

# Statistical Evaluation of Renewable Energy Technologies and Initiation Programs in Rural Area of Lakhimpur-Kheri, Uttar Pradesh, India: Prevailing Schemes, Barriers Faced and Future Scope

Utkarsh Awasthi, Faraz Yusuf Khan, Noman Ahmad, Shrish Bajpai

**Abstract :** *This paper scrutinizes the present scenario of Renewable Energy Technologies, usage of Renewable Energy Technologies, hindrance and future of Renewable Energy Schemes launched by the Government of India and Government of Uttar Pradesh in rural areas of India, using responses of 200 individuals residing in Lakhimpur-Kheri, an agriculture based rural district in the most populated state of India, Uttar Pradesh. Respondent's view towards Government's policies, educational background, environmental issues which have been covered in this paper. Role of Private and Public sectors in order to spread knowledge about the usage of renewable energy technology and to accelerate their adoption has also been analyzed. Role of biogas energy in rural areas of India by considering area-specific economic growth, employment generation and availability has been taken into consideration.*

**Keywords:** *Lakhimpur-Kheri, Awareness, Rural Economy, Renewable Energy Technology*

## I. INTRODUCTION

A viable supply of energy in rural areas is a step towards reacting to the rising global and national environmental problems. In rural areas Biogas Energy may ought to be proved as a viable option in terms of eco-friendly technology. As it has proven, Renewable Energy Technology helps to reduce the emission of Green House Gases like Carbon dioxide, Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs) and Sulphur Hexafluoride etc. As well as it is cheaper in cost to the energy produced by the coal and other fossil fuels [1-2]. To raise awareness among people some international treaties like Agenda 21 and Kyoto Protocol have been signed by major and emerging economies of the world for laying stress over the need to develop and promote the utilization of Renewable Energy Resources. India being a part of United Nations Sustainable Development Goals (UNSDGs)

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is committed to its policies, 17 Sustainable Development Goals and 169 targets have to be completed till 2030 i.e. to provide clean and green energy despite of the economic challenges [3]. This paper analyses the factors which are acting as barriers in midst of Renewable Energy Technology. Government of India has launched various schemes which aims to promote the usage of renewable energy, but the efforts of government have not shown desirable results, India needs to lift it up in terms of using Renewable Energy Technology [4]. Lack of Awareness and Lack of Promotion from the side of public and private sectors alike proved to be a major barrier along with the literacy rate of people have a direct affect on the implementation of Renewable Energy Technology. India has the natural resources that provide it the cushion against energy security concerns [5]. In India, Biogas can be produced by degradable organic wastes such as cattle dung, kitchen waste and poultry waste etc. Biogas also helps to increase the nutrient content and fertility of the soil [6]. Biogas waste can also be used in some other manner like as a bio-fertilizer. Biogas can be easily supplied to both rural and urban areas of India and can act as a shield against hike in the prices of fossil fuels as in the recent case 2017-18 there is a hike in the prices of fuel, also it can increase the economy of rural areas in multiple ways such as by providing more earnings from dung and by improving crop production through the involvement of organic fertilizer [7]. Biogas due to its flammable nature can be used in energy production and transport. The efficiency of biogas is approximately 85%. Of the total energy of the biogas 30-40% is converted into electricity and 45-55% is converted to heat and this heat can be used for heating purposes [8]. The largest biogas plant is situated in Methan village of Gujarat which saves 500 metric tons of Fuelwood annually likewise, there are 1 MW Biogas Plant is situated in Ludhiana, Punjab, 2 MW Plant of Biogas is situated in Ankleshwar, Gujarat. In Maharastra, the biogas plant has a capacity to produce 2500 cubic meter biogas per day from 600 cubic meter of sugar waste, 3000 cum bio methanation project for solid waste management in Andhra Pradesh,

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Indian Government should think of planting more biogas plants like these in every state of India and main emphasis should be laid in rural areas.

