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- REPORT -
Broadening the scope for Solar Keymark products

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The report has been presented to the workgroup AP6, established by decision M20.D10 of the Solar Keymark Network group meeting, consisting of: Gerard Van Amerongen (Chair), Ulrich Fritzsche, Pedro Dias, Jaime Fernandez, Oscar Mogro, Christian Stadler, and Korbinian Kramer.

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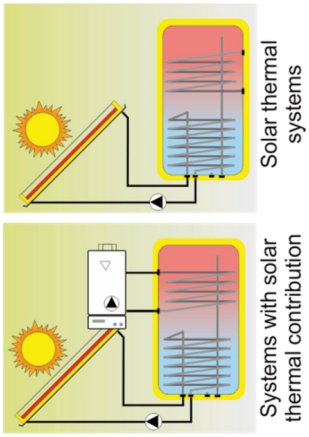
Executive summary

► Introduction



During the 8-9 March 2016 meeting of the Solar Keymark Network Group in Berlin an action plan was adopted, together with erection of several working groups. In the next meetings follow-up actions were defined. One of those actions was aimed at a feasibility study towards broadening the scope of the Solar Keymark products moving upwards to ***solar thermal systems*** and ***systems with solar contribution***. The rationale behind this choice is the current lack of success of the certification scheme for custom built systems, governmental support schemes tent to look more and more to system performance [1] and the observation that solar thermal is more than only a collector; the solar thermal expertise is also needed in solar thermal systems and in systems with solar contribution. This report describes the findings.

► Market values for system 'certification'

Appropriate market values for the end users of the system certificates are essential for success. Since the scheme is not yet in place, these values have not materialized yet.

The main market value is the determination of uniform technical system specifications, used in companies product catalogue, system comparison, procurement processes and input for installation planners. Additional values could become a link to regulations (ErP, EPBD) and governmental support schemes.

► Solar Keymark certification schemes

Analysing the current Solar Keymark schemes, it is concluded that out of the five current schemes, the scheme for collectors and factory made solar water heaters are successful. The schemes for custom built systems is not successful because it is currently not yet fully implemented. That on its turn (also) causes the schemes for tanks and controls to lack market value. Therefor the first most evident thing to do is to fully implement the certification scheme for custom built systems.

► The method for systems

The EN 12977-2 forms a good starting point for the new approach aimed at systems. However, the scope of the standard is limited to solar thermal systems, and does not extend to systems with solar contribution, and the performance determination method needs more specific requirements and reference conditions.

Recently, a set of EPBD standards have been published, that also contain hourly calculation methods, to determine the performance of a broad spectrum of heating products (EN 15316 series of standards). It is proposed to insert the EPBD standards in the EN 12977-2 approach for the calculation of the system performance based on component test data. By doing so, the EN 12977-2 is reinforced on the aspect of energy performance (strong reference to a CEN standard), while the option of the extension towards systems with solar contribution becomes possible.

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[1] Solar Keymark and the new legal requirements and changes in the market, SCF publication, 30.09.2016, Gerard Van Amerongen at al.

Recently a SCF project 6C14_1_Other_model is finalized showing that the hourly EPBD standard series gives good and accurate results for commonly applied solar thermal water heaters and combi heaters. The SCF project results in an open source, validated, model that can be applied in the framework of the EN 12977-2.

► New approach to certification

The current Solar Keymark schemes are product certification schemes: one sample of a series is tested and declared valid for the whole series of that product.

Compared to the Solar Keymark schemes for components, the market for systems is characterized by smaller series and with more versatility in time. Additionally, the potential Solar Keymark client group for systems is much wider, including also wholesalers, installer companies, consultants and engineering offices.

Certification on the *level of systems* requires a flexible, cheap and fast scheme. The implication is a different approach compared to the current Solar Keymark product certification. Instead of certifying each individual system, the method is certified and the companies executing that are to be recognized. At the end, each system receives a declaration stating that:

- the system is composed of Solar Keymark certified components,
- the total assembly is in accordance with the general requirements of EN 12977-1,
- the performance statement is determined with a Solar Keymark certified calculation tool based on the EN 12977-2 and
- the procedure is executed by an Solar Keymark recognized company.
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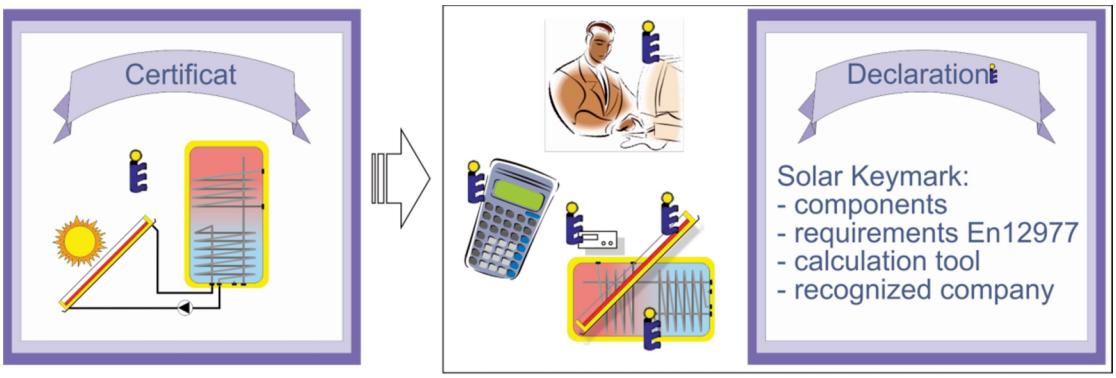


