

2. Timing – Commencement and Completion

This agreement comes into effect on the date the last signature is appended on this agreement and will be carried out for a period of two years, starting 01 May 2014 and ending 30 April 2016.

Should it become evident to either Party during the implementation of the Project that an extension beyond the expiration date set out in paragraph 1, above, of the present Article, will be necessary to achieve the Objectives of the Project, that Party shall, without delay, inform the other Party, with a view to entering into consultations to agree on a new termination date. Upon agreement on a termination date, the Parties shall conclude an amendment to this effect, in accordance with Article 13, below.

3. Project Contacts

USAB Contacts:

Dr. Balakrishna Gowda

Professor Dept. of Forestry and Environmental Sciences and coordinator biofuel Park, Madenur Hassan University of Agricultural Sciences, Bangalore-560065

Dr. K.T.Prasanna

Professor Dept. of Forestry and Environmental Sciences, UAS, GKVK, Bangalore-560065

Dr A.C. Girish

Program Assistant
Krishi Vignyana Kendra
Kandli, Hassan
University of Agricultural Sciences, Bengaluru

ICRAF Contact:

Dr. Navin Sharma,

Programme Director - Biofuels
World Agroforestry Centre (ICRAF)
1st Floor, C-Block
Dev Prakash Shastri Marg
NASC Complex, Pusa Campus
New Delhi - 110012.

4. Key Personnel

The Activities as described in the Annex 1: Work Plan shall be under the general guidance and technical direction of **Dr. Balakrishna Gowda**.

5. Budget, Payments Schedule and Reporting

5.1. The budget is Indian Rupees 85, 50,000 (Rs. Eighty five lac fifty thousand only) for a period of 2 years as detailed in the budget annexed to this agreement as Annex 2.

5.2 Disbursement of funds:

- 50% of the total budget i.e. first year budget of Rs. 42, 75,000 (Rs. Forty two lac seventy five thousand only) on signing of the agreement and submission of certified invoice.
- 40% of the total budget upon submission of financial report due 1 May 2015 signed by the Comptroller of USAB and satisfactory technical report.
- 10% on submission of Final technical and financial report due 30 April 2016.

6. Insurance

6.1. ICRAF declines every form of responsibility for actions, claims, demands, costs and expenses which may arise from or be a consequence of any unlawful or negligent act or omission of UASB or its employees or agents in carrying out the work described in the Work Plan (Annex 1).

6.2. Therefore when deemed necessary, UASB should take out appropriate insurance cover for all staff and/or activities financed through this agreement, such as, but not limited to: health, life, accidents, long term disability, workers compensation, travel, public liability, etc. The decision whether or not such insurances are required, rests entirely with UASB.

7. Taxation

ICRAF undertakes no liability for taxes, duty or other contribution payable by UASB on payments made under this contract. No statement of earnings will be issued by ICRAF.

8. ICRAF Coordinator

The person holding, occupying or performing the duties of Programme Director – Biofuels, currently Dr. Navin Sharma, shall have responsibility for supervision of the Agreement on behalf of ICRAF and will have authority to issue and receive any written notification under the Agreement.

9. Intellectual Property Rights (IPR)

9.1. All Background Intellectual Property used in connection with this Research Project shall remain the property of the Party introducing the same, and records should be made of Background Intellectual Property introduced. The Party introducing the Background Intellectual Property hereby grants to the other Party a license to use and sublicense the Background Intellectual Property for the purposes of the Research Project.

9.2. Any IPR associated with products jointly generated by ICRAF staff or consultants and UASB shall reside jointly with ICRAF and UASB, not the individual. Due recognition of the contributions of individuals will be made.

9.3. ICRAF will take steps to ensure that it is in full and complete compliance with international IPR treaties and national regulations and the CGIAR Principles on the Management of Intellectual Assets¹ as they relate to our operations and programs.

9.4. ICRAF views its final research outputs as "International Public Goods" and as such shall use the most appropriate mechanisms to make the results freely and widely available to all.

¹ http://www.cgiarfund.org/intellectual_assets

10. Confidentiality

During the course of this Agreement, either party may acquire confidential information or trade secrets of the other ('Confidential Information'). Confidential Information of a party means all information of whatever description, whether in permanently recorded form or not and whether or not belonging to a third party, which is by its nature is confidential or which the party identifies as confidential to itself. It does not include information to the extent that information is: (i) independently created or rightfully known by, or in the possession or control of, the other party and not subject to an obligation of confidentiality on the other party; (ii) in the public domain (otherwise than as a result of a breach of this Agreement); or (iii) required to be disclosed by law.

