Available online at www.sciencedirect.com

ScienceDirect

Energy Procedia 61 (2014) 1544 – 1548

Energy Procedia

The 6th International Conference on Applied Energy – ICAE2014

Development of the Process for Deploying Optimal Photovoltaic System

Taehoon Hong[a], Minhyun Lee[a,*], Jimin Kim[a]

[a]*Department of Architectural Engineering, Yonsei University, 50 Yonseiro, Seodamun-gu, Seoul, 120-749, Republic of Korea*

Abstract

As global warming and environmental pollution become one of the widespread concerns, there is a growing interest in nearly zero energy building (NZEB) in the construction industry worldwide. In order to achieve NZEB, it is crucial to apply the new renewable energy (NRE) to the building. Among the common NREs, the solar energy is an unlimited energy source having the highest potential. However, the current process for deploying PV systems has some limitations: (i) lack of information and analysis of the target facility; (ii) lack of sensitivity analysis of key factors affecting system performances; and (iii) Lack of optimization process.

This study develops the process for deploying PV system which makes it possible for potential users and installers to maximize the performance of each system. The proposed process consists of the following 4 steps: (i) establishing the basic information for the system installation; (ii) selecting key factors affecting system performances; (iii) estimating system energy output of the possible system alternatives; and (iv) selecting the optimal system through the life cycle cost (LCC) and life cycle CO_2 ($LCCO_2$) analysis.

The results of this study could help potential users and installers to install a PV system in several ways: (i) maximize the financial benefit of the system; (ii) maximize the efficiency and utilization of the system; (iii) select the optimal PV system according to the target facility and the users' preference.

Peer-review under responsibility of the Organizing Committee of ICAE2014

Keywords: New Renewable Energy; Photovoltaic Systems; Process Development; Performance; Optimal System Selection

1. Introduction

There is a critical need for a new renewable energy (NRE) system to achieve nearly zero energy building (NZEB), which is considered great solution against global warming and environmental pollution [1]. Among the common NREs, the photovoltaic (PV) system that generates electricity from solar energy

* Corresponding author. Tel.: +82-2-2123-8322; fax: +82-2-365-4668.
E-mail address: mignon0110@naver.com.

Peer-review under responsibility of the Organizing Committee of ICAE2014
doi:10.1016/j.egypro.2014.12.166

has the highest potential with an unlimited energy source [2]. However, the current process for deploying PV systems has some limitations: (i) lack of information and analysis of the target facility; (ii) lack of sensitivity analysis of key factors affecting system performances; and (iii) Lack of optimization process.

Therefore, this study developed a new process for deploying optimal PV system, which can overcome the limitations listed above: (i) by understanding the target facility, it is possible to select the PV system suitable for the target facility; (ii) by conducting sensitivity analysis of key factors affecting system performances, it is possible to maximize the utilization of the system; and (iii) through the life cycle cost (LCC) and life cycle CO_2 ($LCCO_2$) analysis, it is possible to maximize the financial benefit of the system.

2. Development of the Process for Deploying Optimal Photovoltaic System

This study aims to develop a process for deploying optimal PV system. By applying the proposed process of PV system deployment, the user will be able to install optimal system with respect to economic and environmental aspect. The details of the proposed process are described below.

2.1. Step 1: Establishing the basic information for the system installation

Before installing a PV system, basic information for the system installation should be established. This basic information is categorized in Fig 1 and details are described below.

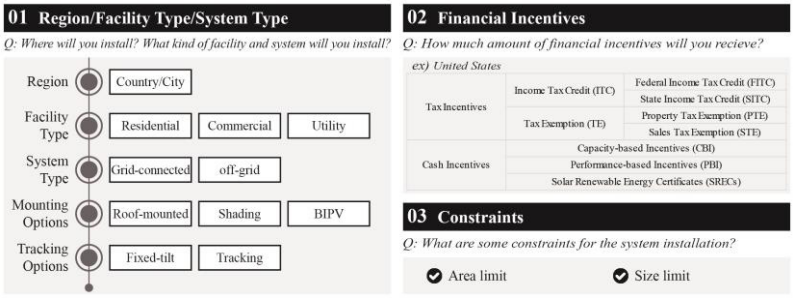

Fig. 1. basic information for the system installation

First, basic information regarding region, facility and system should be determined. Depending on this information, there can be a significant difference in performance and initial investment cost of the system.

Second, Different types and amount of financial incentives are given in different region, facility, and system. Since each country or city has different incentive policies and schemes, it is crucial to know and understand what kind of financial incentives are available in the region where a system will be installed.

Finally, some constraints should be considered when planning and designing a PV system. The two main constraints are the area and size limit: (i) the installation area limit should be enough for installing the desired system size; and (ii) to prevent oversizing of the PV system, the system size should not exceed the system size limit considering the electricity consumption of the target facility.

2.2. Step 2: Selecting the key factors affecting system performances

There are some key factors that affect the PV system performances. These factors should be considered in advance in order to estimate system energy output and economic benefits under variable conditions. These key factors are categorized in Fig 2 and details are described below.