Figure 1- Graphical representation of an extension towards system certification

The new approach should make the certification faster, more flexible and cheaper, while the result should adequately guarantee its expected commercial values .

► Action plan

An action plan is drafted for the implementation of the new approach. The first step is to fully implement the EN 12977-2, using the EPBD based simulation model developed in 6C14_1_Other_model. The next steps are concerned with formalizing the procedures: establish a Solar Keymark Working group to manage the open source software, draft scheme rules to certify the simulation model and draft rules for recognition of companies involved in issuing the system quality declarations. When enough experience is gained, in the Solar Keymark framework, the involved standards will have to be revised accordingly.

In addition to these key tasks, the following additional tasks are defined:

- Extend the approach to systems with solar contribution
- Further open up the accessibility of the method through a web platform
- Further develop the market values for this type of system certification
- Investigate options to extend certification, along the lines of this new approach, for larger systems, like heat distribution.

Contents

Foreword

During the 8-9 March 2016 meeting of the Solar Keymark Network Group in Berlin the following was discussed and decided:

> The next action plan was the one regarding the analysis of all of the new Legal Requirements and future changes in the Market under the proposal:
>
> ErP Directive (LabelPack A+), CPR, Energy labelling of collectors, revision of 3 Directives,(Renewables, EPBD and Energy Efficiency). How will Building Information Modelling (BIM) or the Industry 4.0 revolution affect the Industry and Certification? Prepare a specific plan and be prepared for all changes in the next years.
>
> After some debate and exchange of ideas, the following Decision was taken:
>
> **Decision M20.D10 – Establishment of a WG for AP6: Prepare a thorough plan for all the new Legal Requirements and future changes in the Market**
>
> Establish a WG with the following members Gerard Van Amerongen (Chair), Ulrich
>
> Fritzsche, Pedro Dias, Jaime Fernandez, Oscar Mogro, Christian Stadler, and Korbinian
>
> Kramer.
>
> *Information on vote: Unanimous decision*

The workgroup AP6 produced a final report: "Solar Keymark and the new legal requirements and changes in the market", 30.09.2016.

Following the recommendations of the report the Solar Keymark Network group commissioned a SCF funded project in conformity with

> **Decision 1 on broadening the scope of the solar keymark**
>
> The working group will continue its work and prepare an SCF Project ''A feasibility study aimed at scale of the scope of the Solar Keymark''. The project should focus on two paths to attack the 'pyramid': using the components data and broadening the scope upwards in the 'pyramid'. The goal of the project is to increase and ensure the value of the Solar Keymark now and in the near future. It should give clear directions to move to, how to come there, timetables, types of customers and expected commercial values. In particular, it should make a feasibility study on a new certification scheme for systems with solar contribution. (this includes decision 3 of AP4-New Prod)
>
> The project should be executed by proven experts in the broad field of certification, heating markets, regulations, government policies and people with a good commercial mind.

1 Introduction

The feasibility study investigates route to extend from certification of components to certification of solar thermal systems and systems with solar contribution. In figure 2 illustrates this extension of the scope of the Solar Keymark. Installations, typically very unique and not in line with product certification, are not evaluated in this report.

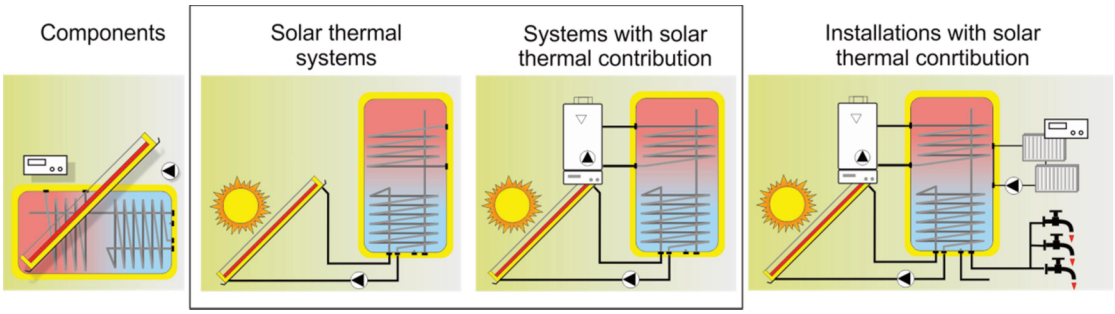


Figure 2 - Graphical representation of scope of systems. Extending from components, through solar thermal systems and systems with solar contribution, to installations. The scope of this report excludes installations.

