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Guidelines for addressing climate change in standards

Lignes directrices pour la prise en compte des changements climatiques dans les normes

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by the ISO Technical Management Board Task Force on Climate Change Coordination.

Any feedback or questions on this document should be directed to the user’s national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

This document is intended for developers of ISO standards and other deliverables to encourage the inclusion of provisions in standards to address climate change impacts, risks and opportunities, and aims to:

— enable standards committees to determine if the standard under consideration should take into account aspects, issues, impacts, risks and/or opportunities associated with climate change;

— provide standards developers with a systematic approach to address climate change impacts, risks and opportunities in a coherent and consistent manner, with regard to both new and revised standards, and in a manner related to the objective and scope of the standard being developed;

— promote consistency and compatibility to the extent practical among standards that directly or indirectly address climate change and their wider uptake in support of sustainability.

NOTE Standards developers are encouraged to consider the mandatory committee-specific policies in the ISO/IEC Directives, Part 1, for the development of sector-specific environmental management standards and sector-specific environmental management system standards.

Figure 1 provides a schematic overview of this document as a process for addressing climate change in standards.

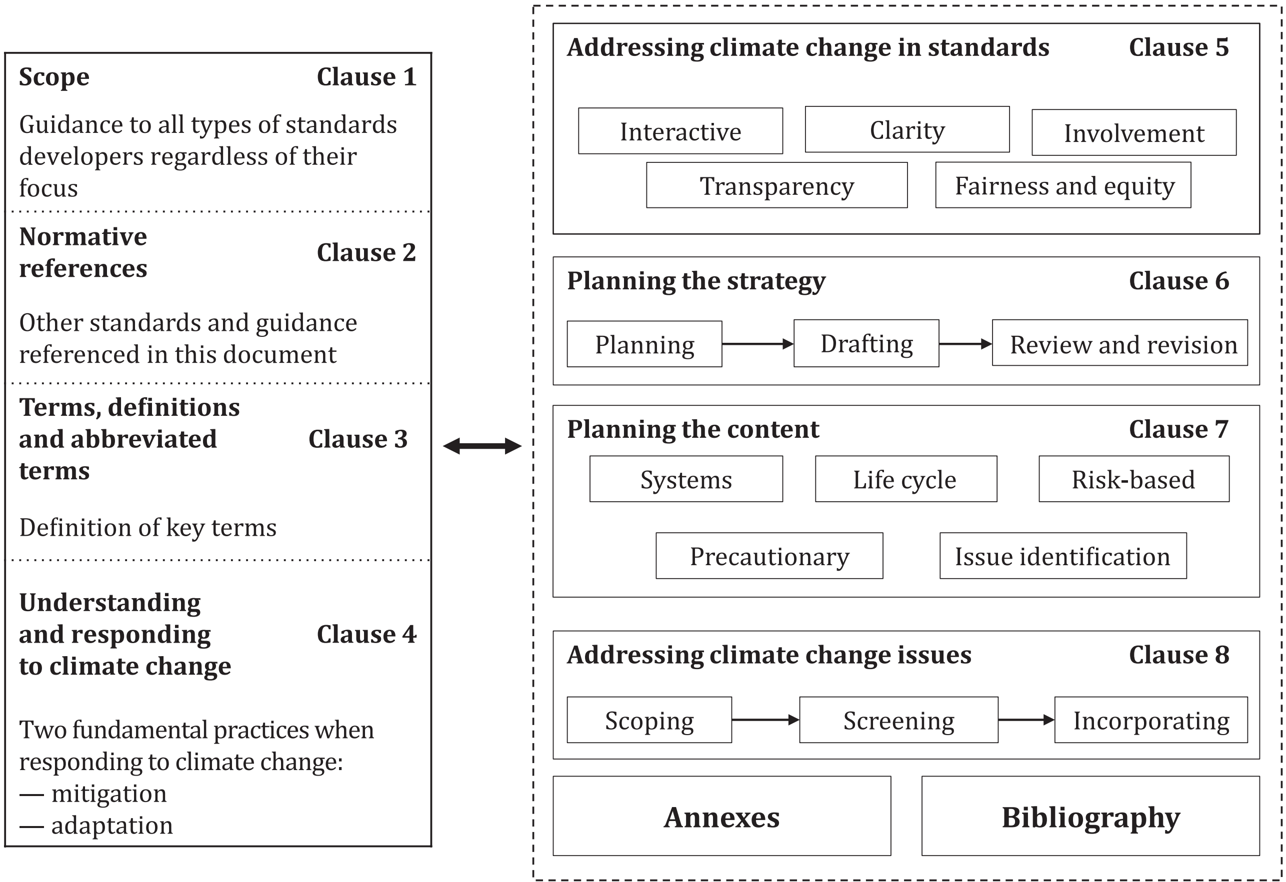


Figure 1 — Schematic overview of this document

The international community has expressed a commitment to strengthen the global response to the threat of climate change, in the context of sustainable development, including:

a) holding the increase in the global average temperature to below 2 °C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1,5 °C above pre-industrial levels, recognizing that this would significantly reduce the negative climate change impacts;

b) increasing the ability to adapt to the adverse impacts of climate change and foster climate resilience and low greenhouse gas emissions development, in a manner that does not threaten food production.

Climate change affects many regions of the world and includes significant climate change impacts, risks and opportunities arising from changing weather patterns, rising sea levels and more extreme weather events. Rapidly expanding urban areas are recognized to be particularly vulnerable. Climate extremes affecting urban systems, such as power supplies, can lead to cascading failures in other utilities and services compromising the health and well-being of the population. The potential consequences of such climate-related impacts, risks and opportunities include the disruption of different environmental, social and economic systems within national economies, affecting communities and organizations, as well as individuals, with the poorest and most vulnerable people expected to be affected the most. Action is needed, involving both climate change adaptation and mitigation, in order to limit the effects of climate change impacts, risks and opportunities, while also contributing to the reduction of the world's average surface temperature. Against this challenging outlook, the scope, need and opportunity for action on climate change is extensive.

Climate change is acknowledged as a foremost challenge with regards to the goal of sustainable development, which encompasses any state of the global system in which the needs of the present are met without compromising the ability of future generations to meet their own needs.

Standards that take into consideration climate change adaptation and/or mitigation can contribute to the achievement of sustainability, either directly (where they specifically address sustainability issues such as climate change) or indirectly (where they relate to testing, products, procedures, services, terminology, management systems or assessment). It is recognized that both climate change mitigation (CCM) and adaptation to climate change (ACC) are important for all processes related to a technology, activity or product (TAP). Although there are very important interactions, the two disciplines are distinct and are addressed individually within this document.

Standards developers are encouraged to consider climate change issues in their work at all stages in the standards development process. If climate change issues have not been considered, this can be a valid reason to start the revision of a standard. In addition, the significance or relevance of specific issues can have changed since the previous edition of a standard was drafted or reviewed. Whenever a new standard is drafted, or an existing standard is revised, all standards developers (including project leaders, convenors, committee chairs, committee managers and secretaries) are encouraged to actively promote the application of this document, and to involve experts knowledgeable in the subject.

When standards developers address climate change in different existing or new standards, the result can be an increased awareness of climate change issues among the user community across various market sectors. Through the application of this document, users of such standards will be better able to address climate change mitigation and/or adaptation in ways that many would not have expected or considered. And with entirely new standards, users will realize that there are new opportunities for the market to respond to these issues in ways not previously considered or contemplated.

Guidelines for addressing climate change in standards

1 Scope

This document provides guidance to standards developers on how to take account of climate change in the planning, drafting, revision and updating of ISO standards and other deliverables.

It outlines a framework and general principles that standards developers can use to develop their own approach to addressing climate change on a subject-specific basis.

It aims to enable standards developers to include adaptation to climate change (ACC) and climate change mitigation (CCM) considerations in their standardization work. Considerations related to ACC are intended to contribute to increasing preparedness and disaster reduction as well as impacting the resilience of organizations and their technologies, activities or products (TAPs). Considerations related to CCM consist primarily of approaches that seek to avoid, reduce or limit the release of GHG emissions and/or increase GHG removals.

2 Normative references

There are no normative references in this document.

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1.1
climate
statistical description of weather in terms of the mean and variability of relevant quantities over a period of time ranging from months to thousands or millions of years

Note 1 to entry: The classical period for averaging these variables is 30 years, as defined by the World Meteorological Organization.

Note 2 to entry: The relevant quantities are most often near-surface variables such as temperature, precipitation and wind.

[SOURCE: ISO 14090:2019, 3.4]

3.1.2
climate change
change in *climate* (3.1.1) that persists for an extended period, typically decades or longer

Note 1 to entry: Change in climate can be identified (e.g. by using statistical tests) by changes in the mean and/or the variability of its properties.

Note 2 to entry: Climate change might be due to natural processes, internal to the climate system, or external forcings such as modulations of the solar cycles, volcanic eruptions, and persistent *anthropogenic* (3.1.36) changes in the composition of the atmosphere or in *land use* (3.1.37).

[SOURCE: ISO 14090:2019, 3.5, modified — Note 1 to entry has been modified.]

3.1.3
adaptation to climate change
climate change adaptation
adaptation
process of adjustment to actual or expected *climate* (3.1.1) and its effects

Note 1 to entry: In human systems, adaptation seeks to moderate or avoid harm or exploit beneficial opportunities.

Note 2 to entry: In some natural systems, human intervention can facilitate adjustment to expected climate and its effects.

[SOURCE: ISO 14090:2019, 3.1, modified — The preferred term "adaptation" has been added.]

3.1.4
climate change mitigation
mitigation
human intervention to reduce *GHG emissions* (3.1.13) or enhance *GHG removals* (3.1.14)

[SOURCE: ISO 14080:2018, 3.1.2.1, modified — The preferred term "mitigation" has been added, and the words "to reduce the sources or enhance the sinks of greenhouse gases (GHGs)" have been replaced with "to reduce GHG emissions or enhance GHG removals" in the definition.]

3.1.5
climate change impact
effect on natural or human systems as a result of being exposed to *climate change* (3.1.2)

Note 1 to entry: Impacts can be adverse or beneficial.

[SOURCE: ISO 14090:2019, 3.8, modified — The preferred term and definition have been contextualized to directly refer to climate change: the term "impact" has been replaced with "climate change impact", the words "as a result of being exposed to climate change" have been added to the definition and the original Note 1 to entry has been replaced.]

3.1.6
climate change risk
risk (3.1.7) of negative *climate change impacts* (3.1.5) that reflects the interaction among *vulnerability* (3.1.8), *exposure* (3.1.10) and *hazard* (3.1.11)

Note 1 to entry: A risk assessment can include the consideration of vulnerabilities, exposure and *climate change* (3.1.2) hazards, or the consideration of *likelihoods* (3.1.44) and *consequences* (3.1.43).

[SOURCE: ISO 14080:2018, 3.1.3.3, modified — The preferred term has been changed from "climate risk" to "climate change risk", the words "potential of negative impacts of climate change" have been replaced with "risk of negative climate change impacts", and the original Note 1 to entry has been replaced.]

3.1.7
risk
effect of uncertainty on objectives

Note 1 to entry: An effect is a deviation from the expected. It can be positive, negative or both, and can address, create or result in opportunities and threats.

Note 2 to entry: Objectives can have different aspects and categories, and can be applied at different levels.

Note 3 to entry: Risk is usually expressed in terms of *risk sources* (3.1.41), potential *events* (3.1.42), their *consequences* (3.1.43) and their *likelihood* (3.1.44).

[SOURCE: ISO 31000:2018, 3.1]

3.1.8
vulnerability
propensity or predisposition to be adversely affected by *climate* (3.1.1) variability or *change* (3.1.2)

Note 1 to entry: Vulnerability encompasses a variety of concepts and elements including *sensitivity* (3.1.9) or susceptibility to harm and lack of capacity to cope and adapt.

[SOURCE: ISO 14090:2019, 3.15, modified —The definition has been contextualized to directly refer to climate variability or change: the words "by climate variability or change" have been added to the definition.]

3.1.9
sensitivity
degree to which a system or species is affected, either adversely or beneficially, by *climate* (3.1.1) variability or *change* (3.1.2)

[SOURCE: ISO 14080:2018, 3.1.3.7, modified — The note to entry has been removed.]