In India a total of 65% electricity is generated by thermal power, 53.7% of commercial energy demand is dependent on coal, only 3% of the electricity is produced by inclusion of solar, wind and biomass power [9-10,25].

## II. THE HISTORY OF BIOGAS PRODUCTION:

People were aware of the biogas since 17<sup>th</sup> century but the construction of biogas plants had started amid of 19<sup>th</sup> century. At that time the biogas systems like septic tanks were widely used for the waste water treatment. It was used where there was no sewerage system. In 1890's Donald Cameron constructed a special septic tank, from which the gas is collected and used for street lighting [11]. After the second world war there was a significant growth in the biogas industry, particularly in Germany, France and Britain. After that biogas technology also found its way in agricultural purposes such as running an engine for irrigational purpose [12-13].

## III. GLIMPSE OF LAKHIMPUR KHERI :

India comprises of 712 districts as per the data record which was taken in this recent year 2018 [14]. Lakhimpur-Kheri stands at top in terms of area which is equal to 7,680 square kilometers becoming the largest district in Uttar Pradesh (India) [15,26]. Lakhimpur Kheri comes under a municipality board namely Nagar Palika Lakhimpur and it comprises of four sub-municipality boards namely Gola Gokaranath, Palia Kalan, Mohammdi. The city Lakhimpur is termed as administrative capital of Lakhimpur-Kheri. Lakhimpur-Kheri shares an international border with Nepal on the Northern side. The average temperature in Lakhimpur-Kheri is highest in month of May i.e. 32.3 degree Celsius and coldest month is January having average temperature of 15.4 degree Celsius. According to 2011 census data it has a population of 4,021,043 and a literacy rate of 60.56% approximately. Awadhi/Hindi is the language spoken by a majority populace of Lakhimpur Kheri [16-17].

The only National Park in Uttar Pradesh, the Dudhwa National Park is situated in Lakhimpur Kheri. Lakhimpur Kheri is the home to some of India's largest sugar mills such as Bajaj Hindustan Limited (BHL) Sugar Plant in Palia Kalan and Bajaj Hindustan Limited (BHL) Sugar Plant in Gola Gokaranath and Gobind Sugar Mill in Aira Estate. In Lakhimpur-Kheri district, agriculture is mainly dependent on these crops mainly like sugarcane, wheat, rice, maize, barley and pulses etc.

## IV. DISCUSSION:

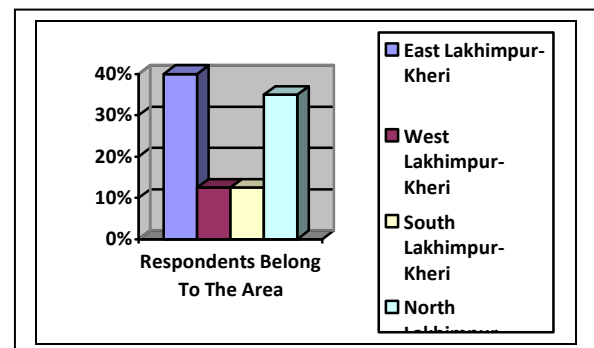
This survey consists of 200 respondents from the district of Lakhimpur Kheri, Uttar Pradesh, India.

As Fig. 1 illustrates, lion's share of respondents is taken by East Lakhimpur-Kheri which is at 40%. East Lakhimpur Kheri covers area like Isanagar, Amethi, Gulariya, Palia Kalan etc. Second position of respondents' origin is taken by North Lakhimpur at 35%. North Lakhimpur covers areas like Gauri Phanta, Phularia, Phanta, Sarkhana etc. Third position

