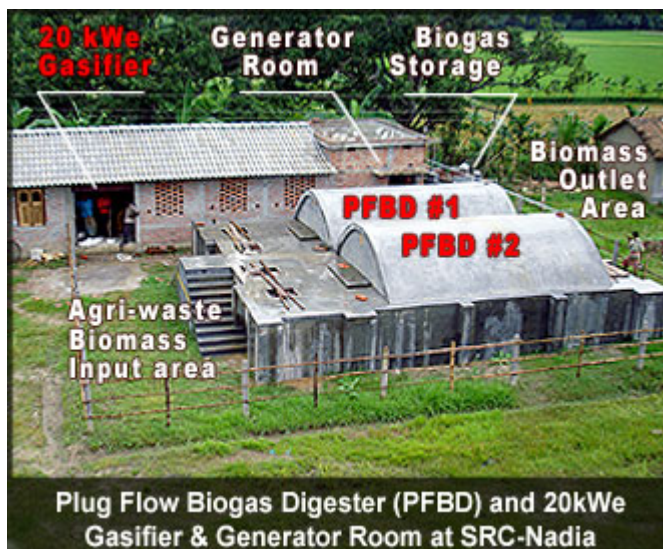


## Concept Note: Conjoint Biomethanation and Gasifier Project

**Title:** Conjoint biomethanation and gasifier operation program at Baidyapur Village, District Nadia, WB, India as demonstrative models for rural energy security and training programs, based on ISO 9000 Standards.

**Preamble:** In this one-year project, we propose to continuously run a combination of (a) a 60 Nm<sup>3</sup> Plug Flow Biogas Digester (PFBD) and (b) a 20 kWe Biomass Gasification Based Power Plant (BGBPP), in order to demonstrate and establish the viability and validity of these eco-friendly technologies for providing energy security in rural areas and for village-based communities. We also propose to (a) build a 3kVA 100% biogas genset; (b) develop a 'Renewable Energy Training Center' for imparting training and educational programs for the rural people in West Bengal and the eastern region of India, in renewable energy technologies in general, and for operating PFBDs and BGBPPs, in particular; and (c) develop formal procedures based on ISO 9000 Standards for appropriate quality management systems in village-based energy programs.



### A. This project is a collaborative effort between the following coalition partners:

a.) **Sankalpa Trust**, (Registered Trust/NGO devoted to rural development)—Lead Partner

**Contact Person:** Subhrankar Mukherjee, PhD, MBA—Managing Trustee and PI for the project  
**Address:** P6: Cluster 2, Purbachal, Salt Lake, Calcutta 700097, India.  
**Telefax:** 91-33-23359812      **Mobile:** + 91 94330 19821      **eMail:** [subra@enr.colostate.edu]

b.) **Center of Energy & Environment Management (CEEM)** (Energy and environment)

**Contact Person:** Professor Sujay Basu—Director  
**Address:** 7 Sarat Bose Road, 1<sup>st</sup> Floor, Kolkata 700 020.  
**Telephone:** 91-33-22893943      **Mobile:** 9831558126;      **eMail:** [basusujay@gmail.com]

c.) **Indian Association for Productivity, Quality and Reliability (IAPQR)**, (Education & Quality)

**Contact Person:** Professor S. P. Mukherjee—President  
**Address:** AD-276, Sector - I, Salt Lake City, Kolkata 700 064.  
**Telefax:** 91-33-23346234      **Mobile:** 9831558126;      **eMail:** [prof.mukherjee@gmail.com]

d.) **Millennium Inst. of Energy & Environment Management (MIEEM)**, (Think Tank)

**Contact Person:** Professor H. S. Ray—President  
**Address:** 203, Sarat Bose Road, Kolkata 700 029.  
**Fax:** 91-33-24730957      **Mobile:** 9339865451;      **eMail:** [hs\_ray@yahoo.com]

**Project Website:** [<http://www.sankalpacmfs.org/src/02ene/02ene.html>]

**Prepared by:** Subhrankar Mukherjee PhD, MBA  
Managing Trustee - Sankalpa Trust, Calcutta &  
Affiliate Professor - Colorado State University, Fort Collins, USA.