The rationale behind for expanding the scope of control of Solar Keymark, is the observation that systems, including solar thermal components, need solar thermal expertise to function adequately. It is expected that system certification will represent enough commercial values for our clients to become a success (see 2).

The route to the extension needs a method (see 4), a fitting certification scheme (see 5) and well defined implementation plan (see 6).

2 Market values for system certification

System certification consists of a assessment method and an assurance procedure. The assessment method is an implementation of European standards that has market values by itself. The assurance procedure is the 'finishing' of the method to add trust to the result.

2.1 Market values for the 'system' certificates

The market values of the certification scheme for the Solar Keymark are essential for success. In this report we are considering certification schemes for solar thermal systems and systems with solar thermal contribution.

The current certification scheme for (factory made) solar water heaters is successful, but solar combi systems are excluded. The scheme for (custom built) solar thermal systems is in place, but not yet fully implemented. A scheme for systems with solar contribution is not introduced in the framework of Solar Keymark.

The Solar Keymark schemes for collectors and solar water heaters have demonstrated their market values over the years. However, the scheme for solar thermal systems and systems with solar contribution currently lack a proven assessment of market values.

The primary market values are based on the *uniform system specifications* and secondly based on the *objective assurance* of the truthfulness of these specifications. The system specifications include quality aspects like safety, lifetime, conformity to regulations and energy performance.

System specifications are included in the company's product catalogue, deployed in system comparison and procurement processes and used by installation planners. Uniform and assured system specifications make market communication more effective and cheaper, increases market confidence and allows for a link to European and member states regulations and governmental support schemes.

Values related to governmental regulations of support schemes often need some familiarization time to gain trust in the new methods. Governments tent to look more and more to the system and less to the component performance [1]. ErP and EPBD are examples of that.

- **Member states energy performance regulations**
  It is obvious that the method could be used for EPBD purposes. However, that can be achieved already by using the EPBD standards as is. Adding the certification aspect, allows for a declaration of conformity to the EPBD standards that could allow for system specific performance data to be accepted in member states energy performance regulations; also those member stated that do not fully implement the EPBD standards.

- **European ErP regulation**
  Systems with solar thermal components are included in the 'package' part of the ErP, that relies strongly on the access to product performance data of its components. The European commission is intending to introduce a database for ErP products that excludes entrees specifically meant for packages. Under the condition that the Solar Keymark new approach for systems implements a commonly accessible database and an easy accessible automated procedure, this could form the missing link between the EU database towards packages.
  The ErP regulation is currently using a very simple method to determine the solar contribution from a combi systems. By implementing the Solar Keymark new approach a more accurate assessment of the performance could be put forward. Ulti-

mately the complete heating system, including boilers, water heaters, controls, could be handled by the method for systems with solar contribution in order to determine the system performance.

- **Support schemes**
  Some governmental support schemes are already linked to system performance (e.g. output of solar water heater) [1].. The method for solar thermal systems and systems with solar contribution fits well in this manner of thinking and could become a very important added value.

2.2 Derivative market values for existing certification schemes

The existing certification schemes for components can benefit from a successful systems certification scheme.

- **Solar Keymark for collectors, tanks and controls**
  Clients having this certificate can gain extra market values by the application of the results in the systems method. Additionally the systems method can also be seen as a promotional value for the use of these Solar Keymark certification schemes.

- **Heat pump Keymark**
  Extending from solar thermal systems to systems with solar contribution brings the Heatpump Keymark within the scope of the new approach and be of mutual extra market value.

2.3 Requirements for the certification scheme

A certification scheme for systems can be made successful when the certificate represents enough commercial values for the applicants, if the scheme is flexible and easily accessible and the total involved costs are well balanced to the values its represent.

Commercial values increases by smooth access to different markets. Generally speaking, that would mean no trade barriers across borders, automatic access to support schemes, commonly recognized prove of quality and performance and standardized product specifications made for planners and purchasers. For most of the current Solar Keymark schemes, these values are in place. A new scheme aimed at systems could well contribute and further built on that.

Flexible means a certification process allowing for a fast processing of (small) changes in the system during its lifetime. The lifespan and design time of systems is typically much shorter than for components, while systems are often subject to small changes during their lifetime..

Accessible means that a broad range of (system) clients can finds its way to the certification scheme and make use of it.

Fitting pricing implies that the cost should be well related to the *commercial values* since an evaluated system represents less duplicates in a series than components.

