EXECUTIVE SUMMARY

Increasing energy demand and climate change have significantly affected global practices and use of energy resources in the built environment. To save energy, improve energy efficiency and combat climate change, practical tools in the form of standards are needed. Developing such tools is where ISO can help. Many of these standards define methods of test, analysis, and specification of materials. Global consensus on such methods and specifications allows meaningful comparisons. This is vital in dealing with environmental and climate change problems – which do not respect borders – and provide the basis for international cooperation to solve such problems.

Buildings are the biggest energy consumer and CO2 polluter, yet hardly any other sector in society has a greater prospect for energy saving as the building sector. In many countries space heating and cooling are the main “consumers” of energy. For a healthy indoor climate, the buildings must be well insulated, well ventilated and moisture safe. To meet these goals well established design and evaluation methods are needed. Apart from dwellings and commercial buildings the industrial built environment is also a significant contributor to energy consumption and greenhouse gas emissions.

The initiatives taken by ISO at the Climate Technology Initiative (CTI) conference in Kyoto stressed the need for practical tools in the form of standards to address these problems. Since its inception in 1975, this is exactly what ISO/TC 163 has been achieving; tools that can be used to design, construct and evaluate energy efficient buildings and facilities and to retrofit existing installations. The overall aim is to reduce our dependency on non-renewable resources and to reduce the emission of harmful substances to the air, to bodies of water, and to the water table.

To achieve this, methods are needed for the evaluation of the energy performance of complete facilities, buildings, their component parts and associated materials. In order to accomplish energy efficiency, we require construction assemblies, materials, products and methods that effectively contribute to improvement of thermal performance. In this area, standards dealing with the design and evaluation of materials, components and systems play an important role, as well as standards that can be used to check compliance with performance requirements at various levels, from materials to methods to complete buildings and facilities. These performance requirements may either be expressed in trade or building documents or in national codes and regulations. It is also important within buildings and installations to use materials that effectively contribute to the thermal performance of related equipment. These include central heating plants, boilers, space heating appliances and air-conditioning units. To the extent possible, the methods referred to in the above specifications shall be internationally standardized horizontal / general test and / or calculation methods. Reference to these can be made in trade documents.

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

2.1 Description of the Business Environment

ISO/TC163 was formed in 1975 by ISO TMB with the scope and defined purpose of improving energy use and thermal performance of civil and industrial facilities within the built environment. The focus at the time was solely on the application and use of materials to achieve these goals. Subsequently, as research and technology grew, the scope of the TC was formally revised to recognize that other parameters and interactions within the built environment, additional to materials, could strongly influence the accomplishment of these goals.

The scope of the built environment to which TC163 addresses its work however remains the same as in 1975: the civil and industrial built environments. These environments are the largest consumers of energy within society, and the largest contributors to greenhouse gas emissions. They are the areas to which ISO/TC163 addresses its standardization work in the accomplishment of its goals.

2.2 Quantitative Indicators 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:

During the Earth Summit in Rio de Janeiro in 1992, the Business Council for Sustainable Development (BCSD) emphasized that “business and industry needs tools to help measure environmental performance, and develop powerful environmental management techniques”. On 4 December 1997, ISO signed a partnership agreement with the United Nations-backed CTI (Climate Change Initiative) which aims to combat global climate change caused by industrial pollution and economic development. In a message at the Kyoto conference, the ISO Secretary General said: “It would be difficult now to find a voice not in favour of positive action on environmental issues like climate change, but business and industry need more than calls for action. They need practical tools, including standards, for doing the job. Developing such tools is where ISO can help. Many of these standards define methods of test and analysis. Global consensus on such methods allows meaningful comparisons. This is vital in dealing with environmental and climate change problems – which do not respect boarders – and also provides the basis for international cooperation to solve such problems.”

Basically, all countries in the world have signed the Paris Agreement, which entered into force in November 2016. The most important objective is to keep global warming below two degrees. Preferably it should be below 1.5 degrees. Every five years, a review is made whether the countries’ ambition is sufficient to achieve the objective.

Under the Kyoto protocol, the EU committed itself to reduce the emissions of greenhouse gases (GHG) by 8 % in the period 2008 to 2012, compared to the level in 1990. With the Paris Agreement, the EU has raised its ambition to reduce emissions. They should decrease by at least 40% from 1990 levels, by the year 2030. The Commission is investigating a new target for 2030 with an emission reduction of 50-55%.
The emissions of carbon dioxide (CO2), the most important greenhouse gas, are mostly linked to the combustion of fossil fuels. Therefore, increases in energy efficiency are expected to contribute considerably to the achievement of the GHG emission-reduction goals.