3.1.10
exposure
presence of people, livelihoods, species or ecosystems, environmental functions, services, resources, infrastructure, or economic, social, or cultural assets in places and settings that could be adversely affected by *climate* (3.1.1) variability or *change* (3.1.2)

Note 1 to entry: Exposure can change over time, for example as a result of *land use* (3.1.37) change.

[SOURCE: ISO 14090:2019, 3.6, modified — The definition has been contextualized to directly refer to effect of climate change and climate variability: the term "affected" has been replaced by "adversely affected by climate variability or change" in the definition.]

3.1.11
hazard
potential source of injury or damage to the health of people, or damage to property or the environment

Note 1 to entry: The potential for harm can be in terms of loss of life, injury or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision, ecosystems and environmental resources.

Note 2 to entry: In this document, the term usually refers to climate-related physical *events* (3.1.42) or trends or their physical impacts.

Note 3 to entry: Hazard comprises slow-onset developments (e.g. rising temperatures over the long term) as well as rapidly developing climatic extremes (e.g. a heatwave or a landslide) or increased variability.

[SOURCE: ISO 14090:2019, 3.7, modified — The word "harm" has been replaced by "injury or damage to the health of people, or damage to property or the environment" in the definition.]

3.1.12
greenhouse gas
GHG
gaseous constituent of the atmosphere, both natural and *anthropogenic* (3.1.36), that absorbs and emits radiation at specific wavelengths within the spectrum of infrared radiation emitted by the Earth's surface, the atmosphere, and clouds

[SOURCE: ISO 14064-1:2018, 3.1.1, modified — The Notes to entry have been removed.]

3.1.13
greenhouse gas emission
GHG emission
release of a *GHG* (3.1.12) into the atmosphere

[SOURCE: ISO 14064-1:2018, 3.1.5]

3.1.14
greenhouse gas removal
GHG removal
withdrawal of a *GHG* (3.1.12) from the atmosphere

[SOURCE: ISO 14064-1:2018, 3.1.6, modified — The words “by GHG sinks” have been removed from the definition.]

3.1.15
greenhouse gas source
GHG source
process (3.1.35) that releases a *GHG* (3.1.12) into the atmosphere

[SOURCE: ISO 14064-1:2018, 3.1.2]

3.1.16
greenhouse gas sink
GHG sink
process (3.1.35) that removes a *GHG* (3.1.12) from the atmosphere

[SOURCE: ISO 14064-1:2018, 3.1.3]

3.1.17
carbon dioxide capture and storage
carbon capture and storage
CCS
process (3.1.35) consisting of the separation of CO_2 from industrial and energy-related sources, transportation and injection into a geological formation, resulting in long-term isolation from the atmosphere

Note 1 to entry: CCS is often referred to as carbon capture and storage. This terminology is not encouraged because it is inaccurate: the objective is the capture of carbon dioxide and not the capture of carbon. Tree plantation is another form of carbon capture that does not describe precisely the physical process of removing CO_2 from industrial emission sources.

Note 2 to entry: The term "sequestration" is also used alternatively to "storage". The term "storage" is preferred since “sequestration” is more generic and can also refer to biological processes (absorption of carbon by living organisms).

Note 3 to entry: Long-term means the minimum period necessary for geological storage of CO_2 to be considered an effective and environmentally safe *climate change mitigation* (3.1.4) option.

[SOURCE: ISO 27917:2017, 3.1.1, modified — The admitted term “carbon capture and storage” has been added, and Notes 4 and 5 to entry have been removed]

3.1.18
carbon dioxide capture and utilization
CCU
process (3.1.35) of separating (capturing) CO_2 from an industrial or manufacturing process or from air, and converting it for use as material feedstock within another *product system* (3.1.30)

Note 1 to entry: CCU is sometimes referred to as CO_2 transformation, CO_2 conversion, CO_2 recycling or CO_2 upcycling.

Note 2 to entry: Currently, the CO_2 that is captured is typically converted for use in creating fuels, chemicals, or material feedstock or used directly for enhancing plant growth in horticulture.

3.1.19
greenhouse gas inventory
GHG inventory
list of *GHG sources* (3.1.15) and *GHG sinks* (3.1.16), and their quantified *GHG emissions* (3.1.13) and *GHG removals* (3.1.14)

[SOURCE: ISO 14064-1:2018, 3.2.6]

3.1.20
greenhouse gas programme
GHG programme
voluntary or mandatory international, national, or subnational system or scheme that registers, accounts or manages *GHG emissions* (3.1.13), *GHG removals* (3.1.14), *GHG emission reductions* (3.1.22) or *GHG removal enhancements* (3.1.23) outside the *organization* (3.1.40) or *GHG project* (3.1.21)

[SOURCE: ISO 14064-1:2018, 3.2.8]

3.1.21
greenhouse gas project
GHG project
activity or activities that alter the conditions of a *GHG baseline* (3.1.24) and which cause *GHG emission reductions* (3.1.22) or *GHG removal enhancements* (3.1.23)

[SOURCE: ISO 14064-1:2018, 3.2.7, modified — Note to entry has been removed.]

3.1.22
greenhouse gas emission reduction
GHG emission reduction
quantified decrease in *GHG emissions* (3.1.13) between a *baseline scenario* (3.1.25) and the *GHG project* (3.1.21)

[SOURCE: ISO 14064-2:2019, 3.1.7]

3.1.23
greenhouse gas removal enhancement
GHG removal enhancement
quantified increase in *GHG removals* (3.1.14) between a *baseline scenario* (3.1.25) and the *GHG project* (3.1.21)

[SOURCE: ISO 14064-2:2019, 3.1.8]

3.1.24
greenhouse gas baseline
GHG baseline
quantitative reference(s) of *GHG emissions* (3.1.13) and/or *GHG removals* (3.1.14) that would have occurred in the absence of a *GHG project* (3.1.21) and provides the *baseline scenario* (3.1.25) for comparison with project GHG emissions and/or GHG removals

[SOURCE: ISO 14064-2:2019, 3.2.5]

3.1.25
baseline scenario
hypothetical reference case that best represents the conditions most likely to occur in the absence of a proposed *GHG project* (3.1.21)

[SOURCE: ISO 14064-2:2019, 3.2.6]

3.1.26
life cycle
consecutive and interlinked stages related to a *product* (3.1.29), from raw material acquisition or generation from natural resources to end-of-life treatment.

[SOURCE: ISO 14067:2018, 3.1.4.2, modified — Notes to entry have been removed.]

3.1.27
life cycle assessment
compilation and evaluation of the inputs, outputs and the potential environmental impacts of a *product system* (3.1.30) throughout its *life cycle* (3.1.26)

[SOURCE: ISO 14040:2006, 3.2]

3.1.28
life cycle inventory analysis
LCI
phase of *life cycle assessment* (3.1.27) involving the compilation and quantification of inputs and outputs for a *product* (3.1.29) throughout its *life cycle* (3.1.26)

[SOURCE: ISO 14040:2006, 3.3]

3.1.29
product
goods or service

[SOURCE: ISO 14067:2018, 3.1.3.1, modified — Notes to entry have been removed.]

3.1.30
product system
collection of *unit processes* (3.1.31) with elementary flows and product flows, performing one or more defined functions and which models the *life cycle* (3.1.26) of a *product* (3.1.29)

[SOURCE: ISO 14067:2018, 3.1.3.2, modified — Note to entry has been removed.]

3.1.31
unit process
smallest element considered in the *life cycle inventory analysis* (3.1.28) for which input and output data are quantified

[SOURCE: ISO 14040:2006, 3.34]

3.1.32
carbon footprint of a product
CFP
sum of *GHG emissions* (3.1.13) and *GHG removals* (3.1.14) in a *product system* (3.1.30), expressed as *CO2 equivalents* (3.1.34) and based on a *life cycle assessment* (3.1.27) using the single impact category of *climate change* (3.1.2)

[SOURCE: ISO 14067:2018, 3.1.1.1, modified — Notes to entry have been removed,]

3.1.33
partial carbon footprint of a product
partial CFP
sum of *GHG emissions* (3.1.13) and *GHG removals* (3.1.14) of one or more selected *process(es)* (3.1.35) in a *product system* (3.1.30), expressed as *CO2 equivalents* (3.1.34) and based on the selected stages or processes within the *life cycle* (3.1.26)

[SOURCE: ISO 14067:2018, 3.1.1.2, modified — Notes to entry have been removed.]

3.1.34
CO_2 equivalent
carbon dioxide equivalent
unit for comparing the radiative forcing of a *GHG* (3.1.12) to that of carbon dioxide

[SOURCE: ISO 14067:2018, 3.1.2.2, modified — The third preferred term and Notes to entry have been removed.]

3.1.35
process
set of interrelated or interacting activities that transforms inputs into outputs

[SOURCE: ISO 14067:2018, 3.1.3.5]

3.1.36
anthropogenic
resulting from or caused by human activity

3.1.37
land use
human use or management of land within the relevant boundary

Note 1 to entry: Typically, the relevant boundary is the *product system* (3.1.30) under study.

[SOURCE: ISO 14067:2018, 3.1.7.4, modified — The abbreviated term "LU" has been removed and the original Notes to entry have been replaced with the new Note to entry.]

3.1.38
standards developer
individual or group taking part in the development of a standard

[SOURCE: ISO Guide 82:2019, 3.5]

3.1.39
interested party
stakeholder
person or *organization* (3.1.40) that can affect, be affected by, or perceive itself to be affected by a decision or activity

EXAMPLE Customers, communities, suppliers, regulators, non-governmental organizations, investors and employees.

[SOURCE: ISO 14001:2015, 3.1.6, modified — The additional preferred term "stakeholder" has been added, and Note 1 to entry has been deleted.]

3.1.40
organization
person or group of people that has its own functions with responsibilities, authorities and relationships to achieve its objectives

Note 1 to entry: The concept of organization includes, but is not limited to sole-trader, company, corporation, firm, enterprise, authority, partnership, charity or institution, or part or combination thereof, whether incorporated or not, public or private.

[SOURCE: ISO 14001:2015, 3.1.4]

3.1.41
risk source
element which alone or in combination has the potential to give rise to *risk* (3.1.7)

[SOURCE: ISO 31000:2018, 3.4]

3.1.42
event
occurrence or change of a particular set of circumstances

[SOURCE: ISO 31000:2018, 3.5, modified — Notes to entry have been removed.]

3.1.43
consequence
outcome of an *event* (3.1.42) affecting objectives

[SOURCE: ISO 31000:2018, 3.6, modified — Notes to entry have been removed.]

3.1.44
likelihood
chance of something happening

[SOURCE: ISO 31000:2018, 3.7, modified — Notes to entry have been removed.]

3.2 Abbreviated terms

ACC	Adaptation to Climate Change
CC	Climate Change
CCM	Climate Change Mitigation
CCS	Carbon Dioxide Capture and Storage
CCU	Carbon Dioxide Capture and Utilization
CFP	Carbon Footprint of a Product
GHG	Greenhouse Gas
GWP	Global Warming Potential
IPCC	Intergovernmental Panel on Climate Change
MSS	Management System Standard
TAP	Technology, Activity or Product
UNFCCC	United Nations Framework Convention on Climate Change

4 Understanding and responding to climate change

4.1 What is climate change?

Climate change is defined as the change in the state of the climate that can be identified by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer. It is leading to a large-scale, long-term shift in the planet's weather patterns and average temperatures. Both natural processes and human activity can cause climate change.

Human activities over the past two centuries have significantly increased the amount of greenhouse gases in the atmosphere, mainly (but not exclusively) in the form of carbon dioxide, both by modifying the ability of ecosystems to extract carbon dioxide from the atmosphere and by emitting it directly, e.g. by burning fossil fuels and manufacturing goods with a high carbon intensity such as concrete. The atmosphere and oceans have warmed, accompanied by sea level rise, a strong decline in Arctic sea ice, and other climate-related changes. From 1880 to 2012, the global average surface temperature has increased by about 0,85 °C (1,4 °F) according to the IPCC Fifth Assessment Report[33]. Much of this warming has occurred since 1975. Anthropogenic influence on the climate system is clear, and recent emissions of GHGs are the highest in history.

Although there is natural variability in Earth's climate, current climate change is well above historical variability. Natural factors that can contribute to interannual variability include aerosols and phenomena such as El Niño and La Niña (which cause warming and cooling of the Pacific Ocean surface). There is now an underlying trend of global warming, and a wide scientific consensus that this is due to the increase in GHGs being emitted by human activities.