2.4 Solar Keymark client groups expanding

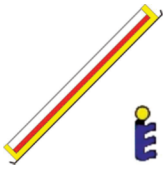
The Solar Keymark client group are commonly the suppliers (manufacturer or OEM) of the components or systems. The new approach introduces a new client group of engineering or consultant companies that offer the service of issuing the declarations to a broad group of end users: wholesalers and companies engineering or designing small or medium large series of solar system configurations, installers and consultants. For systems with solar contribution this will move towards installation planners and (perhaps) builders. Moreover, this new client group could also extend to software engineering companies supplying the automated tools.

3 The Solar Keymark certification products

3.1 Current Solar Keymark products

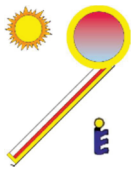
Currently the Solar Keymark has the following certification schemes:

1.	**Solar collectors**	
	Based on:	EN ISO 9808
	Type:	Solar thermal component
	Issued:	1277 certificates
	Application:	Product specifications, 'passport' for export, solar thermal system design, government support schemes, ErP regulations, member states EPBD regulations and custom built solar thermal systems certification scheme



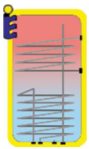
The collector certification scheme is the most successful scheme, that exists already many years, is well known and well embedded in market mechanisms.

2.	**Factory made solar water heaters**	
	Based on:	EN 12976
	Type:	Solar thermal hot water system / whole system testing
	Issued:	184 certificates
	Application:	Product specifications , 'passport' for export, government support schemes, ErP regulations and member states EPBD regulations.



The solar water certification scheme is the second best successful Solar Keymark certification scheme, that exists already many years, is well known in designated markets and is well embedded in market mechanisms. The scheme is particularly successful for so called Mediterranean solar water heaters.

3.	**Solar water heat storage tanks**	
	Based on:	EN 12977-3 and -4
	Type:	(Solar) thermal component
	Issued:	1 certificate
	Application:	Product specifications, ErP regulations, member states EPBD regulations and the custom built solar thermal systems certification scheme.

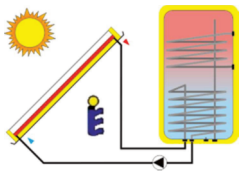


The tank certification scheme is not a very successful Solar Keymark certification scheme, although well embedded in market mechanisms like governmental regulations, standards and support schemes.

4.	**Solar thermal controls**	
	Based on:	EN 12977-5
	Type:	Solar thermal component
	Issued:	1 certificate
	Application:	Product specifications and the custom built solar thermal systems certification scheme.

The control certification scheme is not a very successful Solar Keymark certification scheme that is not very well embedded in market mechanisms.

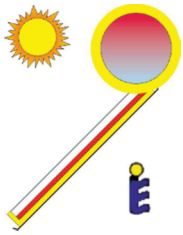
5.	**Custom built solar thermal systems**	
	Based on:	EN 12977-2
	Type:	Solar thermal system / component tests and system calculation
	Issued:	0 certificates
	Application:	Product specifications



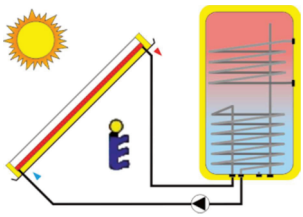
The certification scheme custom built solar thermal systems is not a successful Solar Keymark certification scheme.

3.2 Solar Keymark products for systems analysed

Out of the five Solar Keymark products, two are aimed at systems: factory made solar water heaters and custom built systems. Three schemes cover components, that have their own intrinsic values, but also support (feed) the custom built systems certification scheme with component data.



The *factory made solar water heater* scheme is especially successful for so called Mediterranean solar water heaters and solar water heaters with an integrated collector and heat storage tank. These are typical systems that can only be evaluated as a whole and not by the performance of its compositions. The certification scheme is limited in its scope to solar water heaters, and excludes as such space heating, combi-systems and systems with solar thermal contribution.



The *custom built systems* scheme is aiming at broad spectrum of solar thermal systems, while the methods are most detailed for heating applications in buildings. By nature (custom built) the targeted product group can be evaluated by the performance of its composition. The certification scheme is limited in its scope to solar thermal systems, and excludes as such systems with a solar thermal contribution.

The *custom built systems* scheme is important in the context of the subject of this study: systems. A further analyses of the lack of success is therefore justified.

- **Not fully implemented**
  The method is currently not fully implemented. The major shortcomings are the requirements on the simulation model and reference conditions for water heating and up to date load patterns for space heating.
  ⇨ The method applied needs to be revised, completed and implemented

- **Not well embedded in market mechanism**
  Potentially, the method could be well embedded in market mechanisms. However, if the method and the certification scheme is not applied, the market values will not develop (' chicken-and-egg' problem). Moreover, acceptance in market mechanisms need unambiguous results, that on its turn needs clear requirements from a fully implemented certification scheme.
  ⇨ The improved scheme needs to be implemented to show its full potential in order to be included in market mechanisms

- **Product certification?**

The Solar Keymark is currently a so called 'Product' certificate; a sample of a series is evaluated and the results are declared valid for the whole series. This type of certification is clearly fitting for series products, but is it also fitting for custom built systems?

