International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395 -0056
Volume: 04 Issue: 05 | May -2017 www.irjet.net p-ISSN: 2395-0072

Essence of Green Energy and Innovative Lighting Systems

Dr H Naganagouda[1], Shashikiran N[2], Dr Adarsha H[3], Naveen S[4], Mufassireen Ahmed[5]

[1]*Director, National Training Centre for Solar Technology, KPCL, Bangalore, Karnataka*

[2]*Student, Dept. of Mechanical Engineering, Jain University, Bangalore, Karnataka*

[3]*Assistant Professor, Dept. of Mechanical Engineering, Jain University, Bangalore, Karnataka*

[4]*Founder, Pro Earth Foundation, Bangalore, Karnataka*

[5]*Co-Founder, Pro Earth Foundation, Bangalore, Karnataka*

Abstract – *Energy conservation is the top priority of our daily life due to fast development and ever changing global economy, be it residential, commercial, educational and industrial. Another reason being - Global warming and limited resources of fossil fuels have been increasingly driving the world towards clean energy development. The need to conserve energy be it any form viz., Thermal, Hydel etc., is at its peak. . The 3 stages of Energy i.e., Generation, Distribution and Utilization is always a challenging task to improve its efficacy. Today the amount of energy consumed to generate these energies are more than that we are utilizing.*
The present paper deals with efficient utilization of electrical energy and proposing adoption of solar energy for the given energy requirement in a public/govt buildings taken up for study. Buildings with different energy requirements have been surveyed. Consumption of daily load w. r. t. present general lighting system was observed and for the same load requirement, consumption of energy replaced with the efficient lighting system is calculated.

Key Words: **Energy Conservation, Efficient utilization, Green Energy, General lighting system.**

1.INTRODUCTION

Residential and business buildings account for approximately 20% of the overall world-wide energy consumption [1], with an increasing trend over time. The major causes of energy consumption in buildings are lighting, space heating, conditioning, water heating, computers and other electronic devices [2]. A significant part of this energy consumption is due to usage of inefficient lighting systems.

Lighting accounts for about 18% of all electricity consumed in the country. The majority of the lamps and fixtures used are Incandescent Light Bulbs or General Lighting Systems (GLS), with low efficiency. 90% of electricity consumed by GLS is wasted as heat and only [4] 10% gets converted into visible light. Energy efficient LED lamps consume much lesser energy than Fluorescent Tube Lights (FTL) and Compact Fluorescent Lamps (CFL), also giving increased brightness and cooler to touch.

1.1Need for Energy Conservation

Energy efficiency and green energy are two sides of same coin of energy conservation. Conservation means using optimum energy for carrying out a specific work without affecting quality of work. The need for energy conservation is due to the depletion of fossil fuels and damage to the environment with the use of conventional or non-renewable energy resources. Green energy/ power is the power generated from environment friendly sources that do not degrade the environment. The chief source of energy generation is Sun and its indirect sources such as wind, hydro power, tidal power etc.

Improving Energy efficiency by opting for energy efficient technologies, processes, equipment and appliances etc., will lead to conservation of energy. Also, adoption of renewable energy sources serves the purpose.

1.2 Building Energy

Building energy consists of energy for lighting, energy for comfort, i.e. air circulation, cooling, heating, energy for lifts, water pumps, and energy losses in the local electrical distribution network. Building energy depends on factors such as: ambient temperature, weather conditions and daylight hours, building design, inherent efficiency of equipment used and installed efficiency of equipment used.

Green Buildings are designed to [3] provide internal comfort with much less consumption of conventional fuel resulting in savings of recurring and capital costs.

2. METHODOLOGY

An extensive survey was conducted in the building which was taken up for study, where in all types of electrical

loads were taken for consideration floor wise where in only GLS was looked in. Total loads with respect to each room of the building and total load of the entire building was noted. For all these loads, energy consumption on daily basis was calculated considering hourly load and peak load. For the entire building if all GLS are replaced by new lighting system it will consume less energy and gives better illumination with better efficiency [4].

In the following tables, it is shown how much power can be saved for an entire year and how much beneficial it will be if we implement efficient electrical systems including lightings further more power consumption can be brought down.

