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Research Paper

An Analysis of Energy Consumption pattern in Shivaji University Campus, Kolhapur, Maharashtra.

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ABSTRACT

Energy management is one of the environmental management issues which need to be addressed by facilities managers, as part of their support to their organization's effectiveness and well-being. Overall energy consumption is significant in majority of higher educational institutions due to their large number of buildings. Improving the energy performance of buildings is one of the ways to address this challenge. A strategy for achieving this is proper targeting and monitoring of energy consumptions.

The aim of this paper is to study the energy consumption in the form of electricity of higher education institution like Shivaji University, Kolhapur. For analysis of energy consumption pattern in the University campus, the entire University area is divided into industrial, commercial, and residential area for study purpose. From the data collected regarding electricity consumption in different study areas of University reveals that the University requires large amount of electricity. With the time the numbers of students are increasing and use of new facilities and technology are also increasing the utilization of electricity and that is how the utilization of electricity is going on increasing. The results with a representative example of higher academic institution are taken for discussion. .

Key Words: - Energy consumption pattern, educational institute, energy performance, higher education institutions, Environmental sustainability

Introduction:-

In recent years there is growing interest in energy consumption and costs among property owners. Concerns about rising energy costs and the need to address sustainability in the workplace are making organizations to realize how facilities management affects the bottom line [1]. From an environmental and economic point of view, reducing energy consumption and cost is becoming central to planning, construction, and use of buildings [2].

Electricity plays a vital role in our life and all over the world. In modern age all equipments work on electricity. When the electric supply stops leads to stop all the activities. In the educational institutions electricity plays a vital role e. g supply of water, light, fans, machineries etc. Shivaji University is located on the outskirts of the historic township of Kolhapur (Maharashtra) India, Shivaji University is situated in lush green surroundings spread over 853 acres (356 hectare) area . Energy demand of Shivaji University, Kolhapur is increasing with developmental activities and progress.

It may be said as Garrett Hardin, (1968) that energy problem of modern society of the problem of population, that it has no technical solution [3]. Energy use in institutional building is a function of the buildings capital stock, that is the buildings and the installed energy using equipment energy use also depend on the technical performance of the buildings energy using equipment such as its barriers, furnace water heater and chillers and it depends on the way in which this equipment is operated [4]. The large number and diverse type of building in higher educational institutions make the process time consuming and tedious. To enhance the process of monitoring and benchmarking there is need to develop an energy performance information system [3]. There are more than 7, 00,000 educational institutions operating all over India. A developing university like Shivaji University consumes about 8, 00,000 liter of water and uses about 5333 KWH of electricity per day for their operation. Thus, educational institution should also be focused with industries to preserve our natural resources and methods are to be developed to improve their environmental performance [5]. The study is undertaken to understand how efficiently the electrical energy consumption is possible in academic higher education institutes.

Material and Methods:-

Study area

Geographically Shivaji University Kolhapur, Maharashtra India is located at an altitude of about 550 meters above MSL at latitude 160, 40', 31.81" North and 740, 15'.12.10" East. For conducting proper survey of university campus, it is divided into various study areas like industrial, commercial and residential. The various study areas of University campus are as follows.

1) Departments: - There are about 39 departments. All the departments have to be considered for such data collection as monthly electricity bills.

2) Laboratories: - All Science Departments have one or more laboratories with an array of instruments required for their experimental purpose which requires electricity for their operation and working.

3) Streets: - The streets of the campus of Shivaji University were considered as separate entity, almost 50% of the 356 hectors of the university property is covered by street light. The street light mostly includes tube light and it requires highest electricity supply.

4) Hostels: - After the department and official institution the second largest energy requirement is in ladies and boys hostels. There are total severs hostels for boys and girls of the

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Post Graduate Department of the University. There are four boys' hostels with accommodation facility for 700 students and three girls' hostels for 400 students. Facilities of recreation, indoors and out door games are available for students in the hostels and sports hostels.

5) Staff Quarters: - Another major source of energy users in Shivaji University Campus is staff quarters which are situated within the campus. In these quarters most of the teaching and non teaching staff is receding.

6) Other buildings: - In these buildings other than Departments and Hostels are considered such as Library, Study Center, Examination Building, and Internet Hall which requires maximum amount of energy for their regular use.

Methodology: -The areas which are covered by Shivaji University for energy consumption the Departments like Science Departments, Library and Internet section uses more electricity than Social Science Departments, Garden and Sport Complex. Collection of monthly Electricity Bills of University for the analysis of energy consumed by using suitable statistical methods.

The entire University campus is divided into three categories for consumption of energy.

