Executive summary

ISO/TC 180 prepares International Standards for the development, testing, installation and servicing of equipment and systems related to solar thermal energy conversion. The committee's major activity is in relation to thermal applications for water and space heating. With the markets applying solar thermal energy conversion technology more and more in the application field of process heat and industry the norms and standards are relevant here too. For field installations in the context of district heating networks, industrial heat preparation and to the thermal part, for solar thermal electricity generation as well, some of the standards develop are significant. The committee also prepares standards on the instrumentation and procedures used for measuring solar energy and solar measurement.

ISO/TC 180’s aims in regard to international standards in this area are:

- To facilitate international trade in solar heating equipment;
- To provide means of assessment of products with regard to their performance and safety; and
- To facilitate accurate measurement of solar resources.

The committee acts in liaison with IEC/TC 82 Solar photovoltaic energy systems, the World Meteorological Organization, IEC/TC 117 Solar thermal electric plants and The International Energy Agency’s Solar Heating and Cooling Technology Collaboration Program. The Standards are developed for a market of approximately $US 24 billion per annum.

The technological aspects of solar energy use for thermal or energy conversion processes have been known for over a hundred years. The concern for conservation of energy resources since the 1970s and the consequent growth of solar heating industries led many countries to begin work on solar heating standards. The increased global understanding of the very adverse global environmental effects of greenhouse pollution from combustion of fossil fuels on a large scale has also stimulated increased use of solar energy as a substitute for fossil fuel-based energy. Many Governments worldwide are actively supporting the market for solar heating systems as a cost-effective means to reduce greenhouse pollution, increase energy security and develop sustainable industries. (At government level, solar is often considered in conjunction with other renewables, e.g. wind, wave and hydroelectric power). Transparency over the technical and economic potential of products is essential for a sustainable market development.

Solar energy is essentially a widely distributed energy resource, and this delivers inherent advantages in terms of energy security as well as inherent constraints on its applications. The most widely used active solar heating systems are those used for water heating. The economics of the use of fossil fuels have previously been such that solar energy systems have not had a strong advantage based on fuel costs. With the increasing understanding that a large proportion of energy is used as heat worldwide, solar systems have become a more attractive means of further reducing fossil fuels emissions. With changing boundaries conditions in many political systems around the world the advantages of solar thermal energy conversion become more visible.

International trade in solar energy related equipment has rapidly increased from a low base since 2000, and there is a significant but highly specialized interest in the description and measurement of solar energy, as part of the broader study of climatic systems.

ISO/TC 180's current areas of priority interest may be summarized as:

(a) *Communication of information* – standards for uniformity of terminology and climatic data, including instrumentation standards and measurement procedures, with particular reference to resource evaluation, monitoring of test conditions and traceability of calibration.

(b) *Uniformity of test methods* – standard test methods to promote data exchange between different test sites, and to facilitate trade.
(c) ** Provision of test methods** and where appropriate, specifications for materials for solar energy applications, as an aid to designers, consumers and government agencies providing support for market development.

International standards support the international trade in solar water and air heaters by providing a means for harmonization of performance and other requirements across international borders. This limits the costs incurred by manufacturers in accessing new markets and allows consumers a wider and more informed choice of complying products.

The ISO technical committee on solar heating, ISO/TC 180, has been operating since 1983. During that time it has produced 16 standards documents, four of which relate to thermal performance of collectors or systems. Many of those documents were produced in the 1990s and are now being updated. New trends/technologies (e.g. digitalization, hybridization of heating solutions, new business models, CO₂ pricing) are taking into account in the revisions process.
1 Introduction

1.1 ISO technical committees and business planning

The extension of formal business planning to ISO Technical Committees (ISO/TCs) is an important measure which forms part of a major review of business. The aim is to align the ISO work programme with expressed business environment needs and trends and to allow ISO/TCs to prioritize among different projects, to identify the benefits expected from the availability of International Standards, and to ensure adequate resources for projects throughout their development.

1.2 International standardization and the role of ISO

The foremost aim of international standardization is to facilitate the exchange of goods and services through the elimination of technical barriers to trade.

Three bodies are responsible for the planning, development and adoption of International Standards: ISO (International Organization for Standardization) is responsible for all sectors excluding Electrotechnical, which is the responsibility of IEC (International Electrotechnical Committee), and most of the Telecommunications Technologies, which are largely the responsibility of ITU (International Telecommunication Union).

ISO is a legal association, the members of which are the National Standards Bodies (NSBs) of some 164 countries (organizations representing social and economic interests at the international level), supported by a Central Secretariat based in Geneva, Switzerland.

The principal deliverable of ISO is the International Standard. An International Standard embodies the essential principles of global openness and transparency, consensus and technical coherence. These are safeguarded through its development in an ISO Technical Committee (ISO/TC), representative of all interested parties, supported by a public comment phase (the ISO Technical Enquiry). ISO and its Technical Committees are also able to offer the ISO Technical Specification (ISO/TS), the ISO Public Available Specification (ISO/PAS) and the ISO Technical Report (ISO/TR) as solutions to market needs. These ISO products represent lower levels of consensus and have therefore not the same status as an International Standard.