**Date:** 25<sup>th</sup> April 2009.

## B. Summary of Program:

### B1.0 Background:

**Sankalpa Trust** has developed an impressive array of renewable energy technologies at **Sankalpa Research Center (SRC)**, Village Baidyapur, Nadia—that showcase appropriate technologies and sustainable livelihoods for rural areas for (a) empowerment of beneficiaries in the tribal community through energy security; (b) dissemination of energy products and services that promote sustainable livelihoods. **The SRC is therefore an ideal place to develop a ‘Renewable Energy Training Center’ (RETC), the focus of this project.**

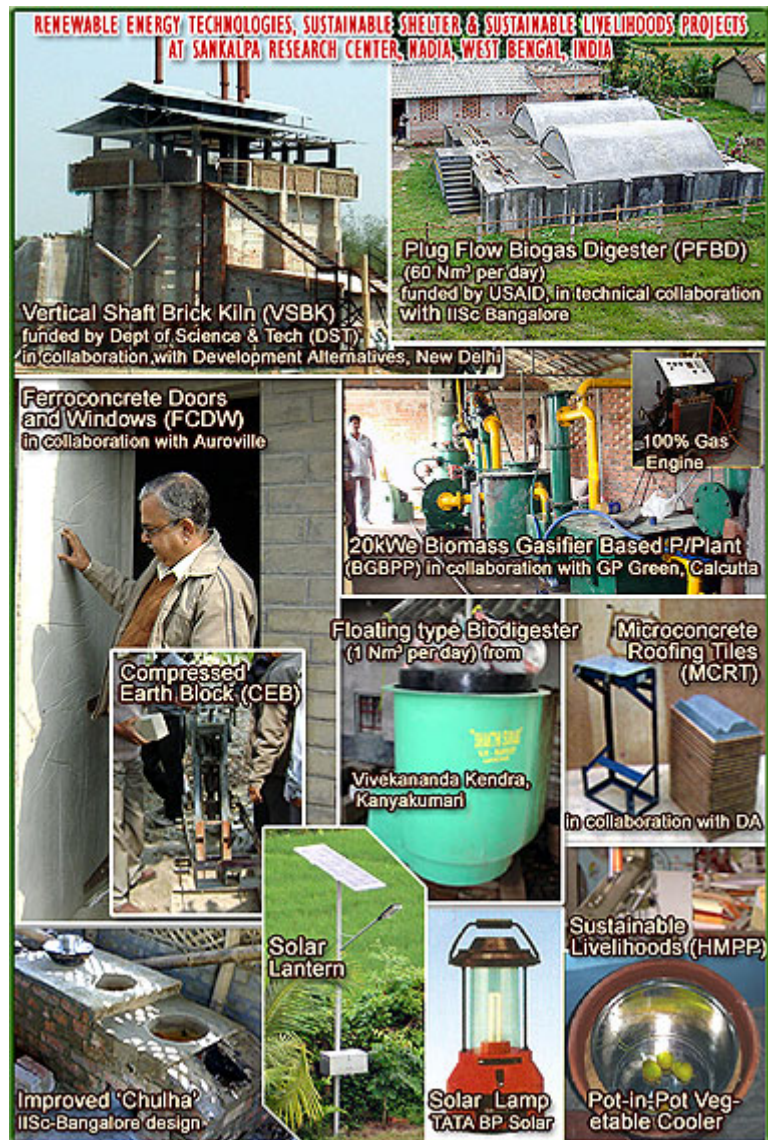
Two of the largest energy installations at the SRC involve (a) a 60  $\text{Nm}^3$  Plug Flow Biogas Digester (PFBD) built with funds from **USAID** in technical collaboration with **IISc Bangalore** and (b) a 20 kWe Biomass Gasification Based Power Plant (BGBPP) with technical support from **GP Green Energy Systems, Kolkata** and **DIYA Automobiles, Kolkata**.

