OVERVIEW ON EUROPEAN STANDARDS AND CERTIFICATION ISSUES FOR SOLAR THERMAL SYSTEMS

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Abstract

European Standards can be used to enhance safety and performance, improve energy efficiency, and protect consumers, workers and the environment. They complement European and national policies, and make it easier for businesses and other actors to respect relevant legislation. European Standardization is a key instrument for consolidating the Single Market and facilitating cross-border trade – within Europe and also with the rest of the world. Furthermore, "Keymark" is the voluntary European certification mark demonstrating conformity with European Standards. In the last years solar installations have advanced to standard house equipment, attracting also the attention of the European legislators. Solar products, as all products, must meet certain essential requirements related to health, safety and environment before they can be placed on the European market. These requirements are defined by the European Union directives, which are adopted by each member country as national legislation. Several directives offer considerable support to the development of the solar market. Furthermore public subsidies are allocated by states/communities provided that the product is certified under a proper certification scheme. The scope of this work is to present an overview of European standards for solar thermal systems and components, to update on the Solar Keymark quality label, as well as to discuss on relevant legislative issues as "Energy Labelling" and "Energy Performance in Buildings Directive" in relation with solar thermal systems. Future trends and needs for standardization are also discussed and highlighted.

Keywords: Type your keywords here, separated by commas,

1. Introduction

Solar energy is a form of renewable energy which can be converted into useful thermal or electrical energy for use in the residential, commercial and industrial sector. The conversion of solar energy in thermal energy is made with the use of solar thermal systems. The main component of a solar thermal system is solar thermal collector. Solar thermal collectors may be classified in two categories: with or without sun tracking mechanism. Sun tracking mechanism is used to adjust the collector orientation in a sun-following solar collector system. For low-medium temperature applications are usually used solar thermal collectors where all the parts of the collector system are stationary. Solar thermal collectors with solar radiation concentration are used for medium and high temperature applications. Solar concentration is the re-direction of solar radiation to enhance the irradiance received by the absorber or the receiver. Concentrating solar thermal systems use mirrors or lenses with tracking systems to focus a large area of sunlight onto a smaller area.

Solar thermal systems may produce fluid of low ($T < 100\ ^{\circ}C$), medium ($100\ ^{\circ}C < T < 400\ ^{\circ}C$) and high ($T > 400\ ^{\circ}C$) temperatures that can be used directly or be transformed into other forms of energy as mechanical, electrical and chemical.

The most common applications of solar thermal systems are:

- Sanitary hot water production
- Hot air production for space heating and drying

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- District heating
- Space heating / cooling
- Solar desalination
- Industrial process heat
- Electricity production

Solar heat thermal systems must be clearly distinguished from two other renewable energy technologies using the sun directly – Photovoltaic and Concentrated Solar Power – both of which provide electricity, while solar heat thermal systems produce heat that conveyed to a heat transfer medium – usually a liquid but also air in the case of air collectors. The heated medium is used either directly (to heat tap water for example) or indirectly by means of a heat exchanger which transfers the heat to its final destination (for instance in space heating or industrial process heat).

Most of the solar heat systems in use today are related to low-temperature heat demand in buildings: providing hot water and space heating. The solar heat can be produced on-site for individual houses or delivered via a district heating network. For industrial processes, solar heat systems are well suited for generating low temperature heat up to 150°C. There are well-known applications of solar heat in breweries, mining, agriculture (crops drying) or textile sector. (SHE-ESTIF, 2020). The global cumulated solar heat thermal capacity in operation at the end of 2019 was 479 GWth (684 million square meters), the vast majority of which is installed in China and Europe. The corresponding annual solar thermal energy yield amounted to 389 TWh, which correlates to savings of 41.9 million tons of oil and 135.1 million tons of CO_2 (IEA, 2020).