NOTE 1 The IPCC Fifth Assessment Report states that scientific publications available for assessing climate change impacts, adaptation and vulnerability more than doubled between 2005 and 2010 with especially rapid increases in publications related to adaptation.

Increasingly the scientific consensus on climate change is now transferring into a growing number of political and economic frameworks. A foremost, but not the only example is the United Nations Framework Convention on Climate Change (UNFCCC) Paris Agreement[29], which has a long-term goal of keeping the increase in global average temperature to well below 2 °C above pre-industrial levels; a further aim to limit the increase to 1,5 °C (since this would significantly reduce climate change risks and climate change impacts) and also the need for global emissions to peak as soon as possible, recognizing that this will take longer for developing countries. There is wide understanding that such transitions cannot be achieved by governments alone and that so called “non-state actors” will also be instrumental. This is important context for this document, which seeks to assist standards developers and users to contribute to and benefit from this transition by including climate change considerations into a wide range of future standards.

NOTE 2 The IPCC Special Report[34] identifies the impacts of global warming of 1,5 °C above pre-industrial levels and related global greenhouse gas emission pathways. The report was intended to strengthen the global response to the threat of climate change.

One important aspect here is that atmospheric emissions are now so high and our global warming trajectory so severe that some continued level of warming and climate change is widely seen as unavoidable. Environmental limits (sometimes referred to as planetary boundaries, see Annex C) are arguably already being exceeded on climate change with atmospheric GHG emissions at an all-time high.

A source of potential climate change related conflicts is occurring as a consequence of transgressing the planetary boundaries. Anthropogenic pressures on the Earth system have reached a scale where abrupt global environmental change can no longer be excluded. In reaction to this finding, the scientific community proposed a new approach to global sustainability in which planetary boundaries are defined within which humanity can operate safely.

4.2 Climate change mitigation and adaptation to climate change

4.2.1 General

Two approaches or processes to address climate change are separately outlined in this document. These are climate change mitigation (CCM) and adaptation to climate change (ACC).

4.2.2 Climate change mitigation

Climate change mitigation (CCM) consists primarily of approaches that seek to avoid, reduce or limit the release of GHG emissions that contribute to anthropogenic climate change. It can also include actions that will increase the removal of GHG atmospheric emissions (e.g. carbon sequestration through woodland creation, conservation and wider land management practices). The ideal is to pursue a strategic approach whereby overall emissions are quantified and reduced, assisting a transition towards a low or net zero carbon economy. CCM activities are discussed further in ISO 14064-1:2018, Clause 7.

A range of direct or indirect mitigation actions are possible, sometimes presented within a hierarchy of avoiding emissions where possible (e.g. virtual meetings rather than travel), reducing emissions (e.g. through effective energy management and energy efficiency actions), substitution (e.g. using a low carbon fuel) and compensation of residual emissions (e.g. carbon offsetting). Standards developers can consider, amend and incorporate new requirements and context (as appropriate) to help their standards to support GHG mitigation. Systems thinking (see 7.2.2) and life cycle considerations (see 7.2.3) can help standards developers to scope how the direct and indirect use of their standard can lead to GHG emissions.

4.2.3 Adaptation to climate change

Adaptation to climate change (ACC) represents adjustments in ecological, social or economic systems in response to actual or expected climatic stimuli or their effects or climate change impacts, risks and opportunities, with a subsequent improvement in resilience.

Standards developers are used to taking into account weather-related climate change risks, when drafting provisions. Within a process of ACC, standards developers are encouraged to also take into consideration the climate change impacts, risks and opportunities of a changing climate, such as trends in monthly and seasonal averages, rising sea level, changes in the frequency and intensity of extreme climate events.

While it is necessary to continue to mitigate climate change through the measurement and management of GHGs, it is also now recognized that the impacts of climate change are already observable and more changes are expected. Measures to adapt to the current new climate and the climates in the medium to long-term future are clearly also required. Although their stated objective can differ, adaptation and mitigation actions should where possible be carried out in concert with one another.

4.2.4 Interrelation between climate change mitigation and adaptation to climate change

CCM and ACC are clearly interrelated (see 8.2). For ease of use, this document addresses issues related to CCM and ACC separately. Mitigation involves having knowledge about the identification and quantification of sources of GHG emissions (and removals) and the different means of reducing (and increasing) those flows to (and from) the atmosphere. Adaptation involves having knowledge about vulnerabilities to climate change and the potential for future global and local climate projections that can be used to identify potential risks and opportunities on which to base decision-making.

NOTE Confusion can arise around the use of the terms “mitigation” and “adaptation”. Mitigation can be understood as describing actions that moderate climate change impacts and risks rather than addressing the cause of climate change. Confusion can exist with wider views of mitigation, for example within risk management or impact assessment, where significant climate change impacts and risks are being mitigated (reduced and alleviated) rather than being addressed at source.

5 Addressing climate change in standards

5.1 General

When addressing climate change aspects in standards, standards developers should be directed to identify sources (if any) of policy applicable to the industry involved that address relevant aspects and potential climate change impacts, risks and opportunities at all stages of the life cycle of a product or during the testing process. In the absence of an applicable policy, the standards developers should consider addressing such issues according to considerations established by their committee. In addition, standards developers should consider a risk-based approach (see 7.2.4) when taking into account and responding to climate change.

NOTE In this document, unless otherwise stated, the term “committee” includes technical committees (TC), project committees (PC) and subcommittees (SC).

Depending on the nature of the relevant climate change impacts, risks and opportunities identified and the scope of the standard, standards developers should decide if such provisions need to be included in a standard as requirements, recommendations or informative statements.

Existing information related to climate change, including information that has already been the subject of standardization, can be used to identify and evaluate relevant and significant issues. A preliminary scoping exercise should also be carried out to determine the relevance and significance of the various issues. Further details are provided in Clause 8.

5.2 Principles related to addressing climate change in standards

5.2.1 General

The application of appropriate principles is fundamental in ensuring that significant climate change impacts, risks and opportunities are considered when developing standards. These principles are the basis for, and will guide the application of, future requirements and guidance in the context of climate change.

5.2.2 Interactivity

Standards development is an interactive process of drafts and reviews focused on research of science, best practice, practicality, technical rigour, consensus, and market implementation.

Standards developers should be diligent in checking and rechecking summaries of internationally accepted climate change research such as the IPCC Assessment Reports[32],[33] and other sources of relevance to their TAPs. Such references are instrumental in addressing the significance or relevance of specific climate change issues.

5.2.3 Clarity

Standards development relies on clear and concise concepts, terms and definitions. Standards should be understandable and unambiguous.

Care should be taken in translation of language and interpretation of potential meanings across cultural, technical, regulatory and legal domains. This attention is especially important when addressing specific climate change issues. Because the taxonomies and lexicons of climate change are evolving differently around the world, standards developers need to be aware of these differences.

EXAMPLE The use of terms such as “low carbon”, “zero carbon” and “carbon neutral” can have different meanings depending on the jurisdiction, policy objectives, governmental perspectives, and industrial sector.

5.2.4 Involvement of interested parties

Standards development is designed for the widest audience possible. Developing countries and minority voices should be encouraged to contribute by facilitating participation and eliminating barriers as much as possible.

EXAMPLE Virtual standards development approaches can be used to encourage wider participation.

When identifying relevant and significant climate change issues, standards developers should be aware of and, where possible, incorporate perspectives and develop consensus from a variety of countries and regions. It is important to recognize that developing countries, which are typically underrepresented in standards development, are expected to be impacted disproportionally by climate change. For this reason, their perspective related to climate change issues is important.

5.2.5 Transparency

Standards development is a transparent process relative to decision-making and activities. Standards developers should present information in a manner that is open and comprehensive when they consider different climate change issues in the context of a particular standard and its provisions (if any), which are included to address the potential climate change impacts, risks and opportunities of an issue on society, the economy or the environment.

Any inherent limitations to the standards should be clearly communicated to and understood by the intended users. In context of climate change issues, the justification of relevance and significance is critical.

5.2.6 Fairness and equity

Standards development decisions are made with fairness and equity among all international participants where no party dominates or guides the process. The ISO standards development process has evolved with this in mind.

Addressing climate change can result in many differences of opinion and even controversy. To be effective, standards developers should understand and embrace ISO's standards development process.

5.2.7 Performance-driven approach

Certain materials, technologies, products and services perform better in relation to future climate risks (mitigation and/or adaptation). This difference in performance should be acknowledged by standards developers. Such improved performance should be promoted in standards.

5.2.8 Future orientation

Standards developers should consider the dynamics of climate change over the short and long term and the consequence of climate change and its social, environmental and economic impacts for the subject of their standards.

NOTE Further information on timescales and future considerations is given in Clause B.7.

6 Planning the strategy

6.1 General

Climate change concepts (adaptation, mitigation and adaptation-mitigation) can be addressed either within an existing committee or by establishing a new committee, as applicable to a particular TAP.

NOTE Consideration of climate change is expected to occur primarily within the existing ISO committee structure.

Existing or new TCs can choose to establish a new SC, a new Working Group (WG), or simply adopt a committee policy on climate change (e.g. recognizing and recommending use of this document). This is to ensure that any new work item undertaken within a committee work programme includes the consideration of these climate change concepts and whether they should be addressed within the scope of the document, as applicable.

The consideration of climate change, as applicable to a particular TAP, should also be addressed within a TC's strategic business plan.

Existing committees should include the review and discussion of the different aspects of climate change, as applicable to their respective TAP. Following publication of this document, this can occur at their next upcoming plenary meetings or via committee forums, as convenient. TCs should also consider updating their strategic business plans within 18 months after the publication of this document.

Regardless of the approach (if any) chosen to address climate change within a particular document, the guidelines in 6.2 should be followed for the initial planning of this work.

Regardless of the approach (if any) chosen to address climate change in the TC strategic business plan, the guidelines in 6.3 should be followed for planning and execution of this work.

Guidance for review and revision of existing documents to address climate change is provided in 6.4.

6.2 Issues to think about before establishing a committee

Climate change should be taken into account during the formation of committees and in subsequent phases of the development process of standards.

This enables climate change to be integrated into the scope, structure and work plan of a committee from the start, as well as promoting awareness of climate change amongst the committee's leadership and participants, and clarifying that climate change will be an integral part of the committee's work.

The considerations that should be taken into account at this stage include the following.

a) Scope: Has climate change been taken into account in a manner appropriate to the subject matter of the committee?

b) Structure: How will climate change be addressed through the structure of the committee? Options include:

   — including climate change as a discrete issue to be dealt with by a committee;

   — creating a task force on climate change;

   — integrating climate change into the efforts of each committee or WG;

   — a combination of these options.

c) Participation: Will the committee have the appropriate participation (consistent with and taking into account the ISO/IEC Directives and guidance on participation), in terms of both diversity of stakeholders and expertise, to effectively address climate change issues? What measures can be taken to address any shortcomings?

NOTE Not every TC will create or need to create a climate change committee. In some cases, the extent of climate change knowledge needed will be fairly limited, and in other cases, this knowledge will need to be extensive.

When a committee is created, the documentation should include a description of how each of these questions has been addressed. It is recommended that existing committees also go through this process and update their scope, structure and participation processes accordingly. These same concepts can be applied to the formation of one or more SCs within a TC.

6.3 Strategic business plan

ISO requires each TC to prepare a strategic business plan for its field of activity within 18 months of its creation. The strategic business plan is reviewed by the ISO Technical Management Board (TMB).

NOTE PCs and SCs are not required to prepare a strategic business plan.

As outlined in this document, it is recommended that each strategic business plan should include a climate change planning component that describes how the TC intends to address climate change in its work. TCs currently in existence should update their strategic business plans to include climate change considerations.

This climate change component(s) of the strategic business plan should be appropriate to the TC's field of work, given that climate change issues, particularly as they relate to whether the TC will consider adaptation, mitigation or both, can be more directly implicated in some areas of standardization than in others. The climate change plan should include:

— defined processes describing how climate change will be taken into account in the selection of new work items, including the setting of the scope of such work items;

— programmes for ensuring that TC participants are aware of climate change and how it applies to standards development, including the guidance provided in this document;

— a description of how the work of the TC will be reviewed with respect to the identification of relevant general principles and approaches related to climate change, and how particular adaptation and/or mitigation issues can emerge in the context of the standard being developed.