**These installations, shown on the right, are complete in all respect, and minimal support is needed to make them operational. Capital investments are required for procuring SPV Home Systems and a Wind Generator, to complete the RETC facility.**

In collaboration with our coalition partners (a) **CEEM**; (b) **IAPQR** and (c) **MIEM**, it is proposed that we develop a one-year project in order to:

- Demonstrate and establish the viability and validity of these two biomass-based eco-friendly technologies for providing energy security in rural areas and for village-based communities, and especially to study the impact of mixing the products from gasification and biomethanation, to achieve a stabilized source of biomass-based, methane-rich fuel;
- Develop a 3kVA biogas engine-cum-generator system that is presently unavailable commercially, including appropriate biogas cleaning equipment, essentially to remove  $\text{H}_2\text{S}$  and  $\text{CO}_2$ ;
- Develop training and educational programs by which the rural people in West Bengal and the eastern region of India, can be exposed to formal exposure and training in renewable energy technologies in general, and for operating PFBDs and BGBPPs, in particular—thereby **establishing a “Renewable Energy Training Institute”** at the SRC-Nadia;
- Develop formal procedures and systems based on ISO 9000 Standards, for enhancing the quality and delivery of these state-wide educational and training programs.

The funding request for this one-year project is **Rs. 36 Lakhs**, with total in-kind contribution from partners of **Rs. 31.5 Lakhs** (See Table 1: ‘Budget Summary’)—yielding a leveraging ratio of about 1.87, for a total project cost outlay of **Rs. 67.5 Lakhs**.



## **B2.0 Brief Project Description:**

The *primary goal* of this project is to demonstrate and establish the viability and validity of the two biomass-based eco-friendly technologies—**gasification** and **biomethanation**—for (a) providing energy security in rural areas; (b) develop and disseminate a model by which a village-based community can generate sustainable livelihoods, while preserving Mother Nature for future generations; and (c) develop appropriate village based training programs for scientific quality management systems.

### B2.1 Continuous operation of the BGBPP and the PFBD:

As the plants are fully constructed, the funds requested from WBREDA will be used only to operate:

(a) The 20 kWe Biomass Gasification Based Power Plant (BGBPP) at 80% Plant Load Factor (PLF); as it consumes 30 kg of rice husk per hour at full load operation, operation at 80% PLF represents a daily consumption of about 576 kg/day, at a cost of about Rs 1,000 per day, @ Rs.1.75 per kg;

(b) The 60 Nm<sup>3</sup> Plug Flow Biogas Digester (PFBD) consumes 200 kg of rice straw per day; this represents raw material cost of about Rs 300 per day, @ Rs.1.50 per kg.

The coalition partners—with Sankalpa Trust as the Lead Partner—will set up and operate the 20 KWe BGBPP and the 60 nM<sup>3</sup> PFBD. **A major objective would be to study the impact of mixing the ‘Producer Gas’ from the Gasifier and the methane-rich biogas from the PFBD, to produce a composite fuel.** Such a project will greatly benefit scientific knowledge, and the Sankalpa Research Center at Nadia is uniquely positioned to do this study, as the gasifier and PFBD are in close proximity (see Figure 1).



Additionally, the specific aims of continuously operating the BGBPP and the PFBD are to:

- Develop ‘best practices’ for operating BGBPPs and PFBDs that are practical and relevant to the rural environment that is prevalent in West Bengal villages and eastern India;
- Establish the technical, production and quality management systems needed for BGBPPs and PFBDs;
- Assess learning needs and the impact of community development and lifelong learning models in the target village communities;
- Share knowledge and experiences about the operational processes with network partners, which contribute to the creation of open learning communities.

### B2.2 Develop a 3kVA biogas engine-cum-generator:

GP Green Energy Systems in consultation with DIYA Automobiles will design and develop a special 3kVA 100% biogas engine-cum-generator, which will be a unique contribution from this project, as there are presently no standard biogas generators available in the market.