European Standardization plays an important role in the development and consolidation of the European Single Market. The fact that each European Standard is recognized across the whole of Europe, and automatically becomes the national standard in 34 European countries, makes it much easier for businesses to sell their goods or services to customers throughout the European Single Market. Innovation needs standardization and that standards are essential for market uptake of innovative products and services since they provide a strong long term platform for further innovation.

Standards provide opportunities for:

- Transfer of innovative know-how to the market
- Dissemination of research results (Subtasks A, B and C)
- Opportunity to network
- Helping access to public procurement markets
- Comparability & interoperability: measurements, quality indicators, test methods
- Reassurance for European consumers
- Faster and easier access to markets

Standardization supports economic activity, boosts productivity, increases trade within the European Single Market and allows businesses of all sizes to access markets around the world. Recent studies highlight the positive relationship between the use of standards and economic growth, labour productivity, and the ability of companies to export their products. Standardization is supported by specific policy context, as:

- the Innovation Union, 2010: “Standards play an important role for innovation”,
- the Standardization Regulation, 1025/2012: “Standards can help to bridge the gap between research and marketable products or services”,
- Horizon 2020 “Contribute to European competitiveness through support to the standardisation process and standards”
- the Single Market Communication 550/2015 “Standards are crucial for innovation and progress in the Single Market: they increase safety, interoperability and competition and help remove trade barriers”.

Standardization is not the same as legislation. Standards are developed through a process of collaboration among stakeholders and they are approved and published by recognized standardization bodies. Regulations and other types of legislation are adopted by governments at national or regional level, or by supranational and/or inter-governmental organizations such as the European Union. Moreover, the use of standards is voluntary whereas regulations are legally enforceable. Standards can facilitate compliance with legislation. The relationship between standardization and legislation at European level has been developed in accordance with the so-called 'New Approach' to technical harmonization and standards, which was introduced in 1985. Additionally there are European Commission's standardization requests, the so-called European "Mandates". Mandates are the mechanism by which the European Commission (EC) and the secretariat of the European Free Trade Association (EFTA) request the European Standardization Organizations (ESOs) to develop and adopt European standards in support of European policies and legislation.

European standards are the basis for the "Solar Keymark", the European quality mark for all solar thermal products. The Solar Keymark is a voluntary third-party certification mark for solar thermal products, owned by CEN/CENELEC. Every certified product is in full conformity with the relevant European standards and fulfills additional requirements to assure constant quality. This level of quality is maintained by initial type testing and by regular check of the products and their production sites by independent inspectors. Consumers and authorities can fully rely on the certified products. The "Solar Keymark" is the basis for most European supporting schemes and it is also increasingly recognized or adapted worldwide.

This research work is focused on standardization, certification and legislative issues in European level related to solar thermal systems and their components.

2. European standardization on solar thermal systems

Standards are documents that set out specifications and other technical information with regard to various kinds of products, materials, services and processes. The European Committee for Standardization is called CEN. CEN is one of three European Standardization Organizations (together with CENELEC and ETSI) that have been officially recognized by the European Union and by the European Free Trade Association (EFTA) as being responsible for developing and defining voluntary standards at European level.

The Members of CEN are the National Standardization Bodies (NSBs) of 34 European countries – including all the member states of the European Union (EU) and other countries that are part of the European Single Market. CEN works with its Members to develop and define European Standards in response to specific needs that have been identified by businesses and other users of standards.

European Standards (ENs) are developed by teams of experts who have particular knowledge of the specific sector or topic that is being addressed. The members of Technical Committees (TCs) as well as sub-committees and Working Groups (WGs) are nominated by the national standardization organizations. Each NSB that is part of the CEN system is obliged to adopt each EN as a national standard and make it available to customers in their country. They also have to withdraw any existing national standard that conflicts with the new EN. Therefore, one EN becomes the national standard in all 34 countries covered by CEN Members. Moreover, many ENs are also adopted as identical national standards by CEN Affiliates, which are the NSBs of 17 neighboring countries, and by NSBs in other countries around the world.