Each party agrees to keep all such Confidential Information in a secure place, and further agrees not to publish, communicate, divulge, use or disclose, directly or indirectly, for its own benefit or for the benefit of another, either during or after performance of this Agreement. This obligation of confidence shall not apply with respect to information that is (a) available to the receiving party from third parties on an unrestricted basis; (b) independently developed by the receiving party; or (c) disclosed by the other party to others on an unrestricted basis

11. Severable Provisions

Each and every provision in this Agreement shall be read (where possible) in relation to each and every individual case instanced by each and every individual word or combination of words contained in that provision as a combination of separable provisions and each and every of such separable provisions shall be read as entirely independent and severable from the other or others. In all cases where a provision of this Agreement is reducible, invalid or unenforceable in terms of any legislation or other legal authority, such provision shall not affect the validity of the remaining portion of this Agreement which shall remain in force and effect as if this Agreement had been granted with no such provision and it is hereby declared the intention of the parties that they would have executed the remaining portion of this Agreement without including therein any such provision.

12. Assignment

UASB can assign or delegate any of its duties to any other parties of equivalent skill, experience, resources, and expertise to provide the services set out provided it receives consent for such action in advance and in writing from ICRAF;

The appointment of any other party shall not affect the obligations of UASB towards the ICRAF under the terms of this Agreement;

ICRAF shall have the right to accept or reject the parties proposed within five days of receiving notification from of the proposed assignation or delegation.

13. Amendments

The terms of this agreement can be amended, with the approval of both parties, by means of exchange of letters or email through the authorized officials at each institution. Either party may initiate the exchange of letters or email.

14. Termination

This Agreement may be terminated by either party by giving written notice of intent to terminate the Agreement. Such termination shall not affect the execution and conclusion of specific activities in effect under the terms of this Agreement nor publication and dissemination

of results of research in progress. Such notice will be given 3 months in advance of the desired termination date.

Either party may terminate this Agreement by giving 3 months' notice in writing to the other party if:

- (i) There is a material breach by the other party of any of its obligations hereunder which, if it can be remedied remains unremedied on the expiry of five days after receipt by the party in breach of written notice from the other specifying the breach and the action required to remedy same; or
- (ii) The notifying party is of the opinion that in the circumstances of the breach, it is not appropriate for the Agreement to continue in force.

The Agreement will end automatically if either party enters into bankruptcy, or makes other arrangements for the benefit of its creditors, or becomes otherwise legally incapacitated;

In the event that the Agreement comes to an end or is terminated before the completion of the services, UASB shall be entitled to payment by ICRAF for work completed on a pro-rata basis;

Termination of this agreement shall not affect the rights of either party against the other in respect of the period up to the date of termination;

The failure on the part of either party to exercise or enforce any right conferred upon it under this Agreement shall not be deemed to be a waiver of any such right or operate to bar the exercise or enforcement thereof at any time or time thereafter.

15. Applicable Law and Dispute Resolution

The applicable law shall be the law of the Republic of India in so far as it is not in conflict with municipal law of the country of implementation.

The Parties shall try to settle amicably through direct negotiations, any dispute, controversy or claim arising out of or relating to the present Agreement, including breach and termination of the Agreement. If these negotiations are unsuccessful, the matter shall be referred to arbitration in accordance with United Nations Commission on International Trade Law Arbitration Rules. The Parties shall be bound by the arbitration award rendered in accordance with such arbitration, as the final decision on any such dispute, controversy or claim.

16. Entire Agreement

This agreement supersedes all prior representations, arrangements and understandings between the parties relating to the subject matter hereof and except as expressly provided herein is intended by the Parties to be the complete and exclusive statement of the terms and conditions of this agreement. Any amendment to this agreement must, to be effective be in writing and signed by the authorized representatives of each party.

17. Force Majeure

Neither party shall be liable to the other party in respect of any delay in performing or failure to perform any of its obligations hereunder if such delay or failure results from:

- a. Acts or intervention of Government or Government agencies.
- b. Fire, flood or explosion;

- c. Acts of God;
- d. Declared or undeclared war or riots or civil commotion;
- e. Strikes or other industrial disputes;
- f. Any act neglect or default of the other party; or
- g. Any cause outside reasonable control.