The deliverables will include appropriate biogas cleaning equipment, essentially to remove H<sub>2</sub>S and CO<sub>2</sub>. Once the standards for this combination of equipment are set, the designs will be made available to interested parties under open source licensing models.

### B2.3 Develop training and educational programs in biomass-based technologies:

A major part of the budget for this project is proposed to be used to set up a “**Renewable Energy Training Center**”, to address the lack of a rural-based training and education facilities for RETs in general, and gasification and biomethanation, in particular, in village-based communities in West Bengal and North Eastern region. Any person from a village-based community can then access high quality training programs and materials, including hands-on apprenticeship programs, in theory and also in the practice of operating gasifiers and biodigesters, for the payment of very nominal user fees. A small fee will be charged to ensure sustainability of the training and education programs, beyond the duration of the project.

**B2.4 Develop quality management systems based on ISO 9000 Standards:**

A major work in this project would be to develop a full set of procedural documentation on operation of gasifiers and biodigesters, which the operators can read in the Bengali Language. For instance, there is a formal “Start-up Procedure for Plug Flow Biogas Digester”, which can be downloaded from the Sankalpa cMFS website at [http://www.sankalpacmfs.net/arts/directives/procedure/apr.se.7611\_pfbid\_startup\_procedure.pdf]. It will be seen that there is a provision for translating the procedural instructions in the English language, to Bengali, as this crucially important for the village-based staff to access and learn from.

Sankalpa Research Center is one of the first rural development centers in the region to initiate formal quality management systems based on ISO 9000 Standards<sup>1</sup>.

**B2.5 Criteria for success**

Important measures of success are:

- An advanced technology base for operating BGBPPs and PFBDs;
- Dissemination of 100% biogas gensets
- An informed and skilled village-based community for (a) technical operations and scientific management systems; (b) quality management controls vetted under ISO 9000 Standards;
- A vibrant village-based community well conversant with renewable energy technologies, which will guarantee energy security for the future.

**B2.6 Coalition’s financial as well as in-kind participation**

Details of the ‘In-kind contribution’ from coalition partners for the one-year period is shown in Table 1; it amounts to a total of Rs **31.5 Lakhs**, which is approximately 87% of the budgetary request of **Rs 36 Lakhs**. This results in a leveraging ratio of 1.87 for a total project cost outlay of **Rs. 67.5 Lakhs**.

**B2.6 Proposed time-line/duration of the project:**

| # | Activity Description             | Time Taken (Months) |               |               |         |         |                |
|---|----------------------------------|---------------------|---------------|---------------|---------|---------|----------------|
|   |                                  | 1-2                 | 3-4           | 5-6           | 7-8     | 9-10    | 11-12          |
| 1 | Initiation & Project Design      | [Preliminary]       |               |               |         |         |                |
| 2 | Procurement of project resources | [Preliminary]       |               | [Final]       |         |         |                |
| 3 | Installation of bio-generator    | [Preliminary]       |               | [Final]       |         |         |                |
| 4 | Operation of PFBD & BGBPP        | [Preliminary]       |               |               |         |         |                |
| 5 | Develop ‘Training programs’      |                     | [Preliminary] |               | [Final] |         |                |
| 6 | Develop procedures & QMS         |                     |               | [Preliminary] |         | [Final] |                |
| 8 | Project documentation & Closure  |                     |               |               |         |         | [Final Report] |

**B2.7 Monitoring and Evaluation**

The Monitoring and Evaluation (M&E) program will provide a framework and structure to (a) validate the assumptions that have been made in the project; and (b) fine-tune the design and implementation plans of the project. M&E Program will also provide a continuous feedback loop of information to project staff and the funding agency, for achieving continuous improvement and project sustainability.

**B5.0 Beneficiaries**

The direct beneficiaries of this project are (a) the poor people of Village Baidyapur and its surrounding areas; (b) the rural people of West Bengal and the North Eastern part of the country. The expected **outcomes** are: (a) poverty reduction within the first two years of this project in Village Baidyapur and its surrounding areas; (b) formal training of about 250 people per year in the field of renewable energy technologies, in general, and biomass energy



<sup>1</sup> “ARTS Management Manual”: [http://www.sankalpacmfs.net/arts/directives/manual/arts\_management\_manual.pdf]

conversion technologies, in particular.

