

Solar thermal statistics in Europe

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Introduction

The present document was produced within the framework of the Intelligent Energy-Europe project Key Issues for Renewable Heat in Europe (K4RES-H)¹. The project looks at providing guidelines for best practice policies to support renewable heating and cooling (RES-H) technologies.

In order to evaluate the success of such support policies, it is important to monitor the development of RES-H markets: Have the policies contributed to increasing the uptake of solar thermal, bioheat and geothermal technologies? This document describes the current state of solar thermal statistics, and proposes concrete steps to improve their accuracy and comparability.

¹ The K4RES-H homepage can be found at: http://www.erec-renewables.org/projects/proj_K4_RES-H_homepage.htm

Collection, evaluation and compilation of available statistics

Overview and description of available statistics and information sources

The solar thermal statistics in Europe stem from very different sources, use different definitions of solar thermal and are generally of varying quality in terms of (assumed) accuracy.

Even the data available at European level (e.g. Eurostat, Eur'Observer, ESTIF, IEA-SHC) show considerable variations, often due to different methodologies used.

Raw data

Until today, the raw data collected did not refer to the energy produced by solar thermal technologies, but typically to the solar thermal collector area.

Differences in the raw data most often stem from the use of different sources (i.e. from different persons/organisations collecting and aggregating the data) and their different methodologies.

The most typical reasons for differences are: In- or exclusion of unglazed collectors, and survey-based data collection vs. expert based data.

Different definitions used

Most obviously, solar thermal statistics depend very much on the definitions used: While some solar thermal statistics include all active solar thermal technologies (glazed and unglazed collectors) others only show data for glazed collectors. Unfortunately, some statistics do not immediately state what the data refers to. And although glazed collectors make up the largest part of the market in Europe, there is a considerable market for unglazed collectors, which are typically used to heat the water of swimming pools.

There is a particularity, which leads to the IEA's massive understatement of solar thermal energy in their publication *Energy Statistics of OECD Countries. 2002-2003*: In these statistics, the IEA only show solar thermal energy, which was used in the "Transformation Sector". This means that only part of the solar thermal energy was counted, that was fed into a (district) heating grid. This excludes 99,8% of the solar thermal energy production, which takes place locally – without feeding into a grid. As it is the only place where solar thermal energy is shown in that publication, it gives the impression, that this energy source is absolutely negligible. Other IEA publications, namely the annual *Renewables Information* show a more complete picture of the market.

Different collection of data

In several countries, the “official” data (i.e. those published by national statistics offices, energy agencies, ministries etc.) are based on surveys of solar thermal companies active in that country (manufacturers or importers). These surveys are carried out by solar thermal associations or governmental agencies. The accuracy of this data depends on the coverage of the market – e.g. have all relevant companies been identified? have all of them answered the survey? – and the truthfulness with which the survey was answered. For different reasons, companies may have a reason to under- or overstate their own sales figures, especially where the raw data could become public.

Other statistics are based on the estimations of one or several market experts. The accuracy of those statistics then depends on the good knowledge and honest estimation of the expert.

Different assumptions on the base of installed systems

A typical source for deviations between different statistics for the same country is due to a different concept of cumulative installed capacity vs. capacity in operation.

Cumulative installed capacity

Those statistics which are based on the first concept typically add all solar thermal capacity (either expressed in square metres of collector area or in kW_{th} of installed capacity) installed in the past. The market data for the latest year (newly installed capacities) is added to the total cumulative capacity. This, however, does not take into account that any heating system – including solar thermal systems – is replaced at some point in time. Thus the concept of cumulated capacities overstates the really existing capacities.

Capacity in operation

This is where the second concept, based on capacities in operation, provides a more realistic picture. It is based on an assumed life expectancy of the solar thermal systems or on (regular) surveys of heating systems in buildings. So far, only the assumed life expectancy has been used in solar thermal statistics: In our 2003 study Sun in Action II – A Solar Thermal Strategy for Europe, ESTIF introduced this concept by assuming a life expectancy of 20 years for solar thermal systems installed since 1990 and of 15 years for older systems. While typical solar thermal systems today could work for much longer than 20 years, it is safe to assume that even a share of the working systems are replaced or decommissioned at some point, e.g. because the building they were built into was torn down, because the use of the building changed, making the solar thermal system superfluous, or because the roof was refurbished without putting the existing solar thermal collectors back in place. Based on the ESTIF assumptions, systems installed before 1990 are not “in operation” anymore.

As in most European countries, as most of the installations took place after 1990, this assumption does not make a big difference in the final data today. However, in a few countries such as Greece or Cyprus, many solar thermal systems were already installed in the 1980s. In ESTIF's statistics these installations are not included anymore, while others still count them in. For example: For Cyprus, the data of IEA-SHC are based on the cumulative capacity, showing 514 MW_{th} of installed capacity. ESTIF on the other hand shows a capacity in operation of 315 MW_{th}.

Aggregation and conversion of raw data

The existing statistics show a different degree of detail. While some of them explicitly show installed capacities of flat plate collectors, vacuum tubes or unglazed collectors, others show only aggregated and/or converted data. E.g. Eurostat does not directly publish solar thermal energy production. Instead the publication *Energy: Yearly Statistics* gives the primary solar energy production. The solar thermal energy production must then be inferred by subtracting the given electricity production of photovoltaic modules.