In the DIRECTIVE 2002/91/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 16 December 2002 on the Energy Performance of Buildings (EPBD), the importance of the energy use in the building sector is underlined. The EC Directive gives several reasons for improving the energy performance of buildings: The residential and tertiary sector is expanding, the major part of which is buildings and accounts for more than 40 % of final energy consumption in the Community. This trend is bound to increase energy consumption and hence also carbon dioxide emissions unless action is taken. On 19 May 2010 a recast of the 2002 Energy Performance of Buildings Directive was adopted by the European Parliament and the Council of the European Union. This strengthened the energy performance requirements to clarify and streamline some of the provisions from the 2002 Directive. One major item was that by 2020 new buildings in the EU will have to consume 'nearly zero' energy and the energy will be 'to a very large extent' from renewable sources.

In regard to construction products, measures in the strengthened EPBD requires construction works and their heating, cooling and ventilation installations to be designed and built in such a way that the amount of energy required when in use will be low.

The EPBD measures further seek to improve the energy performance of buildings by taking into account climatic conditions, local conditions, including indoor climate environment, location of the occupants and cost-effectiveness. These measures should not contravene other essential requirements such as accessibility, prudence and the intended use of the building or facility.

“A revised version of the EPBD was published in 2018 (Directive 2018/844/EU). It gives a stronger role of the EPB standards:

From the amended (2018) text of EPBD Annex 1, point 1:


Although the new EPBD does not force the Member States to apply the set of EPB standards, the obligation to describe the national calculation methodology following the national annexes of the overarching standards will push the Member States to explain where and why they deviate from these standards. This will lead to an increased recognition and promotion of the set of EPB standards across the Member States and will have a positive impact on the implementation of the Directive.
Five ‘overarching’ EPB standards explicitly mentioned in the new EPBD:
The EPBD lists five EPB standards explicitly as can be read in the quote above. All these five standards (ISO 52000-1, 52003-1, 52010-1, 52016-1 and 52018-1) have been developed by TC 163 (incl. SC2; and in cooperation with CEN and TC 205 where applicable) and have in common that each of these describes an important step in the assessment of the energy performance of building."

International standardization in the field of light and lighting is driven by the International Commission on Illumination (CIE), ISO/TC 274, IEC/TC 34 and CEN/TC 169. Cooperation has been established with CIE and ISO/TC 274 to make it possible to apply the same products and the same design in different countries even under consideration of different national lighting habits based on and in accordance with ISO/CIE standards.

2.3 Quantitative Indicators of the Business Environment

The following list of quantitative indicators describes the business environment to provide adequate information to support actions of the ISO/TC:

Hardly any other sector has such greater prospects in energy saving as the building sector. In industrial countries space heating and cooling are the main “consumers” of energy (globally mainly fossil fuel is used). In the early years of the 21st century, the energy use in the built environment in the European Union (EU) accounted for more than 40 % of the total energy use. This means that buildings, in contrast to popular belief, contributed more greenhouse gases than traffic (~31 %) and industry (~28 %). Buildings are the biggest energy consumer and CO2 polluter. Here the large existing energy stock must also not be forgotten. Stopping this energy waste will save energy costs, conserve non-renewable resources and create jobs. If buildings undergoing modernization were brought up to today’s energy efficiency levels, some 400 million tons of CO2 emissions could be saved annually – in Europe alone.

Cost-effective technologies exist that could reduce the energy use in buildings considerably. This would help to minimize greenhouse gas emissions. One of the greatest opportunities in conserving energy is to reduce heat transfer through the building envelope (walls, roofs, floors, windows, etc.) by improved thermal performance (better insulation, better windows and air tightness). These measures are suitable for both new and existing buildings and have a strong linkage to a sustainable development. There is also a great opportunity to reduce cooling demand by improved thermal insulation, especially in attics and roofs, and by using different solar shading devices.

Other aspects are related to comfort and economy. By reducing the need for heating and cooling the annual cost of running the building is lowered. The cooling demand in moderate and warm climates can be dramatically reduced with an optimal insulation strategy. At the same time the hours of discomfort can be reduced.