The strategic business plan should identify relevant climate change issues that can be applicable to all or most of the TC's work. The strategic business plan should be updated regularly. Alternatively, relevant climate change issues can be identified at SC or WG level, or on a document-by-document basis, or by a combination of these approaches, as appropriate (e.g. a TC-wide evaluation of climate change issues can be fine-tuned at both SC and WG levels).

The value of the climate change plan is in its implementation in the standards development itself. Central to the success of the plan are the processes to verify that relevant climate change issues are being identified and addressed in the documents being produced.

6.4 Review and revision of standards

All ISO standards are required to undergo regular systematic reviews. If a standard has not previously addressed climate change adequately, this can be used as an argument for proposing a revision and it should be considered by the committee conducting the systematic review and the experts in the national mirror committees when making a decision on whether to revise the standard or not. Committees and experts should bear in mind that the relevance or significance of specific climate change issues can have changed since the previous edition of a standard was drafted or reviewed.

When revising an existing standard, the WG can have an advantage based on their previous experience in the implementation of the standard. The WG should consider any requirements for adaptation and mitigation in each of the relevant clauses that can be impacted by climate change. The WG should consider involving new experts who have the appropriate expertise in adaptation and mitigation. The development of a new standard provides the opportunity for the WG to consider climate change impacts, risks and opportunities, and incorporate them at the New Work Item Proposal (NWIP) stage. One approach to identify appropriate interventions is through the use of flow charts and decision trees.

The flow chart in Figure 2 indicates a logical sequence for the development of provisions for ACC and CCM for new and existing standards, and provides some guidance on questions for consideration.

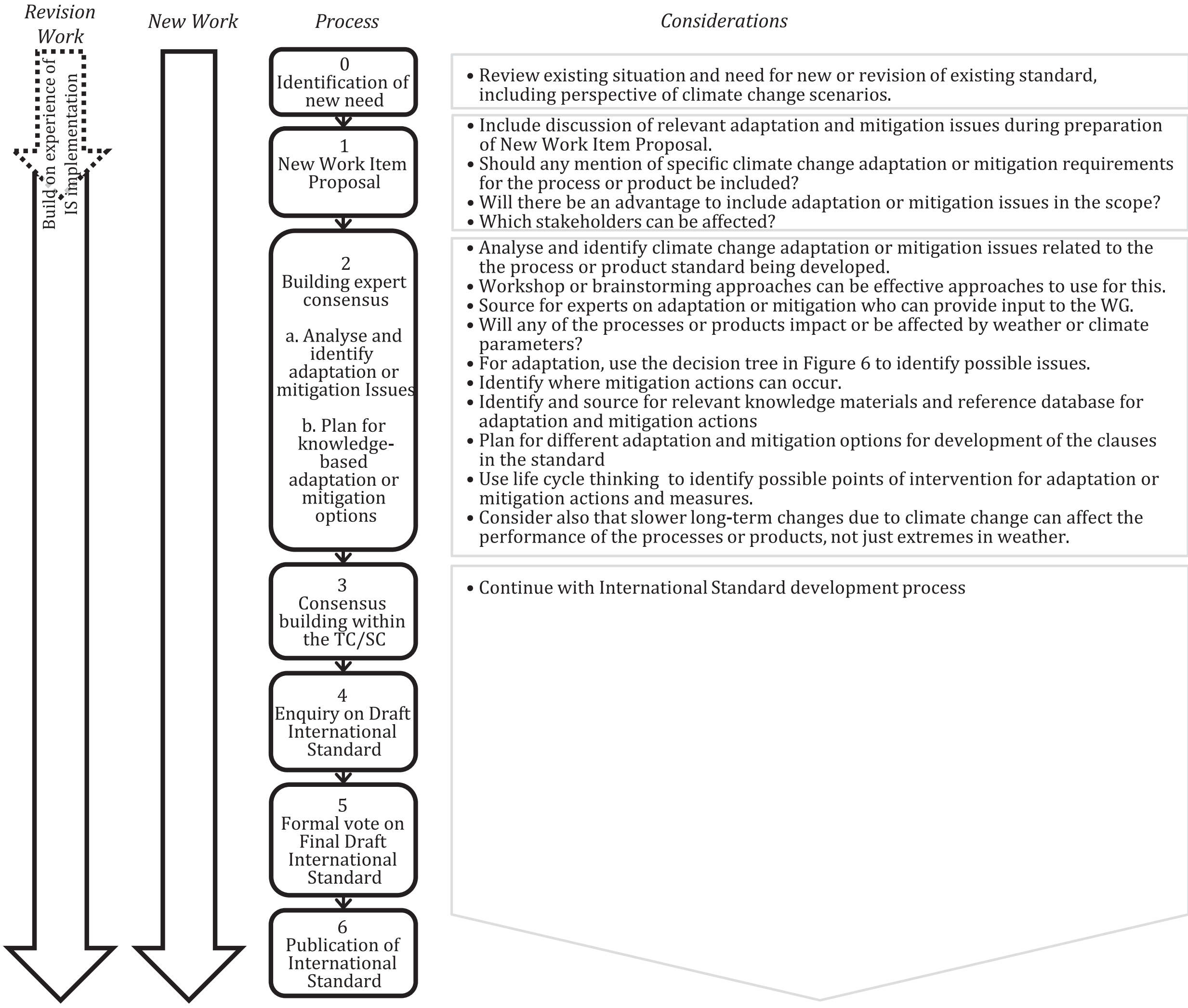


Figure 2 — Development sequences for new and existing standards

7 Planning the content

7.1 Responsibilities

After determining the general strategy under the strategic business plan for addressing climate change within the committee work, agreement should be reached on how it would be applied in the context of a specific standardization project. Unlike strategic planning, which is usually carried out at TC/PC level, this task is usually performed within the WG responsible for developing the technical content for a particular standard.

7.2 Understanding approaches to responding to climate change

7.2.1 General

Addressing climate change in standards is an iterative exercise in order to reflect new changes and trends as they develop. A number of approaches are outlined and described below. These are described so that standards developers can understand the range of approaches they can consider and use when addressing CCM and ACC. In many cases, standards developers can draw on elements of all approaches outlined:

— systems approach;

— life cycle approach;

— risk-based approach; and

— precautionary approach.

7.2.2 Systems approach

Systems thinking suggests that, when considering a certain climate change issue within a given TAP, the related sub-systems (which can also be TAPs) should also be considered, because they are all interconnected and interdependent.

Systems thinking can be useful where the standardization subject is operating within a dynamic wider system and where there are multiple direct and indirect interactions.

An overview of interconnections and interdependencies, derived from an understanding of the overall system, can help standards developers to scope and focus their considerations on priority sub-systems.

For example, a systemic approach can be used to evaluate climate-related sub-systems, which can affect the performance of a TAP and the interactions with that TAP. Standards developers should therefore identify whether their standardization subject interfaces with any climate influenced TAPs and consider steps to make sure that their subject does not constrain action at these interfaces. This can include consideration of the supply chain and other processes within the system such as the wider value chain associated with the subject.

When developing standards for adaptation purposes, it can be helpful for standards developers to follow a systems thinking approach. Annex A contains a more detailed discussion, including examples of systems mapping for using systems thinking to set boundaries for climate change[1)].

As outlined in ISO Guide 82:2019, Clause 7, systems thinking encourages the internalization of costs. Economic costs are often externalized in the form of environmental and social impacts, for which the monetary costs are not necessarily known. Similarly, by including appropriate provisions directly within the text, standards developers can also encourage the users of the standards to apply systems thinking in the application of the standard. For more information on the systems approach, see Clause A.2.

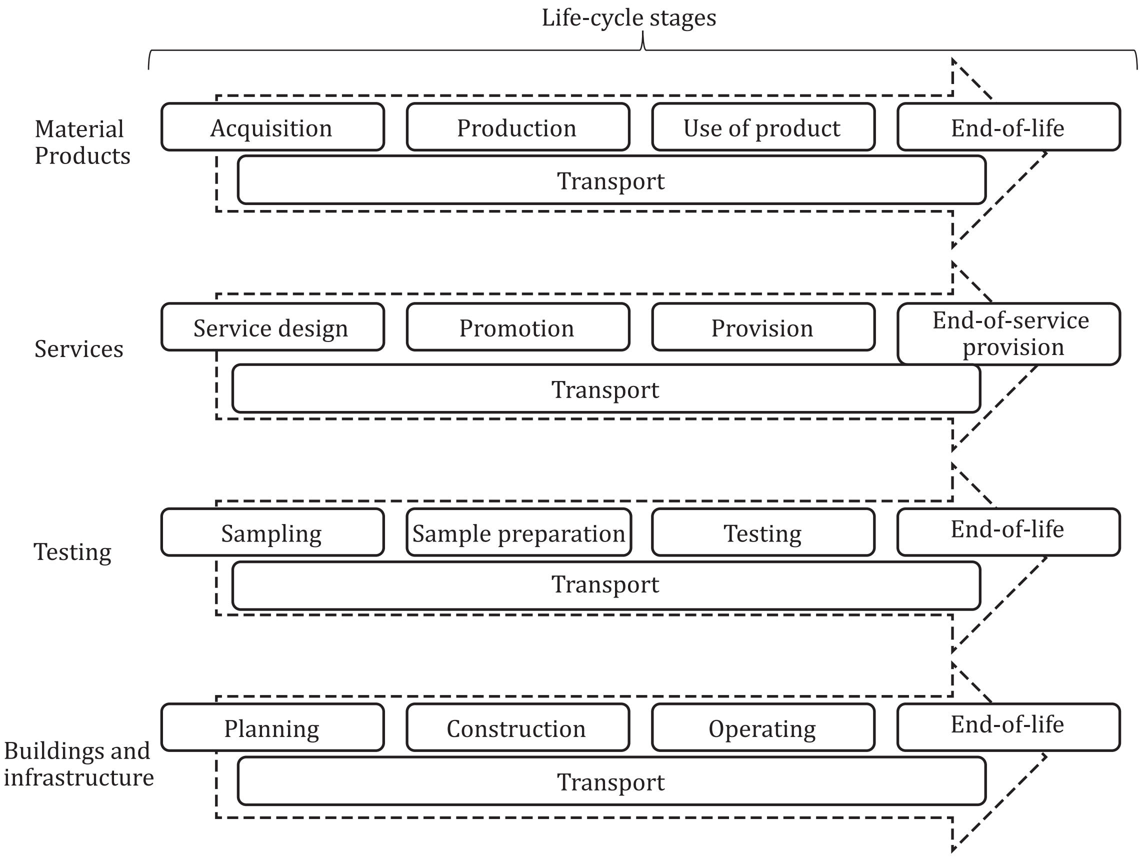
7.2.3 Life cycle approach

Life cycle thinking examines all stages of the life cycle of a particular activity or product in order to identify the widest range of relevant climate change issues.

A life cycle approach can be useful for approaches to ACC and CCM where the standardization subject has multi-stage interactions. From a purely climate change standpoint, an example of the range of issues related to the life cycle of manufactured equipment can include the supply chain (e.g. GHG emissions during sourcing and transporting) and GHG emissions resulting from the manufacturing stage, as well as the impact resulting from its distribution and operation during the use stage of the equipment. The end-of-life stage can involve consideration of issues related to designing for disassembly, which can impact the ability to minimize GHG emissions during recovery and reuse or recycle of materials. The life cycle approach can also be used to address economic and social aspects and their climate change impacts, risks and opportunities (e.g. as assessed in life cycle costing and social life cycle assessments). For more information on the life cycle approach, see Clause B.3.

Figure 3 shows how the life cycle stages of goods, services, testing, and infrastructure and buildings compare.

1) Annex A is reproduced from ISO 14090:2019, Annex A.



NOTE 1 Material and product life cycles can form part of the life cycle of services as well as buildings and infrastructure.

NOTE 2 Testing can take place in different stages of a material or product life cycle.

NOTE 3 Adapted from CEN/CENELEC Guide 32:2016, Figure 2.

Figure 3 — Life cycle stages

Figure 4 shows the climate drivers, climate change impacts and consequences for life cycle stages as it relates to the particular object of consideration.

