

The Study of the Facility Management Concept for Low-Carbon Building, College of Allied Health Sciences, Education Center of Samut Songkhram Suan Sunandha, Rajabhat University

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ABSTRACT

At present, the world is concerned about the importance of environmental conservation, and varieties of campaigns for reducing global warming have been launched. The Sustainable Development Goals (SDGs) set by the United Nations have been adopted by many countries around the world with the aim to reach sustainable development. Sustaining cities is one of the 17 standard goals. The highlight of such a goal is to transform cities into low-carbon ones. For two or three years now, Thailand has been under a 20-year strategic plan, and under this plan one of the topics is to mitigate climate change and global warming—carbon reduction in cities would result in the mitigation of climate change.

The College of Allied Health Sciences is located in the Samut Songkhram Education Center near Bangkok, Thailand. It is a 10-year-old educational institution. Under the campaign of energy reduction by the Thai government, the educational building is a type of building that meets energy-saving standards. This study applies the criteria of a low-carbon building, which is a guideline by the Thai Greenhouse Gas Management Organization (Public Organization) (TGO). The objective of the study is to clarify greenhouse gas emissions from various activities in the building. The study uses the concept of facility management (FM), which consists of the 3 Ps: process, people, and place. In addition, the guideline of TGO's greenhouse gas emissions is used as a framework to determine the scope of the operations in the organization and to analyze the emissions' source in the building mentioned above. The results of the study indicate the activities in the building that emit greenhouse gas.

Keywords: educational institution, low-carbon building, facility management

INTRODUCTION

Environmental concerns have grown worldwide. Resolving or alleviating climate change is one of the UN's Sustainable Development Goals (SDGs). Gas emissions from buildings worldwide are the main thing that has caused climate change. Based on IPCC statistics, buildings consume approximately 32% of the total global energy used in 2010 and released about 19% of energy-related GHG emissions. It can be said that one third of GHG emissions is the construction sector [1]. In Thailand, greenhouse gas emissions from this construction sector are from the production process of the materials. Hence, the mitigation and reduction of greenhouse gas emissions in construction would lead to building a sustainable economy.

The Sustainable Development Goals have been adopted by many countries around the world with the aim to reach sustainable development. The goal of sustaining cities is one of the 17 standard goals [2]. The highlight of such a goal is to make the city low-carbon. For two or three years now, Thailand has been under its 20-year strategic plan, and under the plan, one of the topics is to mitigate climate change and global warming. The carbon reduction in cities results in mitigates climate change. Presently, Thailand has severed impact of climate change in term of droughts, and floods that increasing frequent and intensified losses to countries [3]. Therefore, mitigates climate change increase Thailand's economic strength.



Fig.1 The Sustainable Development Goals, 2015

Source :<https://www.un.or.th/globalgoals/th/the-goals/>

The College of Allied Health Sciences is located in the Samut Songkhram Education Center near a Bangkok vicinity. It is a 10-year-old educational institution. Under the campaign of energy reduction by the Thai government, the educational building is a type of building that meets energy savings standards. The college as established with the aim to provide teaching in the fields of the health and medical sciences, as the university is known for good experience and success in teaching and learning Thai traditional medicine, health sciences (program in Nursing Care for Young Children and the Elderly), and Health and Beauty Sciences. The college consists of 1,037 individuals separated into 943 students, 62 lecturers, and 32 officers [4]. The college's building consists of five floors that consist of four departments as follows.

1. Program in Applied Thai Traditional Medicine
2. Department of Public Health
3. Health Sciences for the Elderly; the Health Care Field, Child Health Care, and Health Care and Beauty
4. Department of Medical and Public Health Secretary



Fig.2 College of Allied Health Sciences, Education Center of Samut Songkhram,

Suan Sunandha Rajabhat University

The objective of the study is to clarify the greenhouse gas emissions from various activities in the building, using the criteria of a low-carbon building, which is a guideline from the Thai Greenhouse Gas Management Organization (Public Organization) (TGO) [5]. In addition, the concept of facility management

(FM), consisting of 3 Ps, namely process, people, and place, is used [6,7]. In addition, the guideline of TGO's greenhouse gas emissions is used as a framework to determine the scope of the operations in the organization and to analyze the emissions' sources of the building of the Allied Health College, Samut Songkhram Education Center, Suan Sunandha Rajabhat University.