For a healthy indoor climate, the buildings must be well insulated, well ventilated and moisture safe. To meet these goals well established design methods are needed. In Japan, by contrast, according to the Ministry of Economy, Trade and Industry "Energy supply-and demand actual result in 2002 fiscal year", the corresponding figures are buildings 27 %, traffic 24 % and industry 49 % and focus on the industrial built environment in Japan would be more productive.
3. BENEFITS EXPECTED FROM THE WORK OF THE ISO/TC

The initiatives taken by ISO at the Climate Technology Initiative (CTI) conference in Kyoto stresses the needs for practical tools in the form of standards. This is exactly what ISO/TC 163 is aiming at; tools that can be used to design and construct or retrofit energy efficient buildings and installations. The overall aim for this is to reduce our dependency of non-renewable resources and to reduce the emission of harmful substances to the air, lakes, streams, rivers and oceans, and into the ground. In order to arrive at this goal, ISO/TC 163 has produced and will produce sets of standards to reference by which performance requirements can be expressed at various levels, from materials to methods to complete buildings and facilities. These performance requirements may either be expressed in trade or building documents or in national codes and regulations. In recent years considerable effort has been made in many countries to improve the energy efficiency of buildings. In some countries, the requirements in the building and national codes have been made more stringent several times over the last decades. Nor can the focus remain on new buildings and facilities. Considering the environmental effects of existing buildings and facilities, methods and procedures for the evaluation of the energy performance of existing installations must be developed.

3.1 Trends

There is a trend to set limits for the total energy use of a building, based on one overall calculation procedure. ISO/TC 163 is the natural committee to take responsibility for a standard calculation procedure for the overall energy use of buildings. The first version of (EN) ISO 13790 (2004) (Energy performance of buildings -Calculation of energy use for space heating and cooling) was the first in a consistent and successful line of standards providing a calculation method for the heating and cooling needs of buildings. The most recent version is (EN) ISO 52016-1:2017 (Energy performance of buildings -- Energy needs for heating and cooling, internal temperatures and sensible and latent heat loads - Part 1: Calculation procedures), one of the core standards of the EPB set of standards, that are described further on. The next step will be a closer relation with building simulation, by gradually moving towards performance-based standards instead of a fully described and prescribed set of formulae, and by more attention to dynamic interactions between different technologies.

On a global level it is also of interest to know the amount of CO2 emitted from a building. It is therefore important that the standards produced by ISO/TC 163 give sufficient information on the different energy wares used or needed so that the emission of CO2, etc. can be calculated. Further, in addition to requirements on the total energy use of buildings, additional requirements on specific aspects are often given on e.g.:

- Heat transfer through the building envelope;
- Ventilation losses;
- Performance of space heating, hot water supply and drainage;
- Performance of ventilation and air conditioning systems;
- Solar gains and loads;
- Performance of lighting;
- Energy use for heating, cooling, hot water, lighting, etc.
- The energy requirements may also deal with comfort aspects such as:
  - Thermal comfort (internal temperature and humidity);
  - Indoor air quality;
  - Visual comfort.
Methods are needed for the evaluation of the energy performance of existing buildings. The methods, by which complete buildings and parts of buildings or installations can be assessed, can also be used to check the results of energy-efficiency measures. However, for existing buildings more than information about the energy performance is needed – the owner also needs advice on how to improve the building and its installations.

To arrive at energy efficient buildings…construction materials, methods, component parts and products that effectively contribute to the thermal performance of the building and its installations must be used. To accomplish this, standards dealing with the design and evaluation of materials, components and systems play an important role. Also, in order to avoid barriers to trade, comparable specifications, as well as test and calculation methods, have to be achieved not only for one product applied under different climatic conditions but also for product families.

It is also important to use materials that effectively enhance the thermal performance of such equipment as central heating plants, space heating appliances, air-conditioning units, and equipment in industrial plants. To enhance that goal, ISO/TC 163 elaborates specifications for industrial thermal insulating materials and systems, to which reference can be made in trade documents.

The methods referred to in the above specifications shall as far as possible be horizontal/general test and/or calculation methods. ISO/TC 163/SC 1, Test and measurement methods, and ISO/TC 163/SC 2, Calculation methods, are encouraged to elaborate horizontal methods that could be applied regardless of the material(s) used both within TC 163 and by others preparing specifications. By using the same methods and by reporting properties in a harmonized way, fair competition on the marketplace is encouraged. Material properties or product information to be used as input for calculations also must be comparable and suited for that purpose.

