Energy Audit to Fulfill the Requirement through Non-Conventional Energy Resources in K.N.I.T. Sultanpur

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I. INTRODUCTION

Energy is basic requirement of human beings in modern society .it is an important input in all sectors of country's economy. As such there is a close relationship between the availability of energy and the growth of a country. The degree of prosperity of a country can be measured from the energy consumption by its people. Lack of energy resources has an adverse effect on the economic growth and the progress of country. Power generation is done from the various sources of energy. It is increasing exponently from last few decades due to increasing demands in industries, domestic use and other purposes. As population is increasing day by day, the energy consumption is also increasing very rapidly. Therefore, adequate supplies of clean, reliable and economic energy is required through exploiting various sources of energy. The energy available in the natural form is not directly usable. The natural forms of energy are chemical energy of fossil fuels, nuclear energy of radioactive materials, photon and thermal energy of the sun and potential or kinetic energy of air and water flow.

II. ENERGY CRISIS

India faces an enormous demand supply gap of about 11% energy shortage and 14% peak power shortage.

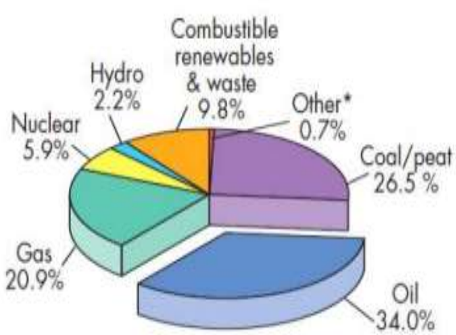


Fig 1.1- A breakdown of the world energy supply in 2012

III. ENERGY CRISIS IN INDIA

There have been 3 chief energy crises until now – the 1973 oil crisis, the 1979 energy crisis, and the 1990 oil-price hike, aside from a couple of regional crises. Prices have been briskly escalating for the past five years, due to the rising desire and the escalating shortage of energy resources.

Table 1.2- Energy use in terawatt-hours

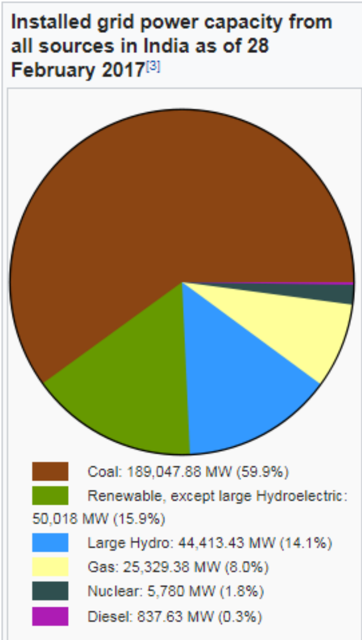
	Fossil	Nuclear	Renewable	Total
1990	83,374	6,113	13,082	102,569
2000	94,493	7,857	15,337	117,687
2008	117,076	8,283	18,492	143,851
Change 2000-2008	+23.9%	+5.4%	+20.6%	+22.2%

Note: 1 terawatt-hour (TWh) = 1 billion kilowatt-hours (kWh) = 10^{12} watt-hour

Fossil energy use increased most in 2000-2008. In October 2012 the IEA noted that coal accounted for half the increased energy use of the prior decade, growing faster than all renewable energy sources. Since the Chernobyl disaster in 1986 investments in nuclear power have been small.

IV. THE RENEWABLE ENERGY SPACE INDIA

India is one of the countries with the largest production of energy from renewable sources. In the electricity sector, renewable energy (excluding large hydro) accounted for 18.37% of the total installed power capacity (60.98 GW) as of 31 October 2017. In previous years the share of renewable grid capacity increased 6 fold from 2% (3.9 GW) in 2002 to around 13% (36 GW) by 2015. Large hydro installed capacity was 44.41 GW as of 28 February 2017, contributing to 13.6% of the total power capacity. Unlike most countries, India does not count large hydro power while accounting for renewable energy targets as it comes under the older Ministry of Power instead of Ministry of New and Renewable Energy. Thus, renewable energy including large scale hydro-power currently adds up to more than 32% of the total installed power capacity in India.