Greenhouse gas emissions from various activities, i.e. human consumption, agriculture, industry, transportation, including the destruction of natural resources, are major causes of global warming. At present the problem has become serious, and therefore reducing greenhouse gas emissions from these various activities is of great concern worldwide. The Thai Greenhouse Gas Management Organization (Public Organization) has set up the Carbon Footprint for Organization (CFO), in which there are five steps; (1) to determine the scope of the organization's carbon footprint; (2) to calculate the carbon footprint; (3) to send a report to a group of inspectors registered with the TGO; (4) to sign a certificate of results and send it the TGO by group; and (5) to consider and approve the CFP registration by the Working Group on the Development and Promotion of Carbon Label by the TGO. In the process of calculating the carbon footprint, it can be separated into three topics: Direct GHG Emissions, Energy Indirect GHG Emissions, and Other Indirect GHG Emissions.

The concept of facility management (3 Ps) consists of process, people, and place. Process represents all the business procedures of the organization that create all of the activities within it. This step is the most vital part of the concept because it contributes to creating activities that require energy usage. People mean all the kinds of users in the building. The main part that supports doing such activities by the users is the place that needed management [8].

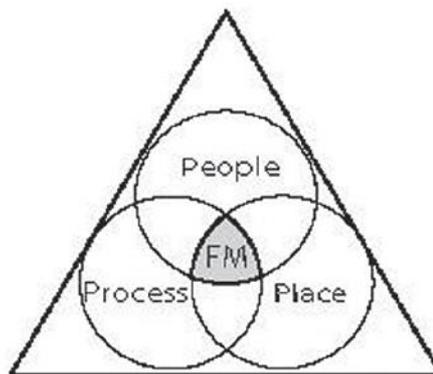


Fig.3 FM's Concept by International Facility Management Association (IFMA)

Source: Patanapiradej, 2006

Buildings, which are workplaces, are where people run their businesses and various kinds of processes that are related to work. Consequently, buildings create jobs, strengthen communities, and improve health and well-being. There are many activities in the buildings that consume various kinds of resources, for example energy and water supply. Therefore, in order to achieve the SDGs, the building users have to save all forms of energy, which can help a lot in reducing carbon emissions. The low-carbon or green building does reduce carbon emissions, and thus influences climate changes [9].

How **green offices** can provide the foundations towards meeting several **Sustainable Development Goals**

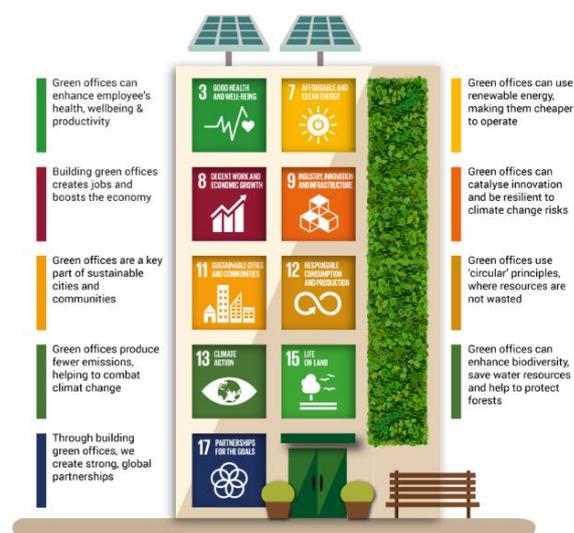


Fig.4 Green buildings and the SDGs

Source: World Green Building Council, 2021

MATERIALS AND METHODS

This study has used the concept of facility management, which consists of 3 Ps, namely process, people, and place. In addition, the guideline of TGO's greenhouse gas emission is used as a framework to determine the scope of operations in the organization and to analyze the emissions' source of the building of the Allied Health College, as mentioned above. Based on TGO's emissions guideline, greenhouse gas emissions are calculated from three main sources; (i) direct emissions from activities of the organization; (ii) the carbon footprint from energy indirect energy emissions; and (iii) the indirect carbon footprint. The data for calculation are the activity data and the emissions factor.