⇨ A more fitting certification scheme for systems needs to be put in place.

Without analysing the other Solar Keymark schemes in further details the following two points are noted.

- The schemes for tanks and controls are primarily intended to support the certification scheme for custom built systems (inputs for the method). Making the certification scheme for custom built systems successful will also increase the interest for these components schemes.
- One factor in the lack of success for the scheme of tanks is the lack of interest for the underlying method (EN 12977-3/4), caused by competition between standards aimed at the determining the standing losses in the framework of the ErP. The more general lesson to be learned is that a successful certification scheme is heavily dependent on the successful application of the underlying method. Turning this around could well mean that the introduction of a successful method is an indirect way to create a successful certification scheme.

4 Methods for systems

In this chapter the options for a method to be applied in Solar Keymark certification schemes for solar thermal systems and systems with solar contribution are explored and the best fitted is proposed.

4.1 Long list of available methods

The following methods are evaluated for application in certification of systems with solar contribution.

1. EN 12977-2 - Thermal solar systems and components — Custom built systems —

The method bundles the results of component standards (EN 12975, EN 12977-3,4,5) and adds to that a calculation method to determine the thermal performance (simulation model)

The method is described in a CEN standard, is part of the Solar Keymark certification schemes and covers the complete set of relevant quality issues.

The method is currently not successful. Weak points are the requirements on the simulation model and a missing set of reference conditions. Moreover, the scope does not include systems with solar thermal contribution.

2. EPBD series of CEN standards

The standard series includes a broad spectrum of methods that describe calculation methods to determine the thermal performance of components / products in installations to be applied in buildings.

The methods are available for an monthly and hourly calculation step. The hourly methods are expected to be the most accurate and transparent.

The methods are described in CEN standards, refer to solar thermal component standards, includes all typical types of backup heaters, should be flexible in its use for system suppliers and installation planners, the number of inputs are limited and transparent in their definitions.

The methods are limited to thermal performance, exclude reference conditions and are not specifically meant for product certification.

3. Commercial available design software (Polysun, TiSun, …)

Method to design solar thermal systems and determine the thermal performance, based om component specifications and system design parameters.

The software is publicly available with a user-friendly interface and commonly applied by solar system composers on the level of solar thermal specialists.

The method does not cover other quality aspects besides thermal performance, the source code is not available, no publicly available validation results are available, the development of the method cannot be directly managed by the Solar Keymark, the method is not described in a CEN standard and the scope does not include systems with solar thermal contribution.

4. TRNSYS scientific simulation tool for solar thermal applications

Method to design solar thermal systems and determine the thermal performance, based om component specifications.

The software tool differs from commercial available software by its intended use by specialists that often work with the model on the level of source code. The tool is very broad in its application, able to model systems in very much detail and is specifically referred to in the EN 12977-2 as an applicable simulation model.

The use of the method is limited to experts only. The input parameters are not unambiguously described and extend beyond the test results of the solar thermal standards. As a result, the reproducibility of the calculation results is not always optimal.

5. EN 12976-2 - Thermal solar systems and components - Factory made systems -

Method based on whole system testing.

The method does not fully conform to the scope of this feasibility study (limitation to solar water heaters) but is presented as a good example of what can be achieved with whole system testing.

The method is a strongly managed 'one issue' method aimed at factory made solar water heaters, described in CEN en ISO standards, covers the complete set of relevant quality issues, accepted by ErP and EPBD and is successfully implemented.

The main drawback for the method is the none disclosed source code that is outside the control of Solar Keymark or CEN TC 312. Moreover, the method is not flexible enough to be broadly acceptable for others than factory made systems.

4.2 Selection of a system method

The following selection criteria are applied:

- **Scope**
  Does the method cover the range of systems with solar contribution?
- **Quality aspects**
  Does the method includes all relevant quality aspects, currently in the solar thermal standards?
- **CEN based**
  Is the method described in a European standard?
- **Manageable**
  Can the method be controlled (or influenced) by the Solar Keymark?
- **Accurate**
  Is the method accurate enough for certification?

The results are shown in table 1

	EN12977-2	EPBD	Commercial	TRNSYS	EN 12976
Scope:	+/- Solar Thermal only	+	+/- Solar Thermal only	+/- Solar Thermal only	- Solar water heaters only
Quality aspects:	+	+/- Thermal performance only	+/- Thermal performance only	+/- Thermal performance only	+
CEN based:	+	+	-	-	+
Manageable:	+/- Depending on model used	+ Through CEN TC 228	-	+/- Through user group	- No source code
Accurate:	+/- Depending on model used	+/- Validation in progress	+/-	+/- Depending on the user	+

Table 1 - Evaluation results of the available methods

4.3 Proposed method to use

None of the available system methods comply fully to what's required. Through combining EN 12977-2 with the EPBD standards, the best compliance with the requirements can be achieved.