CLIMATE DRIVERS
Annual/Seasonal/Monthly
Average (air) temperature Extreme (air) temperature (frequency / magnitude) Average precipitation Extreme precipitation (frequency / magnitude)
Wind Speed
Average wind speed Maximum wind speed
Humidity
Solar radiation

SECONDARY EFFECTS / CLIMATE-RELATED DRIVERS
Sea level rise (SLR) (plus local land movements) Sea/water temperatures Water availability Storm (tracks and intensity) including storm surge Flood Ocean pH Dust storms Coastal erosion Soil erosion Soil salinity Wild fire Air quality Ground instability / landslides / avalanche Urban heat island effect Growing season length Icy conditions / ground frost Thawing of permafrost

CLIMATE CHANGE IMPACTS[a]
Physical change
Loss of access
Behaviour change
Health effects
Social change

OBJECT OF CONSIDERATION	CONSEQUENCE	Life cycle stages			
		1	2	3	4
Material / Products	Changes to prices and availability of inputs	X	X		
Service		X	X		
Testing		X			
Buildings and infrastructure		X	X	X	X
Material / Products	Disruption to supply of raw materials	X	X		
Service		X			
Testing		X	X		
Buildings and infrastructure		X	X	X	
Material / Products	Changes in demand	X	X	X	X
Service			X	X	
Testing				X	
Buildings and infrastructure		X	X	X	X
Material / Products	Changes in user requirements	X	X	X	X
Service		X	X	X	
Testing		X	X	X	
Buildings and infrastructure		X	X		
Material / Products	Effects on quality / performance	X	X	X	X
Service		X		X	
Testing				X	
Buildings & infrastructure		X	X	X	
Material / Products	Effects on chemical or mechanical processes		X		X
Service				X	X
Testing				X	X
Buildings and infrastructure			X	X	X
Material / Products	Transport disruption	X	X	X	X
Service		X	X	X	X
Testing		X	X	X	X
Buildings and infrastructure		X	X	X	X

Key

[a] **Climate change impacts can also involve potential beneficial risks and opportunities.**

NOTE Adapted from CEN/CENELEC Guide 32:2016, Figure 3.

Figure 4 — Climate drivers, climate change impacts and consequences for life cycle stages

7.2.4 Risk-based approach

The risk-based approach involves identifying impacts (e.g. evaluating the nature and significance of risks and vulnerabilities) and then managing those risks in accordance with climate change criteria and other considerations that are determined to be applicable to the situation. Risk management actions can include eliminating the risk entirely (e.g. by not undertaking the activity), decreasing the risk associated with the activity (e.g. by modifying the activity), mitigating the consequences of the activity, accepting some or all of the risk, or a combination of these approaches.

For risk-based analysis, it is necessary to identify and evaluate all relevant risks. For the risk assessment, both the probability and the expected extent of impacts should be quantified as far as possible. Currently, the probability of climate change impacts, e.g. severe weather events, is mostly based on computational modelling. In the context of risk management, it should be examined the extent to which some impacts, in the case of a risk realization is still acceptable for the affected communities and businesses. This can inform the necessary measures for risk mitigation. It can also be used to evaluate a range of adaptation options. Individuals and organizations have different objectives and attitudes to risk (how much risk they are prepared to accept) so in many cases it is not appropriate to standardize the outcome of a risk assessment, especially in an organization. However, at the level of the product, the main objective should be seen as fitness for purpose and standards developers can in some cases see merit in standardizing the level and type of adaptation required using a risk-based approach. For more information on the risk-based approach, see Clause B.4.

NOTE While following a risk-based approach, it is important to consider potential for missed opportunities.

7.2.5 Precautionary approach

The risk-based approach is workable if the risks are well known and quantifiable in a credible way. The precautionary approach deals with risks with poorly known outcomes and poorly known probability, making this traditional approach problematic. The precautionary approach suggests that, where uncertainties in climate change projections and/or adverse impacts have been identified, the lack of full scientific certainty is not used as a reason for postponing cost-effective measures to help prevent or reduce environmental degradation or damage to human health. While the precautionary approach can provide a basis for acting in the absence of scientific certainty, available scientific information should be relied upon, and efforts should be made to identify and close gaps in the relevant scientific knowledge.

Examples of precautionary robust adaptation options for extreme weather events (e.g. storms, floods, droughts) include the development of early warning systems, land use controls in vulnerable areas, developing insurance and compensation arrangements, modifying building codes and setting up international cost sharing mechanisms. For more information on the precautionary approach, see Clause B.5.

7.3 Identifying climate change issues

7.3.1 General

With reference to the approaches and principles outlined in 7.2 (approaches) and 5.2 (principles), standards developers should identify those that are considered relevant and significant for the subject area for which a standard is being drafted. Many sources of information about responses to climate change can be useful in this process. These sources include GHG inventories at the organizational level, climate-related financial risk reporting, studies on climate change risks, trends, scenarios and/or projections, legal requirements, product declarations, sustainability reports, impact assessment reports, published peer-reviewed scientific studies and the results of stakeholder consultations.

Climate change issues can also be identified by considering the latest science of climate change (e.g. periodic and special reports from IPCC) or the evolving scientific insights into the planetary boundaries.

NOTE 1 Reference documents are provided in the Bibliography.

Responses to climate change are typically discussed in terms of mitigation of climate change and adaptation to the effects of climate change and their global, regional and local challenges. Interactions between mitigation requirements to reach the targets of 2 °C/1,5 °C set out in the UNFCCC Paris Agreement[29] and appropriate adaptation strategies are therefore very important. A broad number of potential issues can arise, including the following:

a) climate change impacts, risks and opportunities on organizations, including communities, cities, countries and regions;

b) climate change impacts, risks and opportunities related to the activities performed by an organization;

c) climate change impacts, risks and opportunities related to the development, deployment or utilization of technologies;

d) climate change impacts, risks and opportunities related to the production and supply chain, use, end-of-life of products, taking into account a life cycle approach;

e) financing of capital improvements and deployment of assets that will mitigate climate change impacts, risks and opportunities or fund adaptation measures;

f) the rate and intensity of climate change (as measured in terms of radiative forcing on the Earth's surface), both in terms of

1) global warming as an average value around the Earth, and

2) global warming in localized hotspots;

g) the severity of weather events associated with climate change.

Table 1 can be used to make a preliminary assessment as to whether a document addresses climate change issues.

NOTE 2 Table B.1 provides an example of Table 1 for the preliminary scoping of climate change issues/topics related to a sustainable events standard.

Table 1 — Preliminary scoping of climate change (CC) issues/topics related to the standard

Column A	Column B	Column C	Column D	Column E	Column F
CC issues/topics relevant to the standard and/or its related TAP	**CC issue/ topic is specifically addressed in the referenced standard or NWIP (Y/N/NA)[a]**	**CC issue/topic is typically addressed when the standard is used (Y/N/NA)[a]**	**If "Y" in Column B or C, explain how the standard or NWIP addresses CC issue(s)**	**If "N" in Column B or C, is the issue of significance to the standard/ related TAP? (Y/N/NA)[a b]**	**If "Y" in Column E, explain context where CC is a potential consideration**
Direct or indirect GHG emissions (e.g. from energy use, fuels, fugitive emissions)					
GHG removals (sequestration)					
Land use or land use change (in particular soils, forestry, peatland, impacts upon "carbon sinks")					
Quantification of GHG emissions and removals					
Vulnerability or resilience to CC impacts					
Adaptation to climate change					
Communication or claims concerning CC					
Audit, certification, verification relating to CC					

[a] Y/N/NA: Yes/No/Not Applicable. For "Y" responses, note also the clauses of the referenced standard.

[b] Significance relates to the standard/TAP impacting on or being impacted by the issue (see 7.3.3).

Table 1 *(continued)*

Column A	Column B	Column C	Column D	Column E	Column F
CC issues/topics relevant to the standard and/or its related TAP	**CC issue/ topic is specifically addressed in the referenced standard or NWIP (Y/N/NA)[a]**	**CC issue/topic is typically addressed when the standard is used (Y/N/NA)[a]**	**If "Y" in Column B or C, explain how the standard or NWIP addresses CC issue(s)**	**If "N" in Column B or C, is the issue of significance to the standard/ related TAP? (Y/N/NA)[a b]**	**If "Y" in Column E, explain context where CC is a potential consideration**
Skills and competencies relating to CC					
Technology developments relevant to CC					
Other important developments of significance to CC such as carbon trading, environmental financing, investments and legal claims (loss and damage)					

[a] Y/N/NA: Yes/No/Not Applicable. For "Y" responses, note also the clauses of the referenced standard.

[b] Significance relates to the standard/TAP impacting on or being impacted by the issue (see 7.3.3).

7.3.2 Identifying relevant climate change issues

Not all climate change issues are relevant to all types of standards. In order to identify which climate changes issues are relevant, standards developers should consider such issues in the context of the subject and scope of the standard, its intended users, and the overall goal of the standard.

To determine relevance, standards developers should

— understand and discuss the scope of the specific standard, and identify the relevant climate change impacts, risks and opportunities;

— identify and, where appropriate, engage relevant stakeholders and experts;

— identify the ways in which the standard, depending on its content, can either positively or negatively affect CCM or ACC.

It is important to consider the timing of any climate change impacts, risks and opportunities, so standards developers should identify both the issues that arise from both the day-to-day use or application of the organization's or technology's climate change impacts, risks and opportunities and the issues that arise only occasionally under very specific circumstances.

7.3.3 Identifying significant climate change issues

When relevant climate change issues have been identified, standards developers should examine these issues and develop criteria for deciding whether any of them have any significance for the standard intended. The significance of an issue that has been identified as relevant according to the scope of a standard is related to the potential magnitude of its climate change impacts, risks and opportunities and whether the climate change impact, risk or opportunity is positive or negative (see 7.3.2), direct or specific, or indirect and cumulative. A consideration is the vulnerability of the subject (e.g. individual person, group of persons, flora, fauna) to any potential climate change threat. The significance of an issue can vary independent of how relevant it is.

When determining level of significance, standards developers can use criteria drawn from topics such as:

— the climate change impact, risk and opportunities on organizations, including communities, cities, countries and regions;

— the impact of an organization on climate or climate change;

— the exceedance of regulatory or voluntary norms or science-based targets;

— planetary boundaries; and

— the concerns of stakeholders/interested parties.

8 Addressing climate change issues

8.1 General

When the relevant and significant climate change issues have been identified, standards developers need to decide whether and how to provide guidance or requirements within the standard, according to the scope of the standard.

Standards developers are also encouraged to introduce and/or apply existing methods for quantifying GHG emissions and removals and assessing climate change impacts, risks and opportunities, where appropriate.

If such provisions are included directly in a standard, it is more likely that using the standard will effectively address any negative climate change impact, risk and opportunity, as well as enhancing any beneficial climate change impact, risk and opportunity.

Standards developers should recognize that there can be several appropriate ways to address these issues, and that the resources and capabilities to implement particular solutions can vary considerably.

8.2 Consider interrelations between adaptation and mitigation

Climate change experts recognize that both adaptation and mitigation are needed to tackle climate change and its impacts, risks and opportunities. Simply stated, even if all GHG emissions due to human activities are reduced significantly from now on, climate change will still occur because of historical GHG emissions.

Adaptation and mitigation approaches differ in many respects. For example, there is a focus on different target groups. This implies that decision criteria, parameters and reporting are different for adaptation than for mitigation.

As a result, it is helpful to refer to a conceptualized approach of interrelationships between adaptation and mitigation where there are synergies on the one hand and trade-offs on the other hand.

Adaptation measures being considered in a new or revised standard can result in more GHG emissions, and mitigation measures can result in unintended effects on climate change resilience and adaptation.

Four types of interrelationships can be identified:

— adaptation actions that have consequences for mitigation;

— mitigation actions that have consequences for adaptation;

— decisions that include-trade-offs or synergies between adaptation and mitigation;

— processes that have consequences for both adaptation and mitigation.

Regarding this typology, the IPCC Fourth Assessment Report[32] (Chapter 18, pp. 745-777) provides a broad framework for looking at the potential synergies and/or trade-offs. The IPCC Fifth Assessment Report[33] (Chapter 1, p. 184) builds on these interrelationships.

Avoiding conflicts and building synergies between adaptation and mitigation approaches is of great importance, both for the selection of options regarding action and for the prioritization of measures to adapt to climate change impacts, risks and opportunities.

