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Role of Renewable Energy Technologies for Improvement of Rural Livelihood and Energy Savings

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Abstract—*The survey has been conducted on 11 villages (these were remote and suffered from poverty and deprivation in multiple ways) in Akola District of Maharashtra, for finding ways to integrate the renewable energy technologies in rural life. During survey it was found that there was an immense potential to use RETs in rural life such as in cooking, use of improved chulha and biogas. In place of irrigation system one can use the solar pump or gasifier based pumping system which saves 23.4 lakh KWh of electricity, 20.8 lakh tonne of CO_2 emission reduction per annum and about 1.05 crore per year. For mid day meals provided at schools, an improved biomass chulha can be used which saves up to 7334.4 kg/year of fuel and associated GHG emission. For street lighting, solar street light or gasifier based street lighting can be a better option and it saves up to 1.5 lakh KWh. The study revealed that, if RETs are used within the rural areas, then total energy of 24.99 lakh KWh/year could be saved which might improve the rural livelihood.*

1. INTRODUCTION

India is a country with vast population and limited natural resources. It is endowed with rich solar energy resource. Current installed capacity of renewable energy is around 9220 MW, constituting about 7.3 per cent of India's total installed generation capacity of 146 GW(Ref-MNRE).

2. OBJECTIVES

To find the potential of Renewable Energy Technologies for Improvement of Rural Livelihood and energy savings.

3. METHODOLOGY

We Plan for the survey and Prepare questionnaires. We visit agriculture offices, Tehsil office & collect basic data about Akola District. On the basic of BPL percentage data we select the targeted villages and Contact with concern Krushisahayak & Gramsevak. After it we Prepare & plan visits to villages and respective Grampanchyat members, Sarpanch and local villagers. We discused the concern personnel on various social aspects such as Education systems, Irrigation, Energy, Drinking water, Cooking systems, Industries & Farm Machinery. Finally we Draft & study the collected data from respective village and Draft the future possibilities.

4. DISTRICT AKOLA (MAHARASHTRA)

4.1 Geographic Location and Demography

Akola district is situated at latitude 20.7^0 to 21.17^0 north and longitude 76.7^0 to 77.4^0 east. Melghat Hills and forest region surround the Akola District. There are 178 Villages under Akola Tehsil having population 18, 18617 and population density is 321 person /sq.km. The Literacy percentage is 87.55%. By analyzing the BPL percentage data of villages we sort out the following eleven villages having BPL percentage above 50 in Akola Tehsil of Akola District.

selected villages with BPL percentage are: Goregaon Kh(69), Goregaon Bk(67), Mazod(65), Nimbimalokar(39), Kalambeshwer(63), Lakhanwada(62), Kharap Kh.(52), Loni(42), Kapashi Talav (52), Somathana(55), Hingana(75). Following graph depicts the Scenario of BPL in Akola District.

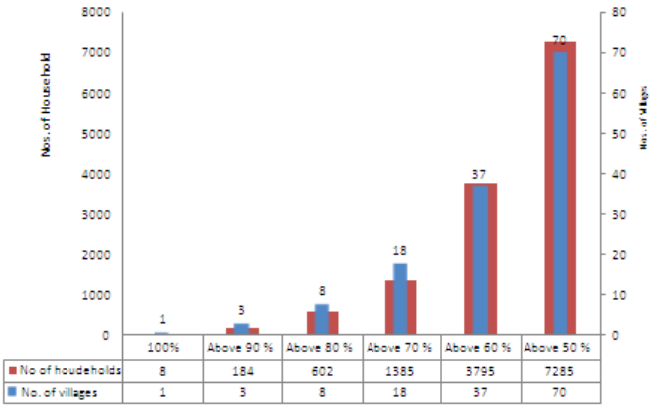

Fig. 1: No. of villages & households having 100 & above 90, 80, 70, 60 and 50 % BPL.

5. ANALYSIS

Household Level Analysis

The total numbers of households in eleven villages are 3, 411. In which 1, 365 houses are in poor structure whereas remaining is of concrete structures. The majority of households in the villages are engaged in agriculture, raise livestock and work as casual labour. Access to these villages is difficult during the rainy season as the road becomes slushy.

Lighting and Energy

We have survey information regarding the solar home lights, streetlights, biogas and gasifier systems in targeted villages. All targeted villages have electricity access. For cooking purpose mainly an average 95 % villagers used Chula (wood as a fuel). Some households used Kerosene, dung cake as well as LPG for cooking.

