

STUDY OF SUSTAINABLE UTILITY OF BIOMASS ENERGY TECHNOLOGIES FOR RURAL INFRASTRUCTURE AND VILLAGE POWER-OPPORTUNITIES BY DEVELOPING BIO VILLAGE MODEL

Harsha D N¹, Aravind Rao Yadwad², Bheemsh Arya³, Ravikumar S⁴

¹Assistant Professor, Department of Mechanical Engineering, ATMECE, Mysore, Karnataka, India

²Associate Professor, Department of Mechanical Engineering, NIE Mysore, Karnataka, India

³Associate Professor, Department of Mechanical Engineering, BMSCE Bangalore, Karnataka, India

⁴Assistant Professor, Department of Mechanical Engineering, ATMECE, Mysore, Karnataka, India

Abstract

Bio village is a process that can keep a village attaining sustainable development. It is also the habitat on which human being can live with pleasant environment. Effective and efficient planning of bio village is main consideration for its maximum benefits. Aim of designing and planning is based on the Bio Village uses all the nature friendly farming and environment friendly rural technologies. First Bio farming that is organic farming in farms. Bio-fuel for diesel engines also for power generation at village level, Biogas and gobar gas technologies for on free energy production, Biomass utilization techniques for conserving on farm charges is ASTRA Cholas, ASTRA drivers. Value addition to Biomass that is charcoal, wood in wood carbon and active carbon preparation, growing Bio-fuel trees on all builds, wastelands, tanks bunds, soil and water conservation structures, canal bunds and water shell areas to conserve mother nature. For the first time the whole village will be 'self-independent' by conserving nature through Bio village concept. In present work an attempt has been made to reveal feasibility of use of bio Village. Under this work detailed studies will be conducted for analyzing the problem of rural area The concept of bio village seems to be the best solution for many problems of rural areas.

Keywords: Bio village, Bio gas, Bio Diesel, Bio fertilizer

1. INTRODUCTION

Energy is the main constraint for village development. Modern technologies of power generation doing by hand in hand with Mother Nature. But our vision Bio-energy village will not only give energy and feel independence to every village and every whole world. Increasing electricity demand, hike in fuel prices, environmental concerns are the main factors which motivates the use of renewable energy sources in India. In past few year India has shown a significantly growth in utilization of renewable energy sources. Today the share of renewable energy sources is almost 12% in total electricity generation[1]. According to Ministry of Power in India so far 1.15 thousands of villages still unelectrified.

The function of a bio village mainly depends on the major bio-productive systems such as agricultural lands, grasslands, forest and wetland, which together form important physical resource base. In developing countries like India, the rural sector with high population density and high level of poverty poses a serious threat to the environment. Degradation of the environment is closely related to the pattern of resource use which is influenced by population level, migration pattern, market access and land use practices.

A bio village is a human settlement that enables its residents to live a good quality of life while using maximum

natural resources. It has successfully solved environmental problems including poverty, poor environmental management and wasteful production and consumption methods[2].

India the land of villages and leader in agro based economy will become world super power and leader by 2020, if the model of Bio village is replicated in each and every village of the country. India lives in villages and village breathes though rural households, the dream, yes, the dream of total self-reliant village can only be achieved with 'Bio Village' concept.

2. PLANNING OF BIO VILLAGE

The concept starts from micro level in individual farmer and grows up to man level that is Bio nation! The whole idea is like this. Every farm family first plant neem, pongamia and mahuva saplings on the bunds and boundaries only. When they grow as trees, the farm Bio fencing to every farm land, increase farm yields by conserving soil and water, give good leaf manure to improve soil fertility. Above all give Bio-fuel and conserve nature[3]. The farmer can either sell the oil seeds or extract oil from it though small expeller units in his house. The expeller units at house hold level can be unutilized for extracting oil form edible oil seeds also apart using it for bio-fuel production. Oil cake product as byproduct will go back to soil to which soil nutrients and to

improve soil health. If the farmer directly sells the oil seeds he will be losing oil cake. The first value addition is in farmer's farm.

