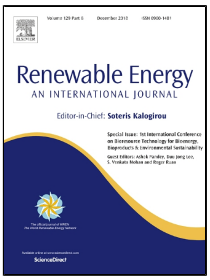
Accepted Manuscript



Analysis of Status, Potential and Economic Significance of Solar Water Heating System in Ethiopia

Alemnew Endale

PII:	S0960-1481(18)31044-9
DOI:	10.1016/j.renene.2018.08.094
Reference:	RENE 10521
To appear in:	*Renewable Energy*
Received Date:	02 September 2017
Accepted Date:	28 August 2018

Please cite this article as: Alemnew Endale, Analysis of Status, Potential and Economic Significance of Solar Water Heating System in Ethiopia, *Renewable Energy* (2018), doi: 10.1016/j.renene.2018.08.094

Analysis of Status, Potential and Economic Significance of Solar Water Heating System in Ethiopia

Alemnew Endale[a,1]

[a]School of Mechanical and Industrial Engineering, Dire Dawa Institute of Technology, Dire Dawa University, P.O.Box 1362, Ethiopia

Abstract

Dependence on imported oils, unmet electric energy demand and unsustainable consumption of forestry resources for water heating are the greatest problems in Ethiopia. In this study the economic potential saving of these energy sources in future through solar water heaters (SWHs) is presented. The System Advisor Model (SAM) and Long-range Energy Alternatives Planning System (LEAP) are used for analysis in the study. It is estimated that 5.474 million m^2 flat plate collector (FPC) areas can save 47,730 tonne kerosene, 45,001 tonne diesel, 1,480 GWh of electric energy and 1,698,116 tonne firewood in 2025. The amount that can be saved equals to 5% of the industry diesel demand, 50% of urban households' kerosene demand and 50% of urban households' and commercial sectors' electricity and firewood demand for hot water production. The energy saving through SWHs is analyzed considering the useful energy output at end use devices. The estimated 1,480 GWh of electric energy saving is equivalent to 2.211 million m^2 FPC gross areas. This energy equals to an installed power generation capacity of 691 MW wind, 429 MW hydropower or 1,045 MW grid connected PV including a corresponding minimum added investment capital of 533.96 million USD, 1,237.4 million USD and 1,908.4 million USD.

Keywords: Solar water heater, flat plate collector, Useful energy output, System advisor model

1. Introduction

More than half of the world final energy consumption is used for heating applications. Currently, three-quarters of the total energy use (129 Exajoules) for heat is met by fossil fuels which are contributing 33% of global carbon dioxide emission [1]. In Europe, solar thermal systems can cover 50% of the total heat demand by 2030 considering demand reduction through energy conservation measures [2]. This shows that there is huge potential to satisfy thermal load requirements using solar thermal technologies. SWHs are the most economical and environmental friendly systems as they can use the free energy of the sun [3].

In Ethiopia, modern energies covered 8.4% and biomass 91.6% of the total primary energy supply in 2015 [4]. High reliance on traditional energy resources has a strong impact on the

[1]Corresponding author. Tel.:+251 920 016 840
E-mail address: alemnew2001@gmail.com