The ENs published by CEN are developed by experts, established by consensus and adopted by the Members of CEN. It is important to note that the use of standards is voluntary, and so there is no legal obligation to apply them. Around 30% of the ENs published by CEN have been developed in response to specific requests (standardization mandates) issued by the European Commission. Many of these standards are known as 'harmonized standards'. They enable businesses to ensure that their products or services comply with essential requirements that have been set out in European legislation (EU Directives). In such cases, we can say that the standard provides 'presumption of conformity' with the essential requirements of the relevant legislation (CEN, 2020).

CEN develops via its technical committee on CEN TC 312 “Thermal solar systems and components” the European Standards for solar thermal systems. CEN/TC312 is engaged in the standardization of thermal solar systems and their associated components. Its main scope is the preparation of ENs and other CEN products, to

cover Preparation of European Standards to cover terminology, general requirements, characteristics, test methods, conformity evaluation and labelling of thermal solar systems and components.

CEN/TC312 was created after a request of the European Solar Industry Federation (ESIF) to CEN. Afterwards, a liaison between CEN/TC312 and European Solar Thermal Industry Federation (ESTIF) was established. Moreover CEN/TC312 works in close liaison status with the International committee for solar energy ISO/TC 180 “Solar energy” under Vienna Agreement, for producing EN ISO standard.

The main focus of CEN/TC312 is to ensure homogenous testing procedures for solar thermal systems and components. The standards and specifications of CEN/TC312 are required by a large number of different parties. These include manufacturers of solar thermal collectors, systems and components, manufacturers of solar water heater stores and combisystems and appropriate control equipment, national authorities, energy service companies, engineers and consumers. CEN/TC312 has elaborated a set of products (ENs) in the solar thermal energy field including solar collectors, factory made systems, solar energy vocabulary, custom built systems as well as collectors’ components and materials.

Currently the published standards under the responsibility of CEN TC312 are as shown in Tab.1.

Tab.1 CEN TC312 published standards

Reference	**Title**
EN ISO 9488:1999	Solar energy - Vocabulary (ISO 9488:1999)
EN 12975-1:2006+A1:2010	Thermal solar systems and components - Solar collectors - Part 1: General requirements
EN ISO 22975-3:2014	Solar energy - Collector components and materials - Part 3: Absorber surface durability (ISO 22975-3:2014)
EN ISO 22975-1:2016	Solar energy - Collector components and materials - Part 1: Evacuated tubes - Durability and performance (ISO 22975-1:2016)
EN ISO 22975-2:2016	Solar energy - Collector components and materials - Part 2: Heat-pipes for solar thermal application - Durability and performance (ISO 22975-2:2016)
EN 12976-1:2017	Thermal solar systems and components - Factory made systems - Part 1: General requirements
EN ISO 9806:2017	Solar energy - Solar thermal collectors - Test methods (ISO 9806:2017)
EN 12977-2:2018	Thermal solar systems and components - Custom built systems - Part 2: Test methods for solar water heaters and combisystems
EN 12977-4:2018	Thermal solar systems and components - Custom built systems - Part 4: Performance test methods for solar combistores
EN 12977-5:2018	Thermal solar systems and components - Custom built systems - Part 5: Performance test methods for control equipment
EN 12977-1:2018	Thermal solar systems and components - Custom built systems - Part 1: General requirements for solar water heaters and combisystems
EN 12977-3:2018	Thermal solar systems and components - Custom built systems - Part 3: Performance test methods for solar water heater stores
EN 12976-2:2019	Thermal solar systems and components - Factory made systems - Part 2: Test methods

The standards under development (not published) under the responsibility of CEN TC312 are as shown in Tab. 2.