Aggregations and conversions of data sometimes make it difficult to understand the cause of differences between different statistics.

Conversion from m² to kW_{th}

The conversion factor from square metres of collector area into kW_{th} of solar thermal capacity has been generally accepted to be 0,7 kW_{th}/m² (for details see the information at www.iea-shc.org or www.estif.org) This number gives the installed nominal capacity (similar to the peak capacity of photovoltaic modules). In many statistics, the nominal capacity more and more replaces the old collector area. Even the IEA has announced that kW_{th} as the unit for solar thermal statistics should be used from 2007 onward.

Conversion from m² to kWh

Several energy statistics report the energy production from solar or solar thermal. However, since a generally accepted conversion methodology does not exist yet, each statistic and country often uses a different methodology.

Differences stem from different definitions as well as from different assumptions. The definitions for solar thermal energy range from the solar thermal irradiation meeting the collector surface (primary energy used) to the (conventional) energy saved by solar thermal. Eurostat and IEA use the concept of collector output, i.e. the energy that is available after the conversion of the sunlight in the collector. But even that assumption can be interpreted differently: Some statistics use the output as calculated based on the collector performance in the European norm EN 12975. Others calculate the energy production of the collector as if it was built into an existing system (with parameters different from the test procedures).

A calculation of the Eurostat data shows that the annual energy production of one square metre of collector area was assumed to be 451 kWh/(m²*a) in Germany but only 357 kWh/(m²*a) in Austria, although both countries use very similar technologies



and applications. In Belgium this factor would be as high as $1600 \text{ kWh}/(\text{m}^2 \cdot \text{a})$, which is physically impossible.

Conclusions

The biggest differences between different statistics are due to two reasons:

- Different raw data (due to different collection or methodology/definitions)
- Different aggregation and conversion methodologies

The existing statistics approach solar thermal in different ways, sometimes with very different results. In many cases this is not a question of high or bad quality of the data, but rather a question of definitions and methodologies used. Differences between statistics for the same country thus do not mean that one is right and one is wrong. Rather they show different views of solar thermal energy production.

This poses a problem when comparing different statistics/countries: 100 GWh of solar thermal energy may have different meanings in statistic X and statistic Y.

It is desirable that (solar thermal) energy statistics are harmonised at least in their definitions and methodologies. This would help make different statistics comparable, which again would help in setting European solar thermal targets broken down by country.

Recommendations to improve the quality of solar thermal statistics in Europe

There are several ways in which solar thermal statistics should be improved:

Improvement of the data quality

- (1) Improvement of data collection
- (2) Non-inclusion of old systems, which can be assumed not to be in operation anymore

Furthermore, it would be highly desirable to come to a more harmonised approach when aggregating and converting the raw data. This is not so much a recommendation for improvement of the individual statistics but for making different statistics more comparable.

Improvement of comparability of statistics

- (3) Inclusion of all active solar thermal systems
- (4) Unified definition of solar thermal energy production
- (5) Unified conversion methodology (from m^2 or kW_{th} into kWh)

(1) Improvement of data collection

Whilst no national register of solar thermal systems exists (“what is where installed and in operation?”), data collection should be based on:

- Surveys of solar thermal manufacturers/importers, which are done in co-operation with the relevant national trade association and which keep the individual data confidential
- Data obtained from financial support schemes at national level, if they are generally believed to cover most of the solar thermal market (i.e. only few installations are done, which do not receive these financial incentives)
- Ideally, the two methods are used together in order to cross-check the data and to fill potential information gaps

(2) Non-inclusion of old systems, which can be assumed not to be in operation anymore

Statistics which do not foresee that old systems are decommissioned at some point in time will show less and less realistic figures.

ESTIF strongly recommends using a uniform assumption on the usage time of solar thermal systems: Due to various reasons, solar thermal systems are decommissioned after 20 years (15 years for systems that were installed before 1990). This means that systems installed before 1990 are not included in today's data of solar thermal systems in operation.

(3) Inclusion of all active solar thermal systems

For many reasons, ESTIF and others have only included in their statistics systems which are water-based and use glazed collectors. Although these systems make up the large majority of the market and systems in operation, it is desirable to include all active solar thermal systems. This would include systems which use unglazed collectors (typically for swimming pool heating) or air collectors.

(4) Unified definition of solar thermal energy production

Energy statistics are gaining importance at national and international level. In order to facilitate the comparability of different (country's) statistics, it is important that the growing use of solar thermal technologies is represented based on comparable definitions.

ESTIF recommends that for statistical purposes solar thermal energy should be defined as the energy output of the collector under conditions of a real (reference) system.

(5) Unified conversion methodology (from m^2 or kW_{th} into kWh)

The approach mentioned in (4) allows for a formula, which is both reasonable (science-based) and simple. Different countries/regions could use different factors to accommodate for different climatic conditions and reference systems. ESTIF is currently in the final phase of agreement with IEA-SHC and other experts on such a unified methodology.