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Integrated Energy Planning for Energy Management for Sustainable Development in Rural Areas: A Case Study of Jharkhand Village

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Abstract: ***The goal of an energy audit is to balance overall energy inputs with total energy outputs, as well as to locate all energy streams in a site. Recent years have seen a rise in concern about environmental degradation and energy security, which has increased the importance of new and renewable energy sources. The problem will be exacerbated by the rapid depletion of fossil fuel reserves, the poor quality of fuels, the high cost of basic materials plus transportation costs, and, above all, the harm to the environment caused through the use of conventional sources of energy. Clean and green energy, which are non-conventional and renewable energy sources that are environmentally friendly and pollution-free, have arisen as major alternatives to traditional energy sources in such circumstances. Alternative energy sources such as wind, solar energy (thermal and photovoltaic), biomass, and hybrid sources all will contribute significantly to increase power capacity. Private investments, which are encouraged by policies created by the Central and State governments, make up the majority of investment. The Integrated Rural Energy Planning (IREP) Program's goals are to provide rural residents' minimal household energy demands for lighting, heating, and cooking. This paper presents a case study of IREP Programme implemented in the village of Ranchi and Hazaribag districts of Jharkhand state and future energy planning with available resources.***
Keywords: Energy Audit, Integrated Rural Energy Planning, Renewable energy sources

I. INTRODUCTION

Energy plays a great role in any human activities industrialization, social and economic development. Unfortunately use of energy, which is generally met by conventional fossil free resources, is invariably associated with environmental degradation. The country presently faces severe energy shortages even when the availability of energy has been growing at a compound annual rate of 4.9%. There is a peaking power shortage of about 18% which may go as high as 30% by the end of the current plan and an energy shortage of about 8.5% which may go as high as 15% by the end of the plan. The energy shortage has an adverse impact on all sectors of the economy [1]. Due to the demand for electricity exceeding the capacity for its production and the dispersion of villages with relatively modest levels of demand, it has not been possible to achieve the national goal of providing electricity to all villages in India via the main grid (leading to proportionately large investments and losses, associated with the corresponding distribution systems). Decentralized solutions have thus been given a justifiable emphasis in order to address the electrical energy needs of villages, particularly those that are currently completely unelectric. It is only proper that a given village share an optimal combination of renewable technologies to meet the demand for electrical power; the combination should be consistent with more cost-effective usage of local energy resources [2].

II. INTEGRATED RURAL ENERGY PLANNING PROGRAMME (IREP)

The Integrated Rural Energy planning programme (IREP) which was concerned during the 6th plan and launched as Centrally Sponsored Scheme in the Seventh Plan period by the planning commission and is the right step in this direction. The IREP's goal is broad in scope, with a particular emphasis on offering instructions for creating and carrying out area-based integrated rural energy plans and projects that would effectively promote all bypass energy resources and technologies in an integrated manner for enhancing the living conditions of rural people [3,4].

It is crucial to conduct a survey of villages to get accurate field data and then make recommendations for future action in order to determine the best combination of different energy sources to meet the demands of rural communities. This is why the current study for the village in the Ranchi district is being done.

The decentralized planning principle can only be applied as far as village-level energy planning. The rural identities of the district are formed by the different villages, which are typically separated from one another by a large area that is sparsely or completely depopulated. As a result, they are the smallest aggregate social units within the administrative framework of rural areas where energy consumption takes place. [5]. While the village level study presented here, although does not form a part of a broad planning frame work, it is nevertheless illustrative of how the planning process can be formalized at the village level.

Based on the vital projections statistics for the village for cooking sector &lighting sector, an IREP plan is formulated. The available energy resources (renewable as well as non-renewable) can be utilized in best possible way by making their optimum combination. A realistic plan has been formulated involving use of renewable energy technologies as well as energy conservation aspects [6].