Tab.2 CEN TC312 standards under development

Reference	Title
FprEN 12975	Solar collectors - General requirements
FprEN 12976-1:2018	Thermal solar systems and components - Factory made systems - Part 1: General requirements
prEN ISO 9488	Solar energy - Vocabulary (ISO/DIS 9488:2020)

3. European certification on solar thermal systems

In the 1990s the solar thermal market in Europe started to grow considerably, in part due to financial support programs in various countries. The European market grew quickly from 250.000 kWth to over 800.000 kWth of newly installed capacity per year. Many companies started exporting their products into other European markets but found hurdles in the form of different requirements in the incentive programmes, which became an obstacle to market entry. As a result, if a company wanted to sell one collector to different countries in Europe, it had to undergo several different tests and gain additional certificates and approvals. This process was extremely complicated, expensive and cumbersome and hindered the development of solar thermal in Europe and the growth of solar thermal manufacturers.

In 2003 ESTIF and major testing institutes formulated the Solar Keymark Scheme rules as a unified and simple solution in order to get solar thermal products recognized all over Europe. This work was done on the framework of an EU co-financed project running from 2000 until 2003: Solar Keymark I (ALTENER - Solar Keymark - AL/2000/144). This work was followed up by Solar Keymark II (EU-IEE (Solar Keymark II - EIE/05/052/SI2.420194). After these two projects the Solar Keymark was the most successful Keymark scheme and more than two thirds of the collectors sold had the Solar Keymark. Testing, inspection and certification were now organized into a single streamlined process and was recognised by authorities all over Europe.

The Solar Keymark is a voluntary third-party certification mark for solar thermal products, demonstrating to end-users that a product conforms to the relevant European standards and fulfills additional requirements. The Solar Keymark logo is shown in Fig.1.

Fig.1 The Solar Keymark logo

Every certified product is in full conformity with the relevant European standards and fulfills additional requirements to assure constant quality. This level of quality is maintained by initial type testing and by regular check of the products and their production sites by independent inspectors. Consumers and authorities can fully rely on the certified products. The Solar Keymark aims at reducing trade barriers and promotes the use of high quality solar thermal products in the European market and beyond. It is used in Europe and increasingly recognized worldwide. The Solar Keymark is a CEN/CENELEC European mark scheme, dedicated to:

•Solar thermal collectors,

•Solar thermal systems, storages and controllers.

The Solar Keymark is the main quality label for solar thermal products and is widely spread across the European market and beyond. The Solar Keymark is not the same as CE-mark. The Solar Keymark is a voluntary quality label and CE-mark just attests that the product fulfills minimum legal requirements according to specific European Directives.

A Solar Keymark can only be issued by an empowered "certification body" after the product has been tested by an accredited testing laboratory. The certification bodies are empowered by the CEN Certification Board (CCB). The certification body is the organization responsible for awarding Solar Keymark certificates and the testing laboratory is the organization responsible for all the testing. Solar Keymark certification it is essential that the product tested is a sample taken randomly from the current production or stock by an independent inspector. Furthermore, the production and Quality Management System as implemented at the factory will be checked by an independent inspector on site or under remote factory inspection procedure. Currently it is allowed also collector efficiency tests in a real-life environment. In this aspect it is possible to create efficiency curves and to calculate all values required for a Solar Keymark Certificate by using only the results gained from field-testing. Large flat plate or on-site built vacuum tube collectors, as is typical of solar district heating, benefit from this new option.

The Solar Keymark certification process in order to obtain the Solar Keymark is shown in Fig.2.

