Tropical Technology Journal
Volume 15, No. 1-2, January - June 2012
ISSN: 1656-0264

ENERGY AUDIT AT CEBU INSTITUTE OF TECHNOLOGY, CEBU CITY TOWARDS AN ENERGY SAVING PROGRAM

Cornelio G. Duaso
CTU-Main Campus

ABSTRACT

This study sought to identify and analyze energy saving opportunities, analyze existing policies or programs, analyze existing practices through energy audit at the Cebu Institute of Technology, Cebu City as basis for saving energy of the institution. It utilized the descriptive method of research with a researcher-made questionnaire as the main instrument for data collection. Interviews and actual physical survey of all physical facilities of the school are also conducted.

The monthly energy consumption of the total connected load at Cebu Institute Technology per building as reflected in electric bills were higher than the calculated data based on survey and perceptions of administrative personnel and working students.

The causes of high electrical consumption per building of Cebu Institute of Technology were found out that the major consuming facility were continuously “switched- on” and poor monitoring on the electrical and mechanical devices that consumed electricity.

INTRODUCTION

Power consumption poses a great problem mainly in the form of electricity for refrigeration and air conditioning system, lighting system, and other electrical consuming devices. The identification and evaluation of these potential areas for improving a building’s energy utilization efficiency are carried out through the conduct of energy audit.

An energy audit is an in-depth examination of an energy consuming system or facility. It is conducted for the following reasons: to examine historical energy used and cost data; to verify current energy data, analyze existing practices and procedures; to establish or improve energy record keeping procedure; to identify areas where energy waste can occur; and to develop possible measures to reduce energy consumption.

The monthly electric bill of Cebu Institute of Technology (CIT) increases every year.Thus it needs to be audited through the following objectives: 1) to set energy conservation goal, 2) to develop energy standards, 3) to identify and analyze energy saving opportunities, and 4) to establish an accounting and reporting system.

Basically, the purpose of the study was to conduct an energy audit at the Cebu Institute of Technology to propose an energy saving program in the institution. This energy audit for Cebu Institute of Technology was specifically aimed to: determine the status of power consumption of Cebu Institute of Technology buildings; ccompare the monthly power consumption as reflected in the electric bills; evaluate the perception of the employees and students as to the existing practices; and improve the present energy saving based on the findings of the study.

The Cebu Institute of Technology has existed for more than fifty years now, however no study so far has been conducted to explore the areas of energy conservation as well as recommend efficient energy management measures.

MATERIALS AND METHODS

The materials , tools and equipment used were the thermometer, clampmeter, calculator and others to

 ISSN: 1656-0264

measure the needed data to counter check the wattage rating.

This study used the descriptive method of research and analysis of practices and using the instruments in assuring the present scenario to elicit the needed data.

A researher-made questionnaire was the main tool used in the data gathering, therefore, a dry run was necessary with some teachers and engineering students.The results of the dry run pointed out the need to modify some part of the questionnaire more inclusive and understandable.

Basically, the two sets of questionnaire are designed to obtain relevant information about their existing practices and the status of power consumption of Cebu Institute of Technology.

In this study, an actual audit per building was conducted to get the adequate data needed and to determine the total connected load. The researcher conducted an unstructured interview to the respondents, employ detailed inspection and observations for data gathering. Even though interview did not provide sufficient information, it was of great help in generating substantial data when combined with other procedures.

In data collection, observation was used as another method. Observation took place during accounting of energy consuming devices and outlets to determine the total installed capacity. This method is used to evaluate the existince of energy loss and other practices which run counter to energy saving.

Inspection was another means of data gathering. This was conducted as sort of evaluation in validating audit evidences of any recent changes in the system,renovation made of the structures, operating and occupancy status. Since there were no available electrical drawings, a through inspection on the actual connected loads per building was the option of the investigator and drafted the same for future reference. A walk-through survey was conducted that formed part of inspection.

This study used the descriptive method of research and experimental analysis of practices and using the instruments in assuring the present scenario to elicit the needed data.

RESULTS AND DISCUSSION

The monthly energy consumption of the total connected load at Cebu Institute of Technology per building as reflected in electric bills were higher than the calculated data based on survey and perceptions of administrative personnel and working students.

Monthly Consumption of CIT Based on Rated Capacity and Electric Bills

Area	Items	Monthly Energy Consumption, KW-hr	
		Rated Capacity	Electric Bills
College Building	Refrigerator/Freezer	386.955	
	Room air conditioner	7025.485	
	Electric Fan	1913.785	
	Drinking fountain, Dispenser & Blender	1494.665	
	Lighting system	5938.13	
	Other electrical devices	15306.84	
	Sub-total	**32,065.86**	
High School Building	Refrigerator/Freezer	155.125	
	Room air conditioner	974.87	
	Electric Fan	115.755	
	Drinking fountain, Dispenser & Blender	1199.99	
	Lighting system	1270.73	
	Other electrical devices	2500.68	

 ISSN: 1656-0264

	Sub-total	**6,217.15**	
	Refrigerator/Freezer	44.11	
	Room air conditioner	848.202	
	Electric Fan	814.32	
	Drinking fountain,	49.8375	
Elementary	Dispenser & Blender		
Building	Lighting system	1386.72	
	Other electrical devices	847.485	
	Sub-total	**3,940.837**	
	Grand Total	**42,223.847kw-hr**	**48,664.00 kw-hr**

The existing practices of air conditioners per building were used more or less ten hours a day.

