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Energy Audit For Implementation Of Solar Rooftop In Rural Areas

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Abstract- *In this paper, the importance of energy auditing and process of energy auditing are presented in detail. A sincere attempt has been made to conduct the Energy Audit at three villages Dongargaon, Bothli, and Dhuti, Nagpur, Maharashtra to estimate the Energy consumed in a day, week and month. Identification of areas of energy wastage and estimation of energy saving. Also, detailed analysis of data collected is done by suggesting cost-effective measures to improve the efficiency of energy use. Estimation of implementation costs and payback periods for each recommended action has been made. The govt. of India has approved JNNSM which aims at development & deployment of solar energy technologies in the country to achieve parity with grid power tariff by year of 2022 of 20,000 MW or more. To minimize the cost per KW of energy consumptions by implementing solar power system in rural areas. Unnat Bharat Abhiyan mission to development of rural area of India. The main agenda of a solar rooftop project for which clean & non- polluting electricity can be generated on sustainable basis rural areas Under the MEDA policy, solar power projects of 7500 MW capacity will be develop.*

INTRODUCTION

This paper represents the study of energy audit on rural areas. Rural electrification is an integral component of poverty alleviation & rural growth of nation. Being the seventh largest country in the world, 6000 villages in habit 72.02% of its human resource (census 2001). 40% of the total energy is in rural areas. Gross domestic product (GDP) is increasing with 8% where as contribution of agriculture sector is 1.09%. Solar installed capacity

of India reached 23 GW as of 30 June 2018. Government of India has ambitious target of providing electricity with rural electric corporation. Case study has to be done under The "UNNAT BHARAT ABHIYAN".

An energy audit is an inspection survey an analysis of energy flows, for energy conservation in a building, process or system to reduce the amount of energy input into the system without negatively affecting the output. In commercial and industrial real estate, an energy audit is the first step in identifying opportunities to reduce energy expense.

The conceptualization of Unnat Bharat Abhiyan started with the initiative of a group of dedicated faculty members of Indian Institute of Technology (IIT) Delhi working for long in the area of rural development and appropriate technology. The concept was nurtured through wide consultation with the representatives of a number of technical institutions, Rural Technology Action Group (RUTAG) coordinators, voluntary organizations and government agencies, actively involved in rural development work, during a National workshop held at IIT Delhi in September, 2014. The workshop was sponsored by Council for Advancement of People's Action and Rural Technology (CAPART), Ministry of Rural Development, Govt. of India. The program was formally launched by the Ministry of Human Resource Development (MHRD) in presence of The President of India on 11th November, 2014.

As we are working under the Unnat Bharat Abhiyan for transforming technology into rural areas, also we done survey in three different allotted villages from U.B.A for data collection as per project aim energy audit, in process of survey maximum number of data were collected from houses of that villages, it is as follows:

a. Dongargaon :80,
b. Dhuti :35,
c. Bothali :46.

After observing electric rating data from grid connected bills, calculate as follow:

a. Per month ratings.
b. Load factor of houses per year or 4 months.
c. Average load factor of villages per year or 4 months.
d. Maximum demand of houses per year or 4 months.
e. Average maximum demand of villages per year or 4 months.

Next step to suggestion Solar Rooftop PV system as per their maximum demand on basis of consumed load by past year for each houses. In procedure of survey we understand the problem of those areas and also found that people of villages are facing very much load fluctuations problems resulting in there increase of ratings in bills, the main reason to be happen this improper way of wiring system, earthing, lack of knowledge about electrification, etc…,in these three villages many of houses are not connected with grid and they are taking direct line connection at transformer line.

Electrical Energy Audit a Case Study: Gousia Sultana1, Harsha.H.U.**:-**

1-In this paper, the importance of energy auditing and process of energy auditing are presented in detail.
2-Estimation of implementation costs and payback periods for each recommended action has been made.
3-The Energy Auditing for a day is the index of the consumption which normalizes the situation of Energy crisis by providing the conservation schemes.

OFF-GRID SOLAR ROOFTOOP TOP

Solar PV cells converts sunlight to generate electricity through a photovoltaic process. There are two types of solar PV systems: standalone and grid connected. Standalone solar PV systems work with batteries. In off Grid rooftop solar, the DC power generated from solar photovoltaic (SPV) panel is converted to AC power using inverter and is fed to the load through single phase lines and at the same DC power is stored in Battery during day time and loads are served by Battery back in night hours.