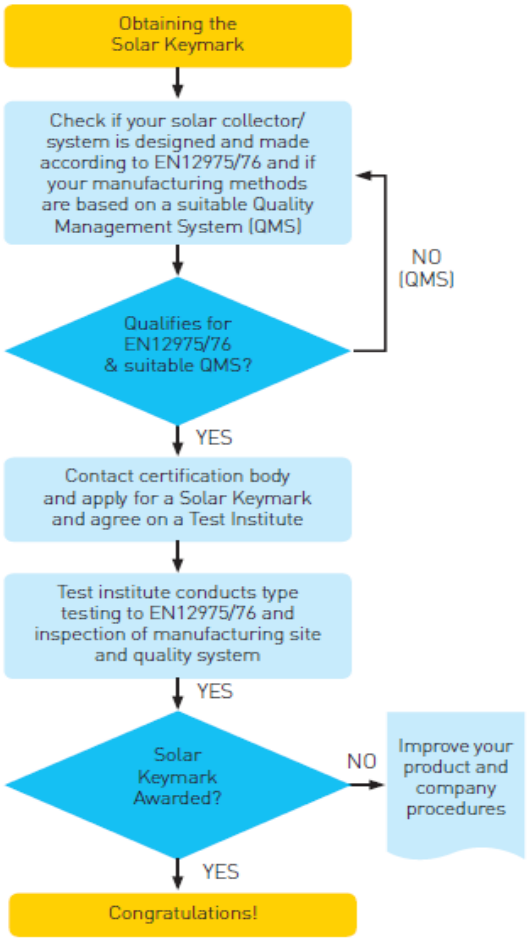

Fig.2 The certification process in order to obtain the Solar Keymark

Currently, 1358 Solar Keymark licenses are granted from which 1109 are attributed to solar thermal collectors, 237 to factory made and custom built solar thermal systems and 12 are attributed to solar water heater and solar combistores and controllers (Solar Keymark, 2020).

4. European Legislation on solar thermal systems

The EU legislation on Ecodesign and Energy Labelling aim at improving the energy efficiency of products, and providing information on product's efficiency to consumers. It helps orientating the choices of informed consumers, and eliminate the least performing products from the market, contributing to the EU's 2020 energy efficiency objective.

The Ecodesign Directive provides consistent EU-wide rules for improving the environmental performance of products, such as household appliances, information and communication technologies or engineering. The Directive sets out minimum mandatory requirements for the energy efficiency of these products. The Energy Labelling Directive complements those Ecodesign requirements with obligations regarding consumer information, namely by the use of energy labels indicating the efficiency of the product or package, besides additional relevant information to the market and consumers.

More specifically EU Directive 92/75/EC established an energy consumption labelling scheme. The directive was implemented by several other directives thus most white goods, light bulb packaging and cars must have an EU Energy Label clearly displayed when offered for sale or rent. The energy efficiency of the appliance is rated in terms of a set of energy efficiency classes from A to G on the label, A being the most energy efficient, G the least efficient. The labels also give other useful information to the customer as they choose between various models. The information should also be given in catalogues and included by internet retailers on their websites.

In an attempt to keep up with advances in energy efficiency, A+, A++ and A+++ grades were later introduced for various products; since 2010, a new type of label exists that makes use of pictograms rather than words, to allow manufacturers to use a single label for products sold in different countries. The labelling and eco-design obligations for heaters (LOT1) and water heaters (LOT2) came into force on the 26th September 2015. Directive 92/75/EC was replaced by Directive 2010/30/EU and was again replaced by Regulation 2017/1369/EU from 1 August 2017. Updated labelling requirements are expected to enter into force in 2021.

The Commission Regulation (EU) No 813/2013 (Ecodesign regulation) and the Commission Delegated Regulation (EU) No 811/2013 (Energy labelling regulation) regulate domestic space and combination heaters. Water heaters by the Commission Regulation (EU) No 814/2013 (Ecodesign regulation) and Commission Delegated Regulation (EU) No 812/2013 (Energy labelling regulation). Solar thermal systems and collectors are falling under these regulations. The main purpose of the regulations is to visualize the primary energy consumption of different appliances for different applications. Not only to inform the consumers, but also to provide a legislative tool for continuous reduction of the emissions. The European mechanism for reducing the energy consumptions and CO_2 emissions is a step-by–step increase of the minimum energy class for the products brought to market. Every few years these minimum requirements are adjusted depending the current situation and the available technologies.

The energy labels are separated into at least four categories:

- The appliance's details: according to each appliance, specific details, of the model and its materials.
- Energy class: a colour code associated to a letter (from A to G) that gives an idea of the appliance's electrical consumption.
- Consumption, efficiency, capacity, etc.: this section gives information according to appliance type.
- Noise: the noise emitted by the appliance in decibels.