Operating Hours use of Room Air Conditioners Per Day Per Building

Area	Type	Existing Quantity	Rating, watts	KW-hr per month
	Refrigerator	**16**	**93w**	14.88
	Window type	11	1746w	192.06
	Package type	1	1680w	16.80
College Building	Split Type	1	3516w	35.16
	Electric Fan	120	75w	90.00
	Drinking Fountain	8	75w	6.000
	Water Dispenser	8	600w	48.00
	Juice Dispenser	2	620w	12.400
	Blender	1	100w	1.000
				263.30
	Refrigerator	5	93w	4.650
	Freezer	1	187w	1.870
	Window type	4	1119w	44.76
High Building	Electric Fan	6	93w	5.580
	Juice Dispenser	6	400w	24.00
	Water dispenser	5	600w	3.000
	Blender	1	200w	2.000
				85.86
	Refrigerator	2	93w	1.860
	Window type	4	1119w	44.760
:lementary	Electric Fan	40	90w	36.000
uilding	Drinking Fountain	1	75w	0.750
	Blender	1	300w	3.000
				86.37
	Grand Total			**435.53**

The existing practices of lighting systems per building were used more or less ten hours a day.

Operating Hours use of Lighting System Per Day Per Building

Area	Type	Existing Quantity	Rating, watts	KW-hr per month
	Fluorescent Lamp	852	20	204.480
College	Fluorescent Lamp	379	40	181.92
Building	Mercury Lamp	1	150	1.800
	Emergency Lamp	5	10	0.060

 ISSN: 1656-0264

	Spot Light	3	100	3.600
				391.86
High	Fluorescent Lamp	61	20	14.640
Building	Fluorescent Lamp	120	40	57.600
				72.24
Elementary	Fluorescent Lamp	27	20	6.480
Building	Fluorescent Lamp	122	40	58.56
				65.04
	Grand Total			**529.14**

The existing practices of other electrical devices per building were used more or less ten hours a day.

Operating Hours use of Other Electrical Devices Per Day Per Building

Area	Type	Existing Quantity	Rating, watts	KW-hr per month
	Computer Machine	218	225w	10,791.00
	Computer Printer	27	175w	1,039.5
	Electric pot	7	600w	924.00
	Buzzer	3	30w	19.800
	TV set	5	130w	143.00
	Projector	1	614w	135.08
	Xerox Machine	2	200w	88.00
	Fax Machine	1	200w	44.00
	Validating Machine	4	60w	52.80
	Karaoke/cassette	14	175w	539.00
	Adding Machine	10	60w	132.00
	Electric stove	2	1150w	506.00
	Compressor	1	1500w	330.00
	UTM	1	1500w	330.00
	Water Pump	1	1119w	246.18
	Lathe Machine	2	2238w	984.72
	Shaper	1	2797w	615.34
	Power hacksaw	1	1119w	246.18
College Building	Computer Machine	218	225w	10,791.00
	Computer Printer	27	175w	1,039.5
	Electric pot	7	600w	924.00
	Buzzer	3	30w	19.800
	TV set	5	130w	143.00
	Projector	1	614w	135.08
	Xerox Machine	2	200w	88.00
	Fax Machine	1	200w	44.00
	Validating Machine	4	60w	52.80
	Karaoke/cassette	14	175w	539.00
	Adding Machine	10	60w	132.00
	Electric stove	2	1150w	506.00

 ISSN: 1656-0264

	Compressor	1	1500w	330.00
	UTM	1	1500w	330.00
	Water Pump	1	1119w	246.18
	Lathe Machine	2	2238w	984.72
	Shaper	1	2797w	615.34
	Power hacksaw	1	1119w	246.18
	Post drill	1	2490w	547.80
	Electric furnace	1	4000w	880.00
	Electric motor	1	373w	82.06
	Welding machine	1	3730w	820.60
	Electric grinder	1	373w	82.06
				16,311.08

Area	Type	Existing Quantity	Rating, watts	KW-hr per month
High School Building	Computer Machine	39	225w	1,930.50
	Computer Printer	3	175w	115.50
	Karaoke	1	250w	55.00
	Buzzer	3	30w	19.80
	Rice Cooker	2	1000w	440.00
	Cassette	1	175	38.50
				2,599.30
Elementary Building	Computer Machine	6	225w	297.00
	Computer Printer	5	175w	192.500
	Xerox Machine	2	620w	272.800
	Buzzer	1	20w	4.400
	Electric Stove	3	149w	98.34
	Cassette	2	62w	27.28
	Electric Pot	1	600w	132.00
	Water Pump	1	1492w	328.24
	TV set	1	90w	19.80
				1,372.36

The causes of high electrical consumption per building of Cebu Institute of Technology were found out that the major consuming facility were continuously “switched- on” and poor monitoring on the electrical and mechanical devices that consumed electricity.