The Biofuel trees need at least 4 to 5 years of gestation period to yield. Till that period the concept of Bio village works with existing Bio fuel trees in the area. Truly every village has necessary natural (Resources in it. But without knowing the value, farmers are selling the biofuel seeds for through away price. The project first imparts the importance of Bio fuel and Bio village to every house hold through continuous training and awakens programme. First tries to educate farmers to conserve what they have and what village has continuous education and motivation though training programmes will help farmers to do the work on self-help group concept, which of course is the proven technology for concept (Fig.1).

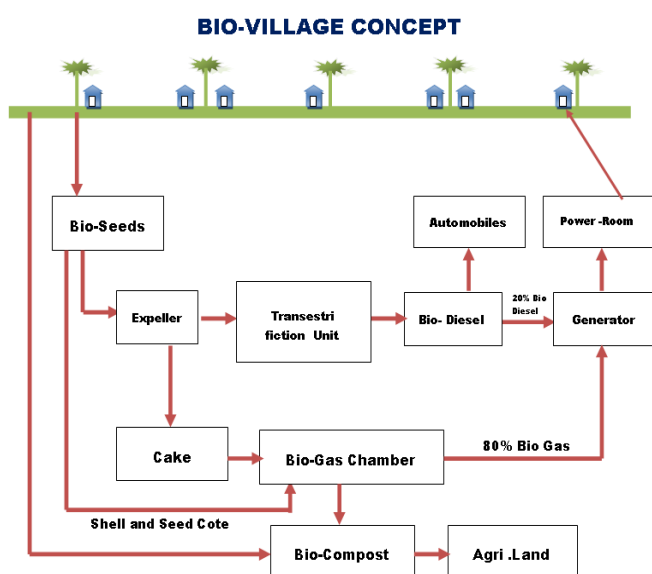


Fig -1: Proposed plan for of Bio Village

After completion of every bund and bunding of farm, the group will then venture into encroached water sold are as of village tanks, and bunds. As the people products continue, even the waste lands will also turn is to Bio fuel parks. What is the effect? The village tank will hold more water in it as the biofuel trees check the silt flowing into the tank. Water table of the village will increase. Ground water pollution will come down. Bio fuel park will hold and the animals entering into village (Monkeys and Birds) and will be home for them. Otherwise they would have attacked the farmer's fields for their food. Naturally whole village will be natural garden by its own.

Collection of Biofuel seeds will be the bread eater for land less and workless people in village. This helps in empowerment of rural poor[5]. The next stage of Bio village is establishment of expeller units at each village for extracting oil depending on the availability of oil seeds. Attached to this unit there will be two other units for further value addition. The next stage is 'Bio living. Every house hold which thrives though tilling well lead contextual life. The Bio living wholly refers organic / Bio farming in farms,

growing everything a family needs, through diversified and sustainable farming, checking the flow of inputs from outside the farm, optimum centralization of on farm resources and finally the family should lead bio life in the farm itself. The peaceful life style of a farmer / rural poor with him healthy living standards should influence the urban people. Thereby putting an end to inflow of urban civilization to rural sector. Urban life style should be influenced by rural Bio life methods rather than vice versa. When urban dwellers copy rural life style, naturally flow of rural farmers to urban areas will stop. And urban population will drive into Bio Villages for food, energy, clean environment and natural living styles. This helps in the flow of urban money into rural sector. The bio village becomes stronger [4].

At this stage the rural farm family can thinks of 'Bio form' apart from leading happy life in Bio farms, a farm family can construct a small home for tourists. The small accommodation will be a divine place to study rural bio living concepts, Bio farming, exchange cultural heritage and enjoy pollution free environment. In addition 'Bio tourism'. Will give the farmer additional confidences in his life style along will revenue. Every farm will be the training confidence in his life style along with revenue. Every farm will be the training cultures of class rural enough is urban mass.