The EN 12977-2 is not specific in the requirements of the simulation model and allows for different tools, without a strict set of requirements on the model to apply. This forms a main drawback for a broad acceptance of the standard for especially governments related issues. A specific requirement for a tool based on the EPBD standards, would prevent the need for a complex set of requirements on the simulation model to use.

The open source model developed in the framework of the SCF project 6C14_1_Other_model is well suited to this purpose. The validation of that model shows good accuracy results (see figure 3. A further evaluation of that tool in terms of accuracy and validation requirements may need to be executed. It is noted that the methods are relatively new and the validation is currently limited to one study. Further validations are advisable.

The reference conditions for water heating (base: EN 12976-2 and ErP) and space heating (update current and extend to nearly energy neutral buildings) need to be completed.

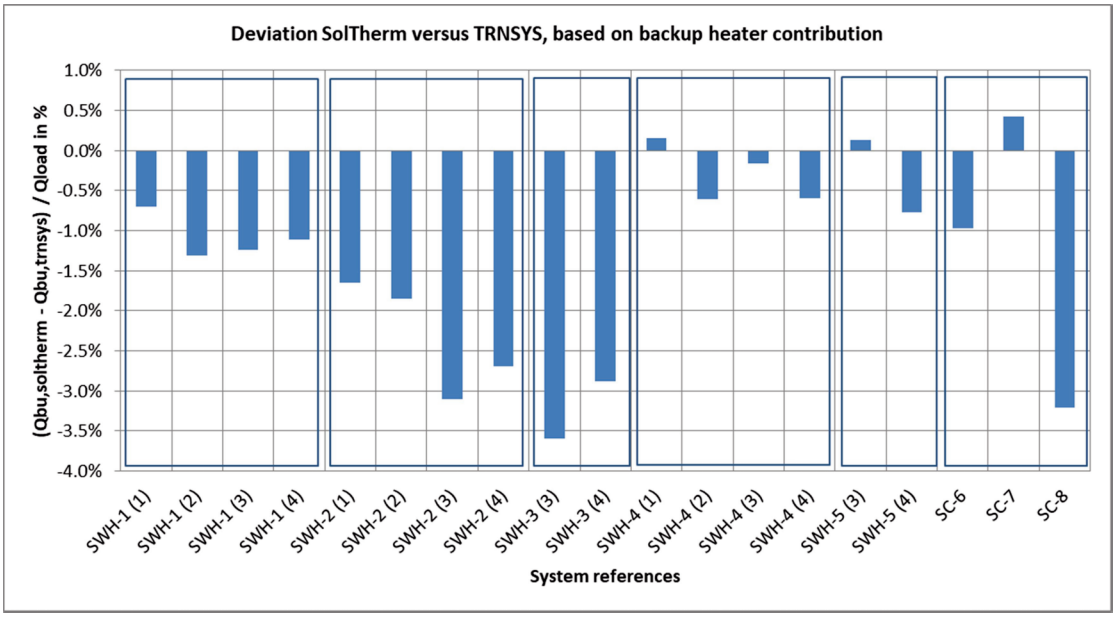


Figure 3 Validation results for the open source model ('SolTherm') compared to the TRNSYS simulation model [2]. The results are illustrated by the backup heater heat contribution. SWH; solar water heater, SC: solar combi system. (x) represents a heat load sequence.

Although the EPBD methods are well equipped with methods for systems with solar contribution, the scope for EN 12977-2 is limited to solar thermal systems. However, the structure of the EN 12977-2 offers good opportunities to expand the scope to a broader range of solar thermal applications. A revision of the standard will be needed for that. Such a revision would add requirements, that link to the other components standards, and extend the requirements of the performance method.

[2] Extracted from the final report of the SCF project 6C14_1_Other_model

4.4 Component tests required

Following the EN 12977-2 procedure the collector (EN ISO 9806), tank (EN 12977-3/4) and controller (EN 12977-5) need to be tested and the test results shall be applied in the energy performance calculation.

The collector tests are commonly available and should not face industry with additional testing requirements. However, the tank test and controller test are not evidently available.

Commonly, other standards are applied for the determination of the so called 'Standing losses' (measure for the heat loss rate) of the tank for use in the ErP energy label. Additional testing, according to EN 12977-3/4, would be required. Unfortunately, this can (and probably will) result in different values for the Standing losses. Nevertheless this is unavoidable for conformity with the EN 12977-2, accuracy requirements and input requirements, not included in those other standards but, needed for the performance calculation method (e.g. locations of tank connections and heat exchanger heat exchange rates).

It is assumed that the EN 12977-3/4 test is, compared to alternative methods, more expensive and not likely to be performed by the supplier company itself. However, due to the so called product family method, that is part of the EN 12977-3/4 standards, one test can cover multiple tanks of the same design.