ISO offers also the International Workshop Agreement (IWA) as a deliverable which aims to bridge the gap between the activities of consortia and the formal process of standardization represented by ISO and its national members. An important distinction is that the IWA is developed by ISO workshops and fora, comprising only participants with direct interest, and so it is not accorded the status of an International Standard.

2 Business Environment of the ISO/TC 180

2.1 Description of the Business Environment

The following political, economic, technical, regulatory, legal and social dynamics describe the business environment of the industry sector, products, materials, disciplines or practices related to the scope of this ISO/TC, and they may significantly influence how the relevant standards development processes are conducted and the content of the resulting standards:

Solar energy is seen as an increasingly valuable source of energy. Its value is perceived at present as a secure, non-polluting, environmentally friendly heat source, and as a heat source which is increasingly economically competitive.
Fossil fuel-based energy instrumentalities (gas and electricity supply) increasingly see the use of solar heating as a means of limiting their rate of use of fossil fuels, through demand side management. This is increasingly so as governments undertake to reduce emission of atmospheric contaminants from combustion of fossil fuels.

With the increasing use of solar water heaters and the realization that they are amongst the most cost-effective renewable energy technologies available, many governments are providing support to increase sales of solar water heaters. The reasons for provision of this support vary, but in most cases they include:

- **Industry development:** There are greater economic benefits arising from the sales and installation of solar heating systems than in using conventional energy fuelled heaters. Investment in labour intensive products that save costs in capital intensive industries leads to greater economic benefits spread wider across the community.

- **Security of energy service:** With a solar heater, availability of heat is less likely to be interrupted by disruption to conventional energy supplies.

- **Cost savings:** Use of solar heaters will result in lower running costs which, in almost all situations, will pay back any additional capital investment within a few years. Internalization of CO2 pricing and trends of reduced subsidies for fossil fuel foster this trend recently.

- **Reductions in greenhouse pollution:** The installation of a solar heating system has the potential to halve the greenhouse pollution associated with heating over most of the world.

Interest in the efficiency and reliability of solar energy conversion/utilization systems has recently increased in the medium to long term as government support programs and consumers target purchase of more cost-effective products.

Development of markets in regional areas is driven by a range of factors and consequently products have different regional characteristics. In many regions solar products are provided with integrated back up boosting to provide heat at times of low solar radiation. These types of hybrid equipment are covered in some system performance standards. Combinations of different renewables can also vary in the level of integration. The activation of solar heat as a heat source for heat pumps for example is a deeply integrating trend another coupling is to use Solar Thermal to re-charge ground heat storages and bore holes. PVT as technological integration of photovoltaics and solar thermal energy conversion is another recently crowing example. Applications rising for solar thermal are as well in connection with district heating. High temperature applications of heat for example to drive chillers for air conditioning is an application field continuing being challenging.

This wide variation in product types and the high market growth rate drives the requirement for more widely agreed testing protocols to meet the need for exchange of data obtained on a uniform, fair and comparable basis.

Currently ISO/TC 180 has not included recycling of solar equipment at end of service life, however, some interest has been shown in this area and so it will be included when resources become available.
2.2 Quantitative Indicators of the Business Environment

According to the International Energy Agency Solar Heating and Cooling Program\(^1\), the largest market is in China, which is dominated by evacuated tube collectors. The USA has the largest stock of unglazed\(^2\) solar heaters mainly used for heating swimming pools.

PV technology has shown a significant increase in capacity over the last years and has thus surpassed Solar Thermal Heat as the solar technology with the highest operational capacity: The global Solar Thermal Heat capacity in 2019 figures at 479 GWth (as compared to 435 GWth in 2014), while PV capacity totals around 672 GWth (2014: 227 GWth). Solar Thermal Power globally remains rather low level, but has a positive growth at 6 GWth (2014: 5 GWth).

There are a range of drivers for these markets. For example, in China the increase in use of solar water heaters is often to meet increases in living standards in areas of insecure fossil fuel supply. Innovative marketing and government support programs in Australia and New Zealand together with public environmental consciousness have succeeded in expanding sales of solar water heater products.


\(^{2}\) “unglazed” is outdated, it means WISC = Wind and infrared sensitive collectors according to ISO 9488
Share of the total installed capacity in operation (glazed and unglazed\textsuperscript{2} water and air collectors) by economic region in 2018
(Source: Solar Heat World Wide 2020)

According to Solar Heat World Wide 2020, the 2018 collector yield of all water-based solar thermal systems combined corresponds to a carbon dioxide reduction of 133.5 million tonnes (2014: 116.4 million tonnes). The same report estimates the number of jobs in the fields of production, installation and maintenance of solar thermal systems at 650,000 for the year 2018 (2014: 730,000). The worldwide turnover of the solar thermal industry is estimated at US$ 16.9 billion.

There are a number of issues that will impact upon the need and use of standards in the immediate future. Solar heating products and components must meet requirements for reliable and durable performance to fulfill the needs of Government sponsored support programs.