8.3 Addressing climate change mitigation when dealing with specific sources

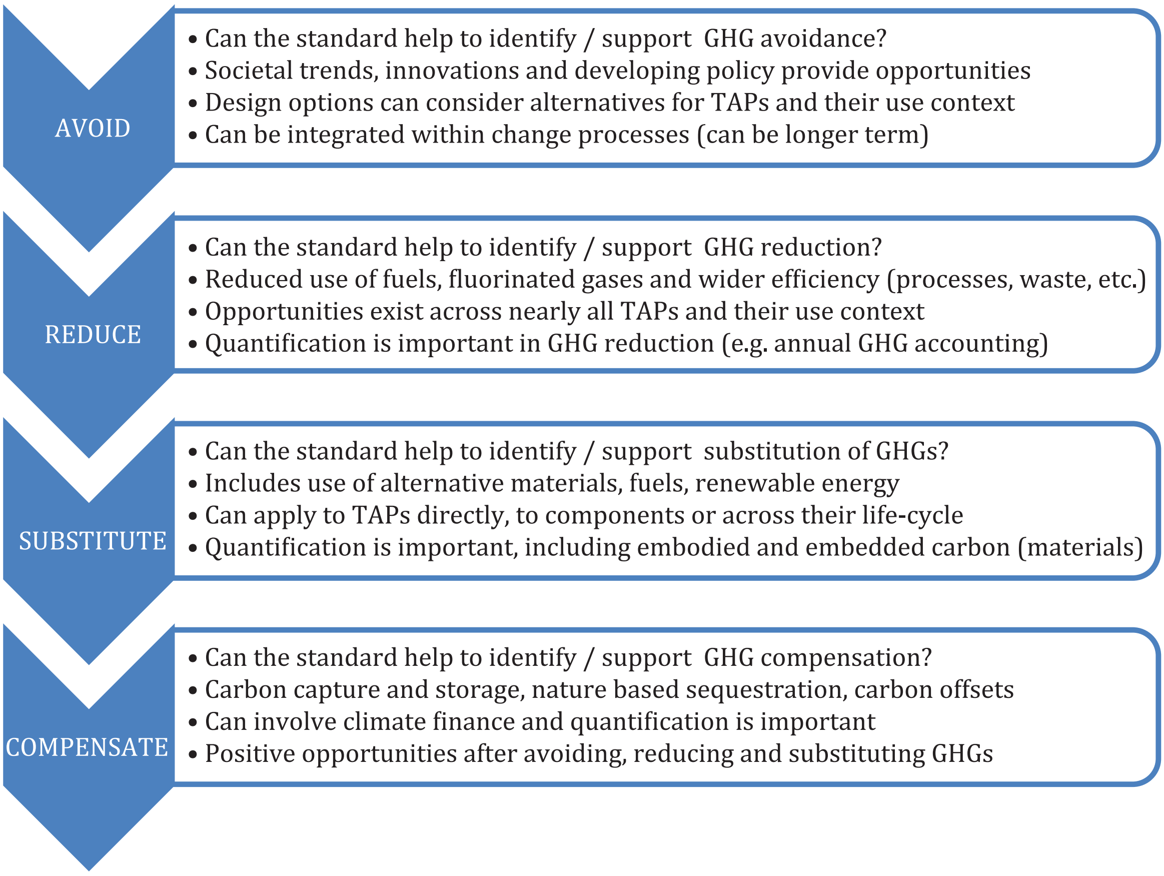
8.3.1 General

Standards developers should be aware of the significant gap between present levels of mitigation activity and the levels of mitigation needed to ensure that anthropogenic emission levels are brought within acceptable planetary boundaries.

CCM is a shared challenge and responsibility of all countries and organizations. Present levels of GHG emissions are not sustainable and are already leading to levels of global warming that jeopardize human health and safety, biodiversity, and the integrity of the built environment. Standards developers have a role to play in facilitating the transition to the low carbon economy that is needed to achieve international goals for limiting global warming to acceptable levels within planetary boundaries.

Standards should promote avoidance of GHG emissions, and reductions in GHG emissions wherever possible. After avoidance, promoting energy management and continually improving energy efficiency should be the goal for the use of fuels, electricity, and heating and cooling. Further, substitution of high global warming potential (GWP) industrial gases and refrigerants should be pursued, and also the use of renewable energy to substitute fossil fuels. Finally, where avoidance, reduction, and substitution strategies are not feasible, standards developers should take into account options for compensating for GHG emissions. Compensation should be viewed not as an end in itself but rather as a means to incentivize the most readily achievable emission reductions, while giving additional time to emitters that require longer timeframes for transitioning to a low carbon economy. Working through a GHG hierarchy approach, as shown in Figure 5 can help standards developers to consider the standard's potential to mitigate these emissions.

The guidance in 8.3.2 to 8.3.11 is primarily concerned with managing and reducing GHG emissions from sources. Standards developers should also consider GHG removals and the potential for increased use of negative emission technologies in the years to come.



NOTE Adapted from the GHG Management Hierarchy, IEMA, 2009.

Figure 5 — Mitigation hierarchy approach for incorporating GHG management into new and revised standards

8.3.2 GHG emissions from the direct or indirect combustion of fuels and energy efficiency

Strategies to avoid or reduce GHG emissions due to combustion of fuels include reducing demand in order to use less, improving combustion efficiency of engines and turbines, substituting more fuel-efficient combustion units, and switching to lower GHG emitting fuels.

NOTE According to the International Energy Agency (IEA)[38], the combustion of fossil fuels represents more than two thirds of global anthropogenic sources of GHG emissions. Fossil fuels include petroleum-based products such as gasoline, diesel, aviation jet fuel (kerosene), and natural gas. The primary GHG generated from the oxidation of the fuel is carbon dioxide (CO_2). In addition, smaller amounts of combustion by-products are also produced. These include methane (CH_4) and nitrous oxide (N_2O).

Standards developers should consider baseline data associated with the GHG emissions of the organization, project, process, supply chain, product, or technology that is the subject of standardization. These data typically should be based on a life cycle perspective, i.e. emissions associated with the production, distribution and use of the energy components under consideration.

Standards developers should consider using performance metrics to measure the effectiveness of energy performance improvement initiatives and associated fuel use reduction. Standards developers should also consider using performance metrics to measure the effectiveness of CO_2 capture and fugitive emissions reductions where appropriate. Encouraging the collection, analysis and disclosure/reporting of data can highlight decreases in GHG emissions and assist organizations, trade associations, and national governments in demonstrating conformity with nationally determined contributions or voluntary science-based targets aimed at CCM.

8.3.3 GHG emissions from the use of fluorinated industrial gases

Standards developers should encourage best practices in the maintenance of equipment that use industrial gases, in order to prevent avoidable leakage and venting of refrigerants to the atmosphere. Many countries have adopted regulations concerning the production, use and reclaiming of industrial gases, as well as the servicing of equipment that use them. Recycling programmes for refrigerants in gaseous and liquid forms and for solid foams produced from industrial gases can be either mandatory or voluntary. Standards developers should be informed about applicable regulations, voluntary emission reduction programmes, and carbon offset programmes that encourage adherence to best practices for avoiding or reducing emissions from these GHG sources.

The utilization of fluorinated industrial gases contributes about the same amount of carbon dioxide equivalent (CO_2e) emissions to the global inventory of greenhouse gases as does the global aviation industry. Industrial gases include hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), nitrogen trifluoride (NF3) and sulphur hexafluoride (SF6). Chlorofluorocarbon (CFC) gases used as refrigerants and in the manufacture of insulating foams are regulated under the Montreal Protocol[40], which established specific target dates by which the production and use of CFCs need to be phased out. Where similar performance metrics can be achieved, standards developers should encourage the substitution of lower GWP industrial gases for higher GWP gases.

NOTE CFCs are not typically included in GHG inventories because they are classified under the Montreal Protocol as “ozone depleting substances”, and for this reason are being phased out.

8.3.4 GHG emissions from the process industries

Some industries generate GHG emissions from industrial processes as well as from combustion of fuels. These process emissions derive from the transformation of raw materials into manufactured products. Standards developers should remain open to specifying or accommodating less carbon-intensive products or tools used to mitigate emissions (e.g. 8.4.3) where the opportunity to do so arises.

NOTE Glass, for example, is made from a mix of raw materials that includes carbonates, and these release CO_2 during the glass manufacturing process. Likewise, the manufacture of cement releases CO_2 when a calcination reaction occurs in the cement kiln. Some pulp and paper facilities use calcium carbonate ($CaCO_3$) or sodium carbonate (Na_2CO_3) in their processes, and these materials release CO_2 during lime kiln and chemical recovery operations. Steel manufacturing releases CO_2 during the processing of carbonaceous material in ovens and furnaces.

8.3.5 GHG emissions from agriculture

Agriculture, forestry and other land use contribute nearly a quarter of global GHG emissions. This category includes CO_2 emissions due to deforestation, CH_4 released during cultivation of certain crops, such as rice, and N_2O released due to excess application of fertilizers to field crops. Sustainable forest management including reforestation and afforestation can increase carbon sequestration. The introduction of best management practices on agricultural land, such as no-till or low-till cultivation, increases soil carbon. The use of monitored soil data in micro grids can result in reduction of N_2O emissions by allowing the application of the precise amount of nitrogen-based fertilizers that growing crops need.

The elements in the FAO and Koronivia Joint Work on Agriculture[39] emphasizes the importance of agriculture and food security in the climate change agenda.

8.3.6 GHG emissions from livestock operations

Livestock operations can be a major source of methane emissions, particularly in large dairy operations and in concentrated animal feedlot operations. Standards developers should be aware of the various existing strategies to mitigate GHG emissions from livestock operations such as the choice of animal species/breed, the choice of feed types, feeding management, or manure management. Regarding the latter, standards developers should be aware that available bio-digester technologies allow for the capture of CH_4 from livestock operations. This gas can be used as a fuel for electricity generation or other uses. Under most circumstances, bio-digester-produced CH_4 can qualify for offset credits under various regulatory or voluntary GHG programmes.

NOTE 1 While the use of animal manure as a soil amendment can be beneficial for a small operator with few animals and a sufficient amount of cultivated farmland, larger operators typically manage livestock manure as a waste. In typical large operations, liquid and solid wastes are flushed into a basin or lagoon where anaerobic conditions develop at a depth of 1 m or more. These conditions result in the generation of CH_4 that, without controls, is vented to the atmosphere.

NOTE 2 In some jurisdictions, air quality regulations have begun to address this GHG emission source. However, in the majority of countries, GHG emissions from livestock operations remain a significant contributor of GHGs at the national level.

8.3.7 GHG emissions from waste management

The largest source of GHG emissions from waste management derive from landfill operations associated with the disposal of household (sanitary) and industrial (technical) waste.

NOTE Both streams of waste (household and industrial) include organic materials that decompose over time. Solid wastes disposed in a landfill are covered with soil and become anaerobic. Under these conditions, CH_4 is generated and, in the absence of collection systems, is vented to the atmosphere.

Standards developers should be aware of the variety of waste management practice and their respective performance with regard to climate change. For instance, the improvement of collection and early sorting of waste is likely to considerably increase the proportion of material being reused, recycled and recovered and thereby decrease the amount of landfilled wastes and their related emissions. Regarding the residual proportion of waste being landfilled, standards developers should be aware that existing technologies permit the collection and valorization of CH4 from landfill operations. This gas can be flared to convert higher GWP CH_4 to lower GWP CO_2, used as a fuel for electricity generation or other local needs, or upgraded to pipeline quality natural gas. Under most circumstances, landfill gas–produced CH_4 can qualify for offset credits under various regulatory or voluntary GHG programmes.

8.3.8 GHG emissions from biomass and natural processes

Standards developers should be aware that CO_2 emissions from the combustion of biomass are sometimes considered carbon neutral, on the theory that the CO_2 emitted from the combustion of biomass derived from sustainably managed sources is part of the natural carbon cycle, and also displaces the use of fossil fuels. Similarly, emissions of CO_2 from fermentation, such as in brewing or in the conversion lignocellulose to sugars, are not considered to be anthropogenic emissions. This accounting convention does not apply to combustion by-products such as CH_4 or N_2O. Standards developers can consult any of a number of GHG accounting standards or regulatory frameworks for accounting rules that apply in various jurisdictions.