 ISSN: 1656-0264

Area	Causes	Strategies	Solution
Refrigeration and Air Conditioning	Lack of Maintenance Personnel	Additional maintenance personnel to monitor the building who will check the energy consuming facility	Filter, lamps, and motors are checked at least once a month
	Excessive use of electricity	Conduct seminar-workshop to CIT employees for energy saving program	Energy consuming devices are used properly
	Frequent opening of doors of refrigerator/freezer and air-condition room	Put instructions near the door to remind them the proper use of refrigerator / freezer and air condition room	Doors of refrigerator /freezer and air condition room are kept closed at all times
	Check the filters every semester	Washing / cleaning the unit	Filters are checked at least once a month
	Setting of high cool in the thermostat of air conditioner will result of high power consumption	Put instructions near the door to remind them the proper use of air conditioner	Thermostat of room air conditioner is normally set low cool.
	Setting of high cool in the thermostat of refrigerator/freezer will result of high power consumption	Put instructions near the door to remind them the proper use of air conditioner	Doors of refrigerator /freezer and air condition room are kept closed at all times
	Excessive use of electricity	Install kw-hr meter per building	All buildings should be installed kw-hr meter
Lighting System	Lack of Maintenance Personnel	Additional maintenance personnel to monitor the building who will check the energy consuming facility	All lights should be off in any room not being used
	Excessive use of electricity	Conduct seminar-workshop to CIT employees for energy saving program	Reduce or eliminate lights of large outdoor areas for decorative or advertising purposes, except those for safety and security purposes
	Excessive use of electricity	Install switches in areas commonly used for short	Use less wattage rating and more efficient light

 ISSN: 1656-0264

		periods of time.	sources.
	Excessive use of electricity	Install kw-hr meter per building	All buildings should be installed kw-hr meter
	Lack of Maintenance Personnel	Additional maintenance personnel to monitor the building who will check the energy consuming facility	All other electrical devices should be off when no one is using
Other Electrical Devices	Excessive use of electricity	Conduct seminar-workshop to CIT employees for energy saving program	A schedule of once a year seminar-workshop on energy saving program be posted
	Frequent breakdown and replacement of mechanical and electrical equipment	Extend the lifeof the mechanical and electrical equipment	All mechanical and electrical equipment be maintained regularly.
	Excessive use of electricity	Install kw-hr meter per building	All buildings should be installed kw-hr meter

CONCLUSIONS

Based on the findings of the study conducted, the energy consumption of refrigeration and air conditioning, lighting and other electrical devices at Cebu Institute of Technology needs effective monitoring and maintenance of energy consuming facilities, and reduce energy consumption by proper scheduling of the major loads as to when to “switched-on”. The institution needs corrective measures in the use of energy consuming facility in as much as higher consumption.

RECOMMENDATIONS

In the light of the findings and conclusions, the following are hereby recommended:

Assign energy manager to monitor and supervise the mechanical and electrical units that consumed electricity.

In lighting system, turn off lights in any room not being used; use natural light whenever possible; clean lamps or bulbs regularly to get more illumination; and use compact florescent lights instead of incandescent bulbs.

Air conditioners in the offices were switched off during noon time.

Other electrical devices must be turned on only when it is needed.

The administration should implement the program for effective energy conservation.

Installed individual kw-hr meter per building to check the power consumption regularly.

 ISSN: 1656-0264

Further, it was also the objective of this study to entails actions that influence the quantity or patterns of use of energy consumed by end users, such as actions targeting reduction of peak demand during periods when energy-supply systems are constrained.

REFERENCES

Kaplan, Seymour Energy Economics. New York: Mac Graw-Hill 1993

Kaplan, Seymour Energy Consumption. New York: Mac Graw-Hill 1993

Energy Conservation Journal Volume III & IV

Energy Management Training Manual 1992

Philippine Electrical Code 1992

Philippine Society of Mechanical Engineer Code 2003

Tickton, Sidney G. The Energy Conservation Handbook. Washington D.C. Academy for Educational Development, 2004

http//www.doe.gov.ph

http//www.energystar.gov

ACKNOWLEDGMENT

It is with great pleasure that the researcher would like to express his gratitude above all to God Almighty for giving the researcher the wisdom and moral courage to withstand all trials, and to the following people who have in one way or another helped in the accomplishment of this research work.

To Department of Science and Technology and to the Assistant Regional Director Engr. Ed Paradela for the chance given to become energy auditor.

To Dr. Cecilio S. Baga for providing his invaluable suggestions on the matter that gives light and direction to the fulfillment of this research.

And to everybody who, in one way or another, contributed great things, and who were instrumental in the completion of this study.