In order to enable the market to develop or evaluate and choose materials, products and systems that reduce energy and to arrive at optimum-performing technical solutions, the tools developed by ISO/TC 163 are needed.

Another important aspect that should be taken into account is the market for technical consultants and persons making energy audits or energy declarations. This further underlines the need for internationally-accepted standards in the areas dealt with by ISO/TC 163.

Finally, as the reduction of energy use is also a political matter, the exchange of comparable data within and between nations is of interest. Here the use of standard methods play an important role, e.g. when collecting and comparing statistical data on energy use of buildings in different countries. A joint working group with ISO TC 205, “Energy performance of buildings using holistic approach”, meet the demands using a systems and holistic approach to today’s ever more complex buildings. It also meets the demands for nearly ‘nearly zero’ energy buildings. The JWG also promulgates internationally agreed terms, definitions and procedures. These are used to compare minimum energy-performance requirements between countries, or to understand and compare data gathered on measured energy use of buildings. The JWG’s work ensure maximum consistency among standards and new or existing work items from both committees concerning energy efficiency and energy performance of buildings, including technical systems. In addition, the JWG prepare proposals for the development of an ISO vision on energy performance of buildings for discussion in relevant technical and higher-level ISO committees.
A Joint Advisory Group between ISO/TC 163 205 and ISO/TC 205 163 on the coordination of the ISO 52000 family of EPB standards has been set up for an initial term of 3 years (autumn 2018 – autumn 2021), in which also CEN/TC 371 is represented.

4. REPRESENTATION AND PARTICIPATION IN THE ISO/TC

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

4.2 Analysis of the participation

27-member bodies participate in the work of ISO/TC 163 as P members. Six of the P members are newly industrialized countries. ISO/TC 163 also has 33 O members of which 16 are newly industrialized countries.

At the founding of the committee in 1975, most of the P members were developed countries with a colder climate. Now as the awareness of the need to reduce the use of energy in both cold and warm areas grows, the number of active members from developing countries, and countries with economies in transition, continues to grow.

The international organizations in liaison with ISO/TC 163 are mainly research organizations and organizations representing producers of materials and products. These have a profound influence on the thermal performance of a buildings, civil engineering works and industrial installations.

As described above, the work of ISO/TC 163 is linked to the national building regulations or energy codes as well as to existing buildings. A more active participation of government representatives, property owners, facility managers and consumer organizations therefore would be desired. Hopefully, these key persons are represented on the national mirror committees but very few attend the meetings of ISO/TC 163. The same applies to designers and technical consultants.

5. OBJECTIVES OF THE ISO/TC AND STRATEGIES FOR THEIR ACHIEVEMENT

5.1 Defined objectives of the ISO/TC

ISO/TC 163 has or is preparing standards for the construction sector in the form of:

- test and calculation methods related to heat transfer;
- test and calculation methods related to moisture transfer;
- calculation of energy use in buildings;
- on site methods for testing air tightness and thermal performance of buildings and building components;
- input data for calculations, including material properties and climatic data;
- specifications for thermal insulation materials, products and systems for building application;
- specifications for thermal insulation materials, products and systems for industrial application;
- test and calculation methods related to these specifications;
- conformity criteria;
- Terminology related to the above-mentioned topics.
ISO/TC 163 prepares standards which address definitions, terminology and test methods for whole buildings.
ISO/TC163/SC1 prepares standards which address test methods for materials, components and elements of buildings.
ISO/TC163/SC2 prepares standards which address calculation methods for materials, components and elements of buildings, and whole buildings.
ISO/TC163/SC3 prepares standards which address specification and testing of thermal insulations and systems

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

Originally, priority was given to terminology and to heat and moisture test and calculation methods. The need for a harmonized terminology was recognized early at the first meeting of ISO/TC 163. The terms and symbols agreed have since been used in the other standards produced by the committee. The terminology standards produced by ISO/TC 163 have also been adopted as European Standards.

ISO/TC 163 has produced several test methods by which the thermal (energy) and hydrothermal performance of a wide range of materials, products and components or elements can be established. The test and calculation methods so far elaborated by ISO/TC 163 are material independent and are to be called up when specifying thermal or hydrothermal properties of materials, products, or building components(elements). There are many reasons for the use of general or horizontal standards. Correctly applied they give comparable properties which can be used when comparing materials and products in trade and design. This in turn leads to more and fair competition on the market and hopefully cost effectiveness.

ISO/TC 163 has also standardized some in-situ methods by which complete buildings or building elements (such as walls, roofs, windows, etc.) can be tested.