This concept also empowers farmer though training programmers. The training includes low cost structures construction in farms for bio tourism, bio fuel production, Bio farming, production of Handmade soaps, Hair oil, teeth powder, etc., all the family needs, without depending on urban economy value addition to crops. The training is regular in nature and the influence is long lasting. The farm family wise naturally uses all these products but can also share term with Bio tourists who visit the farms for learning yes; it is an income generating activity also. The strengthen of rural economy take place without strengthen rural family. The Bio village concept believes in strengthening every rural no use hold, and making them to lead their own life which pride and perfection[6].

3. SWOT ANALYSIS

3.1 Strength

- Demand for fuel is increasing all over the world and natural fuel availability is declining.
- At present importing fuel for our self-sufficiency.
- Bio Fuel is the alternate fuel which formers can grow, process itself.
- Bio fuel can be grown in marginal and work. And lands command areas of tanks and on bunds of all agricultural lands.
- Bio fuel trees conserve soil and water.
- More than 300 species of plants in India have 5 to 70% oil in it. And 30% oil is enough for Bio fuel production.
- Neem tree starts yield daily from 4th year (2 to 5 kg year), Pongemiya from 3rd year (2 to 5 kg) and on 100

years old Mahava tree can yield 500 kg of oil seed kernel.

- Remove 25% of Bio fuel tree yield will increase. The cut vegetation is used as area leaf manure to increase soil fertility which will further increase the yield.
- Approximately for 4kg of oil seeds, 1 kg oil, 2.5 to 3kg oil cake and 10% glycoside can be obtained.
- Bio fuel trees reduce air pollution and use of bio fuel in engineer will further reduce air pollution.
- Money flow from rich to poor.
- Farmer groups at each village level can establish oil expellers, and bio fuel production cultures to strengthen their village economy.
- Individual farmer will be benefited in several ways. Fuel trees will conserve soil and water, though ran water harvesting. His fuel dependency will come down. Because otherwise they should be dependent on electricity for lifting water for the bore well.
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- All rural development of villages is also possible though farmer's class involved in Bio fuel production as they get income from selling Bio fuel.
- The whole project will run through rural people involvement.
- The whole project is a village development plan. Farmers can grow bio fuel plants n their field. Land less can collect the seeds from the crops already available in the village. Every house hold can have a small oil expeller unit. A village can have big expeller units allow with bio Fuel production plant. Fuel produced will be first used in village for their self-sufficiency. After it will be sold for bringing in money from city to villages. A count the bio fuel village is the pride of nation.
- Cooperative set up for procuring, processing and selling to strengthen village economy.

3.2 Weaknesses

- Availability of energy is seasonal and intermittent.
- Renewable energy sources are usually low density energies requiring larger areas of space[1].
- Financial availability in question, particularly in comparison to other conventional energy supply systems.

3.3 Opportunities

- Environment driven awareness;
- Policy initiatives-at global and national levels;
- Short gestation period schemes
- Shorter lead time, quicker implementation of projects;
- Easy to install 'stand-alone 'systems
- Provides opportunities for electrification even in remote areas;
- Lot of support from Government. sector for promotion of Bio fuel production.

- i. 50% subsidy on markets used for disabling, expelling and prude of Bio fuel.
- ii. No VAT on markets of Bio fuel. (Now it is 4%)
- iii. No tax on machineries.
- iv. No profit tax for next 10 years.
- v. subsidy for bio fuel in corporation with diesel
- vi. All the above said concessions are in addition to the available Government support for setting up of industry at rural level.

- Divert profit for farmers form selling oil seeds.
- Cost of other inputs considerably reduced
- Generate employment in rural areas
- In most cases cost of fuel transport eliminated

3.4 Threats

- If the environment driven momentum is lost, renewable energy thrust would die down.
- Cost of other inputs considerably reduced
- Generate employment in rural areas
- In most cases cost of fuel transport eliminated

4. TARGET GROUP

4.1 Primary Target

1. Women,
2. landless laborer's,
3. small & marginal farmers of the selected villages

4.2 Secondary Target

Medium and other farmers of the project area and surrounding villages

5. IMPLEMENTATION STRATEGY

- More importance will be given to community participation in project implementation. SHGs will be formed strengthened and Bio-village project. Committees will be formed in each village.
- This committee will consist of SHG representatives/SC/ST, landless, micro-entrepreneurs/small vendors, GP members and other opinion leaders (not to exceed 15 members – with 40% representation from women).
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- A project level committee will also be formed and it will work on building environment, trouble shooting and lobbying of the project.
- The community will be motivated to contribute at least 10% of the project cost
- Bio-village Development Plan will be prepared in each village. Gaps and resources will be assessed at family and village level in view of Bio-village Bio-living and micro level planning will be prepared. Each micro plan will be prepared thro' different participatory tools in 4-5 days.