18. Communication and Notices

All notices and correspondence between parties shall be sent for the attention of:

If to ICRAF:

Dr. Anthony J. Simons
Director General
World Agroforestry Centre (ICRAF)
P.O. Box 30677-00100,
United Nations Avenue, Gigiri
Nairobi, Kenya
Tel: +254 20 7224000
Fax: +254 20 7224001
Email: t.simons@cgiar.org

If to UASB:

Dr. K. Narayana Gowda
Vice Chancellor
University of Agricultural Sciences
Gandhi Krishi Vignan Kendra
Bellary Road
Bengaluru – 560065
Tele: 011-2333277
Email: knarayanagowda@yahoo.co.in

With copies to:

Laksiri Abeysekera,
Deputy Director General – Finance and Corporate Services
Email: l.abeysekera@cgiar.org

Anne Munene, Acting Head of Contracts & Grants,
Email a.munene@cgiar.org

All correspondence shall normally be by first class air-mail or courier or email, other than correspondence dealing with termination, which shall be recorded delivery.

19. No Joint Venture or Partnership and Indemnification

Nothing in this Agreement shall be construed to create a relationship between the parties, nor to render any party liable for the debts or obligations incurred by any other. No party is authorized to make representations on behalf of the others, or to bind the others in any manner whatsoever.

UASB shall indemnify ICRAF and keep ICRAF indemnified against all loss, damage or liability whether criminal or civil suffered (and legal fees and costs incurred) for any acts of neglect by the UASB or its employees or its agents. ICRAF shall similarly indemnify UASB and keep UASB indemnified against loss, damage or liability whether criminal or civil suffered (and legal fees and costs incurred) for any act of neglect by ICRAF or its employees or its agents.

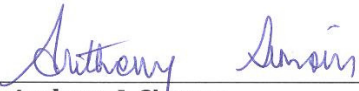
20. Acceptance

If you agree to terms and conditions set out in this agreement, your acceptance must be notified by signing, dating and returning three copies of this letter to ICRAF. Receipt by ICRAF of the acceptance in writing of these terms and conditions will constitute the entire agreement for the provision of the work described in the Work Plan in Annex 1.

IN WITNESS THEREOF, this agreement is signed by the respective officers on the day, month and year indicated below:

For ICRAF:

For UASB



Dr. Anthony J. Simons
Director General



Dr. M.B. Raje Gowda
Registrar

12-05-14

(Date)

7-6-2014

(Date)

Annex 1: Work Plan

Development of sustainable rural energy options through native biofuel crops

Submitted by

Dr. Balakrishna Gowda

Professor Dept. of Forestry and Environmental
Sciences and coordinator biofuel Park, Madenur Hassan
University of Agricultural Sciences, Bangalore-560065

Dr. K.T. Prasanna

Professor Dept. of Forestry and Environmental
Sciences, UAS, GKVK, Bangalore-560065

in collaboration with

Dr. Navin Sharma,

ICRAF, New Delhi

Background

'Energy' is a basic requirement for all human activities. It is harvested from both renewable and non-renewable sources such as fossil fuel, solar, wind, hydroelectric, nuclear energy etc. However, the major source of world's energy supply is from fossil fuels which include petroleum, coal and natural gases. The world, at large depends on natural gas for cooking, the main problem world is going to face is the exhaustion of limited source of fossil fuels very soon. Therefore, there is an emergent need to find alternative sources of energy.

Energy scenario in India

India is one of the largest crude oil consumers in the world. In 2009, India consumed about 3 million barrels/day, making it the fourth largest consumer of oil in the world. As per the US energy information administration report- August 2010, India was the sixth largest net importer of oil in the world in 2009, importing nearly 2.1 million barrels/day which accounted for 70 % of its oil needs. According to the Indian government, nearly 30 % of India's total energy needs are met through imports (Aradhey, 2011).

