

Renewable Energy Technology Transfer for Rural Development

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Abstract: This paper is focusing on Renewable Energy Technology Transfer for Rural Development in India. Renewable Energy sources like solar energy, bio energy and wind energy are having more roles for the development of rural areas. Initially the technology development started from rural areas. But due the present education system, now more renewable energy concepts are developed in national laboratories and educational institutions. The Initial cost is more for these activities. After, these concepts & applications are sent to the rural areas by subsidy driven activities mainly in solar photovoltaic, solar thermal, bio energy and wind energy. In India government has taken responsibility to transfer the technology for rural development using the Government and Non Governmental organisations and eliminate the line between rural and urban areas.

Keywords — Technology transfer, Solar Thermal Energy, Solar Photovoltaic, Bio energy, Wind energy, Rural Development,

I. INTRODUCTION

Villages are the backbone of the country. More Concentration is needed for the development of the villages. If the villages will be developed, automatically the county will develop in all aspects [2]. Recent technological development applications are mostly used in the urban areas for their better living. Initially the rural people developed the new things and innovative ideas by using the available resources. The “Pancha Boothas” like Water, Land, Fire, Wind and Sky are very much helped them for utilization of the resources efficiently. Basically the technology development started from rural areas.

are used for rural electrification and make comfortable living environment. India having the lot of potential in renewable energy sources field. The following table and pie chart indicate the role of renewable energy in total the power generation in India as on 31.01.2019 [10]

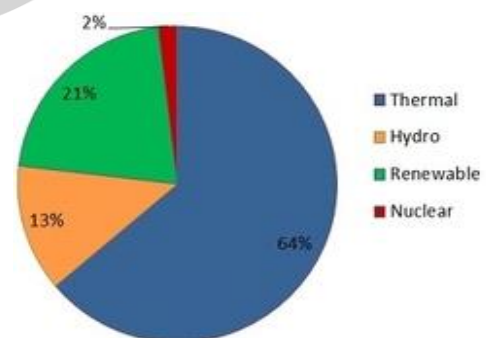
Thermal	2,22,927 MW
Hydro	45,399 MW
Renewable (21.2%)	74,082 MW
Nuclear	6,780 MW
TOTAL	3,49,188 MW

II. RURAL AND URBAN AREAS

Due to the industrial revolution, electrical energy applications and comfortable living environment divide the country into rural and urban areas. Due to the above reasons technological development occurred in the urban areas only [4]. In most of the rural areas the people are living in below the poverty line. They are having more than sufficient manpower and knowledge but due to the poverty, they are not getting the modern living environment for thinking to invent the new technological concepts now. So the recent technological development should be sent to the rural areas for their social and economical development by various funding schemes by Government Departments [6]

III. RENEWABLE ENERGY SOURCES AND RURAL AREAS

Renewable energy sources are having the more roles for the rural development. Mainly renewable energy sources



During the past 20 years, the renewable energy programmes in India has involved the rural development. Initially the renewable energy concepts are developed in national laboratories and educational institutions. After, these concepts and applications are sent to the rural areas by subsidy driven extension activities.

IV SOLAR ENERGY

Solar Energy is the parent energy for all other sources of energy like wind and Bio Energy, etc., solar energy is abundantly available in India [1]. The daily average solar energy incidence varies from 4-7 kwh/m² There are approximately 300 clear sunny days in most part of the country [1] [3]. The potential of solar energy is meeting the growth energy needs of the country.

(1) Solar Photovoltaic

India has the world's largest solar programme and solar energy is being used for a large number of applications. Presently, solar photovoltaic (PV) power systems are being used for a variety of applications such as

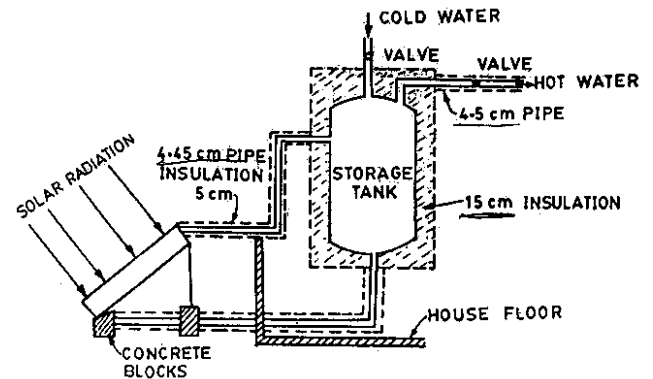
- Community Radio & Television sets.
- Weather monitoring,
- Battery charging,
- Street lighting
- Road signaling Equipment
- Water pumping sets for irrigation
- Home lighting system



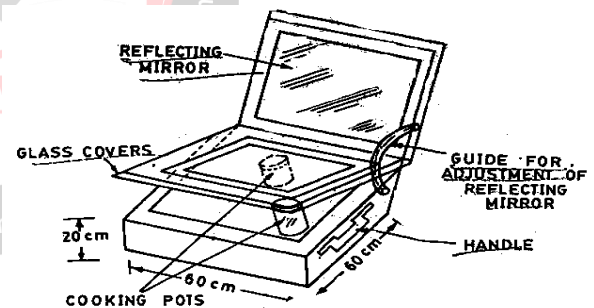
Solar Photovoltaic applications are mainly used for rural electrification. Rural households are major important category of users of PV devices for lighting [7].