NOTE ISO 14067:2018, Annex E, provides guidance on quantifying GHG emissions and removals for agricultural and forestry products.

8.3.9 GHG emissions from road transportation fuels

Road transportation fuel combustion accounts for approximately 25 % of global GHG emissions[32]. Strategies for reducing road transport emissions include electrification of vehicles, use of renewable compressed or liquid natural gas as transport fuel, and use of renewable hydrogen fuel cells in vehicles.

8.3.10 GHG emissions from the aviation sector

The aviation sector contributes approximately 3 % of global GHG emissions. Industry initiatives to reduce emissions, or to achieve carbon-neutral growth from 2020, include improvement of jet engine fuel efficiency, reduction of fuel consumption from flight operations improvements, and increased use of sustainable aviation fuels. Substitution of train travel and electronic means of communication for displacement of persons are other means for reducing climate impacts from this sector.

8.3.11 GHG emissions from maritime shipping

The maritime shipping sector contributes approximately 2,5 % of global GHG emissions. Industry initiatives to reduce emissions from this sector include “slow steaming” to improve fuel efficiency per ton/kilometre, switching to low sulphur fuels to reduce emissions of black carbon, and replacement of high GWP refrigerants with low GWP refrigerants.

8.4 Mitigation approaches

8.4.1 GHG reduction through energy management and energy efficiency

Energy management is a central element in achieving essential GHG reductions. While both goals, economic efficiency and CCM, are important, the standards developer’s attention is drawn to the role of energy efficiency and energy management as a crucial tool in meeting climate goals. In this context, it is possible that simply monetizing GHG emissions reductions does not actually result in the full level of efficiency that is both attainable and cost-effective without additional governance instruments. Policies are already in place to drive energy efficiency in some areas, however more developments in energy efficiency and energy performance improvements are expected.

NOTE 1 As an example, Article 8 of the European Energy Efficiency Directive[42] includes a requirement for large enterprises to identify energy savings. ISO 50001 and ISO 14001 are both referenced as compliance options in the directive.

NOTE 2 ISO 14007 and ISO 14008 provide information on concepts on monetization.

NOTE 3 ISO 50006 details the concept of energy performance and methodologies used to demonstrate energy performance improvement.

8.4.2 GHG reduction through renewable energy

Wind, solar and other renewable energy sources are steadily increasing their share in energy consumption across the world and this trend is driving down GHG emissions from electricity generation, the heating and cooling of buildings, and transport. Renewables have become a major contributor to the energy transition. Increased deployment of renewable energy in combination with activating energy efficiency potentials is contributing to emissions reductions and will be important if global temperature rise is to be limited to no more than 2 °C.

Standards developers should take into account renewable energy technologies as a continuing trend for lowering GHG emissions. Renewable energy encompasses multiple low carbon technologies including alternative fuels. Many renewable energy technologies are now competitive with fossil fuel-based alternatives driven by regulation and technology development with major increases in efficiency and decrease in costs. Opportunities exist to facilitate and incentivize adoption of renewable energy technologies in an environment of changing policies, standards, and market and regulatory frameworks. Challenges remain to ensure system reliability and security of supply while increasing the role of renewable energy technologies. This also includes accelerating energy storage solutions and coordination of electricity supply systems.

For example, industry, transport and the building sectors sometimes need to use more renewable energy. In these sectors, renewable sources including increased renewable electricity supply, but also solar thermal, geothermal energy and bioenergy, need to play important roles.

EXAMPLE The European Renewable Energy Directive[43] set a 10 % target for renewable energy use in the transport sector by 2020.

Standards developers should take such policy direction into consideration whenever a new standard is drafted or an existing standard is revised.

8.4.3 GHG reduction through fuel switching

One transition strategy towards a low carbon economy consists of switching from higher carbon emitting fuels, such as coal and heavy fuel oil, to lower carbon fossil fuels such as natural gas and petroleum distillates. In order to achieve net environmental benefits, the substitution of natural gas for higher GHG emitting fuels should be accompanied by strict controls on CH4 emissions during the extraction, transportation and storage of natural gas.

8.4.4 GHG reduction through resource management

Resource efficiency, policies and measures are expected to substantially develop in the coming years particularly in respect to the development of the circular economy. Typical resource efficiency measures include ensuring that products and materials are long-lasting, light-weight, can be reused, repaired, dismantled, remanufactured, recycled, etc., which can contribute to significant GHG reduction.

8.4.5 Carbon capture, use, and storage

Standards developers should monitor the advancement of carbon dioxide capture and storage (CCS) technology and possible other long-term carbon sequestration through natural processes for improvements so that legacy fossil fuel combustion facilities and process industries can implement CCS when investments become more economically feasible or when implementation or retrofitting is required by regulation. Standards developers should take into consideration the level of maturity of CCS technologies and the potential of other carbon sequestrations before introducing any specific provisions in their standards development.

NOTE 1 CCS is a technology designed to strip CO_2 emissions from the emissions discharge of industrial facilities (capture), such as power generating, cement manufacturing, steel manufacturing and chemical plants, and to direct the concentrated CO_2 gases to storage in underground geologic formations. CCS is a promising, if not yet fully tested or economically feasible, control technology that permits power generating operators to reduce the CO_2 emissions of their facilities without substituting renewable energy sources for fossil fuels. In the early stage of its implementation, CCS has only proven economical where the injected CO_2 presented the additional economic benefit of enhancing oil recovery from aging oil fields. CCS combined with other processes can be considered as a Negative Emission Technology (NET). A number of NETs are emerging, including Bio Energy with Carbon Capture and Storage (BECCS) and Direct Air Capture (DAC) technologies.

Standards developers should also consider carbon dioxide capture and utilization (CCU) in addition to CCS. CO_2, as a source of carbon, has the potential to be used in the manufacture of fuels, carbonates, polymers and chemicals. Due to its inherent potential, CCU is considered a complementary alternative to geological CO_2 storage and should be taken into consideration by standards developers according to technology maturity.

NOTE 2 CCU can delay carbon emissions to the atmosphere while reducing the consumption of the original feedstock and avoiding the emission of other substances associated to them. Enhanced oil and gas recovery (EOR, EGR), as well as CO_2 mineralization, can result in permanent storage, while in the other utilization cases, CO_2 is emitted later in the product chain, i.e. when the CO_2-based product is consumed.

NOTE 3 The technology of Carbon dioxide Capture, Utilization (or use) and Storage (CCUS) includes the concept that isolation from the atmosphere can be associated with a beneficial outcome. CCUS is embodied within the definition of CCS to the extent that long-term isolation of the CO2 occurs through storage within geological formations.

8.5 Financing the transition to a low carbon economy

8.5.1 General

Many GHG emission avoidance or reduction strategies make economic sense on their own merits. The cost of alternative/renewable energy production, photovoltaics and windmill components has declined over time, making many renewable energy projects economically feasible without subsidies. Nonetheless, the financing costs for achieving the transition to a low carbon economy are daunting. While standards developers typically do not specify financing mechanisms, they cannot be indifferent to the financial and other economic implications of the standards and best technological or non-technological (e.g. behaviour change) practices that they define.

There are many methods and paths for transitioning to a low-carbon society, not just innovation through renewable energy. In the transition period, it is necessary to promote steady and continuous GHG emissions reduction. In order to achieve it, it is necessary to shift funding measures to low-carbon fossil fuels and high-efficiency equipment or systems to reduce GHG emissions.

NOTE An OECD study from 2015 estimated at $93 trillion the cost of replacing and adding to the built environment by 2030 such that world targets of constraining average global warming to 2 °C or less (e.g. to the UNFCCC Paris Agreement[29] aspirational goal of 1,5 °C) is achieved. The scale of investments needed far outstrip the financing ability of governments. This means that private capital will need to play a significant role.

8.5.2 Policy incentives

Authorities in some jurisdictions can stimulate GHG mitigation activities and best practices by offering tax incentives. These practices are highly variable among jurisdictions and are subject to discontinuation at any time. Standards developers are not generally encouraged to define performance metrics in either new standards or revisions to existing standards based on the assumption that tax incentives will be available or remain available over time in any one or a number of jurisdictions.

8.5.3 Green debt instruments

Green debt instruments have been identified by many in the investment community as a means for financing the transition to a low carbon economy.

Green bonds are labelled as such by their issuer who agrees in the bond’s official offering statement to follow certain green bond principles or to adhere to a green bond standard. Green bonds represent an opportunity to channel investment into the more sustainable infrastructure needed to support the transition to a low carbon economy.

The issuer of a green bond pledges to spend the money raised by the debt issuance on projects with environmental benefits. Labelling a bond “green” is intended to generate more investor interest and make environmentally beneficial projects easier for investors to find and support. The green bond market has grown rapidly, but investor demand for green bonds in early years outstripped supply. Labelled green bonds do not necessarily lower the cost of capital for issuers, but it is possible that issuers will receive a reputational benefit. Interest rates for the debt are determined by the credit worthiness of the issuer, just as in non-green-labelled bonds.

Green loans come in two forms. Specialized green loans resemble green bonds because borrowers agree to use the proceeds for projects, activities and assets that produce environmental benefits, and to disclose expected and realized impacts. Standardized green loans are emitted by banks and other institutions to borrowers who do not have the resources to assess the eligibility of a proposed project, asset, or activity themselves, e.g. solar panel roof installations, or to report on its impacts. In standardized green loans, the lender assumes responsibility for determining eligibility and reporting on impacts.

NOTE The ISO 14030 series[2)] provides additional information related to green debt instruments.

2) Under preparation.

8.5.4 Mitigation projects

Developing a "GHG project" is one way of covering the additional cost of reducing GHG emissions. A GHG project is developed using ISO 14064-2 or the standard, methodology, or protocol of a specific GHG programme.

NOTE The purpose of developing a GHG project using an approved methodology is to demonstrate that GHG emission reductions or removal enhancements are real, quantifiable, permanent, additional, verifiable, enforceable, and (optionally) consistent with the UN Sustainable Development Goals[41]. This demonstration is achieved through the validation and verification of the project activity, and subsequent issuance of "offset credits". Offset credits have monetary value and can be freely traded on carbon markets, used in compliance mechanisms established to cap GHG emissions, or purchased and retired on a voluntary basis.

Standards developers should be aware of the existence of offset credit trading markets, as the availability and value of offset credits can make specifying a best practice economically feasible for users of a standard. The economic benefit can be limited in time, however, as it is possible that offset projects will only be eligible for crediting until such time as the technology or practice utilized in the project becomes commonplace. Since standards have the effect of raising common practice to new levels, standards developers should understand it is possible that the benefits of this form of carbon finance will only extend to a certain number of "early adopters."

8.6 Addressing climate change adaptation aspects in product and process standards

8.6.1 General

Standards focusing on ACC aim to help organizations cope with the scale of the coming challenges. Procedural standards can, for example, guide companies on how to identify and manage multiple climate change risks, and on how to integrate this work into existing risk management processes. Adaptation related standards help to identify priority adaptation measures, implement measures to reduce vulnerability and increase adaptive capacity and resilience. Adaptation considerations should not be limited to extreme weather events but should also address risks related to slow-onset climate change effects, such as drought, sea-level rise and permafrost thawing, as well as abnormal seasonal variability. They will ensure that an organization or a company is sensitive to climate change risks and does not contribute to increased vulnerability to climate change. The applicability of such standards is established during the social and environmental screening and categorization process. Standards developers should keep in mind that the requirements of ISO adaptation standards apply to all projects that can produce significant GHG emissions, have development outcomes that can be threatened by climate change, or can contribute to increased exposure and/or vulnerability to climate change.

NOTE In this context, adaptive capacity refers to the ability of systems, institutions, humans, and other organisms to adjust to potential damage, to take advantage of opportunities, or to respond to consequences.

Depending on the type of standard that is being developed, standards developers can need to take particular considerations into account when incorporating specific provisions into the standard to address ACC issues.

Where ACC has been identified as relevant and significant with respect to a specific standard, standards developers should take into account that the extent and form of this adaptation can vary depending on the nature and level of risk. The nature and extent of adaptation in each situation will depend on the costs and efforts involved, compared with the benefits of adopting different adaptation strategies to achieve sustainability and a degree of resilience.