of respondents' origin covers Southern Lakhimpur which is at 12.5% and 4<sup>th</sup> position is taken by West Lakhimpur which is at 12.5%. The literacy rate of Lakhimpur Kheri is 60.56% as per the record data of 2011 data census, it lags behind the national literacy rate which is 74.04%. As evident by the survey record, most of the people reside in their parent's houses at 40%, followed by self-owned houses at 30%. 17.50% respondent's reside in houses provided by cooperation and 12.50% respondents reside in rented accommodation as shown in Fig. 2. Uttar Pradesh Awas Vikas Parishad (UPAVP) scheme was implemented with the motives to promote to develop state of art townships at affordable prices, to enclose modern technologies in construction work with price affordability and to promote innovative and new ideas. Uttar Pradesh Awas Vikas Parishad (UPAVP) scheme of Uttar Pradesh Government provides housing to the lower middle class and lower class income groups as well as Pradhan Mantri Awas Yojana - GRAMIN (PMAYG) has a motive to promote "HOUSING TO ALL" till 2022 [18]. PMAY aims to provide pucca houses to all while fulfilling their basic needs too. PMAY-G is also continuously helping to provide homes to the lower income groups and provided relief to them.

On analyzing Fig. 2, we get to know that majority of their respondent's have their own house including both parent's house and self-owned house, this indicated that this group of respondents will face no hurdles from tenants and litigation purposes if they decide to adopt Renewable Energy Technology.

While surveying we get to know that the majority of the



**Fig 1 : Classification of responders in Lakhimpur** populace The Upper Middle Class usually resides in a 3BHK (Bedroom, Hall and Kitchen) House which is 33.50% and the Lower Middle Class in 2BHK House covers 27.30% as shown in Fig. 3.

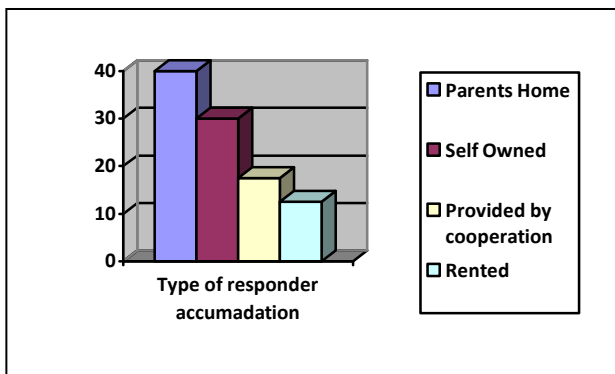


Fig. 2 : Type of respondent's accommodations

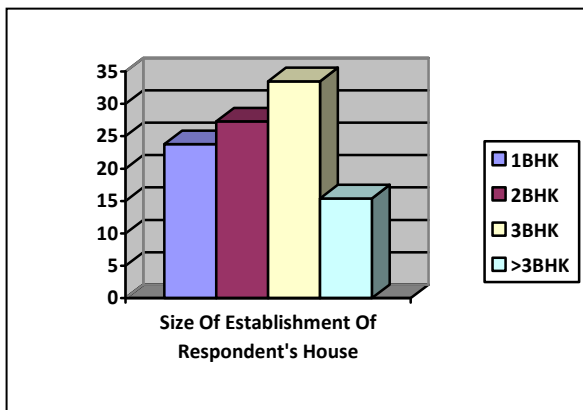


Fig. 3 : Size of establishment of respondent's house

#### V. EDUCATIONAL BACKGROUND OF RESPONDENT'S:

Lakhimpur Kheri is home to some reputed schools like Ajmani International School, Seth MR Jaipuria School, Don

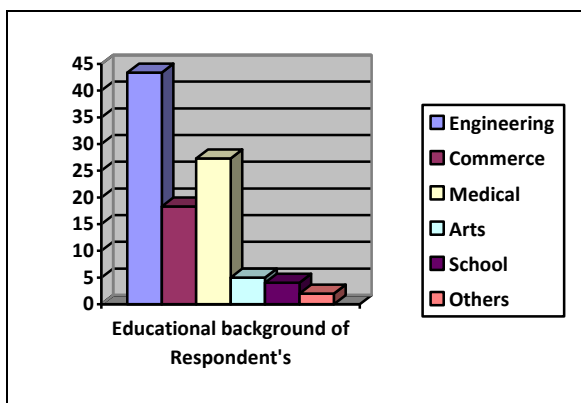


Fig. 4: Educational background of Respondent's

Bosco College and Government Inter College belonging to CBSE, ISC and U.P. board respectively and also some prestigious degree colleges namely Y.D. College, Rajkiya Mahavidyalaya, Ken Grover Nehru P.G. College enriching the quality of education. Educational background of a respondent is also taken into account as all streams of education are represented in this survey as seen in Fig. 4. Most of them are from engineering and medical background covering 43.40% and 27.30% respectively. The next part of this survey scrutinizes the future of Renewable Energy Technology in Lakhimpur-Kheri according to response of its