When it comes to complete buildings it is in most cases more realistic to calculate the energy performance. A series of standards to accomplish that purpose have been published or are in final stages. Some other calculation methods for building products and components/elements may be alternatives to the more expensive testing, e.g. the calculation of the thermal transmittance of windows is an alternative to hot box testing.

As a complement to the calculation methods standards for input data have been worked out, dealing with e.g. climatic data and tabulated hydrothermal properties for common building materials.

The work in ISO/TC 163 has also resulted in specifications for insulation materials/products and systems for both building and industrial applications.

Energy performance levels for buildings are governed by national authorities. Consequently, ISO/TC 163 has worked out standards with stated principles on how to express thermal performance and energy use of buildings and principles for energy declaration of buildings. A correct evaluation of the energy status of a building is one of the most crucial factors for a total environmental declaration of a building.

When designing healthy and sustainable buildings, the interaction between the building envelope, the installations, the activities in the building, etc. must be considered. In this connection it is important to define the (system) boundaries between the building, the several types of installations, the activities in the building as well as the energy supply systems. When dealing with standards related to the energy performance of a complete building,
cooperation with other technical committees is essential. ISO/TC 163 at present liaises with nine other ISO committees. ISO/TC 163 also cooperates, since many years, closely with CEN/TC 89, Thermal performance of buildings and building components. Preferably, the same system of standards should be arrived at in Europe and the rest of the world. And indeed, many of the calculation methods are the products of this cooperation and have been published as EN ISO standards and continue to be revised in close cooperation. In addition, close cooperation has been established with CEN/TC 371 on the overall energy performance of buildings, especially on the (EN) ISO 52000 family of standards. Standards on thermal insulation materials and products will be adopted by ISO/TC 163 either directly or with minor modifications.

In accordance with the Vienna Agreement, revisions of the EN ISO standards are undertaken by ISO/TC 163 or its sub-committees.

As explained above ISO/TC 163 has three subcommittees. The test and calculation methods elaborated by ISO/TC 163 are general methods and can be used as normative references by ISO/TC 163 and other TC's and subcommittees. e.g.: The hydrothermal test methods elaborated by ISO/TC 163 are to be called up in product standards prepared by other ISO committees, especially by committees dealing with building products or building components. This was an ISO/ TC163 objective from the beginning and it was natural to set up a subcommittee for test methods and another for calculation methods. For many years there were also two subcommittees for thermal insulating products, one for thermal insulating products for building applications and another for thermal insulating products for industrial applications. However, ISO/TC 163 decided to merge these subcommittees into one since there was not enough activity to justify the administration of two SCs. This provided for more efficient use of resources which could be devoted to the standards work instead.
6. FACTORS AFFECTING COMPLETION AND IMPLEMENTATION OF THE ISO/TC WORK PROGRAMME

Even if many parties find the work items within the scope of ISO/TC 163 to be of great interest, we face a problem of lacking resources. Our experience is that there are very limited resources available for horizontal standardization or matters not directly linked to a given product. In these areas, we are convinced that governments and authorities must take an active part in the work or support it financially as well as morally.

The problem of lacking resources could also be met by requesting the product TCs to refer to horizontal methods as far as possible. Instead of preparing test and calculation methods for specific materials/products, representatives of different material groups are invited to participate in the preparation of methods that are material neutral. That would reduce the total work load and release manpower for the elaboration of the general methods.

The present standards or draft standards elaborated by ISO/TC 163 are based on state of the art knowledge. However, during the work, it is often discovered that a more refined method would be preferable, however to achieve that research would be needed. An investment in refining the general methods should be worthwhile.
7. STRUCTURE, CURRENT PROJECTS AND PUBLICATIONS OF THE ISO/TC

This section gives an overview of the ISO/TC’s structure, scope, projects and publications. All this information is updated regularly and is available on ISO’s website, ISO Online.

Information on ISO online

The link below is to the TC’s page on ISO’s website:
https://isotc.iso.org/livelink/livelink?func=ll&objId=8830780&objAction=browse&viewType=1

Click on the tabs and links on this page to find the following information:
• About (Secretariat, Secretary, Chair, Date of creation, Scope, etc.)
• Contact details
• Structure (Subcommittees and working groups)
• Liaisons
• Meetings
• Tools
• Work programme (published standards and standards under development)

Reference information

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

General information on the principles of ISO’s technical work