(2) Solar Thermal

Various Solar thermal systems have been developed by various research institutions as well as by industry. These systems are used for rural areas such as Solar Water heating and Solar Cookers.[5]



typical solar water heater.



Details of a box type cooker

Solar water heaters are used in the domestic sector particularly in rural energy development as well as in large commercial establishments like hotels, hospital, buildings industries



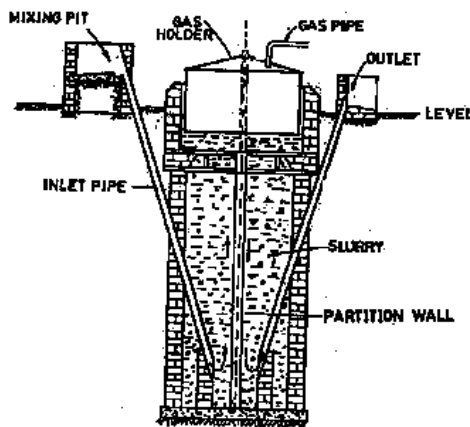
V.BIO ENERGY

India is an agricultural based country. It has more potential in the field of Bio-Energy. Biomass is an organic material produced by plants both terrestrial and aquatic. Generally agro and forest residues like rice husk, saw dust, bagasse are used in bio energy applications [3]. Bio Energy applications are

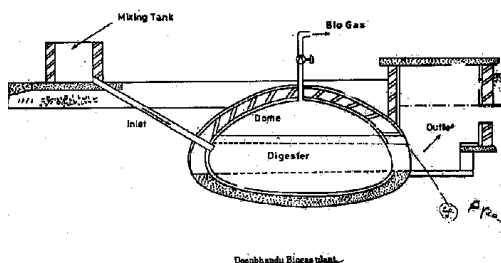
- Combustion
- Gasification
- Pyrolysis
- Biogas production

The biogas plants used for rural development are

- Khadi Village Industries Commission (KVIC) Biogas Plant (Floating Dome)
- China type Biogas Plant (Fixed Dome)
- Deenabandu type Biogas plant
- Oil Drum type (Indonesia) type
- Pragathi Biogas plant



Common circular digester with floating gas holder and no water seal (India), (KVIC digester).



Deenabandu Biogas plant.

VI.WIND ENERGY

Wind energy was used in the earlier period for sailing the boat, water pumping, and crushing [3]. India has more wind energy potential due to southwest monsoon and northeast monsoon.

Now wind energy is mainly used for power generation. Nearly 1,02,788 MW power potential in the area of wind energy [8]. The map indicating the wind speeds in different areas

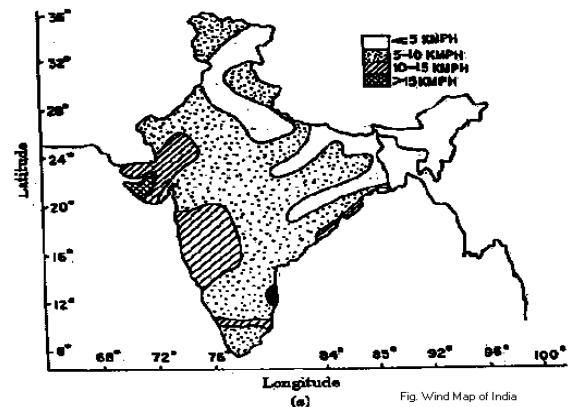


Fig. Wind Map of India

VII. NEW TECHNOLOGIES

Indian government promoting a number of researches in new technologies in the field of renewable energy sources through scientific & academics institutes, universities, national laboratories and industries. So these new technological concepts will be sent gradually to rural people for their development.

VIII.GOVERNMENT AGENCIES FOR RENEWABLE ENERGY SOURCES

The following are the authorized agencies for the development of renewable energy sources; they are giving the loan assistance, guidance, and subsidies for the development of renewable energy sources in rural areas.[8][9]

MNRE(Ministry of New and Renewable Energy Sources)

NIWE (National Institute of Wind Energy)

NISE (National Institute of Solar Energy)

TEDA (Tamilnadu Energy Development Agency)

IX. CONCLUSION

In India, more people living in villages. New technological concepts in the field of solar, wind, bio energy are sent to the rural areas for their development. In this paper we have got the information of how much power generation from various sources, particularly from renewable energy sources and in what way it was transferred to rural development. More rural areas developed using the renewable energy sources. The existing and new technological concepts in renewable energy sources will be sent gradually to all the rural areas, the line between rural and urban will be eliminated definitely.

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