1. Industrial area: - It includes Common Facility Centre (CFC), University Science Instrumental Centre (USIC), Printing Press, Administrative Buildings, etc

2. Residential area: - It includes all Residential Quarters of teaching and non-teaching Staff in University area.

3. Commercial area:-It includes all Departments, Hostels (boys and Girls), Guest House and Sport Complex etc.

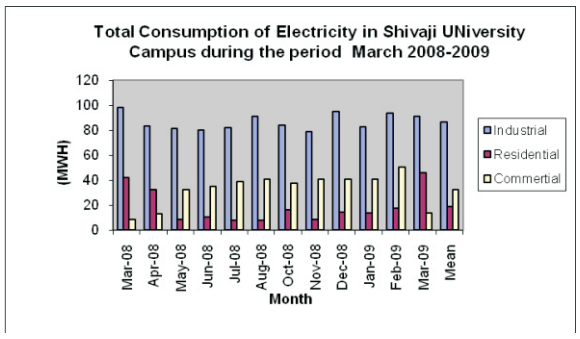
The electricity consumption pattern has been studied for three years period of time i.e. from March 2008 to March 2011.

Results:- Energy consumption pattern of Shivaji University campus has been studied from March, 2008 to March, 2011 and following results were observed which shows the electricity consumption pattern in the last three years.

Consumption of Electricity in Shivaji University Campus,

Kolhapur from March 2008 to March 2009.

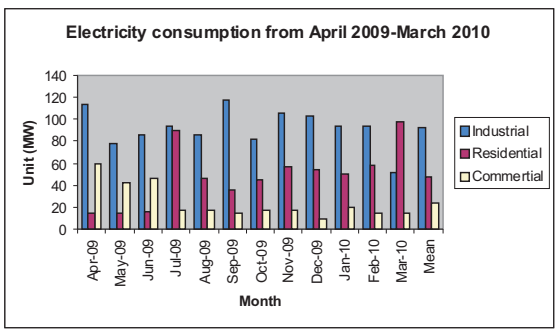
Sr No	Month and Year	Electricity consumption at Industrial area (MWH)	Electricity consumption at Residential area (MWH)	Electricity consumption at Commercial area (MWH)
1	Mar-08	97.77	41.801	8.689
2	Apr-08	83.325	32.332	12.688
3	May-08	81.324	8.705	32.111
4	Jun-08	79.746	10.009	34.76
5	Jul-08	82.25	7.434	38.596
6	Aug-08	90.961	7.976	40.841
7	Oct-08	83.842	16.433	37.57
8	Nov-08	79.013	8.536	40.331
9	Dec-08	95.095	14.413	40.857
10	Jan-09	82.333	13.39	40.802
11	Feb-09	93.505	17.132	50.058
12	Mar-09	90.75	45.795	13.385
	Mean	86.659	18.663	32.557



Consumption of Electricity in Shivaji University Campus,

Kolhapur from March 2009 to March 2010

Sr no	Month and Year	Electricity consumption at Industrial area (MWH)	Electricity consumption at Residential area (MWH)	Electricity consumption at Commercial area (MWH)
1	Apr-09	113.468	14.465	59.157
2	May-09	78.456	13.993	42.341
3	Jun-09	85.597	15.925	45.968
4	Jul-09	92.995	89.264	16.521
5	Aug-09	86.777	46.733	16.48
6	Sep-09	117.738	35.329	15.283
7	Oct-09	82.503	44.687	16.48
8	Nov-09	106.285	56.234	17.306
9	Dec-09	102.925	54.584	8.451
10	Jan-10	94.442	50.372	19.726
11	Feb-10	94.447	57.236	15.287
12	Mar-10	51.339	98.762	13.969
	Mean	92.247667	48.132	23.9140833



Consumption of Electricity in Shivaji University Campus,

Kolhapur from March 2010 to March 2011.

Sr no	Month and Year	Electricity consumption at Industrial area (MWH)	Electricity consumption at Residential area (MWH)	Electricity consumption at Commercial area (MWH)
1	Apr-10	106.247	57.056	21.367
2	May-10	100.462	54.57	15.393
3	Jun-10	77.069	41.949	26.947
4	Jul-10	80.449	41.949	26.947
5	Aug-10	104.461	56.201	13.838
6	Sep-10	97.637	55.125	14.149
7	Oct-10	109.958	58.753	17.634
8	Nov-10	90.835	49.129	13.121
9	Dec-10	94.974	52.573	18.413
10	Jan-11	95.758	52.905	13.687
11	Mar-11	106.238	59.112	17.17
	Mean	96.735	52.665	18.060