III. DEVICES TO BE INSTALLED

It is obvious that the financial constraints always respect to active the highest efficiency use in thermal as well as electricity use. In view of increased households in coming year, it is assumed that all the inefficient devices should be replaced by efficient devices. The full potential of resources are used to complete the total energy needs of the block by installing the energy efficient and renewable energy systems[7-10]. Two cooking devices are preferred to be kept in house. Therefore, are can suggests as Improved chulha in each household. The type of devices to be installed in a typical financial year are given in Table 1. This table also shows the unit cost, subsidies available from Govt. of India and Govt. of Jharkhand and user's contribution. The installation plan for a typical financial year is given in table 2. This also gives the financial outlay for such an installation. It is seen that for the given investments (as given in tables) the payback period is very reasonable in most of the cases. The energy plan for village of Ranchi district is proposed to meet the demand of thermal energy and electricity in the coming years.

Table 1: Type of Devices to be considered for Installation.

SI. No. Unit	Name of Device	Cost (Rs.)	Subsidy	Contribution (Rs.)
1	Family Biogas Plant	8500	4000	4500
2	Solar Cooker	900	350	550
3	Improved Chulha	260	200	60
4	Solar lantern	3825	2400	1425
5	Pressure Cooker	400	Nil	400
6	C.F.L. Tube	110(11watt)	Nil	110

Table 2: Devices to be Installed in each year for thermal Energy Needs in Cooking sector.

Sl No	Devices	No.	Total Cost(Rs.)	Resulting Saving(Rs.)
1	Family biogas plant	30	255000	131400
2	Solar Cooker	135	121500	81000
3	Improved Chulha	135	35100	84870

Table 3: Savings From Biogas

Fuel	Calorific value Kcal/Kg	Way of Burning	Efficiency %	Useful Energy	Amount of fuel which can be replaced by 1 cu. M of bio gas
Biogas	4713	Biogas Chulha	60	2828	
Wood	4708	Traditional Chulha	10	470	6 kg
K.oil	9122	K.oil stove	50	4561	0.62 Lt.
Coal	6930	Chulha	28	1762	1.6 Kg
Electricity	860	Heater	70	602	4.7Kwh

Table 4: Impact of energy development programme in the village of Ranchi district of Jharkhand state

Sl. No	Item	Likely impact	Recommended distribution pattern
1	Improved Chulha	12% reduction in fuel consumption saving of 84807 kg of wood or Rs. 84807 Other benefit improved health	To be distributed uniformly
2	Solar Cooker	Saving of 81000 Kg of wood or Rs. 81000	To be distributed uniformly
3	Community Biogas Plant	Saving of 131400 kg of wood or Rs. 131400. Other benefit Manure, Improved health	To be distributed to 30 family having at least 4 no. of cattle
4	Energy Plantation	Saving of Rs. 18000 per annum from 5^{th} years onwards	1.5 hectare land per year required for 5 years to meet the fuel requirement for cooking

Table 5: INVESTMENTS

Sl. No.	Items	Govt. Subsidy	User Contributions
1.	Solar Cooker	350*135=Rs. 47250	550*135=RS.742500
2.	Improved Chulha	200*146=Rs. 29200	60*146=Rs.8760
3.	Biogas Plant	4000*30= Rs. 120000	4500*30=Rs.135000
4.	Energy Plantation	Rs. 9000	Rs.9000
		Rs. 205450	Rs. 895260

Table 6: Expected Result after implementation

	Before Implementation Net Deficit	Saving	Net Surplus / Deficit after implementation
Fuel wood + Dung(Qt)	160	4772	4612

This surplus amount of wood can be used to produce electricity for lighting & irrigation purpose.

IV. CONCLUSIONS

This paper develops a case study of IREP Programme implemented to the village of Ranchi and Hazaribag districts of Jharkhand state and future energy planning with available resources. It has been shown that improving the efficiency of biomass used and having integrated biomass option for thermal as well as electrical power generation could be the best solution for sustainable development of rural areas. To achieve sustainable development it is not only essential to be aware of energy – environmental dynamics, but also require a scientific energy environmental policy. As a result, the IREP programmes focus on meeting the basic energy needs of economically disadvantaged groups in order to boost productivity and employment.