Table 1: Quantity of imported crude oil for India

Year	Quantity (lakh tonnes)	Value (Rs. in Crores)
2002-03	819.89	76195
2003-04	904.34	83528

2004-05	958.61	117003
2005-06	994.09	171702
2006-07	1115.02	264084
2007-08	1216.72	272699
2008-09	1327.8	348304
2009-10	1592.6	375277
2010-11	1635.9	455276
2011-12	1721.1	672220

(Source: Indian petroleum & natural gas statistics 2011-12, Ministry of Petroleum & Natural Gas, GOI)

The average consumption of petroleum products in India (Aradhey, 2011):

Transport (Petrol, Diesel, CNG, and Aviation Fuel): 51 %

Industry (Petrol, Diesel, Fuel Oil, Naphtha and Natural Gas): 14 %

Commercial and Others: 13 %

Domestic (LPG and Kerosene): 18 %

Agriculture (Diesel): 4 %

Expenditure on import of petroleum products in fiscal year 2010-11 is currently estimated at over \$ 110 billion, up \$24.3 billion over the previous year, and almost five times the value in fiscal year 2003-04. Consequently petroleum consumption in India has also gone up from 91 million tons in Indian Fiscal Year (IFY) 1998/99 to 138 million tons in IFY 2009-10 and over 142 million tons in IFY 2010-11 (Aradhey, 2011). The current growth in transport activity and consequent increase in expenditure and consumption of petroleum products are posing serious concerns for the environment.

Biofuel – An alternative

Biofuels are derived from biomass of plants or of animal origin. Biofuels may be solid, gaseous or liquid, that are derived from the biomass. It comprises mainly wood, agricultural crops and products, aquatic plants, forest products, wastes and residues and animal wastes. Wood, agriculture wastes, charcoal, biomass briquettes used in rural areas for cooking, sugarcane bagasse used for electricity generation and steam in sugar industries are commonly known solid biofuels. Methane gas produced from anaerobic digestion of biomass, animal waste, waste water treatment sludge, household waste etc. by methanogenic bacteria and gas produced by pyrolysis of wood biomass, agricultural wastes are examples for gaseous biofuels. Liquid biofuels include bioethanol, biodiesel and other liquid fuels

derived from the biomass. Bioethanol is produced from molasses, sugar cane, sugar beet, starchy crops such as potato, sweet potato, corn, etc. Ethanol is also produced from agricultural residues and other cellulosic biomass. Biodiesel is produced from the plant based oils and animal fats.

Biogas is a product of anaerobic degradation of organic matter. It contains methane, carbon dioxide, hydrogen, ammonia, hydrogen sulphide and some traces of other gases along with water vapor. It can safely be used as fuel for cooking or for process heating.

Agricultural production process requires energy in the form of heat or electricity for heating, drying, powering electrical equipments etc. Heat energy obtained from burning of biomass produce greenhouse gases (GHG). Unused biomass residues can produce upto 50 % methane during natural degradation or 5-10 % methane during its open burning. (Dubrovskis, 2009). Methane is also emitted by human related activities like animal husbandry, rice cultivation, biomass burning and waste management. Methane is a greenhouse gas with a relatively high global warming potential. Each kg of methane warms up the earth 23 times as much as the same mass of CO₂ when averaged over 100 years. (Rutz and Janssen, 2007).

In this regard bio-methane production from organic matter by controlled digestion process for energy production is of special interest. The emission of methane could be reduced by use of controlled digestion facility and thereby reducing the GHG emissions. Therefore, bio-methane is not only a renewable energy source, but it also contributes to reduction of methane emission.

Table 2: Overview of potential biomass substrates for anaerobic digestion

Type	Substrate
Harvest Residues	Tops and leaves of sugar beet Straw
Manure	Liquid manure pig Liquid manure cattle Agricultural co-digestion
Industrial Organic Waste	Slaughterhouse waste Brewing industry pomace Whey (dairy) Vinasse/distillery residues Mixed waste from food industry Sugar beet meal Molasses residues Fruit pulp Pulp from coffee production Coffee grounds and tea residues Spoilt foods Cooking oil Plant residues Sludge from vegetable oil production Residues from spice production Palm oil cake Oilcakes Waste (water) from cellulose production Waste from textile production Waste water food industry Waste water from sugar production from sugar beet
Horticulture and Landscape Management	Foliage/greenery Potted plant residues Greenery
Municipal Organic Waste	Average data municipal organic waste Organic waste Residues from lawn mowing Average data food waste Kitchen waste Debris
Others	Glycerine Sewage sludge

*(Stucki et al., 2011)

Table 3: Theoretical quantity and composition of biogas formed from carbohydrate, fat and protein

	Biogas formed (m ³ /kg VS)	Biogas composition:CH ₄ :CO ₂ (%)
Carbohydrate	0.38	50:50
Fat	1.0	70:30
Protein	0.53	60:40

* (Schnurer et al, 2010)

Table 4: Specific gas production for various potential substrates in biogas production.