populace. A positive trend appears in Fig. 5 when 66 % of respondents gave a positive response when asked about the installation plan of renewable energy technology in future. It is strange that 24% of the respondents voted that they had no information about renewable energy schemes and policies. It is surprising to know that most of the respondents from Lakhimpur Kheri are unaware regarding Renewable Energy Schemes which shows that government is not effectively promoting the policies of Renewable Energy. Jawaharlal Nehru National Solar Mission (JNNSM) was launched in 2008 by Government of India with a objective to establish India as a global leader in solar energy [19]. It was aimed to achieve a total installed solar capacity of 100GW till 2022 [20]. However, it does not receive its fair share of advertising which is why people in rural areas are still unaware of this policy.

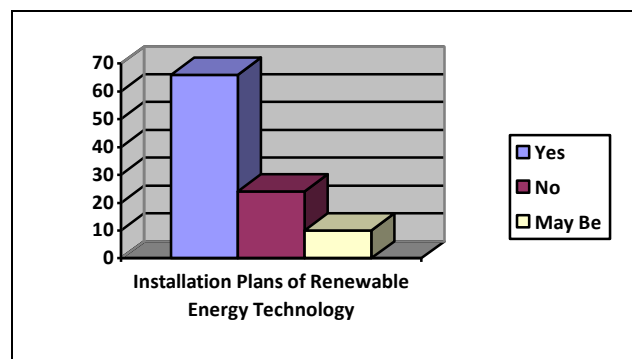


Fig. 5 : Installation Plan Of Respondents

As we can see from Fig. 6, Only 47.10% from the respondents are aware of the schemes while the major section

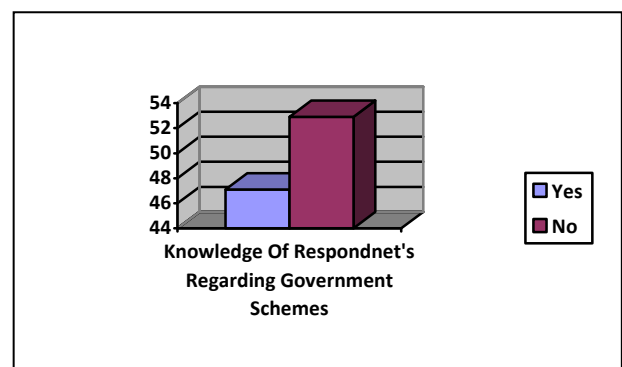


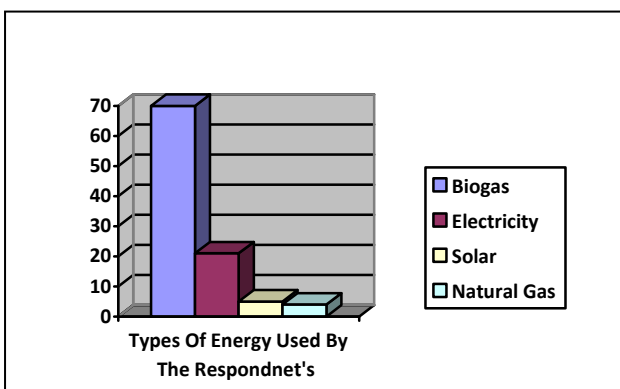
Fig. 6: Knowledge of Respondents Regarding Government Schemes

of the population is still unaware. Another policy was introduced by the government Pradhan Mantri Ujjwala Yojana which has formed to provide five crore LPG connections to the BPL card holders and the preference will be given to Scheduled Caste/Tribe mainly. The Duration of the scheme is only for three years from 2016-2019. Pradhan Mantri Ujjwala Yojana proved to be an effective policy for providing gain to the respondents, but still there is lack of knowledge among people of rural areas about other policies which may be advantageous for them [21].