- Mass IEC and training programmes will be launched to generate awareness among the community
- Convergence of various Departments and Financial Institutions for effective implementation of the project
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6. DESIGN AND OBSERVATIONS

6.1 Village Load Assessment

In a village the demand for electricity is not as high as in urban areas. The basic energy requirements in such areas can be classified as domestic, agricultural and community.

- In the domestic sector electricity is required to use appliances like television, compact fluorescent lamps, ceiling fans, refrigerator, cooler, heater etc.
- In irrigation for water pumping
- The community load serves the community center, village community offices, shops, schools and medical Centre.

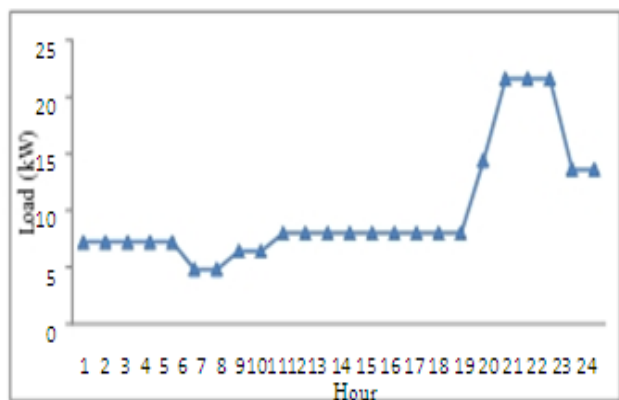


Fig-2: Hourly average domestic demand of Indian village

Fig.2” and “Fig.3” shows hourly average domestic and community load profile respectively in proposed village.

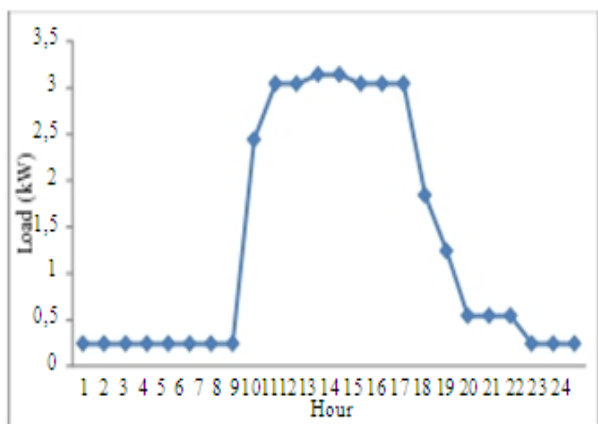


Fig-3: Hourly average community load profile of the village.

6.2 Total Energy Consumption for Domestic Purpose

Let us assume by considering 200 house village and calculate total energy requirements of domestic and community purpose.

“Fig.4” and “Table 1” demonstrates the Load assessment in a single house use incandescent bulbs in a typical Indian village.

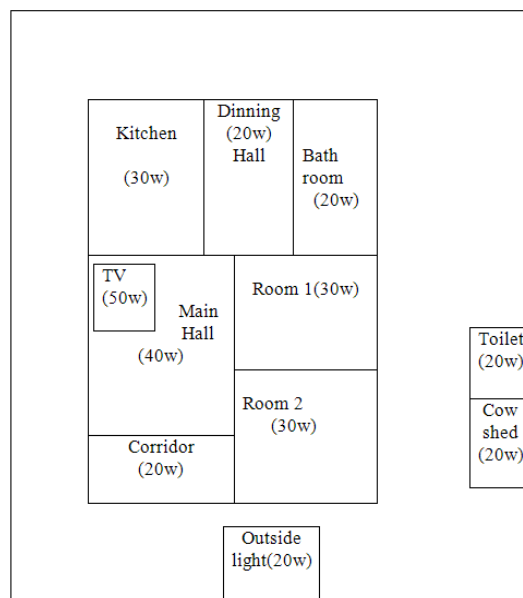


Fig-4: Load assessment in a single house use incandescent bulbs

“Fig.5” and “Table 2” demonstrates the Load assessment in a single house use of CFL bulbs in a typical Indian village .