Substrate	Approx. Methane yield (CH ₄ m ³ /tonne VS)
Food waste	400-600
Fruit and vegetable waste	200-500
Manure from cattle, pigs or chickens	100-300
Slaughterhouse waste	700
Cereals	300-400
Sugar beets	300-800
Silage grass	350-390
Grass	200-400
Straw	100-320
Municipal sludge	160-350
Distillation waste	300-400

* (Schnurer et al, 2010)

Advantages of using Biogas

- As the economics is attractive, it becomes a multipliable and scalable model, Biogas based energy could provide sustainable solution for rural areas
- Supply of energy would assist rural businesses and enterprises to grow and prosper
- Production and use of organic fertilizers would improve soil and increase yields
- Considerable savings in subsidy bills and foreign exchange outflow could be achieved through such projects
- The project would help employment generation by creating local job opportunities
- This will directly help to improve health of the communities especially women

About the study

The intention of the study is to make every village an energy-producing village for improving livelihood and for provision of clean energy solutions for cooking and agricultural operations, through

- Participation of the community/ house hold in production of tree based oil seeds, oil and oil cake
- Use of multispecies trees to get year round availability of biofuel feedstock
- Model that provides additional livelihood options over and above the farm income periodically
- Value addition to various by products of biofuel value chain at village level such as oil extraction, oil cakes as animal feed and organic manure
- Employment to rural people for about 15-45 days in a year
- Minimum input for growing oil seed plants
- Optimum utilization of land resources
- Improve green cover, balancing the carbon in atmosphere
- Improve soil fertility leading to improved agriculture production
- Awareness and capacity building among the communities especially for biofuel crops and their utilization for producing bioenergy

Objectives:

1. To organize educational and hands-on-training for rural women and youth for their socio-economical development, food & nutritional development as well as environment security by the use of tree borne oil seeds
2. To establish Bioenergy production setup in selected villages (Fig. 1 and Annex 3)
3. To establish a system of using the biomass, biomass waste and by products for energy production
4. To utilize the energy locally and also to establish network for marketing the products / by products for income generation.
5. To explore animal fodder and feed opportunities in the present model
6. To demonstrate the effectiveness of biofuels to improve livelihoods of small holder farmers

Methodology:

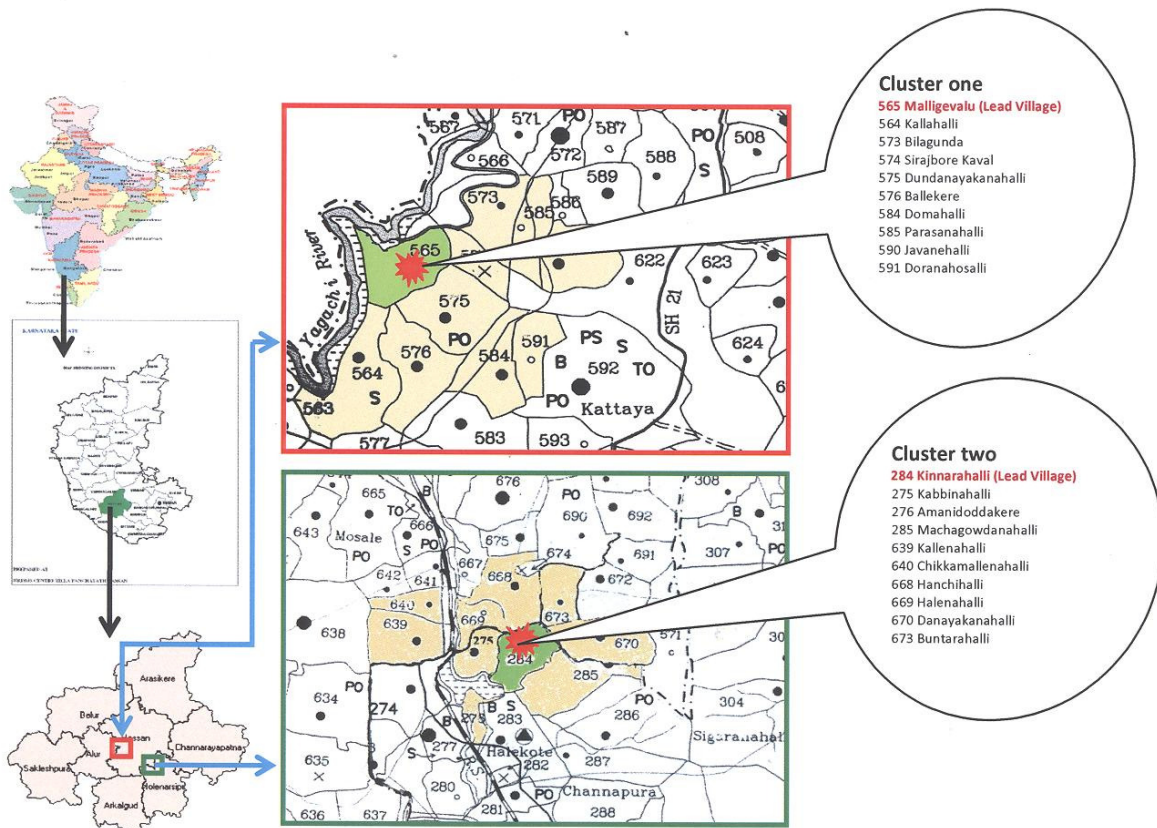
1. Selection of villages

- A. The biofuel Park, Hassan has established network of Farmers to collect the raw materials for biofuel production. Based on the experience 20 villages will be selected for the study.
- B. Training programs will be carried out for farming communities and women groups on biofuels. The associations will be provided with home scale oil extraction unit in the

villages. The oil produced by these associations using the facility can be utilised locally for their own requirement.

- C. Two clusters (9 villages in each) with one lead village in each cluster will be formed from the selected 20 villages for further project activities (Fig.1). The cluster resources and feasibility studies on feed stock processing ability, SVO run generators/ biogas run generators will be proposed for selected villages. Out of these 2 lead villages one will be for SVO generation and one for Biogas run generation (Annex 3)

Fig. 1 Two lead villages and eighteen satellite villages for providing feedstock in Hassan district of Bangalore



2. Awareness programs

Awareness programs will be organised in each of the targeted villages both on site and off site to educate and experience the concept of adoption in the villages

3. Electricity production from the oil/ biodiesel

The village Malligevalu (First Lead Village), a complete biofuel village of Hassan taluk, which is having a population of 429 and 90 household, is selected for electrification through utilization of biofuels. A Vegetable oil operated power generator of 25 kva Capacity will be installed and the partial power requirement of the village will be met out of the power generated by oil.

4. Installation of cook stoves run on straight vegetable oil

Promotion of use of oil expelled in the villages for cooking purpose through appropriate stoves to minimise the ill effects of use of wood in cooking

5. Biogas production

Individual biogas unit will be installed in the village, Kinnarahalli (Second lead villages), Holenarasipupr taluk with the population of 306 and 75 households. Biogas will be utilized for the cooking purpose. The capacity of the biogas units will be designed based on their requirement. This will be known after a detailed survey of their requirement and the raw material availability.

6. Animal feed

Oil cakes and tree leaves will be used as animal feed which will increase milk production and availability of year round fodder for the animals.

7. Assessment of villages

The demand for cooking gas/ electricity and willingness to pay for the use of gas and electricity will be worked out for smooth functioning and for long term management on self-sustaining basis.

8. Support systems

All the support systems for quality planting material, technology for collection, processing, market network and utilization of raw materials, value added products, by product utilization which available with the Biofuel Park and the University of Agricultural sciences, Bangalore will be made use of along with other agencies for related technologies.

9. Impact assessment

Assessment of the interventions provided to the community on the following lines.