**VI. RESPONDENTS USAGE OF BIOGAS:**

Biogas is an operable alternative for producing electricity and for cooking. Mainly two technologies are involved to generate the electricity from biogas i.e. Combustion and Cogeneration in sugar mill. The total installed capacity till 2018 of biogas is 9.54 GW from the total installed capacity of all Renewable Energy Technology of 73.35 GW. Biogas is clean, as it is good for climate and it can overcome sanitation problems by linking toilet with the biogas plants. According to data provided by the Government of India it is said, between 2014-15 about 20,700 cubic meters of biogas is produced in the country which is equivalent to the 5% of the total LPG consumed by the country. Apart from these, National Biogas and Manure Management Program under the twelfth five-year management program (2012-2017) the government of India aimed to set up 6.5 lakhs Biogas Plants across the nation with a budget of Rs. 650 crores [22]. It had been evaluated that by planting these biogas plants, about 1-6 cubic meter of biogas per day and 4745 lakh cubic meter biogas could be produced annually. The program is being implemented by the State Nodal Department and Khadi and Village Industries Commission (KVIC), Biogas Development and Training Centers (BDTCs). After Maharashtra, Andhra Pradesh, Gujarat and Karnataka, Uttar Pradesh is ranked fifth in terms of using Biogas [23].

As per the survey record shown in Fig. 7, 70% of the respondents makes use of biogas for mainly agricultural purpose, cooking and for the purpose of heating water.

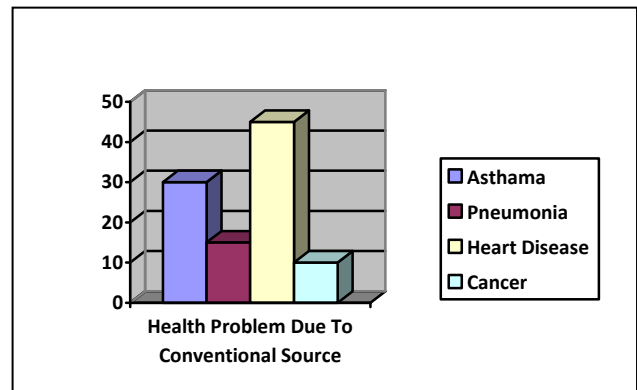


**Fig. 7: Types Of Energy Used By The Respondents**

**VII. ENVIRONMENTAL CONCERNS OF RESPONDENTS**

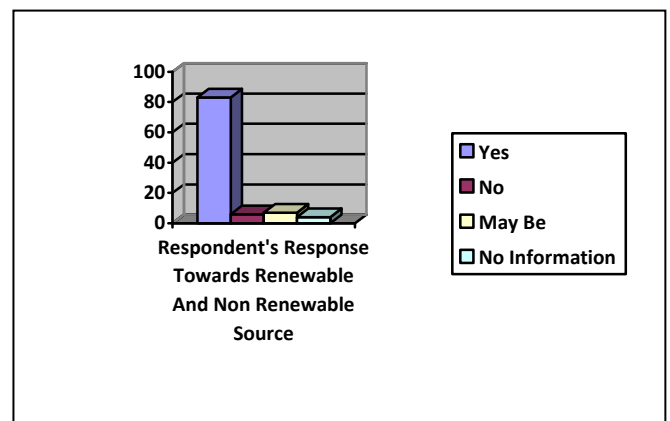
According to World Health Organization report 14 out of 20 most polluted cities are from India. According to this Uttar Pradesh's Kanpur top's this infamous list followed by Varanasi, Lucknow and Agra at 2nd, 7th and 8th position respectively. Air pollution due to conventional sources is a major problem which gave rise to different non-communicable diseases like Asthma, Heart disease, Pneumonia, Cancer etc. As Fig. 8 illustrates, heart diseases and asthma occur to find major diseases 45% and 30% respectively due to pollution caused by conventional sources of energy. World Health Organization states that 7 million deaths were caused in the previous year due to outdoor and household pollution and it also states that in India there are five crore death are only due to unclean cooking fuels. Most number of diseases were caused by the heart disease which

was around 34% and 21% were due to pneumonia and 20% people lost their lives due to stroke.