The participatory processes in this project will socially empower the disadvantaged groups in the villages—such as women and children of the landless labourers. The success of this project will provide sustained energy security and promote a plethora of sustainable livelihood projects in village-based communities.

### C. Budgetary Estimates:

The summary of (A) Budget and Estimated funding request; (B) In-kind contribution or leveraging from partners and (C) Total Project Cost is shown below:

| <b>Budget and Estimated Funding Request (One year period)</b> |                            |                  |                  |                  |             |
|---|----------------------------|------------------|------------------|------------------|-------------|
| #   | Budgetary Head             | SANKALPA         | IAPQR            | Total Amount     | % of 'j'    |
|   |                            | Rs               | Rs               | Rs               |             |
| <b>A. Funding request</b>                                     |                            |                  |                  |                  |             |
| a   | Personnel                  | 1,142,000        | 590,000          | <b>1,732,000</b> | 48%         |
| b   | Travel                     | 51,600           | 210,000          | <b>261,600</b>   | 7%          |
| c   | Equipment                  | 375,000          | 117,500          | <b>492,500</b>   | 14%         |
| d   | Supplies                   | 470,880          | 45,000           | <b>515,880</b>   | 14%         |
| e   | Contractual                | 134,500          | 0                | <b>134,500</b>   | 4%          |
| f   | Construction               | 0                | 0                | <b>0</b>         | 0%          |
| g   | Other Direct Costs         | 15,000           | 125,000          | <b>140,000</b>   | 4%          |
| h   | Total direct charges       | 2,188,980        | 1,087,500        | <b>3,276,480</b> | 91%         |
| i   | Indirect charges           | 218,898          | 108,750          | <b>327,648</b>   | 9%          |
| j   | Total funding request      | <b>2,407,878</b> | <b>1,196,250</b> | <b>3,604,128</b> | <b>100%</b> |
| <b>B. In-kind Partner contributions</b>                       |                            |                  |                  |                  |             |
| k   | Land and infrastructure    | 500,000          | 0                | <b>500,000</b>   | 14%         |
| l   | 20 kWe BGBPP               | 1,200,000        | 0                | <b>1,200,000</b> | 33%         |
| m   | 60 nM3 PFBD                | 1,000,000        | 0                | <b>1,000,000</b> | 28%         |
| n   | Project management         | 270,000          | 180,000          | <b>450,000</b>   | 12%         |
| o   | Total in-kind contribution | <b>2,970,000</b> | <b>180,000</b>   | <b>3,150,000</b> | <b>87%</b>  |
| <b>C. Total Project Cost:</b>                                 |                            | <b>5,377,878</b> | <b>1,376,250</b> | <b>6,754,128</b> | <b>187%</b> |

Details will be made available on request

### D. Conclusion:

The BGBPP and PFBD installations at SRC Nadia are complete in all respects, and no further grants are needed to make them operational. Hence no additional capital investments are required for operating the BGBPP and PFBD installations.

A major outcome of this project will be a sustained presence in West Bengal of a model for rural electrification and renewable energy from biomass resources, where village-based communities can come for direct hands-on training and exposure to the operation and maintenance of biomass gasification and biomethanation technologies.

Another outcome will be the dissemination of a 100% biogas genset.

Another outcome shall be the development of formalized and scientific training programs, backed up by the development of procedures and a quality management system that can be certified to ISO 9000 Standards.

It is believed that this model, when fully developed, can be replicated anywhere in India.

The funding request for this one-year project is **Rs. 36 Lakhs**, with total in-kind contribution from partners of **Rs. 31.5 Lakhs** (See Table 1: 'Budget Summary')—yielding a leveraging ratio of about 1.87, for a total project cost outlay of **Rs. 67.5 Lakhs**.