Table -1: Load assessment in a single house use incandescent bulbs

S l . n o	Places	No's	Watt s	Watt age	Hrs. of Watt age	Ene rgy(watt s/hr s/day)
1	Main Hall	1	40	40	4	160
2	Television	1	50	50	3	150
3	Room1 & Room 2	2	30	60	2	120
4	Kitchen	1	30	30	3	90
5	Bath room, toilet ,caridar, cow shed, dining hall	5	20	100	1	100
6	Fan, mixi, etc	-	-	80	-	80
TOTAL						700

Discontinuous power supply because of difficulty in Connecting them with grid and increase load on conventional system is another problem for villagers so most of them are using diesel pump for irrigation purposes which are again inefficient and polluting[6].

So, for the country like in India where biomass resources are abundantly available for electricity generation to meet the demand without any environmental hazard and making the village self-sustained in its energy requirement is the most suitable one[7][8].

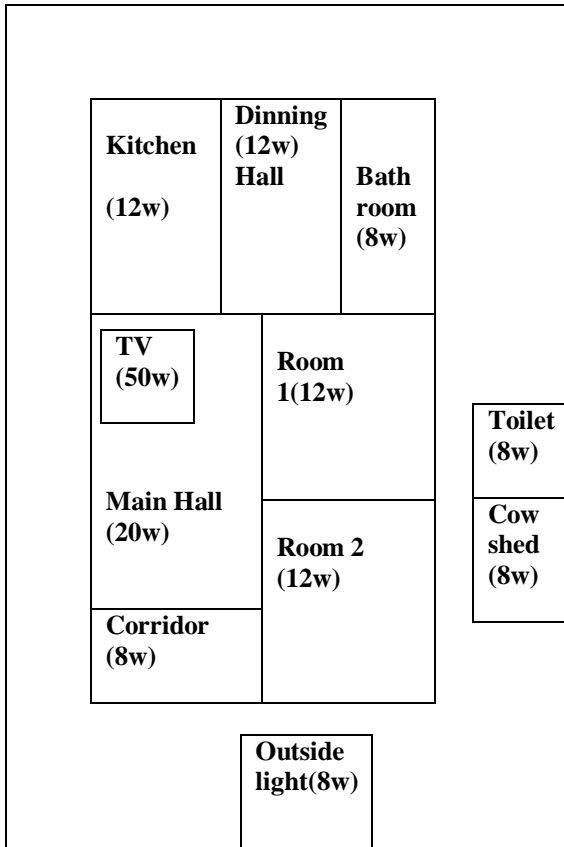


Fig-5: Load assessment in a single house use CFL bulbs

Table -2: Load assessment in a single house use CFL bulbs

Sl. no	places	No .s	W at ts	W at tage	Hrs of Watt age	Energy(watt s/hrs/d ay)
1	Main Hall	1	20	20	4	80
2	Television	1	50	50	3	150
3	Room1 &Room 2	2	12	24	2	48
4	Kitchen	1	12	12	3	36
5	Bath room,toilet, caridar,coo w shed, dining hall	5	8	40	1	40
6	Fan,mixi, etc	-	-	80	-	80
TOTAL						434

6.3 Total Energy Consumption for Community Purpose

Table “3” demonstrates the Load assessment of community purpose in (contains 200 house) typical Indian village.

