# Action towards sustainable rural energy: enhancing energy security for forest villages

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**ABSTRACT**
*India has around 6.41 lakh villages in which 2,474 forest villages& settlements spread over 12 States are completely located in the forest. Forest villages mostly habitat of tribal and their population (Forest dwellers) and their livelihoods are critically linked to the forest ecosystem. These forest dwellers are among the poorest people and are highly vulnerable because of high dependency on natural resources, and lacking clean and efficient energy. This has made them to be remaining poor and poor quality of life. In the absence to grid connected power, they are not in a position to irrigate the land and better utilize their skill and time to enhance their economy. Further, fuel-mix in the forest villages of India is characterized by predominance of bio-energy which includes fuel-wood, crop residues, and animal dung. This heavy dependence on biomass and traditional energy techniques with low conversion efficiency has led to serious environmental and health effects, particularly at the local, regional level. The most obvious solution would be to connect these villages through grid supply, but due to their remoteness and heavy transmission & distribution loss, this may not be a viable solution to get them connected to grid connected power supply. India is committed for enhancing its share of clean energy and also electrify those remote villages, which are not connected through grids. There are efficient renewable energy techniques (RET), widely tested in India may also be suitable to these forest villages also. These villages are rich in renewable energy sources like flowing water, wind, solar and more reliable one is the bio-mass. The paper is discussing on the quantification of forest village resources and proto-typing and institutionalizing RETs for energy security to these villagers. Sustainable management of renewable feed stock for RET will help to conserve the forest and enhance livelihood and quality life of these forest villages.*

***Key words*:** Renewable Energy Technology, Forest villages, Energy Security

## I INTRODUCTION

India has around 6.41 lakh villages located in and around the forests (Census, 2011). Presently there are 2,474 forest villages/ habitations spread over 12 States are completely located inside the forest and have no or limited access to electricity and clean fuel and their population livelihoods critically linked to the forest resources (MoEF, 2006).Their main activities are collection of edible fruits, flowers, tubers, roots, leaves for food and medicines, firewood for cooking, small wood for agricultural implements, timber for house construction and poles for fencing, fodder for livestock and grazing of livestock in forest. Many of these products are consumed and small surplus amount is marketed as Non Timber Forest Produces (NTFPs). Because of selling of these products in raw form, they get little return to their efforts. The best known reasons for lesser return are due to marketing of NTFPs without processed/ value addition. These products can be processed/ value added in their leisure period like late evening and night hours, which is not possible due to the absence of electricity. Further the quality water for drinking and irrigation is not met due to non-availability of energy, which is the requirement to exploit groundwater, which is lowered over the years. Further the energy situation has direct bearing on education and literacy rate in these tribal dominated forest villages, which is lower than the national average. Therefore, the first and foremost problem before tribal communities in India is to sustain livelihoods and need of sustainable energy to enhance the health & hygiene and education level.

## II RURAL ENERGY

In India various initiatives have been made to improve the socio-economic condition and energy infrastructure in rural areas. In this regards, the Kutir Jyoti Program was initiated in 1989 to provide single point light connection to all socially and economically weaker section, which includes Below Poverty Line (BPL) and Schedule Cast/Schedule Tribe and has been the longest amongst all household electrification programs. However the program suffered due to non-grid connected villages and interrupted power supply. The Electricity Act, 2003 seeks to bring about a qualitative transformation of the electricity sector through the creation of a liberal framework for development for the power sector and dissociate the government and the regulator. In 2005, with the launch of the Rajiv Gandhi Grameen Vidyutikaran Yojana, all grids related rural electrification programs were consolidated and a concerted attempt was made to provide “electricity for all” in a time-bound manner. These programmes has done tremendous changes in life style of rural people, but the condition of forest villages remain same as

no programmes are implemented properly in these forest villages because of their remoteness.

## III FUEL IN FOREST VILLAGES

The fuel-mix in the forest villages of India is characterized by predominance of bio-energy based fuels like fuel-wood. Fuel hood is the main source of energy. In India 85–90% of the domestic energy and 75% of all rural energy come from biomass fuels (fuel-wood, crop residues, and animal dung). This heavy dependence on inefficient biomass and traditional devices with low conversion efficiency has led to serious environmental and health effects, particularly at the local, regional level. The most obvious solution would be to shift rural poor towards more efficient energy sources like commercial fuels and electricity and renewable energy technology. However, the low purchasing power of these people, low penetration levels of commercial and clean energy options/ fuels in these areas has resulted in a generic failure in achieving the objective of sustainable development in forest villages.

## IV RENEWABLE ENERGY FOR FOREST VILLAGES

Although, access to electricity is vital for achieving Millennium Development Goals (MDGs) aimed at alleviating poverty (AGECC, 2010) and rural electrification presents a significant challenge in many developing countries (Yadoo and Cruickshank, 2012; Zomers, 2003). Small-scale renewable energy technologies (RET) like solar home systems, residential wind turbines, biogas digesters and wood gasifiers, micro-hydro power projects, and improved cook stoves offer households and communities the ability to tackle extreme poverty and raise standards of living (Sovacool, 2012). Collaborations programs involving governments as well as businesses, nonprofit organizations, banks, and community based cooperatives have blossomed in recent years to expand access to these technologies and the energy services to forest villagers. As one such effort, in 2011 the Secretary General of the United Nations launched the initiative Sustainable Energy for All (SE4ALL) to create a coordinated global response to energy poverty and access problems. That initiative aims to ensure sustainable energy for all by 2030 through the achievement of three goals: Universal access to modern energy services; double the global rate of improvement of energy efficiency; and double the share of renewable energy in the global energy mix.