Wind power capacity was 32,746 MW at the end of 2017, making India the fourth-largest wind power producer in the world. According to a government press release dated 27 December 2017 the country had a strong manufacturing base in wind power with 20 manufactures of 53 different wind turbine models of international quality up to 3 MW in size with exports to Europe the USA and other countries.

The government target of installing 20 GW of solar power by 2022 was achieved four year ahead of schedule in January 2018, through both solar parks as well as roof-top solar panels. India has set a new target of achieving 100 GW of solar power by 2022. Four of the top seven largest solar plants worldwide are in India including the second largest solar park in the world at Kurnool, Andhra Pradesh, with a capacity of 1000 MW. The world's largest solar power plant, Bhadla Solar Park is being constructed in Rajasthan with a capacity of 2255 MW and is expected to be completed by the end of 2018.

Table 1.1: Projected Requirement of Electricity

	Energy Requirement (Billion kWh)		Peak Demand (GW)		Installed Capacity Required (GW)	
GDP growth at	8.0%	9.0%	8.0%	9.0%	8.0%	9.0%
2003-04	633	633	89	89	131	131
2006-07	761	774	107	109	153	155
2011-12	1,097	1,167	158	168	220	233
2016-17	1,524	1,687	226	250	306	337
2021-22	2,118	2,438	323	372	425	488
2026-27	2,866	3,423	437	522	575	685
2031-32	3,880	4,806	592	733	778	960

V. CASE STUDY OF K.N.I.T.

Initially established as the Faculty of Technology in Kamla Nehru Institute of Science and Technology, Sultanpur in the year 1976 by Kamla Nehru Memorial Trust. It was taken over by the govt. of Uttar Pradesh in 1979 with a view to develop a full-fledged engineering institute in the Eastern UP region better known as the Awadh region. Later, in the year 1983 it was registered as a separate society and renamed as the Kamla Nehru Institute of Technology. The Institute is one of the leading technical institutions of the region and is responsible for producing top-grade engineers with skill sets comparable with the best in the world. Being fully aware of its social responsibilities and the addressing the issue of application of technology to industry, it also renders the testing and consultancy services to the neighboring industries and various other agencies. The institute is presently affiliated to U.P Technical University, Lucknow. The Institute is situated 5 Km away from the city (Sultanpur) on Allahabad Faizabad state highway on the bank of river Gomti. It is well connected through road and rail network. The nearest airport is Amousi (Lucknow) and Babatpur (Varanasi) which is about 140 Km far from the Institute. Topology & Geographical area: Sultanpur has a tropical wet and dry climate with average temperatures ranging between 20 to 28 °C (68 to 82 °F). Sultanpur experiences three distinct seasons: summer, monsoon and a mild autumn. Typical summer months are from March to May, with maximum temperatures ranging from 30 to 38 °C (86 to 100 °F). The warmest month in Sultanpur is April; although summer doesn't end until May, the city often receives heavy thundershowers in May (and humidity remains high). Even during the hottest months, the nights are usually cool due to Sultanpur's altitude. The highest temperature ever recorded was 48.3 °C (118.9 °F). The monsoon lasts from June to October, with moderate rainfall and temperatures ranging from 10 to 28 °C (50 to 82 °F). Most of the 722 mm (28.4 inches) of annual rainfall in the city fall between June and September, and July is the wettest month of the year. Autumn begins in November. The daytime temperature hovers around 28 °C (82 °F) while night temperature is below 10 °C (50 °F) for most of December and January, often dropping to 3 to 4 °C (37 to 39 °F). The lowest temperature ever recorded was 1.7 °C. [29] .The Institute having forest more than 2000 trees and plants. Roads are made sloppy. It is spread over more than 60 acres area. It consist Residential, Academic, hostels, etc.

