please mention the daily quantity in cu mtrs of CH_4 delivered to the engine block for power generation (post scrubbing)
16. In your experience what has been the specific fuel consumption in cu mtrs / kWh of electricity generated

Eligibility Criterion

1. Should have supplied this component of equivalent capacity and size to at least 3 to 5 similar applications in service
    a. Reference list needs to be provided
    b. Contact details of two references with whom GreenOil can make contact to validate installation experience and performance over time
2. Should have members in the team who have been part of supplying to other similar applications, and have hands on experience with supply / deployment and O&M
    a. This is a matter of trust – however, we would appreciate names, designations as well as brief one paragraph experience summary of two such people
3. Except for supplier of design, should have a turnover of over ` 2 Crores ($0.5 million) in any of the previous two years
    a. Listed / Public companies can provide reference to where their annual reports can be viewed
    b. Others may please attach self attested copies of their audited financials (scanned copies are just fine)
4. Should be familiar with Indian conditions and local materials and components available in India to facilitate a high indigenous content
    a. Experience in India / local partner in India is desirable, but not necessary

   b. For firms that do not conform to the above condition, a small undertaking will be needed stating that they will do whatever it takes to guarantee that their component will fit into Indian standards, conditions and local materials available

5. In case your firm is a young concern and fails to meet any one of the eligibility criterion, please feel free to apply, providing adequate justification how you will prove to be competent to deliver the level of quality and service that GreenOil expects

Points to be taken care of in the quotation

1. Please keep the proposal as brief as possible. Some necessary sections are:
   a. A simple detailing of some past projects of a similar nature
   b. Broad detailing of your organisation
   c. Past financial performance (to show turnover)
   d. Technical section, clearly highlighting your products quality parameters and the fact that it meets requirements
   e. The performance guarantees of your component
   f. The warrantees inherently included
   g. The Operational and Maintenance services included in the quote
   h. Initial spares included in the offer
   i. Quote for consumables / spares required in the first 5 years of normal operations should be provided
   j. In case some of the information requested for us is too detailed or difficult for you to answer specifically, please state so, and give an approximate answer, but please do try and provide as many specific answers as possible. It will help us to comparatively evaluate your proposal better
2. Please make a two part quote
   a. Part one should be the quote for the detailed design of the digester and associated components mentioned in the previous section (Technical Specifications)
      i. Please note that it should include a component of validation of the construction as per your specifications
      ii. It should also include a component for testing and commissioning of the digester
   b. Part two should be the quote for the construction and commissioning of the digester
      i. This is independent of the design cost and is the cost for construction, testing and commissioning
3. Please make the quotation in INR
   a. In case your component is imported, or you are an international vendor with no presence in India, then the quote should be c.i.f. Mumbai
   b. In case you have an Indian representative / branch or are an Indian company, then you should quote c.i.f. Site Jaipur

4. Please clearly specify the lead time to delivery on site in weeks from placing of formal order with you, and also specify the plant gestation time, or the time taken to make your component production ready
5. Please feel free to mention any specific requirements / conditions that you might have
6. Please do not hesitate to contact Mr Bhatnagar or Mr Jalote for any clarifications
7. Please accept our apologies for giving you such short notice for responding, but clearances for the project were just received, and our timelines are very tight – our target date for initiation of generation is July 2011
8. We will revert after 15 days from receipt of your proposal and bid

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