From 1st January 2019 the registration of space and water heating products in the European Product Registry for Energy Labelling (EPREL) database is compulsory. In this database have to be registered:

- all new products,
- all products placed in the market before the end of 2018 within a 6 month period
- products covered by a delegated act under Energy Labelling regulations
- “solar devices” and other components of a package
- packages, if placed in the market as a package by the manufacturer.

Solar thermal devices are heat generators that can supply up most of water heating needs and supply considerable part of the space heating. They are 100% CO_2 free heating technology, low life cycle costs, high recyclability of materials. Additionally they do not consume energy, hence cannot be applied any product label except for solar water heater, thus the thermosiphon systems with immersion electric heater.

In contrast to most of the traditional systems such as heat pumps, oil or gas boilers, solar thermal systems are

more complex as they usually cannot provide the annual energy demand on their own. Solar thermal systems are usually used together with other appliances. To consider this, the regulations introduced the so-called package label, where the energy efficiency of combinations of heating appliance have to be computed. Of course, such energy efficiency can be computed using dedicated simulation tools considering all specifications of the appliances. For the purpose of legislation it is however not practicable to use such simulation tools. It is therefore mandatory to develop and introduce simple methods such that the efficiency of a system can be computed with simple tools while still providing sufficient correctness of the results. For bigger companies (system houses) offering all parts of a system, simplification is not relevant as they can provide the calculations tools easily for the whole scope of their products. Simplification is however essential for SME who are often combining different appliances from different suppliers. It is common use to mix and install collectors, storages and heat pumps from different suppliers into one system. It is therefore relevant that energy efficiency can be determined with some very simple calculation steps or with a simple tool. The methods that are currently defined in the regulations have shown to be too confusing so that they are not usable. Some studies have also shown that the reliability of the results is not yet satisfactory. The reliability of the results is essential as the energy labelling regulation requires also market surveillance. Products have to be taken form the market and their labelling has to be checked by independent laboratories. To prevent from legal problems it is therefore essential that the calculation methods are unambiguous and reliable.

The current methods have shown to underestimate the performance of solar thermal systems, as they are considered as supplementary heaters contributing with a fixed ratio to the annual energy load. In reality, solar thermal systems easily cover during the summer months the whole energy demand. During the rest of the year, they provide energy anytime the sun is available. The solar thermal system must therefore be considered as primary heater providing CO_2 free energy whenever sun is available. The backup heater or supplementary heater has to provide energy only in the case when solar energy is not sufficiently available. Even if the annual contribution of the backup heater is bigger than the solar contribution it is therefore essential to consider solar thermal as primary energy source.

As an alternative to the current calculation methods, ESTIF has developed the so-called simplified method, which is based on the Gross Solar Yield (GSY) of the collector. The main idea of using the Gross Yield is to base the calculation on the available energy provided by the collector. Using a dedicated simple calculation method the seasonality of the availability is taken into account. In the calculation basis of the method the heat loss of a C-class storage tank with a volume appropriate for the Gross Yield is already considered overall. Thus no storage data are necessary for the calculation. A better or worse label class of the storage tank than the reference class C has a small influence on the result and to keep the method simple it is therefore not taken into account. Moreover there is no need for a detailed consideration of the storage as there are already existing separate requirements for its energy efficiency and it has to be labeled anyway. It is then assumed that the system planner is competent enough to select an appropriate storage type and size. The method proposed by ESTIF will provide simple lookup tables where depending on the number of collectors and the load profile a so called solar device efficiency is determined independently from the backup heater. By multiplying with the energy efficiency of the backup heater, the overall system efficiency is then easily calculated. This simplified method is not only providing a more realistic rating of solar thermal, it is also much more reliable than the current method as it is based on the Gross Solar Yield. This Gross Solar Yield is part of the standard Solar Keymark datasheet and is available for all certified collectors in Europe with very high reliability. As outlined above, this is an important asset in view of the coming market surveillance activities. Main advantage of the proposed method is that it is independent of the backup heater. Thus the same method applies for all backup appliances, meaning that it will be applicable to any future energy providing system, but also for retro-labelling existing systems.