VI. METHODOLOGY

Electrical Load in K.N.I.T Sultanpur

There are two transformers having 250 KVA capacities, in K.N.I.T campus. Power Distributions are:

1st 250 KVA transformer supplies the power to the following areas:

- Residential areas
- Workshop

- Academic Section
- Tube well (there are two tube wells having capacity of 10 HP)
- Gargi hostel
- Bank of Baroda

2nd 250 KVA Transformer supplies the power to the following areas:

- Administrative building
- Arya Bhatt hostel
- V.S hostel
- Khosla hostel
- Matriyee hostel
- Panjab National Bank
- New hostel

Electrical Load in Residential Areas

The colony having five types' houses. [30]

In type-I, it has 10 houses and each houses load is 0.5KW and consumption is 0.5KW.

In type-II, it has 12 houses and each houses load is 1KW and consumption is 1KW.

In type-III, it has 8 houses and each houses load is 4KW and consumption is 1.5KW.

In type-IV, it has 20 houses and each houses load is 5KW and consumption is 2KW.

In type-IV Duplex, it has 8 houses and each houses load is 6KW and consumption is 3KW.

Our main objective is to observe the total load and consumption in Residential area. There are divided into five categories. In a Type-I, Type-II, Type-III, Type-IV and Type-IV Duplex categories, the energy consumption is respectively 0.5kW, 1kW, 1.5kW, 2kW, and 3kW.

S.No.	Residential area's name	Load in KW	load in unit/day Rs 6.35 / unit charge is fixed	Electrical bill/month	Electrical bill/year
1.	Type-I	4.8kW	334	10020	120244
2.	Type-II	11.896kW	659.204	19776	237314
3.	Type-III	31.56kW	979.17	29375	215341
4.	Type-IV	99.2kW	3416.3	102489	833628
5.	Type-IV Duplex	47.74kW	2022.78	60683.4	527059.8
6.	Total	195.196kW	7411.45	222343.62	1933586.8

Total load in this colony is about 195.196kW-hour. And Power supply is about 190kW/hour, by main supply although generator runs to give 100kW power. But generator can not fulfill the requirement continuously.

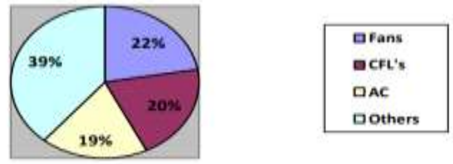


Fig 3.2: Load Distribution in Residential area

Problem Statement: 1. Total load consumption is higher than the Supply so that there is need to fulfill the required load in this building.

2. There are no efficient energy appliances used in this building, which can save energy and power.

VII. RESULT

The Efficient energy appliances (Fans, Bulbs, AC) should set up in Residential area of KNIT campus. We can save about 75% energy in each equipments with five star rating Fans, bulbs and 40% energy with five rating AC. Table shows that if five star equipments used in Residential area, energy demand will fulfilled these are :

Table 4.1 Efficient Energy Appliances Equipments

S. NO.	Residential name	No of fans	No of CFL	No of AC
1.	Type-I	10 X 1 =10	10 X 4 =40	0
2.	Type-II	12 X 2 =24	12 X 4 =48	0
3.	Type-III	8 X 3 =24	8 X 6 =48	8 X 1 =8
4.	Type-IV	20 X 4 =80	20 X 10 =200	20 X 1 =20
5.	Type-IV Duplex	8 X 5 =40	8 X 12 =96	8 X 1 =8
6.	Total	178	432	36

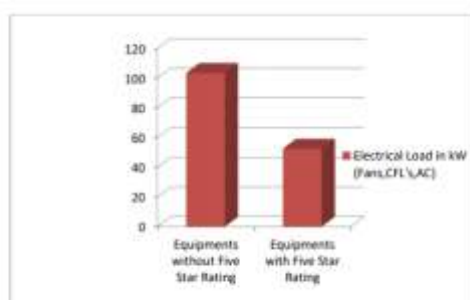


Fig 4.1: Saving of electrical load (kW) in an hour using efficient energy appliances in Residential area.

Result shows that We can save about 75% energy in each equipments with five star rating Fans, LED bulbs and 40% energy in each equipments with five star rating AC.