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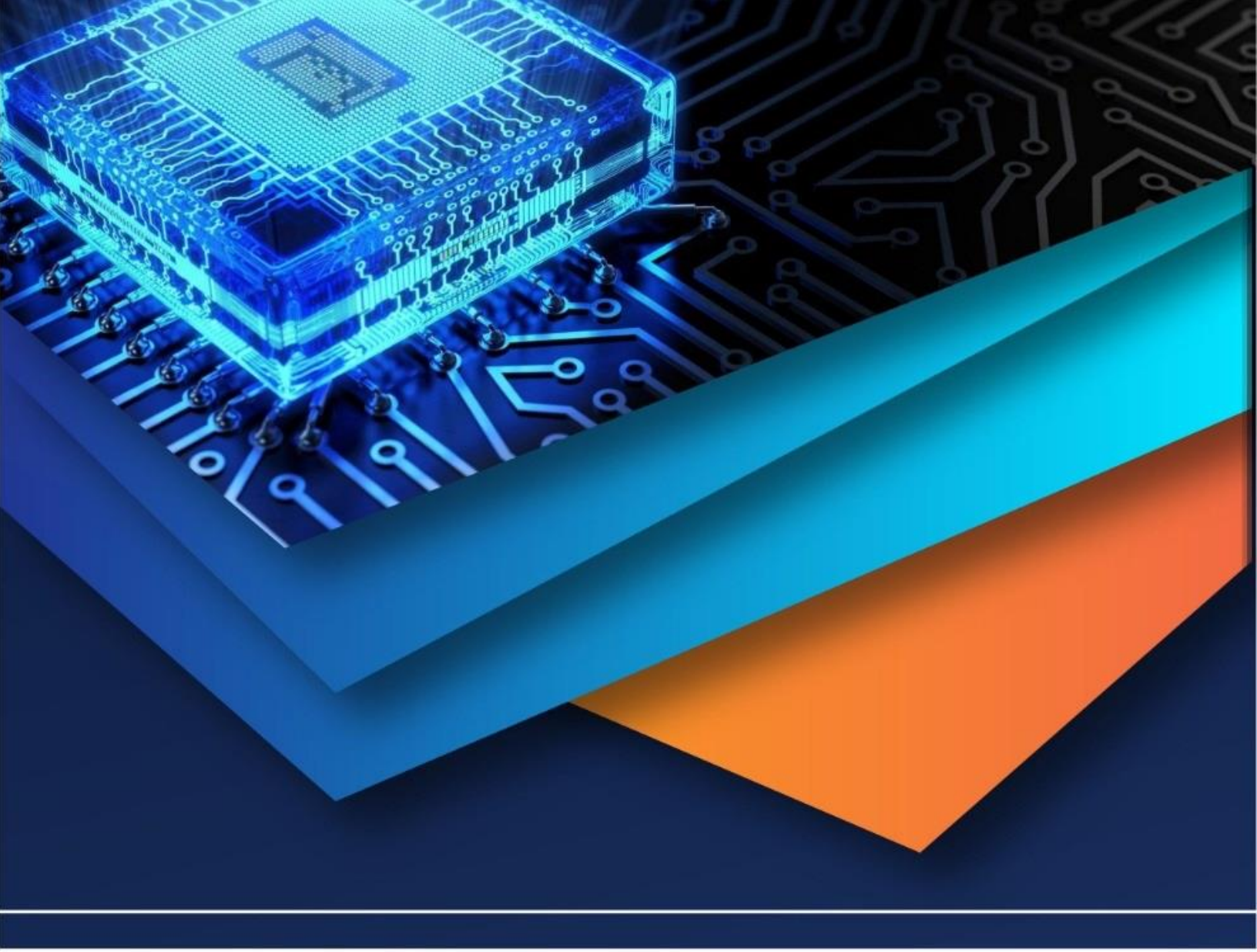

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