NATIONAL AND INTERNATIONAL STATUS

a) **A performance measurement of three dimensional integrated solar PV system in Indian Conditions**.:- Harshal Taneja , Manish Lour, Kartike sharma , Saurabh Tailor.:

The review of literature reveals that three dimensional photovoltaic is having high potential in green power generation but insufficient database is main reason for under utilization of this potential.

b) **Methodology For Energy Audits Regarding Analysis of Electrical Energy Consumption (Energy Audit Report Structure):-** Aleksandar Nikolic, Electrical Engineering Institute Nikola Tesla,anikolic@ieent.org

The mandatory nature of energy audit requires not only establishing guidelines for energy auditing procedures but also calls for standardization of energy audit reports. Power plants consist of equipment of varied nature and functionality performing different functions. There is, therefore, need for establishing procedures for conducting energy audit on different types of equipment at site operating under different conditions according to the process of operation of the power plant. The structure of the energy audit report is governed basically by the directives.

ROOFTOP SOLAR PV SYSTEM

1) Feasibility study and Performance evaluation of a grid-connected Rooftop Solar PV system: Jaya Vasita1, Querie Shakhiya, Jvalant Modi.:

a) In this paper, the potential and cost-effectiveness of a solar photovoltaic (SPV) power plant for meeting the energy demand of educational Institute at Ahmadabad, Western India is analyzed.
b) The research paper focus on solar PV energy generation from a grid-connection installed using PV syst.
c) In this paper, we have studied the design of solar power plant as well as the calculation of power production and its performance evaluation.

2) Impact of High Solar Rooftop PV Penetration on Voltage Profiles in Distribution Systems: Rung Punyachai, Weerakorn Ongsakul, Member, IEEE, Uwe Schmidt.:-

a) This paper provides an assessment on voltage profiles of a distribution system in the presence of high level of solar rooftop PV penetration.
b) Each household solar rooftop PV power generation is calculated by PVWATTs online calculation tool.
c) In this paper, an assessment of over-voltage in low voltage (400/230 V) and medium voltage (22 kV) sub-urban distribution grid with high level of rooftop-PV penetration is provided.

3) Impact of Rooftop Solar PV based DG on Reliability of Distribution Systems: Rohit K. Mathew, Ashok S.,Kumaravel S:-

a) This paper presents the impact of grid connected rooftop Solar PV on reliability of a distribution system.
b) In this paper, mathematical expressions have been presented for the DG penetration in a radial system.
c) Case studies have been conducted on a typical utility feeder, to study the impacts of rooftop Solar PV DG in a distribution system.

4) Improving of Uncertain Power Generation of Rooftop Solar PV Using Battery Storage: Anchuleeporn Chersin, Weerakorn Ongsakul, Member, IEEE and Joydeep Mitra, Senior Member, IEEE.:-

a) In this paper, the battery storage energy management strategy (BS-EMS) is investigated to decrease the effect of sudden power generation variation of rooftop solar PV.
b) BS-EMS operation is efficiently providing a stable power output to the grid during daylight time after feeding a residential load.
c) This BS-EMS is modeled by PSCAD programming which is appropriately for transient analysis.

5) Investigating PV Generation Induced Voltage Volatility for Customers Sharing a Distribution Service Transformer: Abhineet Parchure, Stephen J. Tyler and Melissa A. Peskin, Kaveh Rahimi and Robert P. Broadwater, murat-dilek.:-

a) Many studies have been conducted on analyzing transmission level voltage stability with high PV penetration, and recent efforts have also analyzed voltage stability at the medium and low voltage distribution levels.
b) This work investigates how variable rooftop solar PV generation impacts voltages at customers sharing a service transformer.
c) An investigation into how variable PV generation affects the voltages of customers sharing a service transformer has been presented.

6) Large-scale implementation of grid-connected rooftop solar photovoltaic system in India – potential, challenges, outlook, and technical impact: Adithya S N.:-

a) This paper examines the potential, importance, foreseen challenges, outlook, and technical impact due to large-scale deployment of grid-connected rooftop solar PV systems in India.
b) India has set a target to install 100 GW of solar generation capacity by 2022 in which 40 GW would be grid-connected rooftop solar photovoltaic (PV) system.

7) Performance of Rooftop Solar PV System with Crystalline Solar Cells: Oo Abdul Rosyid, Kawasan Puspiptek, Tangerang Selatan, Banten, Indonesia.:-

a) This paper is investigating the simulated performance of 5 kW rooftop solar PV system with crystalline solar cells. During this study, 15
% efficient glass covered crystalline solar module with a temperature co-efficient of power as - 0.47 %/°C is chosen
b) In this, a study is carried out to analyze the performance of crystalline silicon modules for the 5-kW solar PV system.

c) This study helps to understand how crystalline solar cells performs under the weather conditions of Coimbatore location in India.

