

LIFE CYCLE ENVIRONMENTAL IMPACT ASSESSMENT OF A SOLAR HEATER

C. KORONEOS, G. DROSOS, G. ROUMBAS and N. MOUSSIOPOULOS

Laboratory of Heat Transfer and Environmental Engineering, Energy Division,
Department of Mechanical Engineering, Aristotle University of Thessaloniki
Aristotle University of Thessaloniki
P.O. Box 483, 541 24 Thessaloniki, Greece
E-mail: koroneos@aix.meng.auth.gr

EXTENDED ABSTRACT

The technical and environmental performance of a solar water heater (SWH) is examined using the method of life cycle analysis (LCA). The present LCA study quantifies the environmental benefits of the installation of a SWH. Solar thermal heating produces no emissions during operation but some small levels of emissions are produced during the manufacture and installation of components and systems. The study examines the manufacturing stages of the SWH and records resource consumption and waste streams to the environment. The system boundary includes the production of raw materials such as steel, glass, copper, aluminium, glass fiber and polyurethane insulators, the manufacturing of the various parts of the SWH such as the solar collector and the heat storage tank, and finally the assembly process. The functional unit chosen is 1 MW of produced hot water. The environmental impacts considered in the study are the greenhouse effect, ozone depletion, acidification, eutrophication, heavy metals, carcinogens, winter and summer smog. The impacts are normalised and evaluated based on weighting factors. The acidification effect has the largest contribution to the total environmental score impact. LCA is a powerful tool in the evaluation of the environmental efficiency of processes. The produced results can be very useful in decision-making by providing a quantification basis for assessing potential improvements in environmental performance of an energy system throughout its life cycle.

Key words: solar heaters, life cycle analysis, solar water heater, life cycle environmental impact assessment