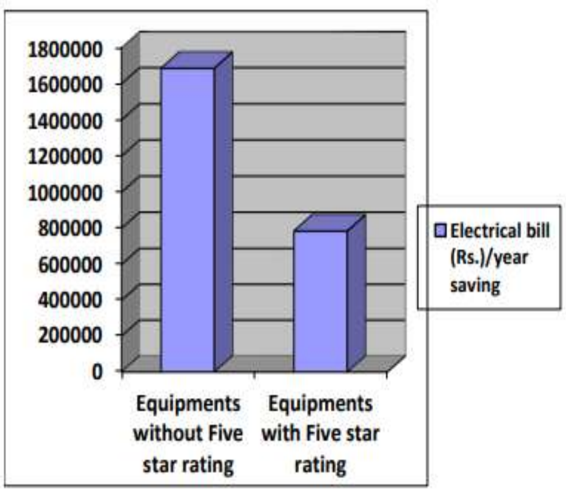
52.44 kW- load can be save by using efficient energy appliances (Fans, bulbs and AC) in the Residential area. Rs. 785652.48 /year electrical bill can be save with efficient energy appliances (Fans, bulbs) in the Residential area.

Installation price of LED bulb is Rs 200-300 per bulb.

Installation price of five star rating Fan is Rs 2000-3000 per fan.

Installation price of five star rating AC is Rs 40000-60000 per AC.

S No.	Equipments	Load (KW)	% Load saving by using five star rating	Bill savings in a month(Rs 6.35/unit is fixed charge)	Bill savings in a year
1.	Fans	178 X 80W= 14.24kW	14.24x75% = 10.68 kW	10.68 kW x 12hrs x 6.35 X 30day = Rs.24414.48	24414.48 X 12 =292973.76
2.	LED	432 X 40W = 17.28kW	17.28 kW x 75% = 12.96 kW	12.96kW x 12hrs x 6.35 x 30day = Rs 29626.56	29626.56 X 12 =355518.72
3.	AC	36 X 2kW = 72kW	72 kW X 40% =28.8kW	28.8kW X 5hrs X 6.35 X 30day =27432	27432 X 5 =137160
4.	**Total**	**103.52kW**	**52.44kW**	**81473**	**785652.48**



Street lights in Residential area (25 Nos.) should be replaced with Solar Street lights having capacity of 120W , Thus total load of street light = 3kW

- Working hour load = 3kW X 10hrs = 30kW-hrs/day
- Saving of electrical Bill = 30kW-hrs/day X Rs 6.35 = Rs 190.5/day or Rs 5715/month 68580/year.
- Result shows that 30kW-hrs/day load saved by using solar street light system, which can fulfill energy demand in Residential area.
- Set up Cost: Rs 15000- 20000/street light thus total cost of 25 street lights is about = Rs 3, 75,000. Payback Period = 375000/68580 = 5.46year

VIII. CONCLUSION

Renewable energy is most adopted and effective methods in present scenario because of their performance, efficiency and cost. Here we use solar energy for street lights because of their efficient work. Once they installed only maintenance required, no other electricity need for working. Solar lights operate long time. Since Total load in Residential area is about 198kW. And Power supply is about 185kW190kW. Thus there are various methods adopted to save the Energy consumption in Academic building at K.N.I.T Campus. Solar street light, efficient energy appliances are most effective methods to fulfill the energy demand. If all methods applied in this Residential area, we can save the energy & cost of the electricity Bill.

- Saving of energy/day by using solar water heater = 270kW- hrs
- Saving of energy/day by using Efficient energy appliances (Fans, Bulbs, AC) = 427.68kW-hrs
- Saving of energy/day by using Solar street lights = 30kw-hrs

The Method which are given in the thesis may adopted to fulfill energy demand in Residential area. This can Fulfill energy demand easily (727.68kW-hrs) these method can save electricity bill.

- Saving of electrical bill per year by using Efficient energy appliances (Fans, Bulbs, AC) = Rs 785652.48
- Saving of electrical bill per year using solar water heater = Rs 205740
- Saving of electrical bill per year by using Solar street lights = Rs 68580
- Hence total savings = Rs 1059972.48/ year savings.

These equipments should be set up by college to save energy demand, Electricity consumption and cost.

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