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Application of renewable energy resourses for sustainable Dairy Development

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Abstract:-
The consumption of the energy is directly proportional to the growing population's need, improvement in the living standard of the humanity and industrialization of the developing country. The objective of the paper is to use Solar Photovoltaic (PV) system as renewable energy resource to compensate the need of energy in coming years. The purpose of this study is to develop simulation model of solar Photovoltaic (PV) system and to estimate the Size of PV array based upon the load requirement of dairy farm, and availability of radiation. The proposed system based on renewable energy is efficient and cost effective for the dairy farming projects around rural and urban areas. It would also overcome the energy crisis in future era.
Key Words*:-Solar Photovoltaic, Bio gas Plant, renewable energy resources, Dairy farm*

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I. Introduction

Now a day the world is facing an 'Energy Crisis'. There is a huge gap in demand and supply of electricity. Every day a word enters a new era that requires a lot of energy. To address the energy crisis, renewable energy sources are future solutions. Renewable energy resources solar energy, biogas, wind power, geothermal energy etc. In the present case most of the energy generation is derived from thermal. Due to the harmful effects on the environment and the extinction of this type of green material there is a growing need to switch to renewable energy sources. Solar energy, in contrast with other energy sources, is widely available throughout India. India is fortunate enough to have 350 hot days which is a fact that can be used to use solar energy to meet its energy needs.

Biogas is a clean and renewable resource that comes as a cost-effective way to generate energy. Biogas production is clean, low-carbon technology, helpful in the efficient management and storage of organic waste into clean renewable biogas and fertilizers. Biogas is derived from the digestion of cow dung and can be used as a source of energy for various applications such as cooking, heating, and gasoline for automotive applications. This waste must be treated to ensure a reduction in methane emissions affecting climate change and or better environmental conditions. In addition to gasoline, the bio gas plant provides high quality fertilizer with soil nutrients, which results improve soil fertility.

II. Literature Review.

Zhang Chi et al. (2017): Electricity usage and cost of milk production with data analysis of dairy farms and evaluate the potential alternative energy supply-solar energy generated by PV water pumping system (PVWP).

Wang Y et al. (2021): An adaptive approach for automatic solar cell defect detection and classification based on absolute EL imaging is proposed here. Specifically, we first develop an unsupervised algorithm to automatically detect defects referring to the defect features in EL images. Then a diagnosis approach is proposed, which statistically classifies the detected defects based on the electrical origin. Experimental results on multiple types of solar cells show that the proposed method can achieve the average

uncertainty of 5.15% at the minimum, with by up to 98.90% optimization ratio compared with two conventional methods.

Simola Aleksi et al (2018): In this study, the profitability of a photovoltaic power system in the conditions of southern Finland is studied, simulated, and analyzed for self-consumption. Three cases, a grocery store, a dairy farm, and a domestic house with direct electric space heating, are presented and used in the simulation. Their electricity consumption is measured by hourly automatic meter reading (AMR) on a yearly basis

Mutungwazi Asheal et al. (2017): This narrative review paper begins with a brief history of biogas digesters in South Africa followed by a listing of the biogas digesters that have been installed in the country then the critical analyses of the different types of small scale biogas digesters since the introduction of the biogas technology into the country in the year 1957. The analysis is done on a basis of conducted studies and observations of the strengths and limitations of each small scale digester design installed

Collotta Massimo et al. (2017): It described the availability of three different technologies adaptable to biogas plants for small sized farm. the first technology is compared with the use of a concrete structure with a storage balloon cover (BC technology), and with the use of a concrete structure as a concrete cover slab (CS technology). Through a streamlined comparative life cycle assessment, the characteristics of the three technologies as well as their environmental performance are analyzed in order to identify the most suitable for small sized biogas plants

Elbaset A. Adel et al (2015): Here the PV-array water pumping system, had been used for abandoned locations. The MPPT technique such as P and O algorithm had been used for improving the efficiency of the system. The MATLAB/SIMULINK based modeling and simulation had been analyzed for PV-array under solar irradiations and ambient temperature. The result shows the upsurge in the quantity and efficiency of the daily pump which is reached by the MPPT technique, in short, the P and O algorithm.

III. Proposed System

The purposed power systems for the Dairy Farm having solar photovoltaic system, inverter, battery-bank, generator set are used. In the day time battery is charged from the photovoltaic system which produced direct current (DC). When the grid supply is interrupted then this direct current (DC) are converted in to the alternating current (AC) with the help of Inverter. Now when the purposed solar PV System is installed then purchase cost of power from grid and running cost of generator can be minimized.

It is purposed to install the solar panel on roof top of the cattle shed. Project lifetime is estimated to be 25 years. Schematic diagram of the purposed system is shown in Figure 1. By using the Matlab simulation model, the size of PV system is optimized according to available average solar radiations, temperature and hourly load for the day.