Education and mid day Meals at Schools

The total numbers of schools are 33 in targeted villages**.** In which Regular mid-day meals are provided to the students in 25 schools. The number of consumptive is 2, 292 students. Uniform and books are provided in some schools under Sarv Shiksha Abhiyan. Mostly Chula (Wood as a fuel, for 3 Kg food requires 1.5 Kg Wood) is used in School for cooking. As per requirements, 229.2 Kg food is cooked per day (100 gm per student). By using Improved Chula instead of Chula it reduces the associated health problem, quantity of fuel and GHG emissions.

Livestock

Total number of livestock population in eleven villages is 10,762. Total wet biomass (dung) production from eleven villages is 180 tons per day.

Water Distribution

Water is the main source for all living things. We have survey data according to which, all villagers used taps and hand pumps for drinking water. Some water distribution channel is on government basis and some are on private basis.

Irrigation Systems

Irrigation increases productivity of crops. Source of irrigation are the Rainfall, Well, Bore well, Canal, Dam, River and Lake. Mainly all targeted villages irrigate the field by using Bore well and well. Bleaching powder is used in tank or nearby the hand pump area for cleaning purpose and Jeevan drop is used on individual basis. Generally Cleaning treatment is adopted either 3 or after 15 days. This irregular water cleaning treatment directly affected on people's health.

Industries

The total number of industries in targeted villages is 22 which include Saw mill, cotton ginning mill, cracker, pani pouch, welding workshop, gas godown, fodder and furniture manufacturing industries etc.

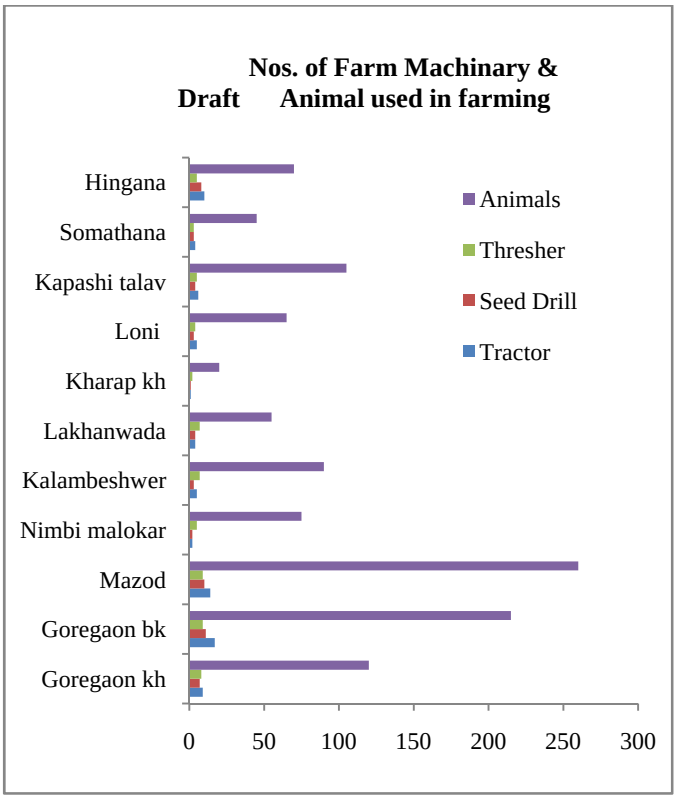

Fig. 2: Farm Machinery used in Villages.

After analysis of the data, in villages major energy consuming area is cooking almost 95% of cooking requirement is met thru wood & agro residue. **Secondly** the energy consuming sector is irrigation & this energy demand met thru electricity. And **thirdly** the streetlight & household electricity requirement.

6. CALCULATIONS

As per survey data, total number of chulas used for cooking purpose at households level is 2973 and 21 in schools. Total numbers of consumptives in schools are 2292. As per requirements, 229.2 Kg food is cooked per day. Total wood required for cooking is 132 kg for one day. So total wood consumed for cooking in one year (**assume 200 days) is 22, 920 kg which have cost of 1, 14, 600 Rs/-.**

-There exist the possibility to use **solar power operated pump and Gasifier** power operated pump instead of electricity based pump. If these pumps are replaced by solar pump as well as gasifier based pump then we can save 23, 42440 KWh electricity and 1, 0540980 Rs/- per year 20, 84, 771.6 tCO2e emission reduction/annum. Gasifier based pumping system can be wok cost-effectively.

Table 1: Calculation of Irrigation Systems in targeted villages.