The EN 12977-5 standard for controllers covers multiple control functions. However, the proposed calculation method (EPBD) does not evaluate the collector pump on/off control, which is a main part of the test procedure. The remaining control functions are not that important to justify the test procedure. In deviation from the requirements in EN 12977-2, this test should not be made mandatory, but preferred. Ultimately, this change should be included in a EN 12977-2 revision.

5 Certification scheme

To make system certification more attractive, flexible, easier and cheaper an alternative to Solar Keymark certification for systems is proposed, where each individual system is awarded a declaration of quality, stating the following:

- the system is composed of Solar Keymark certified components,
- the total assembly is in accordance with the general requirements of EN 12977-1,
- the performance statement is determined with a Solar Keymark certified calculation tool based on the EN 12977-2 and
- the procedure is executed by a Solar Keymark recognized company.
-

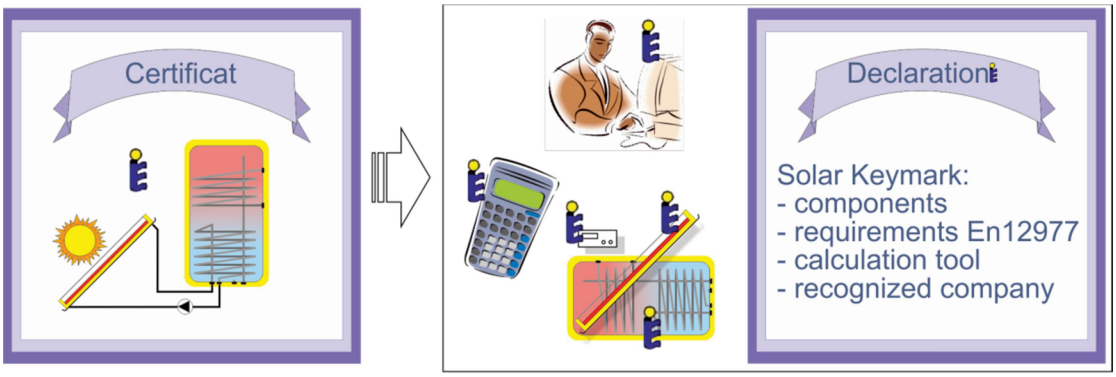


Figure 4 From a system certificate to a declaration of quality graphically illustrated

This procedure effectively avoids the need for certification surveillance at the system supplier, lower the administrative burden on the level of the Solar Keymark for each individual system and stimulates competitiveness between the companies offering the service. All in all, this should make the certification faster, more flexible and cheaper, while the result should be good enough to guarantee the commercial values represented by the declaration.

5.1 Certification of the tool

A new Solar Keymark scheme should be developed for the certification of a tool especially aimed at the energy performance determination of systems. The scheme should cover all that is needed to make sure that the tool is in conformity with the requirements of the EN 12977-2 combined with methods from EPBD standards. The scheme should include requirements on the tool, the procedure to use it and the reporting requirements.

At the start of the new scheme only one tool is considered: the currently developed open source software tool from the SCF project 6C14_1_Other_model. After gaining more experience with the procedures, the certification scheme can be further expanded to include other tools.

The new scheme can built upon experiences gained with the likewise procedure and use for the Scenocalc software, currently applied to produce data for collector datasheet.

5.2 Recognition of companies

The company executing the method is recognised by an empowered certification body for Solar Keymark that will be under supervision. This is a similar procedure as currently applied for test labs.

The base for such a recognition should preferably be laid down in a CEN standard like 17025 or 17065 or through a specially drafted CEN Workshop Agreement (CWA) as a precursor for

a real standard. These requirements should include safeguards for objectivity, expertise, the good use of the certified tool, fees to Solar Keymark and conformity to the requirements of data dissemination.

An important requirement shall be to add the calculation data (inputs and outputs) to a Solar Keymark database with a accessibility level that needs to be further elaborated. Solar Keymark uses the data for surveillance purposes and database procedure can include an authentication procedures. Moreover, the data in the database can be applied in connection with the ErP database for products to support the ErP package scheme.

5.3 Solar Keymark Network

The Solar Keymark Network (=SKN) has the essential task to manage the scheme: define the method by requirements, standardise the reports, make dissections on issues that arise and revise if needed.

The aim of this work should not only be aimed at the certification scheme, but also at the implementation of the method itself: the method needs to be accepted by the market before the certification scheme can be successful.

5.4 The declaration and Solar Keymark

The declaration text should be standardised and approved by the Solar Keymark network. The text should explicitly limit the involvement of the Solar Keymark to the certified components and tool and recognition of the company supplying the declaration. Moreover, it should exclude (‘in fine print’) any Solar Keymark responsibility at the level of the supplier of the system (declaration holder).

