Prioritizing Energy-efficiency and Renewable-energy Measures in a Low-carbon Campus using Analytic Hierarchy Process with Social Awareness Criterion

Dilok Kiatlertnapha* and Nat Vorayos

Department of Mechanical Engineering, Faculty of Engineering, Chiang Mai University, Chiang Mai 50200, Thailand

Corresponding author. E-mail: dilok137@gmail.com

https://doi.org/10.12982/CMUJASR.2017.0004

ABSTRACT

Sustainable development has become a core concept of governments and corporations worldwide. Universities have also tried to develop low-carbon initiatives. On overseas campuses, these initiatives are already at an advanced level, but not in Thailand. The aim of this study was to propose an analytic hierarchy process to rank the available energy efficiency and renewable energy measures for a sustainable low-carbon campus in Thailand, using data from Payap University, Chiang Mai. This study included a social awareness criterion, along with the more traditional criteria of energy consumption, greenhouse gas emissions, and financial feasibility. To assess the social awareness of the campus community, questionnaires were distributed. Energy efficiency and renewable energy measures were then ranked using an analytic hierarchy process. Criteria were weighted by campus executives and comparable normalized scores of each energy efficiency and renewable energy measure were presented. Energy efficiency measures consisted of switching to LED lighting and changing to variable refrigerant flow (VRF) air-conditioning units; renewable energy measures consisted of installing solar photovoltaic (PV) panels. When social awareness was included as a criterion, the analytic hierarchy process showed switching to LED lighting as the highest ranked measure, followed by switching to VRF and introducing solar PV panels.

Keywords: Low carbon campus, Social awareness, Analytic hierarchy process, Energy efficiency, Renewable energy