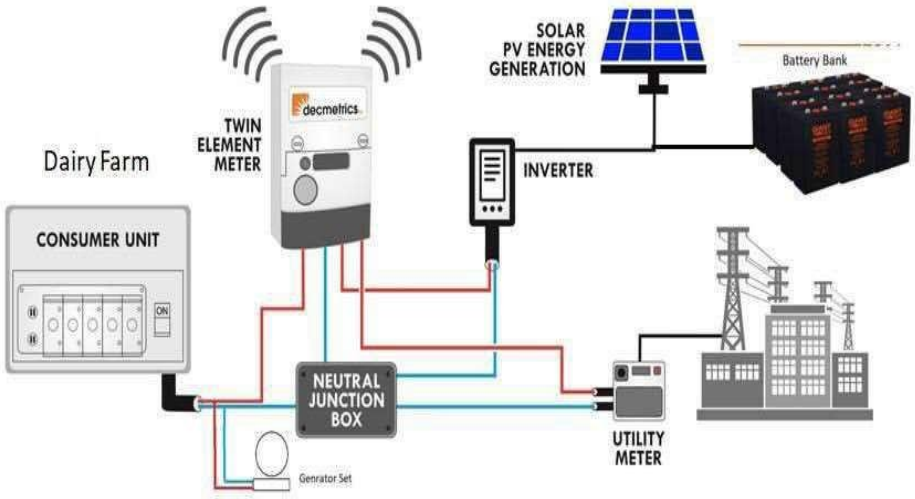

Figure 1 Purposed power system for dairy farm

Now by using the Mat Lab simulation Model, the size of solar PV Panel has been optimized
i.e. 237 watt by taking different hourly load of the day with average temperature 31.25 ° C and solar radiation 4.64 kWh/m2/day (4640 Wh/m2/ day) as shown in following table 3.18. But our total load is 18 kW, so we have to calculate no. of total panels of 237 watts according to 18kW load. Calculation for the load and solar energy is referred from [7]

IV. Results and discussion

The cost saving analysis of purposed system for dairy farm is calculated by comparison between existing and purposed power system with solar PV. In analysis of existing system, the capital cost of DG, Battery Bank, inverter etc. have not been taken into account in sub- sequent years so only Rs.4,53,536 has been taken .In this analysis capital cost of Solar PV system-Rs.5,76,000, battery cost-Rs. 90,233 and inverter cost- Rs. 10,223 have been not taken in sub-sequent years so that only Rs. 312363(cost without solar PV, battery bank and inverter) has been taken in next year's also making the purposed system more cost saving as shown in Table 2

Table 2 Cost saving analysis of purposed system for dairy farm

Contents	Existing system of Dairy Farm	Purposed system with Solar PV System	Total Saving
Capital cost of power system in first year (Rs.)	10,65,212	9,88,819	76,393
Cost of subsequent years after first year (Rs) (Sub sequent years without capital cost of DG, PV, BB inverter etc.)	4,53,536	3,12,363	1,41,173
Energy purchase from grid annually(kWh)	40,500	27,540	12,960
Cost of Energy from Grid(Rs)	3,24,000	2,20,320	1,03,680

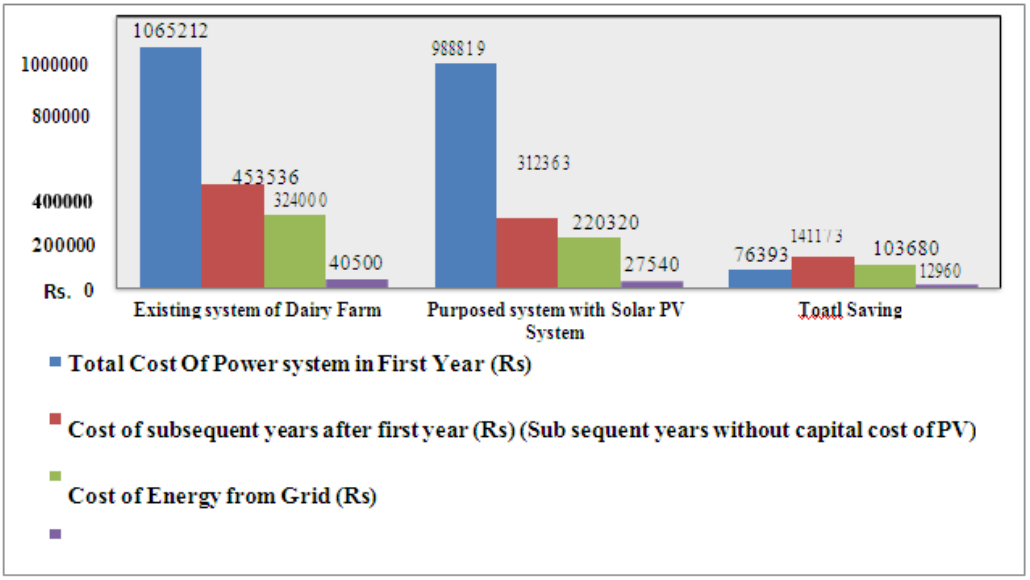

Figure 2 Cost saving analysis of existing and purposed system of dairy farm Table 3 Final cost saving by purposed system for dairy farm.

Contents	Values
Cost of existing Power System	Rs. 10,65,212
Cost of purposed Power System	Rs. 9,88,819
Total saving lifetime(25 years assume)	Rs. 34,64,545
Saving per year	Rs. 1,38,582
Saving per month	Rs. 11,548

In the Dairy Farm by using the Solar systems saving is Rs. 11548 (per month) and Rs. 138582 (per year) so that capital cost Rs. 988819 of solar PV system will be covered-up by seven years.

V. Conclusion

Solar energy are being considered significant option for dairy farm, rural areas, agricultural sites where the solar energy and manure potential are high. The purposed study is design of solar power system

with renewable energy resources like solar radiations and biogas. It has been tried to develop the solar and biogas systems to provide a renewable energy based system and daily requirement of gas for dairy farm. In the present work, the optimized size of PV panel by using Matlab/ Simulink has been found and the size of biogas plant by using Matlab editor function has been calculated. The purposed system gives healthy environment because there will be no pollution from PV and biogas system. The total cost of components of existing power system and purposed power system has been calculated. The capital cost and cost saving of bio-gas system has been calculated. The cost saving analysis of purposed system for dairy farm is done.

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