6 Action Plan

The elements of the action plan are detailed in the following, while the time table of table 2 is proposed

Task:	Start:	End:	Remarks:
Revision scheme rules for Custom built systems	March 2018	October 2018	SCF preferred call
Workgroup to manage the open source tool SolTherm	October 2017	No ending	Call for participants
Scheme rules for the calculation tool			
Phase 1	March 2018	October 2018	SCF preferred call
Phase 2	March 2019	October 2019	n.a. yet
Phase 3	…		n.a. yet
Requirements for recognition	March 2018	October 2018	SCF preferred call
Revision of the standards	2019	2020	n.a. yet

Table 2 - time schedule implementation system certification

The time period up to October 2018 can be made productive by introducing the method and gain experience without the certification and recognition schemes in place.

6.1 Revision scheme rules for Custom built systems

The revision should include the following items:

a. Update and complete the reference conditions for water heating (e.g. adopt the EN12976 and ErP references) and updated the reference conditions for space heating (e.g. nearly energy neutral buildings).
b. Designate the open source simulation model SolTherm, based on the new hourly EPBD standards and developed in the SCF project: '6C14_1_Other_model', as the designated calculation tool [3].
c. Compliment (and revise if needed) the required operating conditions for the calculation tool, adding to the current annex A of the EN 12977-2.
d. Promote the availability of the method primarily within the Solar Keymark client group

6.2 Workgroup to manage the open source tool SolTherm

Formulate an assignment for a special workgroup engaged with the management of the open source software SolTherm and establish the workgroup with involved experts from the Solar Keymark Network Group. The working group shall archive the source code, make it available and adopt revisions. Revisions to correct found errors or aimed at the user interface can be initiated by the workgroup. Other revisions, aimed at the core of the software (and method) shall be executed after a mandate from the Solar Keymark Network Group.

[3] Designating this tool as the only tool allowed, gives a jump start for the certification scheme. When the scheme rules for the tool are drafted (see 6.3), other tools conforming to the rules can be allowed too.

6.3 Scheme rules for the calculation tool

New Solar Keymark scheme rules are developed for the certification of the calculation tool. A three phase development is proposed. Each new phase is started proven success and is initiated by the Solar Keymark Network Group. The scheme rules contain a standard reporting format and a standard text for the declaration.

Phase 1: pro forma scheme rules to justify the application of the SolTherm simulation model.

The scheme rules are only intended to formalize the use of the SolTherm model as a certified calculation tool in the framework of the certification scheme for Custom built systems. The required specifications of the tool are duplicated from the SolTherm specifications and for the management of the software code the dedicated to the Solar Keymark workgroup to be established (see 6.2).

Phase 2: scheme rules that include different implementations (e.g. user interfaces) based on the core of the SolTherm simulation model.

The scheme rules are extended with requirements on validation of other implementations of the SolTherm calculation core software and requirements on the in company management of the software. Moreover, requirements are added to make sure that updates in the core software, initiated and executed by the dedicated Solar Keymark, are implemented.

Phase 3: scheme rules to include other compatible calculation tools.

The scheme rules are extended with requirements on validation of other tools and requirements on the in company management of the software. Moreover, requirements are added to make sure that updates in the software, initiated and executed by the dedicated Solar Keymark, are implemented.

The scheme rules can built upon experiences gained with the likewise procedure for the Scenocalc software, currently applied to produce data for collector datasheet.

6.4 Requirements for recognition

The requirements for recognition of companies to issue the system-declaration needs to be laid down in a formal Solar Keymark document. The requirements are aimed at objectivity, good company management, well-documented and managed work procedures and the good use of the tool management by Solar Keymark.

6.5 Revision of the standards

In the last phase of the implementation the lessons learned are to be implemented in revised standards. This includes the CEN standards: EN 12977-2, EN 15316-4-3 and EN 15316-5.

During the introduction phases the CEN TC 312 will be updated on the last developments and at an opportune moment the TC 312 will be asked to revise the standards.

For the revisions of the EN 15316-4-3 and EN 15316-5 the TC 228 will be contacted through the TC 312 liaison officer. During the TC 228 WG4 meeting (06.09.2017) the subject has been brought forward and in first indication the group is interested to work on the revisions at an opportune moment.

6.6 Supporting tasks

To complete the target set in this feasibility study the following tasks are to be initiated:

a. *Extend the approach to systems with solar contribution*
   Work on the model to include more methods from the EPBD standard (e.g. different types of backup heaters), include quality requirements for the none solar components and implement this.

b. *Further open up the accessibility of the method through a web platform*
The accessibility of the method can be improved by offering services through a web platform. Furthermore, this will increase the marketing value of the resulting declarations.

c. *Work on the further embedment of the approach in market values*
Lobby for embedment of the approach in regulations and government support schemes (Solar thermal Europe) and open up links to product databases and installation design tools.

d. *Research aimed at a further broadening of the scope of the certification*
This report is focussing on applications in dwellings and buildings. Building on the results for systems with solar contribution, a further extension could be investigated towards large systems applied in e.g. heat distribution systems. Both the base certification scheme and the approach (EPBD methods) for performance determination should be applicable. However, the calculation tool should further developed at several points, including the application of large heat storage systems.

The planning in time of these tasks are not further elaborated.