Table 1 Calculating the greenhouse gas emissions in educational institutions

Type of Activity	Activities	Calculation
Type 1	Internal and external travel in educational institution with a institution's vehicles	1) Amount of fuel used × Greenhouse gas emission value according to fuel type 2) Distance × Load weight × Emission value by type of vehicle used 3) (distance / fuel consumption) × emission value of greenhouse gas, by type of fuel
	Chemical reactions and combustion greenhouse gas in teaching and learning activities	1) The amount of greenhouse gas produced by chemical reactions 2) The amount of fuel used × the emissions value according to fuel type
	Using the refrigerant of air conditioners within the organization	Refrigerant amount × greenhouse gas emissions value according to the type of refrigerant
	Use of fire extinguishers	Extinguishing media content × greenhouse gas emissions value according to the type of chemical used for fire extinguishing
	Use of chemical fertilizers	Amount of chemical fertilizers × greenhouse gas emissions
	Wastewater treatment in the organization	1) Calculation based on UNFCCC (2006) 2) Calculation based on IPCC (2006)
Type 2	Electricity	The amount of electricity used × the emissions value

Type of Activity	Activities	Calculation
Type 3	Round trip between organizations and accommodation of personnel	1) Amount of fuel used × greenhouse gas emissions value according to fuel type 2) Distance × loading weight × emissions value according to type of vehicle 3) (distance / fuel consumption) × emissions value by type of fuel
	Travel between faculties within the institution by private vehicle	1) Amount of fuel used × Greenhouse gas emission value according to fuel type 2) Distance × loading weight × emission value according to the type of vehicle 3) (distance / fuel consumption) × emission value greenhouse gas by type of fuel
	Traveling	1) Amount of fuel used × greenhouse gas emissions value according to fuel type 2) Distance × loading weight × emissions value according to type of vehicle 3) (distance / fuel consumption) × emissions value by type of fuel 4) Distance traveled × emissions value of traveling by plane
	Use of chemicals for cleaning by subcontracting companies	Amount of chemicals used × emissions value by type of chemical
	Water use	Amount of water used × greenhouse gas emissions value of tap water
	Use of office materials and supplies such as paper	Amount of paper used × greenhouse gas emissions value of paper
	Power consumption and cooking gas of shops and restaurants rented in the organization	Amount of LPG used × greenhouse gas emissions value of combustion
	Waste disposal	Waste amount classified by composition × greenhouse gas emissions value according to the composition of the waste

RESULTS AND DISCUSSION

The College of Allied Health Sciences' carbon footprint is the amount of greenhouse gas emitted from various kinds of activities, such as fuel combustion, electricity consumption, and waste management and transportation, measured in tons of carbon dioxide equivalents. The main purpose to use the facility in the College of Allied Health Sciences is to educate students. The building activities consume a huge amount energy that release high amounts of carbon emissions. Based on the TGO's emission guideline, the greenhouse gas emissions are calculated from three main sources; (i) direct emissions from activities of the organization; (ii) the carbon footprint from indirect energy emissions; and (iii) the indirect carbon footprint. The data for calculation were the activity data and the emissions factor.

Although a low-carbon building is a way to reduce carbon emissions, it is evident that sometimes such buildings have high energy usage and emit high amount of CO₂ due to the failure of the building system's operations. Therefore, good facility management is a vital means of solving such a problem [10]. Future research on the building's energy usage and calculation process is suggested.

CONCLUSION

Buildings use huge amounts of energy that release high amounts of carbon emissions. Therefore, in order to reduce carbon emissions in buildings, the energy use must be reduced.

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