8) Power Management Strategy for Residential Housing Connected to the Rooftop Solar PV: Karthik Atluri 1, Sunny M Hananya 1, Bhogula Navothna 2.:-

a) This paper investigates operation mode control for residential housing which consists of the rooftop solar PV and Battery Energy Storage System(BESS) which could be regulated by a Charging/Discharging Controller incorporated into a power management strategy.
b) It could operate on the DC-AC Converter which depends on the State of Charge (SOC%), real time of resident load, and real time Solar PV panel generation.
c) This paper proposed the Operation Mode Control of Bat- terry Energy Storage System(BESS) which works from the Charging/Discharging Controller based on SOC (%) for the rooftop residential 50kW solar PV systems.

EXPERIMENTAL SETUP AND MOTIVATION FOR DOING THIS RESERCH

"Renewable energy-based rural electrification": The mini-grid experience from India
Debajit Palit and Gopal K Sarangi

1 This study investigates renewable energy- based rural electrification in India, with a specific focus on the mini and
micro-grid experiences.

2. Chhattisgarh mini-grid model
promoted by the Chhattisgarh Renewable Energy Development Agency (CREDA).

3. Chhattisgarh has implemented the largest number of mini-grids in India covering more than 1400 off-grid habitations in the last decade.

"**A case study: off-grid solar PV in rural Kenya":**
Frida Holmberg Hansen.

1 This paper explores the solar PV market in Kenya and how it can contribute to achieve universal access to all Kenyans within 2030.

2 This paper investigates decentralized, off-grid solar PV power supply in rural Kenya, which is one of the most potential solutions to provide access to basic electricity for households not connected to the conventional national grid.

3 In 2016, there was 21 public mini-grid stations in Kenya, 19 owned by REA and managed by KPLC while the other two stations are owned and managed by Kenya Electricity Company (KenGen).

SURVEY OBSERVATION OF RURAL AREAS

Sr. NO	Villages	Avg. no. of houses	Max. demand	Avg. load
1	Dongargoan	80	120421 unit	10035.07 unit
2	Bothli	36	30201 unit	5221.569 unit
3	Dhuti	44	36579 unit	9413.38 unit

RESULT AND DISCUTION ABOUT SURVEY

1. Micro grids can save money and provide multiple opportunities for increasing income and employment opportunities for rural population.
2. promising new approaches need to be tested to determine if they can address poverty, equity, environmental and public health concerns in the context of on going global restructuring of energy rural areas. Time will tell, but the indicators are promising.
3. There is a vast scope for utilizing of solar photovoltaic energy in India. With continuing R&D and cost reduction it can become the most potent energy source. With a clear renewable energy policy in place, India is the forerunner in this sector. There is room for manufacturers, foreign investors, local financial and institutional agencies and others.
4. Solar energy can be one of the thrust areas due to its accessibility through the country in sufficient quantity. For we owe it to ourselves and our children to provide for sustainable development with due regard to our ecology. Renewable energy is nature's resource and we must use it for human kind in consonance and harmony with nature.

CONCLUSION

1) Rural electrification is a 'selective catalyst' to improve agricultural productivity through mechanization and is essential for many rural activities. Electrification cannot by itself ensure economic development but it is a necessary but insufficient condition.. It works best when it is complemented by social and economic infrastructure.
2) Short-term implementations in next 5 years for immediate improvement Medium term implementations in next 5–15 years-technologies that can potentially achieve improvements relative to current technology. Long-term implementations in next 15–30 years – Proven technologies that could reduce net energy costs and reduce emissions, leading to sustainable development.

SCOPE OF WORK

1. Solar photovoltaic system offers unique chances for the energy sector to provide energy services to remote rural areas such as health are, education communication, agriculture, lightning and water supply.
2. This project represents the study of energy audit on rural areas. Rural electrification is an integral component of poverty alleviation & rural growth of nation. Being the seventh largest country in the world, 6000 villages in habit 72.02% of its human resource (census 2001). 40% of the total energy is in rural areas.
3. Provide rural India with professional resource support from institutes of higher education especially, those which have acquired academic excellence in the field of Science, Engineering Technology and Management.

FUTURE SCOPE

1. For exact connected load number of transformer and load connected on each transformer has to be calculated.
2. Collecting costing details for implementation of centralize mini grid and decentralized solar rooftop.
3. Proposal of Centralized Mini Grid for Villages under U.B.A
4. Proposal of De-centralized Solar Rooftop for Villages under U.B.A
5. Implementation of project.

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