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CAPSTONE PROJECT

POTENTIAL INNOVATION OF ENERGY EFFICIENCY BUILDING IN GOVERNMENT COMMUNITY COLLEGE

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1.0 INTRODUCTION

Green building refers to a structure and using process that is environmentally responsible and resource-efficient throughout a building's life-cycle: from siting to design, construction, operation, maintenance, renovation, and demolition. This requires close cooperation of the design team, the architects, the engineers, and the client at all project stages(Yan Ji,2006).

The Green Building practice expands and complements the classical building design concerns of economy, utility, durability, and comfort (US EPA, 2009).

According to KETTHA, Green Technology refers to products, equipment or systems which satisfy the following criteria:

- It minimises the degradation of the environment;
- It has zero or low green house gas (GHG) emission;
- It is safe for use and promotes healthy and improved environment for all forms of life;
- It conserves the use of energy and natural resources; and
- It promotes the use of renewable resources.

PROBLEMS STATEMENT

Kolej Komuniti Bayan Baru (KKBB) started to operate from their newly renovated building in late 2011.

- The management of KKBB building in Penang lamented that they need to pay higher electricity bill when compared to other community colleges of the same floor area.
- Foresee higher bills in the future

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AIM OF THE STUDY

The aim of this study is to propose innovative solutions (new product/ equipment/ system) to KKBB building to be energy efficient building.

OBJECTIVES

To achieve the aim, there were several objectives that have been decided in this study which are:

a. To identify the energy consumption of KKBB.

b. To investigate requirement of energy efficient building in Malaysia

c. To examine the expected cost saving of KKBB after using the propose innovative solution(s)

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RESEARCH METHODOLOGY

Start

Literature Review

Aim, Objectives, Scope Identification

Questionaire Development

Interview

Data Analysis

Data Interpretation

Solutions And Recommendations

Finish

2.0 LITERATURE REVIEW

Green building generally refers to a structure and using process that is environmentally responsible and resource-efficient throughout a building's life-cycle: from siting to design, construction, operation, maintenance, renovation, and demolition. Green buildings is a buildings that are designed, constructed and operated to boost environmental, economic, health and productivity performance over conventional building (U.S. Green Building Council, 2003).

2.0 LITERATURE REVIEW

According to Cassidy (2003), green building are the practice of increasing the efficiency with which buildings and their sites use energy, water and materials. Also, reducing impacts on human health and the environment through better siting, design, construction, operation, maintenance and removal. There are the complete building life cycle.

2.0 LITERATURE REVIEW

The need for building green arose out of the need and desire for more energy efficient and environmentally friendly building practices. However in Malaysia, the demand for such buildings is not as widespread due to many reasons (Suvarna Ooi, 2010).

2.0 LITERATURE REVIEW

According to Miles Keeping and David Shiers (1996), some potential benefits of a “green” approach to building are, :

- lower energy costs, through the use of simpler, low-tech heating and power installations;
- lower maintenance costs due to simple building services which are easily accessible and low-tech equipment being cheaper to repair or replace; and
- “healthier” buildings have been demonstrated to reduce absenteeism.

GREEN BUILDING INDEX (GBI)

Green Building Index (GBI) is Malaysia's green rating tool for buildings and towns, created to promote sustainability in the built-environment and raise awareness of environmental issues. According GBI rating system, buildings will be awarded based on 6 criteria which are:

1. Energy Efficiency (EE).
2. Indoor Environmental Quality (EQ).
3. Sustainable Site Planning and Management (SM).
4. Materials and Resources (MR)
5. Water Efficiency (WE).
6. Innovation (IN).

ECONOMIC ANALYSIS OF INNOVATION INVESTMENT - PAYBACK METHOD

Various investment proposals can be ranked in one of several ways. Use of the simple payback involves computation of the number of years required to recover the initial investment.

3.0 METHODOLOGY

Generally, it consists of four phases which are planning phase, data collection phase, analysis phase and reporting phase. A case study is conducted on KKBB building where energy consumption will be tracked and observed from previous billing. On the other hand energy cost saving analysis will be determined by using as built drawing, inventory list, interview and calculation.

DATA COLLECTION

PRIMARY DATA

Primary data will be obtained by questionnaires and interview.

SECONDARY DATA

Secondary data is expected to be collected from electricity bills at KKBB. Detail data for every month will be used as comparison.

DATA ANALYSIS

Data collected from questionnaires, interviews and references will be organized, analyzed and summarized so that suggestion of innovative solutions can be proposed to KKBB.

RESULT AND ANALYSIS

The data were analyzed and the result must meet to objectives.

ENERGY CONSUMPTION OF BUILDING

It was found that the power consumption of the building was 68530kW for the whole month. At a TNB rate of RM0.43 per kW-hour, the bill for the building was RM29,468 for that month.

Based on the Gross Floor Area of the building at 3,628sq-meter, it works out that the peak design rate for this building is 40watt/m2, which is much larger than SIRIM's MS 1525 (Code Of Practice On Energy Efficiency And Use Of Renewable Energy For Non residential Building), which stated that the peak design rate should be no more than 10Watt/M2.

water cooled package system.

Two cooling towers are located at the back of the building supplying cold water to Air Handling Units (AHU) at every floor.

The total cooling load for the AHU at the building was found out to be 1,200,000btu/h that requires 351kW/hour to run the air-conditIoning water cooled package system.

For 21 days of operation for 8 hours per day, it will work out that the building air- conditioning power consumption was 58,968kW which is equivalent to RM25,356.24 (note: total bill RM29,468).

Variable Refrigerant Flow (VRF)

A system -an energy-efficient method of providing precise cooling comfort control to indoor environments. VRF offers a wide variety of applications - everything from spot-cooling a single room in a home (using a split-ductless system) to a large commercial building with multiple floors and areas (that require individual comfort control delivered by a split-zoning system).

At a rate of RM350 per square metre, the cost to install VRF systems work out to be RM1,080,000. The amount expected to be saved per month is RM12,678. The payback period to recoup back the investment of installing VRF system will be 7 years and 2 months.

LIGHTING

Item	Lamp Type	Ballast	Color Temp (^oK)	Total Power (W)	Life Time (Hours)
1	Std. T8 36W	Magnetic	6500	80	20,000
			Cool White		
2	LED T8 - 18W	Driver	6500	18	35,000
			Cool White		

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Item	Type	Lighting	Dimension
		Component	1200 mm
1	T8 Magnetic	Bulb (tube)	RM9.50
	(36W)	Magnetic Ballast	RM12.50
			RM22.00
2	LED	Bulb (tube) c/w	RM95.00
	(18W)	driver	
			RM95.00

Overall energy saving by using LED lamps is 62W x 549 = 34,038W
Overall power reduction per month will then will be (34kW x 21days x 8 hours)/2 =2,856kW

Total electricity save = 2,856kW x RM0.43 = RM 1,228 per month

To replace the current lamp with 549 units of LED lamps = 549 x RM95= RM52,155.

So, the payback period will be 42.5 months or 3 years and 6 months to recoup the investment of changing to LED lamps.

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DISCUSSION

	Initial Cost	Electricity Bill Saved per month	Payback period
Changing to VRF air-con	RM1,080,000	RM12,678	7 years and 2 months
Changing to LED lamp	RM52,155	RM1,228	3 years and 6 months
Implement both	RM1,132,155	RM13,906	10 years and 8 months

- The VRF system has longer payback period but will lessen the burden of paying electricity bills tremendously.
- The LED lamp has lower initial cost and should be prioritised if the college has short of fund.

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THANK YOU