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Results of IEA SHC Task 45 Subtask C "Systems - configurations, operating strategies, financing issues"

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Abstract

The main objective of Task 45 was to assist in the development of a strong and sustainable market for large solar heating and cooling systems by focusing on cost effectiveness, high performance and reliability of installed and new solar thermal systems. Subtask C of Task 45 focused on system configurations, system performance, tools and guidelines for operating strategies, and models for ESCo services. The findings were prepared for 6 deliverables, C.1-C.6. To assure up-to-date results, first, more than 300 installed large solar thermal plants were evaluated in a database, operating in over 40 countries. The subtask C provides practitioners, researchers and officials findings on system configurations in a database, new tools, guidelines and templates to overcome a wide range of technical, financial and operational challenges when implementing large scale solar district heating and cooling (DHC) systems.

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Keywords: Task45 Subtask C, Solar Thermal Installations, ESCo Services, System Configuration, Tools, Guidelines

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1. Introduction

Solar thermal district heating and cooling (DHC) systems are an often undervalued component of a sustainable future energy system. DHC systems with large storages can be one important asset for the stabilization of district heating grids, where increasing input from renewable energy sources can be found. Despite early market success, further effort is required to increase the efficiency and to lower costs for these systems to achieve competitiveness in a growing global market [1].

Therefore, Subtask C of the IEA SHC Task 45 focused on system configurations, operating strategies, and financing aspects. First, data on global solar thermal installations were gathered to provide an overview on the configurations of solar district heating and cooling applications above 0.5 MW. Systems with additional heat pumps and chillers were integrated as well. Data reveal large scale solar thermal systems in the context of surrounding regional and national energy systems, and assist decision makers to select one kind of technology and investment for large solar systems in their region.

Additionally, Subtask C evaluated state of the art simulation tools and models to elaborate on general design requirements for solar DHC networks, parameters to identify suitable existing DH networks, and procedures for performance guarantees. The guidelines led to recommendations for monitoring systems and criteria on how to adapt solar systems to existing and new DHC networks [5].

Still, a lot of SDH systems show uncertainties as to what extend calculated outputs are attainable. Sensitivity analyses support the study of how the uncertainty in the output is affected by the different sources of uncertainty in its inputs. Sensitivity analysis of DHC systems were conducted and different parameters were evaluated (DHC distribution temperature, solar fraction, storage size, loads, economics) to decrease uncertainty of DHC outputs. The findings led to new recommendations for installation and operating strategies of large solar thermal systems [8].

The reminder of the article is organized as follows. First, findings on large global solar thermal installations are introduced. Subsequently, main aspects within the newly developed guidelines and the reports on solar thermal installation parameters and stagnation prevention measures are presented. Finally, it is concluded that large solar thermal installations gained momentum within the last decade, and what their further technical development will facilitate its broad application in new and already existing DHC networks.

2. Global solar thermal Installations above 0.5 MW

A comprehensive database on the configuration of worldwide solar thermal heating and cooling systems with over 0.5 MW has been established. The database contains 309 installations on district and local heating (189), cooling (28), process heating (62), process cooling (2), water heating (15), and swimming pool heating (13) from 40 different countries (Fig.1). More than 180 of these systems were installed between 2006 and 2015[7].

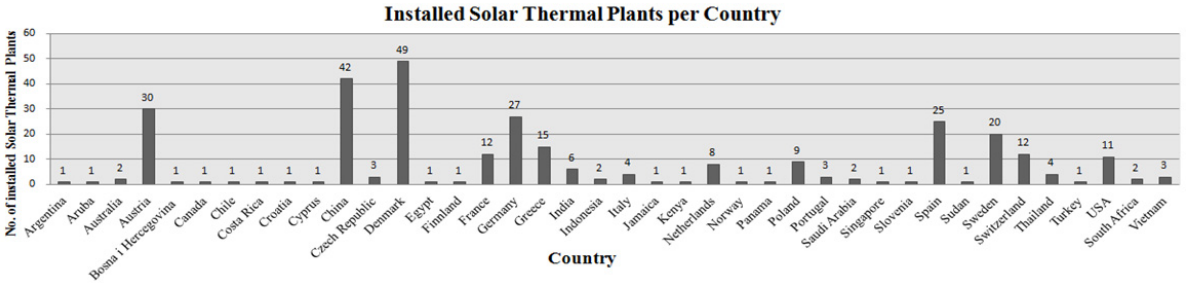

Fig.1. Total installed area of ST systems >0.5 MW per country