ISO/TC 180 standards are used in many countries including the US, Europe, Central and South America, Africa, Asia, Australia, and are the basis for many subsidy and certification schemes such as Solar Keymark, SRCC, SHAMCI.

Furthermore, there is an increasing awareness about the potential for CSP technologies e.g. in electricity generation and process heat applications. Concentrating collectors are as one of the technical products for solar thermal energy conversion therefore explicitly included in the ISO standards set. Hereby a close liaison with IEC/ TC 117 is essential to avoid confusion for the market participants.

3 Benefits expected from the work of the ISO/TC 180

ISO/TC 180's current areas of priority interest will provide the following outcomes:

(a) **Communication of information** – standards for climatic data, including instrumentation standards and measurement procedures, with particular reference to resource evaluation, and monitoring of test conditions.

(b) **Uniformity of test methods** – standard test methods to promote data exchange between different test sites, and to facilitate trade.

(c) **Provision of test methods**, and where appropriate, specifications for materials for solar energy applications, as an aid to designers.
It is ISO/TC 180's policy to direct its efforts primarily towards preparation of test methods, rather than performance specifications, as it is considered that any ISO specification of product performance would only serve to inhibit development of new products.

4 Representation and participation in the ISO/TC 180

4.1 Membership

Countries/ISO member bodies that are P and O members of the committee

4.2 Analysis of the participation

The resources available to ISO/TC 180 have remained static since its formation. These resources are unlikely to expand in the near future.

Accordingly, ISO/TC 180 will make more productive use of existing resources, such as seeking to gain additional project editors from among those P-members not currently holding Secretariat responsibilities and seeking more input from government and industry in areas of high market growth.

A point of concern has lately been the fact that few industry-based delegates attend meetings of TC 180, (compared with researchers). It is expected that the P-members of TC 180, in forming delegations and in handling ISO/TC 180 work, will attempt to get a suitable balance between the interests of research organizations, and those of industry. Holding the meetings predominantly online, is hoped for to increase participations.

5 Objectives of the ISO/TC and strategies for their achievement

5.1 Defined objectives of the ISO/TC 180

ISO/TC 180 has established its general objectives for standards in its fields of activity and these provide a basis against which new work proposals should be judged.

The allocation of subcommittee secretariats, and consequently the work items related to the subcommittees has been generally a result of the specific fields of technical expertise available to the member body providing the secretariat. In this situation there has been a tendency for work items to be undertaken partially on the basis of the subcommittee Secretariat's interest in the subject, rather than the broad general support for the work. However, with only a few exceptions, all work items are slowly showing progress. Those that are not showing progress will be referred to the subcommittee Secretariats concerned for a review of their viability.

To achieve the defined objectives, ISO/TC 180 will maintain its existing standards and develop new standards within the existing ISO Directives timescales.

Many of the existing standards are currently being revised to ensure that the standards are suitable for products currently manufactured for export and import and that performance in climates appropriate to developing markets can be assessed using these standards.

5.2 Identified strategies to achieve the ISO/TC's defined objectives

The strategies that ISO/TC180 has adopted, and will continue to achieve the objectives are to:
1. Encourage active involvement from governments and industry in areas with rapidly developing markets. These countries are being encouraged to become P members and actively participate in the work programme.

2. Continue to hold meetings in conjunction with CEN/TC 312, whenever possible, in order to better align ISO standards and CEN test methods. But also over substitute by offer this to Committees from all parts of the world like India, Pan-America, Africa, Arabia.

3. Encourage Subcommittee meetings and TC meetings to be held adjacent to International solar energy conferences in order to make it more cost-effective for delegations to attend and contribute to meetings (if in person meetings). It is imperative for non-European members to be present to work with other countries which are not members of the European Union, (i.e. USA, China, Israel and South Africa), to ensure issues of regional relevance are given due consideration rather than accepting standards, which in some cases could result in the introduction of technical barriers to trade.

4. Encourage further engagement with the IEA Solar Heating and Cooling Program, especially a follow-up task to TASK 57: Solar Standards and Certification as it is planned to hold a task for “Quality Assurances 4.0; Standards and New Markets”

5. Encourage greater involvement in working meetings (TC, SC and WG) by facilitating the use of electronic tools to allow input from experts not able to physically attend the meetings. To achieve this we will request that web connections and speakerphones be available in all meeting facilities used. It is assumed that ISO meetings will predominantly stay online meetings.

6 Factors affecting completion and implementation of the ISO/TC 180 work programme

As most of the work carried out by ISO/TC 180 is undertaken by subcommittees, the leadership of the Subcommittee Secretariat and the ability of the Secretariat to resource the leadership of the work programme is vital to progressing work items in a timely manner.

7 Structure, current projects and publications of the ISO/TC 180

Information on ISO online

This link provides access to the TC page on ISO website. The following information can be accessed through this link:

- Details of the Secretariat, Chair, ISO Technical Programme Manager
- Scope of the TC
- Published standards and standards under development
- Structure: Subcommittees and Working Groups
- Liaisons

Reference information

Glossary of terms and abbreviations used in ISO/TC Business Plans

General information on the principles of ISO's technical work