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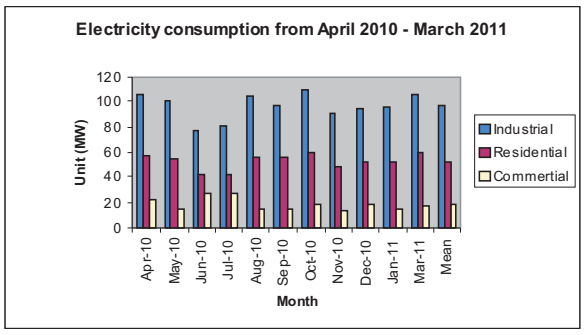
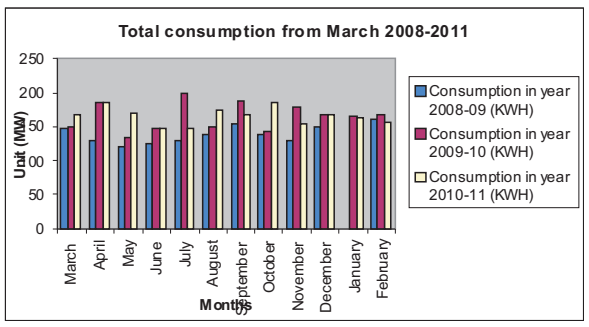


Consumption of Electricity in Shivaji University Campus, Kolhapur from March 2008 to March 2011.

Sr No	Month	Electricity consumption in 2008-09 (MWH)	Electricity consumption in 2009-10 (MWH)	Electricity consumption in 2010-11 (MWH)
1	March	148.260	149.930	166.050
2	April	128.345	187.090	184.670
3	May	122.140	134.790	170.425
4	June	124.515	147.490	145.965
5	July	128.280	198.780	149.345
6	August	139.785	149.990	174.500
7	September	153.925	188.390	166.911
8	October	137.845	143.670	186.345
9	November	127.880	179.825	153.085
10	December	150.365	165.969	165.960
11	January	136.325	164.540	162.350
12	February	160.695	166.970	156.640



Discussion:-

Higher education institutions generally own large stock of facilities (buildings and other infrastructure) for the delivery of their services. A lot of resources (human, material and financial) are devoted for the acquisition, operation and management of the facilities [6].This research recommends that a conceptual model of energy awareness development process be developed in a future study. The model will serve as the guidelines for raising energy awareness and improving energy-use behavior among university students [7]. Graphical representation of energy consumption in University Campus shows that, from March 2008 to March 2009, mean consumption of electricity in the industrial area is highest i.e. 86.65 MWH, than mean electricity consumption in the commercial and residential area i.e. 32.55 MWH and 18.66 MWH respectively. Month of March 2008 and December 2008 shows a highest consumption of electricity in industrial area where as there is lowest consumption of electricity in the month of November 2008. In the Month of July 2008 shows lowest consumption of electricity in residential area i.e. 74.34 MWH. In the month of March, 2008 commercial area shows lowest consumption i.e. 86.89 MWH while February, 2009 shows maximum consumption i.e. 50.058 MWH. In the month of March, 2008 shows lowest consumption i.e. 79.13 MWH.

The representation of energy in the form of electricity consumption from April, 2009 to March, 2010 shows mean consumption of electricity in industrial area is 92.24 MWH which is greater than mean consumption of electricity in commercial and residential area i.e. 23.91 MWH and 48.13 MWH respectively. In the month of September, 2009 shows highest consumption i.e. 117.73 MWH while March, 2010 shows lowest consumption i.e. 51.33 MWH. In the month of March, 2009 shows lowest consumption in residential area i.e. 13.99 MWH while March, 2010 shows highest consumption i.e. 98.76 MWH. In the Month of December, 2009 shows maximum consumption in commercial area i.e. 8.451 MWH while April, 2010 shows highest consumption i.e. 59.15 MWH. Energy consumption from April, 2010 to March, 2011 shows mean consumption of industrial area is highest i.e. 96.73 MWH than residential and commercial area i.e. 52.66 MWH and 18.66 MWH respectively. In the month of October 2010 shows highest consumption in industrial area i.e. 109.95 MWH while January, 2010 shows lowest consumption i.e. 77.06 MWH. In the year April, 2010 to March, 2011 shows nearly same consumption throughout the year. In the month of January, 2011 shows lowest consumption in commercial area i.e. 13.68 MWH while June, 2010 shows maximum consumption i.e. 26.94 MWH. Electricity consumption from March, 2008 to March, 2011 shows consumption of electricity has been increased from year, 2008 to year 2009 but no more increase is observed in the year 2011 than year 2010. From above results it can concluded that the electricity consumption pattern of University is increasing as the number of students increases. Therefore, it is a demand of time to for use non conventional energy sources in Shivaji University, Kolhapur.

From the discussion it can be concluded that as the electrical energy demands are going to get increased in future, the University has to take measures to minimize use of electricity at every place wherever possible to use it at places it is required as well as to reduce unwanted financial burden on students in the form of fees. This type of audits can be replicated at other higher education institute to reduce electricity bills.

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