Table -3: Load assessment for community purpose

Particulars	Watts	Wattage	Hrs. of Wattage	Energy(watts/hr s./day)
Street Lights	80	800	04	3200(3.2 kw)
Flour mill, water supply pump, etc i	340	3400	02	6.8kw

6.4 Total Energy Consumption for Domestic and Community Purpose for 200 Houses Village

- (a) Energy Consumption for 200 houses is 200×700 (Incandescent Bulbs)= 140000W or 140KW
- (b) I (a) Energy Consumption for 200 houses is 200×434 (CFL Bulbs) = 86800W or 86.60KW

Table “4” demonstrates the Load assessment of domestic and community purpose in (contains 200 house) typical Indian village.

Table -3: Load assessment for 200 hoses village

Total Energy Consumption for house lights	140KW
Total Energy Consumption for street lights	3.2KW
Total Energy Consumption for Flour mill, water supply pump, etc is	6.8kw
Total	150KW

Hence with help of table -3 conclude that Total Energy Consumption in a village (200 houses)/day is 150KW

Total Energy Consumption for Single house is $150/200$ is 0.75KW

7. BIO FUEL CONSUMPTION DETAILS

7.1 Case I (By Bio Diesel)

One liter biodiesel produces three units (3KW) energy/hrs.

* Therefore 50 liters biodiesel is require to Produces 150KW energy

* To prepare 50 liters bio diesel require 200kg oil Seeds.

Therefore in a 200 houses village, each house family will collect one kg oil seeds/day or 365 kg/year[9].

7.2 Case II (By Bio Diesel Bio Gas)

In bio diesel extraction process, approximately get **150 kg oil cake**. Using **150 kg** oil cake produces **60 m³** gases and it gives **75KW** energy. Hence to produce remaining 75KW energy requires **25 liters** biodiesel.

Therefore in a 200 houses village, each house family will collect **1/2 kg oil seeds/day** or **183 kg/year**[10].

8. COST ANALYSIS

To meet electricity demand of village, a biomass energy system is proposed whose optimized result is found with the help of MNRE details.

Initial cost (one ton capacity plant) (Rs)

Land (0.5 acre) =	5, 00,000.00
Seed storage house construction cost =	3, 00,000.00
Machineries cost	
Oil expeller unit (125kg/hrs) =	1, 00,000.00
Bio diesel extraction unit =	2, 50,000.00
Re shelling machine =	5,000.00
Seed coat removal machine =	20,000.00
Generator (200KW) =	15, 00,000.00
Bio Gas chamber =	18, 00,000.00
Miscellaneous =	2, 00,000.00

Total =45, 75,000.00

Annual cost (Rs)

Raw material =	54, 75,000.00
(Rs 15/kg*1000*365)	
Processing cost =	10, 00,000.00
(Includes labour, maintenance	
Chemicals, etc)	

Total =64, 75,000.00

Annual income (Rs)

Bio diesel cost =	47, 45, 000.00
(Rs 52/liter*250*365)	
Bio gas cost =	13, 00,000.00
(Rs 9/unit*400*365)	
Oil cake manure =	27, 37,500.00
(Rs 15/kg*500*365)	
Glycerin =	1, 09,500.00
(Rs 6/liter*50*365)	

Total = 88, 92,500.00

88, 92,500.00
 Benefit Cost ratio (B.C ratio) = $\frac{88,92,500.00}{64,75,000.00} = 1.3733$

*In this concept, get BC ratio is 1.3733. Hence project is feasible

Profit =88, 92,500.00 - 64, 75,000.00=24, 17,500.00Rs
 (Payback period is around 03 years)

9. CONCLUSIONS

Bio village module has the advantage of stability and providing power on environmental friendly basis. The objective to meet electricity demand of village can be achieved by making proper utilization of biomass resources. The two major problem of managing the residue left after harvesting and inconvenient electricity supply of villages could be well overcome by utilizing the existing resource of village and making itself sustainable in its energy requirements.

In this paper Bio village module to integrate the abundantly available renewable resources which are a clean source of energy and are currently wasted due to lack of awareness. In this paper efforts are made to exploit biomass resources in the region and suggest some of the cost effective and environment friendly ways to meet the demand. The cost analysis predict in spite of having huge capital and installation cost renewable energy sources prove to be more reliable and environmental friendly source to provide electricity in remote or off grid areas.

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