## V SUSTAINABLE ENERGY FOR FOREST VILLAGES OF M.P.

Grid connected power situation is not satisfactory in the state of Madhya Pradesh. There is a peak power deficit of about 12% and power supply in the rural area which is below the normal power situation of the state. The deficit of energy need to be met from various other sources, which includes renewable and new energy technologies. The major sources of renewable energy in Madhya Pradesh include Wind, Biomass, Small Hydro and Solar. At present renewable energy is contributing 2.95% of total installed capacity of the state (Urja Vikas Nigam, 2014). The topography and climatic conditions of the state offer enormous potential for harnessing the wind and solar energy. The vast river stretches also offers huge potential for the small hydro power plants. MP has an installed capacity of about 214 MW of wind power, about 08 MW of solar power and about 32 MW of biomass-based power (Urja Vikas Nigam, 2011). As the assessed potential is significantly higher (wind – about 1200 MW, solar – about 20 MW/Sq Km and biomass about 1242.4 MW), there are plans to expand the renewable power generation capacity in the state.

Forest villages are resource rich and also remotely located. Forests of the state are rich in terms of tree diversity and productivity. Forest villagers are traditional biomass users to meet the energy, but the techniques used are inefficient and forest becomes vulnerable. To ensure sustainable energy and protect forests from over exploitation, it would be appropriate to extend the efficient wood stoves and techniques to harvest biomass for production of efficient wood fuel and electricity generation for electrification of these forest villages. Biomass can be an alternative source of energy due to defused solar and wind energy. Because electricity generation from solar and wind require huge land and appropriate landscape. Whereas biomass electrification require less area and can be ideally located within the village itself and use the locally available biomass.

## VI DISCUSSION AND CONCLUSION

Biomass is a renewable source that accounts for nearly 33% of a developing country's energy needs. In India, it meets about 75% of the rural energy needs and the rural population constitutes 70% of the total population. As per Ramachandra and Shruthi (2007), annually, 62-310 Mt of wood could be generated in India from the surplus land, after meeting all the conventional requirements of biomass, such as domestic fuel wood, industrial wood and sawn wood, with an investment of Rs.

168-780 billion. The annual energy potential of plantation biomass is estimated to vary from 930 to 4,650 PJ. Madhya Pradesh has 925 forest villages completely situated inside the forest and cover more than 30 % of geographical areas of state under forest (FSI, 2013). Madhya Pradesh has 14,073 Joint Forest Management (JFM) Committees, of which 9,035 are VFCs, 4,201 are FPCs and 785are EDCs. A total of about 60,000 sq. km of forest area is under JFM, which is about 63% of the total forest area of the State (MPFD). More than 17 lakh families are involved in JFM and other forest activities. MP has average 2.15% forest as very dense forest, 11.35% moderate, 11.70% open forest, and 2.08% as scrub (FSI, 2013).As per the estimates about 36 percent of the biomass per ha is in the form of branch and foliage, stumps and root. These are considered as sustainable source of bio-energy conversion (Klass,2004).

These resources are renewable in nature and can produce approximately 0.5 ton per ha of forest residues, which includes, twigs, leaf, dead branches, etc. With about 5 lakh ha of forests under JFMCs can produce about 250000 tons of renewable biomass per year, which is sufficient to meet the energy requirements of these villages. This biomass can be used to produce wood/ bio briquettes. These will be ideal for cooking and also to run a gassifier (A reactor, which converts solid fuels in to gaseous fuel through thermo-chemical process) and produce electricity. There are marginal and field bunds in the fringe villages will be used to raise energy plantation. These will be an additional resource to meet the cooking needs of rural villages and also to run the gassifier.
Apart from this natural availability of forest, tree outside forest and agricultural residue are other two important source of biomass to provide renewable energy sources to forest villages with lesser emission of greenhouse gases and providing better employment. Now a day weeds grows in natural forest is one of the big challenges for forest department, if these weed can be used for energy generation then it will lead to two benefit providing energy and increasing quality forest cover. Cow dung is another source of energy and can be used for methane production. Bio-digester should be so design to utilize all the herbaceous degradable material along with cattle dung to meet the cooking energy requirements.

Solar power can be harnessed to meet the house lighting. Because being the central India about 300 days solar insulation is available to support the PV system. Solar thermal (plat collector) can another area villagers can be sensitized towards use of the technology to meet the hot water requirement. The conceptualized and assessment and estimated biomass energy for the forest villages of MP shows a potential to provide clean energy to forest villages without hampering the natural resources. If a decentralized renewable energy technology based on biomass will be implemented can lead to provide better livelihood and overall sustainable development of forest villages.

Al these require a micro study at the village cluster level to develop RETs and institutionalize the same through community participation.

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