Total electricity consumption (KWh)=(A*B*C*D*E)/1000

	A	B	C	D	E	F	
Villages	**pump**	**HP**	**Watt**	**No. of hour**	**No. of days**	**Total electricity consumption**	**KWh/Rs (F*4.50)**
GorKh.	80	5	746	5	200	298400	1342800
GorBk.	30	5	746	5	200	111900	503550
Mazod	325	5	746	5	200	1212250	5455125
N.M	10	5	746	5	200	37300	167850
Kal	118	5	746	5	200	440140	1980630
Lk	5	5	746	5	200	18650	83925
Khakh.	9	5	746	5	200	33570	151065
Loni	10	5	746	5	200	37300	167850
K.p	7	5	746	5	200	26110	117495
Som	27	5	746	5	200	100710	453195
H.m	7	5	746	5	200	26110	117495
Total	628	5	746	5	200	23, 42440	1, 0540980

Assumptions

Capacity of pumps = 5 HP, Working Hours = 5 hrs/day and working days =200, 4.5 Rs/unit.

Usage of energy efficient motor can also reduces electricity consumption by 5%. In targeted villages almost 23, 42440 kWh/annum & 1, 0540980 Rs/annum.

Calculation of SVL based street lights in targeted villages.

Assumption:-

SVL of 210 watt

Table 2: Calculation of SVL based street lights in targeted villages.

	A	B	C	D	E	F
Villages	**Street light**	**No.s of SVL**	**Working hours**	**Working days**	**KWh for SVL (B*210*C*D)/1000**	**KWh/Rs (E*4.50)**
GorKh.		52	11	365	43843.8	197297.1
GorBk.	45	43	11	365	36255.45	163149.525
Mazod	60	50	11	365	42157.5	189708.75
N.M	45	45	11	365	37941.75	170737.875
Kal	60	50	11	365	42157.5	189708.75
Lk	45	45	11	365	37941.75	170737.875
Khakh.	10	5	11	365	4215.75	18970.875
Loni	10	10	11	365	8431.5	37941.75
K.p	50	40	11	365	33726	151767
Som	25	25	11	365	21078.75	94854.375
H.m	48	35	11	365	29510.25	132796.125
Total	450	400			3, 37260	15, 17670

Calculation for W-LED based street light is same for SVL street light.

Table 3: Comparison between SVL and W- LED based street lights.

Particulars	**SVL based street Light**	**W- LED based street light**	**Difference**
Electricity consumption (KWh)	3, 37260	1, 79872	1, 57388
Cost (Rs/-)	15, 17670	8, 09424	7, 08246

-As per the survey data**,** in targeted villages, we observed that water quality did not check in villages and there is no predefine frequency to conduct water quality test. Use of bleaching powder for cleaning of water is on community basis and Jeevan drop as well as alum treatment is on individual basis. In observed scenario we would like to suggest that,

- To perform frequent water quality test.
- Community water filtration system.
- Proper sanitation near water source site.

This will help to prevent water born disease as well as maintain the social health. This will also support to water management & village cleanliness.

7. CONCLUSION

- Instead of traditional Chula we can used improved cook stoves. it will results into fuel saving of 20-45 %, emission reduction about 45-86% & saving in cooking time about 17-43%.
- Mid-day Meal in School, we can save 7334.4 kg/year of fuel & associated GHG emission.
- The total numbers of electricity based pump in targeted villages are 628. If these pumps are replaced by solar pump or gasifier based pump then we can save2,342440KWh electricity, **20,84771.6 tCO_2e emission reduction/annum,** and 1, 0540980 Rs/- per year. Also by creating awareness & usage of energy

efficient pump will result into 5 % saving of electricity, this added benefit at farmer end.

- The total number of SVL street lights is 400 in all 11 villages. If we replace these SVL based street light by LED, we can save 1, 57388 KWh and cost is 7, 08246 Rs/-.
- Also by creating awareness & usage of energy efficient pump will result into 5 % saving of electricity, this added benefit at farmer end.
- For irrigation purpose we can suggest drip irrigation systems for efficient use of water it save 50-55% of water & 30% associated energy saving.

An important goal of the project is to use the energy for economic activity to enable generation of cash income, reduction of poverty, reduce the drudgery, loss of time in fetching fuel-wood and water. The purpose is to improve the lives of the poor women and men and those who are marginalized and disadvantaged in India. The villages selected for survey of the project in Akola Tehsil are remote (Nimbi Malokar, Lakhanwada and Loni) and the villagers suffer from poverty and deprivation in multiple ways. Through this project activity we aim to find out the ways by which we come contribute to sustainable development of village. After this study we believe that RETs has a potential to make a big difference in rural life & it will be an important factor for Village Prosperity.

We will communicate this report to concern people of villages like Gramsavak & Panchayat People. We believe that if government, university & villagers work together for attaining the prosperity of villages then it be a true integrated & sustainable development.

REFERENCES

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[3] Survey data.