- farmers willingness to accept the concept
- perception on the concept as beneficial to farming community or not?
- acceptance of the group / community approach for managing the resources
- willingness to share and benefit each other
- improvement in green cover of the village
- improvement in the production capacity of the oil seeds
- use of local waste effectively for energy production, % improvement
- reduction in burning of biomass
- improvement in soil fertility as a benefit from the by-products obtained in the biofuel value chain
- use of biomass to agriculture fields as manure
- improvement in agri-productivity
- any economic benefit accrued individually / collectively
- local employment generated
- over all acceptance by the community in the scale of 1-10

Table 5: Activity chart

Activity	Year I (first half)	Year I (second half)	Year II (first half)	Year II (second half)
Awareness among the communities and resource documentation				
Selection of villages for community based value chain activities				
Providing and planting elite plants in the target villages				
Awareness building and demonstration on oil expelling and use of co products				
Installation of machines for value addition in villages and SVO run stoves				
Demonstration of biogas production and use as manure in the selected villages				
Full scale utilization of facility for value chain activities, biofuel and biogas production and power generation for community needs				
Impact analysis of interventions on livelihood benefits to rural community through perception studies				

Expected Outputs:

1. Established a strong resource base for biofuel activities
2. Collection, utilization and marketing for feed stock
3. A pilot project for oil expelling and use in energy production in villages (a minimum of three tonnes of oil / biodiesel produced from the cluster of villages at the end of the project)
4. A community managed biogas system for cooking / power generation
5. Developed a full proof value chain activities for the community
6. Rural energy security model established
7. Involved communities at all levels with focus on women self -help group and entire village at large
8. Increased milk production and availability of fodder

Annex - 2: Budget (in Indian Rupees)

Sl. No.	Item	Year I	Year II	Total (Rs)
1.	Professional services / consultancies –oil expelling, biogas studies etc.	500000	500000	1000000
2.	Travel Cost (vehicle hiring, TA*)	200000	200000	400000
3.	Equipment**	2950000	2950000	5900000
4.	Operational costs (production maintenance nursery, labour contingencies, etc.)	500000	500000	1000000
5.	Training / capacity building (awareness, planting in villages)	125000	125000	250000
	Total	4275000	4275000	8550000
	Rs. Eighty five lac and fifty thousand only			

***Local, domestic and international travel**

****List of equipments:**

Sl No.	Items	Quantity	Cost per Unit in Rs. (lakhs)	Estimated Cost in Rs. (lakhs)
1	Oil expellers- 15kg/hr with accessories 15 nos.	15	0.70	10.50
2	Transesterification unit at Biofuel Park-50 lts multiple batches	1	5.00	5.00
3	SVO run cook stoves	30	0.10	3.00
4	25 kVA SVO run generator	1	5.0	5.00
5	Infrastructure biogas production unit	1	10.00	10.00
6	Biogas unit	20	1.00	20.00
7	Compression unit development (bottling biogas)	1	3.00	3.00
8	Lap top	1	0.70	2.50
	Camera – two no's for field work and documentation	2	0.20	
	Printer / scanner	1	0.50	
	Xerox and accessories	1	0.30	
		1	0.80	
	Total			59.00

Annexure 3: Details of project implementation

	Village cluster - I	Village cluster - II	Lead village for demonstration of energy cycle for basic needs
Number of villages	10	10	Two villages one in each cluster
Present status on feed stock product in kgs	300-1500	300-1500	500-1500
Benefit of participation in net work program on bio-energy	One mini oil expeller machine for every two villages for oil expelling	One mini oil expeller machine for every two villages for oil expelling	One mini oil expeller machine for each of the villages for oil expelling
Employment generation	- A minimum of two persons employed for collection and processing of feed stock	A minimum of two persons employed for collection and processing of feed stock	A minimum of two persons employed for collection and processing of feed stock
Value addition	- A minimum of two persons employed for collection and processing of feed stock	A minimum of two persons employed for collection and processing of feed stock	A minimum of two persons employed for collection and processing of feed stock
Marketing	Market available locally to support lead village	Market available locally to support lead village	Market within the village to produce energy to meet all basic needs
Motivation	Growing additional biofuel tree species to increase feed stock production and also effective collection and marketing of available resources- entrepreneurship development	Growing additional biofuel tree species to increase feed stock production and also effective collection and marketing of available resources entrepreneurship development	Growing additional biofuel tree species to increase feed stock production and also effective collection and marketing of available resources entrepreneurship development
Direct benefits	Employment and income generation	Employment and income generation	Employment and income generation
Indirect benefits	Tree cover, biomass for soil improvement, agriculture production, plant protection, animal feed etc.	Tree cover, biomass for soil improvement, agriculture production, plant protection, animal feed etc.	Tree cover, biomass for soil improvement, agriculture production, plant protection, animal feed etc.
Later Options	Use oil and oil cake for cook stoves and biogas	Use oil and oil cake for cook stoves and biogas	

Fig. 2 Flow chart of activities in targeted villages