Currently it is available the final version of the review study on Ecodesign and Energy Label regulations for Boilers (Lot 1) and Water Heaters (Lot 2) as it was elaborated by Solar Heat Europe association and other solar experts and presented to European Commission and consultants. All details and preparatory studies are public available at https://www.ecoboiler-review.eu/ and https://www.ecohotwater-review.eu/.

In addition to the Ecodesign and Energy labelling regulations, solar thermal collectors also fall under the construction product regulation CPR (Council Directive 89/106/EEC). As for any other building products it is expected also for heating appliances installed in and on the building that some basic safety requirements are

fulfilled and that specific performance are declared. For solar thermal systems this concerns mainly the collector installed on the building. The requirements with respect to safety and the methodology to provide the declarations of performance are defined in harmonized European standards. The most critical performances that must be declared for a collector are the mechanical resistance to climatic loads (wind, snow, …) and the fire safety classification. Other requirements such as the declaration of the thermal performance, the sound level, the electric safety etc. are easy to be declared for solar thermal collectors. The regulation furthermore requires that a dedicated quality management system must be operational in the production of the collectors to be sure that the declared performance are always guaranteed. Most of these requirements, except for fire safety, are already covered by the Solar Keymark scheme, which is based on the European standards. The main difference between a conventional standard and a harmonized standard are the non-technical constraints: The harmonized standard is a legally binding document and not a technical document issued by a private organization. In the current framework, it is therefore very challenging to elaborate a harmonized standard. For the standard EN 12975, which is intended to become a harmonized collector standard under CPR, the de-harmonization is currently in discussion to de-block the pending revision.

5. Future trends

It is a fact that almost 40% of EU's overall energy consumption accounts to domestic heating systems for hot water production and space heating. These systems are becoming more and more hybrid systems including different technologies using intelligent and interacting controllers. New technologies such as home batteries or other applications such as domestic cooling will further accentuate this development.

The standardization of all these appliances is up to now predominately based on individual single appliance testing under well-defined stable boundary conditions. This individual approach induced a series of evident problems. Additionally, the series of standards in the framework of the energy performance of buildings (e.g. EN 15316) is addressing combined / hybrid systems, although limited to the overall effect on the building energy performance and lacking accurate methods for the complex control strategies and interactions. The European Energy labelling and Eco-design (Lot 1 and Lot 2), approach the hybrid issue with the so called ‘Package label’, that is practical for its purpose, but lacks the desired accuracy one would expect from a product standard. Moreover, adding new appliances to an existing system cannot be handled in an appropriate manner. Due to the lack of fitting appropriate standards for hybrid systems ErP regulations lack options for adequate surveillance activities.

There is a clear need for a new generation of energy standards aimed at hybrid systems at the level of product standards; accurate, product performance comparison, harmonized reference conditions and practical in its implementation. In this aspect it is evident that there is a need for the elaboration and development of a new generation of standards for hybrid systems.

One other aspect is related to a new International Energy Agency (IEA) Task for solar heat for industrial processes, namely "Solar Process Heat - IEA Joint SHC Task 64/ SolarPACES Task IV" has already been activated in order to help solar technologies be and also be recognized as a reliable part of process heat supply systems. In this Task is included a dedicated Subtask D „Standardization and Certification" in order to implement the necessary actions for the enforcement of solar process heat competitiveness through support to the standardization and certification issues.

Concluding, legislation in Europe is increasingly putting a significant requirement of testing and paper-work on solar market but on the same time offers a common European wide legislation framework and supports the penetration of the market by solar systems. Through the Solar Keymark certification scheme, cross border barriers are reduced. A set of sound ENs for solar thermal systems exists, supporting both legislation and certification and a well-functioning mechanism is available for the constant development of standards to keep up with new legal issues and needs.

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