**Fig.8: Health Problems Caused Due To Conventional Sources among Respondents**

According to survey it is clear from Fig. 9, that the 83% of the respondents are aware about the pollution caused due to



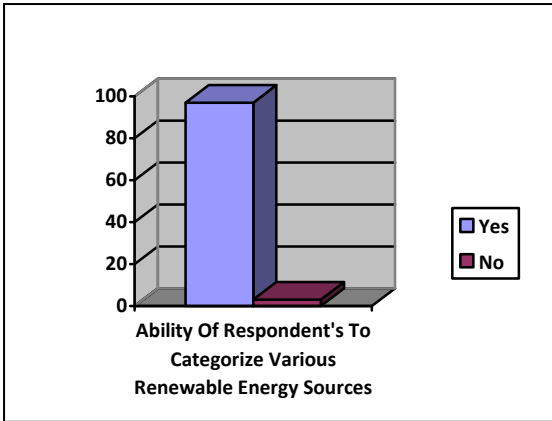
**Fig.9: Respondent's Response Towards Renewable Energy And Non Renewable Energy Sources**

the renewable source versus non-renewable source. Mainly these problems are occurring due to vehicular pollution and deforestation. They are aware about the pollution due to conventional sources but there is still lack of awareness regarding renewable energy technology which may later proved to be as a barrier for not producing and enhancing a better renewable energy technology.

**VIII. FUTURE PERSPECTIVE:**

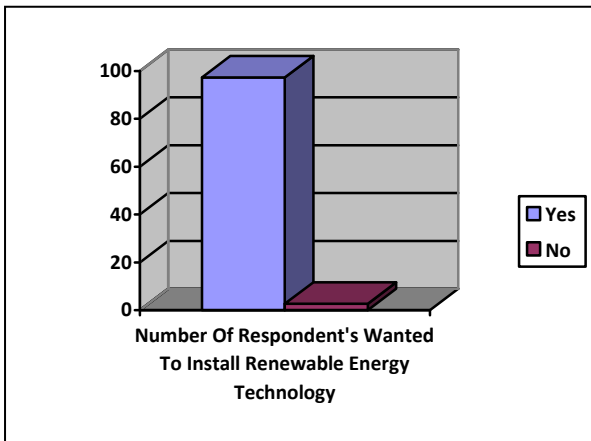
Next part of this survey scrutinizes the future of renewable energy technology. According to Fig. 10, respondents in the survey are able to categorize the various renewable resources, according to the survey 97% are able to categorize because of inclusion of the subject such as Environmental Science till 10th standard in all boards namely CBSE, ICSE/ISC, U.P. board [24].





**Fig. 10: Respondent’s Ability To Categorize Renewable Energy Sources**

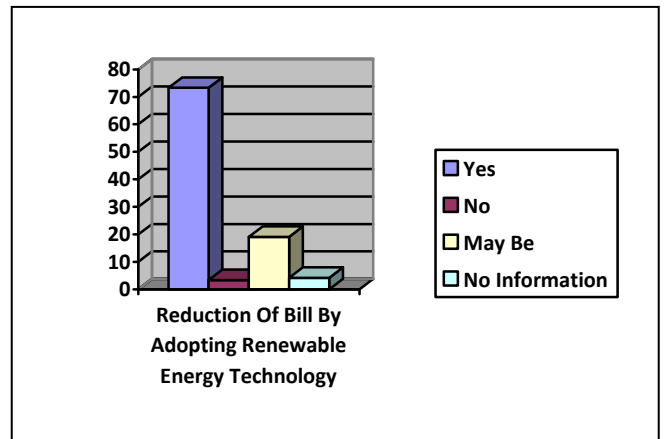
They were asked whether they want to replace majority of conventional energy sources, around 97.30% respondents were in favor as shown in Fig. 11 of adopting renewable energy technology, but the cost maintenance is very effective, this may proved to be a major reason for not using renewable energy technology, also the government is not well promoting renewable technology schemes