Table -1: Existing Load Details- Tube lights

Sl. No	FLOOR	NO. OF FITTINGS	WATTAGE	USAGE in HOURS	KWh PER DAY
1	Corridor	144	50	12	86.4
2	Mezzanine	91	50	12	54.6
3	1st floor	239	50	12	143.4
4	2nd floor	229	50	12	137.4
5	3rd floor	272	50	12	163.2
6	4th floor	286	50	12	171.6
7	5th floor	272	50	12	163.2
Total		1533			919.8

Table -2: Modified Load Details- LED lights

Sl.No	FLOOR	NO. OF FITTINGS	WATTAGE	USAGE in HOURS	KWh PER DAY
1	Corridor	144	18	12	31.1
2	Mezzanine	91	18	12	19.66
3	1st floor	239	18	12	51.62
4	2nd floor	229	18	12	49.46
5	3rd floor	272	18	12	58.75
6	4th floor	286	18	12	61.78
7	5th floor	272	18	12	58.75
Total		1533			331.12

These floors data were calculated taking account of individual rooms in each floor which varied in numbers and the summarized numbers of rooms were given per floor. In the modified load, we have replaced tube lights to LED lights that are more bright consuming very less power. Mezzanine floor is nothing but the ground floor [5].

Table -3: Energy Savings

Sl. No	Existing KWh/day	Modified KWh/day	Energy Saved per day	Energy Saved per month	Energy Saved per year
1	86.4	31.1	55.3	1659	20184.5
2	54.6	19.66	34.94	1048.2	12753.1
3	143.4	51.62	91.78	2753.4	33499.7
4	137.4	49.46	87.94	2638.2	32098.1
5	163.2	58.75	104.45	3133.5	38124.25
6	171.6	61.78	109.82	3294.6	40084.3
7	163.2	58.75	104.45	3133.5	38124.25
Total	919.8	331.12	588.68	17660.4	214868.2

Table 1 shows the number of fittings in the entire building and load calculated for existing tube lights. In Table 2 load details by replacing LEDs have been calculated. It's clearly indicated in Table 3 the amount of energy saved in a year could go up to 2.1 MW.

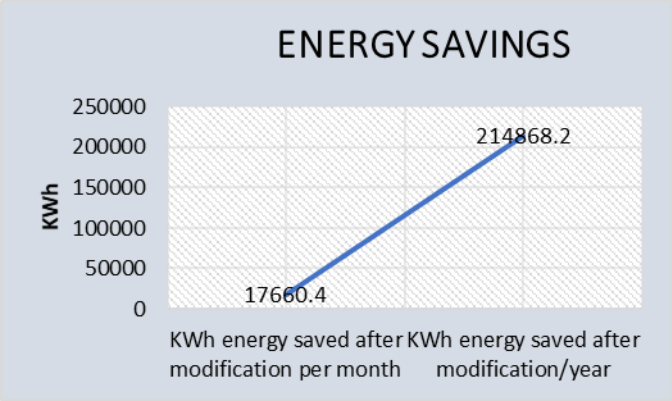

Chart -1: Energy Savings

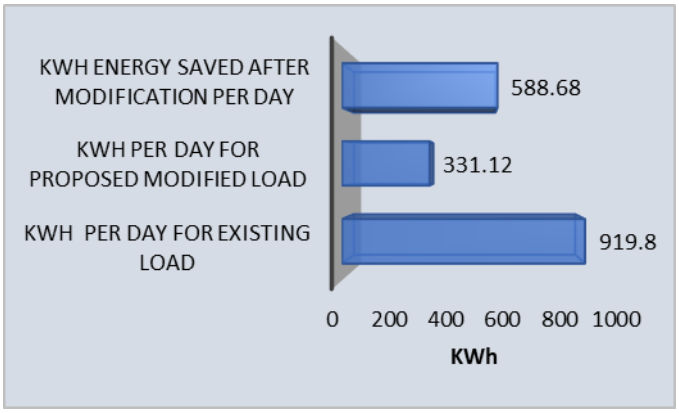

Chart -2: Comparison of existing and modified load

Fig -1: Building taken up for survey

3. PROPOSED SOLAR PV POWER PLANT

From the previous tables, it is revealed that just by replacing lighting fixtures we can save up to 2.1MW per year. Now from Table 3 considering the modified load, it is proposed to incorporate solar roof top power plant, grid connected with net metering. In the following table, both for existing and modified lighting loads solar power plant has been proposed, highlighting its socio-economic [5] and environmental benefits. Considering the present market rate of Rs.70000 per Kw; investment cost is calculated in table 4 for the investment of Solar power plant.

Table -4: Techno Economic Analysis of Solar PV power plant

Sl.No	Details	KWh/day	SPV Power plant in KW	Total Investment in Lakhs	Pay Back Period in Years
1	Existing Load	919.80	204.40	143.08	3.78
2	Modified Load	331.12	73.58	51.51	3.78
3	Saving at Consumer Point	588.68	130.82	91.57	
4	%Saving	64	64	64	

As shown in the Table-4, for existing load proposed solar plant is of 204KW and for modified its 74KW. The payback period for either of them is same i.e. less than 4 years. Hence it is advised to opt for modified load as the percentage savings are close to 65%. Following table clearly shows the environmental impacts due to the installation of Solar PV grid connected power plant with net metering.

