ABSTRACT NO.: 548

TITLE: Energy & Buildings

AUTHOR: Leanna Bhimull (807000985)

SUPERVISORS: Dr. R. Andrews

Dr. K. De Souza

This paper examines photovoltaic power system applications, including remote standalone and dispersed grid-connected. The main focus of this paper is to introduce methodology on how to assess and design the different components of a residential solar photovoltaic system based on cost and size by the use of mathematical expressions. A life cycle cost assessment of a photovoltaic system was performed to relay formulas to acquire the cost per unit electricity produced by the entire system. A case study of the stand alone photovoltaic system at New Delhi in India was executed to demonstrate real use of each of the design and cost formulas. The results of this examination show that the size of a photovoltaic array depends on the daily electrical load and the number of sunshine hours. Factors affecting positioning of the array were studied and found that the array should be perpendicular to the rays of sun facing true south depending on the country since the tilt angle of the photovoltaic modules should be equal to local latitude. Array structures, mounting frames, control circuits, wiring and interconnections are all classified as balance of system costs and were taken into consideration. As a result of these components, expressions for the embodied energy of a photovoltaic panel system and energy pay back time were necessary. The environmental benefits and advantages of having a photovoltaic system were observed with carbon dioxide mitigation being the main form of gain. Formulas and examples of usage of the total mitigation of carbon dioxide emissions from a stand alone photovoltaic system for n years were outlined. The growth of photovoltaics in India, Germany, Japan and Bangladesh has been considerable and is studied in this paper.

Since the 1950s, the cost of photovoltaics has declined by a factor of nearly 100 making it one of the most promising options for sustainably providing the world's future energy requirements.