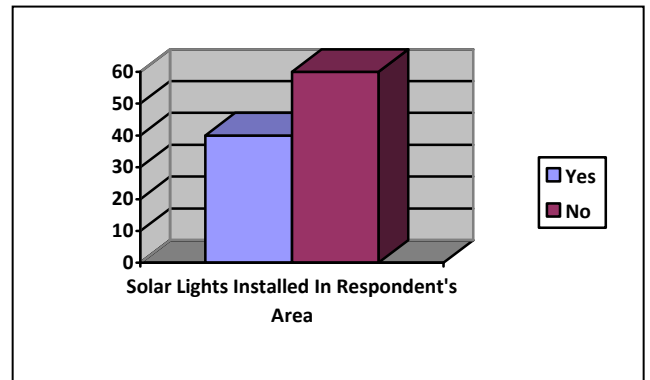
**Fig. 11: Percentage Of Respondents Who Wanted To Adopt Renewable Energy Sources**

Fig. 12 finds that the 73.3% respondents were aware of the fact by using renewable energy they can reduce the cost of their bills. The cost per unit of electricity through renewable source like (Biogas) versus coal electricity is Rs.2.44 per unit and Rs.4 unit respectively. Under report presented by International Renewable Energy Agency (IRENA), Government of India has developed 4,00,000 jobs by adopting renewable energy resources. UP government’s Samajwadi E-Rickshaw scheme under which electric rickshaws were and will continue to be distributed among owners of cycle rickshaw is a fine example of Renewable Energy Technology which has brought positive socio economic change to the lower class of the society [10]. Government of India may further look into to develop job opportunity for people in rural area by promoting biogas and by launching various schemes which may directly provide benefit to the people. Later on till government promises that they can create millions of opportunity of jobs if they succeeded in their project of producing 100GW electricity by Renewable Energy. In short, majority of responders wanted to adopt the renewable energy technology due to its multiple

benefits. Respondents were asked that whether in their particular area have installed solar light or not then in this case it is a 60-40% response as shown in Fig. 13.



**Fig. 12: Reduction Of Electricity Bill When Adopting Renewable Energy Technology**



**Fig.13: Installation Of Solar Light In Respondents Area**

**IX. CONCLUSION**

There is a lot of scope of renewable energy technology in rural areas of India. In agriculture sector there are multiple instruments which are driven by the non-renewable energy resources. As we can drive the engines to pump water for irrigation in fields by using biogas energy, we can also make use of solar energy resources or wind energy but for as solar plate is expensive and it may require number of plates which may prove to be expensive and wind energy is not available everywhere, to generate electricity from wind it should flow at 15km/h and it is only possible in coastal areas [27-28]. For household purpose there are many expensive government schemes which the citizens should take the advantage and complete their daily needs of energy by the renewable energy resources. Renewable Energy should be taught as a subject in schools and all the bachelor’s degree should include the subject on Renewable Energy Technology [4]. It should be mandatory in all institutions to promote and to raise awareness amongst the students regarding using renewable resources [25]. For increasing awareness amongst rural population of India.



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Indian Postal Service should issue postage stamps Post Cards as Indian Postal Network is the largest postal network in India. Government should promote by giving Ads on the front page of National Newspapers and aware the people about advantages of adopting Renewable Energy Technology. Such techniques are bound to increase the usage of Renewable Energy Technology.

On taking account of all these matters Biogas proved to be the best option for generating energy in rural areas [29].

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