Table -5: Environmental Impact Analysis

Sl.No	Details	Coal in kg (1kg/unit)	Water in litres (3.3 lts/unit)	CO_2+GHG in kgs
1	Saving at Consumer Point	241718	797668.08	241718
2	Reduction at Generation Point	483435.2	1595336.2	

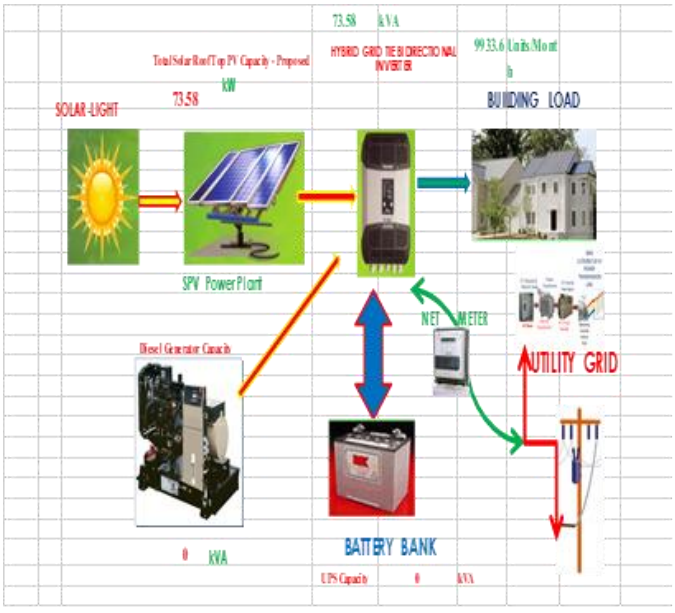

Fig -2: Typical Set up of a Solar PV Grid Connected Power Plant with Net Metering.

3. CONCLUSIONS

In this paper, it is concluded that by replacing lighting fixtures we can save up to 2.1 MW units of energy per year. This truly calls for the modification of existing systems so that by saving energy at consumer point not just

benefits the consumer on its cost, but also has great impact on environment and at the generation point.

Also, its seen that rather than utilizing conventional source of energy, its beneficial to utilize non-conventional or renewable source mainly solar energy which is available in abundance at no cost. Also implementation of solar energy is cost-effective and it is promoted by Indian Government giving subsidies.

4. FUTURE SCOPE AND DISCUSSIONS

Further if all the electrical equipment is replaced with better efficiency; there can be exponential amount of energy savings. If this is for one building only, by incorporating similar energy saving procedures for all types of buildings we can easily overcome the shortage of conventional energy supply.

For the same energy required, if Solar energy is incorporated the building becomes energy independent which is nothing but using green energy. Which in turn is protecting nature w. r. t. reduction in usage [3] of coal and reduction in emission of Carbon di-oxide and other harmful greenhouse gases which are emitted by conventional energy sources.

Other forms of renewable energy such as wind energy, tidal energy, geo-thermal,[5] biomass etc can also be used. Solar-Wind hybrids also are in good demand these days as we can generate energy both in day and night. This topic also is of great research and advantage to develop highly efficient systems, hence opening the path of studies further for the same.

Energy Conservation in future could also be a subject in the annual curriculum if it's been adopted worldwide.

REFERENCES

[1] Energy Information Administration, "International Energy Outlook 2010 - Highlights", http://www.eia.doe.gov/oiaf/ieo/highlights.html.

[2] International Energy Agency, "Cool Appliance. Policy Strategies for Energy Efficient Homes", Paris, France, 2003.

[3] P. Ralli & Thivon Str., Egaleo, "Advanced Control Systems Engineering for Energy and Comfort Management in a Building Environment," A review A.I. Dounis, C. Caraiscos Department of Automation, Technological Educational Institute of Piraeus.

[4] Petr Stluka, Datta Godbole, and Tariq Samad, "Energy Management for Buildings and Microgrids," 2011 50th IEEE Conference on Decision and Control and European Control Conference (CDC-ECC) Orlando, FL, USA, December 12-15, 2011

[5] Dr. H. Naganagouda, "Solar Power Handbook," National Training Centre for Solar Technology, KPCL, Bangalore.

BIOGRAPHIES

Dr H Naganagouda,
B.E., M.E., M.I.S.T.E., F.I.E., C.E., Ph.D.
Director, National Training Centre for Solar Technology, Karnataka Power Corporation Ltd, Bangalore.

Shashi kiran N
B.E.(Civil Engineering), MTech (Energy Management),
Jain University School of Engineering and Technology

Naveen S
B.E. (Mechanical Engineering), Solar-Wind Energy Engineer, Yoga Teacher
Founder - Pro Earth Foundation

Mufassireen Ahmed
B.E. (Aeronautical Engineering), Solar-Wind Energy Engineer,
Co-Founder -Pro Earth Foundation