Strategies for addressing climate change can involve:

— policy and planning approaches to changes to designs or approvals;

— policy and planning for emergency response;

— developing the knowledge base;

— the modification, relocation or replacement of existing infrastructure; or

— the alteration of operations or maintenance regimes.

When action is required for adaptation, standards developers should adopt a systematic process for the identification and evaluation of options, in order to plan the most appropriate adaptation strategies. Numerous policies, planning documents, guidelines and requirements exist and can be used for reference. However, there are currently no central sources of climate change data that can be specified. Individuals and organizations will need to identify for themselves the best available, authoritative and credible data that they can use.

The development of the adaptation landscape can be described as moving from concepts to action. It is now recognized by decision-makers that climate change presents a host of risks that will require adaptation-related actions. A "one size fits all" climate adaptation standard is inappropriate because adaptation is very context-specific. What works for private sector organizations does not necessarily apply to governmental entities or to municipalities. Similarly, guidance at the organizational level does not apply to climate adaptation planning at the regional, national or international levels. Additionally, different planning approaches will likely be relevant in urban areas versus rural areas and, in most instances, planning in the least developed countries (LDCs) will not utilize a framework that is more applicable in developed countries.

In addition to ISO 14090 as a high-level adaptation framework standard, a suite of context-specific adaptation standards are being developed to provide guidance on adaptation planning for organizations including local governments and communities and guidance on vulnerability, impacts and risk assessment. Reference should be made to these standards in order to help the identification of, or assess, any relevant impacts or aspects of the specific adaptation standards to the standard being developed.

8.6.2 Considerations and approaches for adaptation

It is helpful to draw on additional considerations and approaches in incorporating ACC in standards. In particular, adaptation actions can affect both organizational and societal culture. The following considerations provide a useful orientation.

— Adopt integrated approaches: Adaptation components should be embedded into the core policies, planning, steps and practices, of the standard.

— Prioritize the most vulnerable: Standards developers should identify and prioritize people, places and infrastructure that are most vulnerable to climate change (see ISO 14091).

— Use best available science: Adaptation measures should result from considerations based upon the best-available scientific understanding of relevant climate change impacts, risks, and opportunities, and also vulnerabilities.

NOTE 1 As climate change science is continuously progressing, it is important that standards developers always use the most current information in order to develop appropriate adaptation procedures. Advice on where an organization can source historical and future climate data can be found at national and international climate data centres, e.g. national regulatory authorities, state and local agencies, universities, national weather service providers. Information can also be obtained from numerous sources including scientific reports, relevant climate change impact assessments, governmental and intergovernmental publications and databases.

— Build strong partnerships: Adaptation requires coordination across multiple sectors and scales and should build on the existing efforts and knowledge of a wide range of public and private stakeholders who are involved in the application of the standard.

— Apply ecosystem-based approaches: Where standards are related to ecosystems, then adaptation measures should, where relevant, take into account strategies to increase ecosystem resilience and protect critical ecosystem services.

— Maximize mutual benefits: The standard should encourage the use of relevant strategies that complement or directly support other related climate or environmental initiatives, such as efforts to improve disaster preparedness, promote sustainable resource management, and reduce greenhouse gas emissions including the development of cost-effective technologies.

NOTE 2 Additional ACC principles are provided in ISO 14090.

8.6.3 Incorporating climate change adaptation measures into standards

There are a variety of different adaptation measures which can be adopted by organizations at different levels of their implementation of a standard. These range from strategic and management responses to specific technological approaches. There can also be economic and legislative considerations which need to be taken into account. These measures and considerations should be taken into account for any type of standard, irrespective of whether they are process standards, product standards, or management systems standards. These three categories of standards involve or are related to a TAP.

The screening process in Figure 6 provides a guide on appropriate measures to be considered depending on the standard being developed. The screening process in Figure 6 can be used as part of stage 0, 1 and 2 in the flow-chart sequence for the development of any standard (see Figure 2). Annex D provides some more examples of questions that can be considered for revision of standards with regards to ACC.

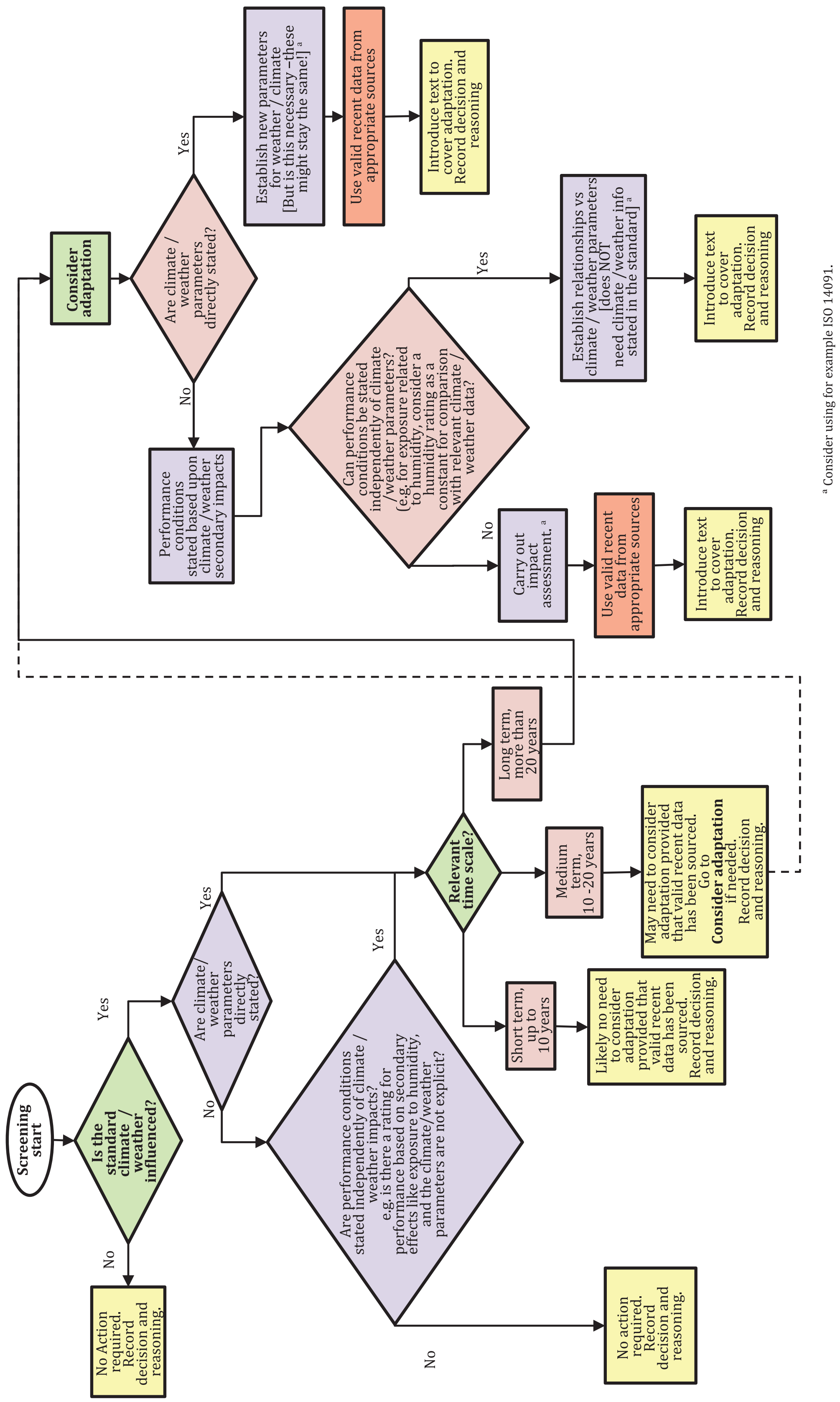


Figure 6 — Screening process: Assessing the need for climate change adaptation provisions in standards

8.6.4 Process standards

Process standards, and standards specifying measurements and definitions, can directly or indirectly govern or affect physical or social processes. Consideration should be given to the nature of such underlying processes, their consequences, and impacts, risks and opportunities from or towards climate change. These can include, but are not limited to:

— the climate change impacts, risks and opportunities and their consequences on the process or production of the materials needed to implement the standard;

— the potential for cost saving by improving adaptation procedures, measurement and definitions through standardization;

— the potential for facilitating the development of technologies that promote new industries and employment, or that provide beneficial services or similar economic benefits (and any resulting benefits for ACC).

8.6.5 Product standards

8.6.5.1 Climate change issues for products

Product standards, including standards related to a TAP, can have many different ACC issues. Standards developers should consider the different climate change issues of the TAP, and how the scope and application of the standard can affect them over their life cycle.

Examples include assessing the sensitivity of the following to climate impacts:

— the resources used and the costs;

— the supply chain;

— the nature and distribution of adaptation action benefits that can result from the use of the products;

— the end-of-life stage.

8.6.5.2 Incorporating climate change adaptation at design stage

The measures for adaptation are often related to changes in the design of the product in all stages of its life cycle, including in the design process itself. Design changes should consider the effect of climate and weather factors, as well as extremes and potentially new hazards that have not been experienced previously, on the exposure or operating conditions for products and systems.

Product standards should:

— consider sensitivity/vulnerability of materials to weather and climatic conditions;

— take into account extreme end use conditions using appropriate calculations;

— consider material composition or structure to adapt to the potential changes in operating conditions;

— include testing in relation to projected changed end use conditions or new hazards (interfaces to testing standards);

— consider increasing maintenance to achieve the planned life of products and in spite of the changed end use conditions (interfaces to service standards); and

— recommend the testing and evaluation method after the product has undergone exposure to an extreme climate event in order to ensure the safety of any continued use of the product.

8.6.5.3 Incorporating adaptation in the product life cycle

8.6.5.3.1 General

This subclause describes how to integrate provisions regarding effects of climate change. It covers each life cycle stage and provides examples of climate change impacts, risks and opportunities and ACC provisions.

Standards developers should consider avoiding where possible the potential for unintended consequences where adaptation measures can result in more GHG emissions than before any standard revision or new standards development.

8.6.5.3.2 Acquisition

Climate change impacts on the acquisition of raw materials include:

— supplier disruption due to weather event, in particular where suppliers are in vulnerable locations;

— raw material production affected by climate change (e.g. agricultural products).

8.6.5.3.3 Production

Climate change impacts on production processes include:

— impacts on staff comfort or health and safety due to severe weather and its impacts;

— impacts on climate, weather or temperature sensitive production processes, such as those reliant on cooling, water use, energy supply, using long-lived assets;

— impacts on outdoor activities that are weather dependent.

8.6.5.3.4 Service provision

Climate change impacts on service provision include:

— impacts on staff or customer comfort or health and safety due to excessively high temperatures or inclement weather;

— impacts on staff or customer travel due to extreme weather events;

— impacts on climate, weather or temperature sensitive equipment or consumables, such as those reliant on cooling, water use or energy supply;

— impacts on outdoor activities that are weather dependent.

These impacts can lead to either a disruption, where service provision ceases entirely or to a change in the quality of the service provided. If resources such as equipment or premises require longer planning horizons, the future climate conditions, including slow-onset climate change effects, should be taken into account. This can even involve the relocation of a service facility.

8.6.5.3.5 Use

Climate change impacts on the use stage include:

— impacts on the effectiveness of a product that is climate or weather sensitive;

— impacts on users leading to changing requirements of products, especially for users in vulnerable locations or those with vulnerable supply chains;

— impacts on maintenance requirements.

8.6.5.3.6 End-of-life

Climate change impacts on a product at the end of its life include:

— some disposal or reprocessing activities can be weather or temperature sensitive;

— reusability can be affected by increased weather-related wear and tear;

8.6.5.3.7 Transportation

Transportation needs to be considered at all stages of the life cycle.

Climate change impacts to transportation include:

— weather events cause disruption to transport infrastructure leading to delays, in particular if travelling over long distances or through affected regions;

— product is damaged or degraded during transport due to temperature or humidity.

8.7 Adaptation and mitigation in management system standards

Management system standards (MSS) can provide a tool for mitigation considerations and also for ACC.

In 2015, ISO 14001 was substantially revised (see Clause D.1). The revised standard makes clearer reference to the two-way relationship between organizations and the environment, i.e. the organization needs to consider environmental conditions being affected by or capable of affecting the organization (see ISO 14001:2015, 4.1). It therefore continues the requirement for organizations to address their impacts on the environment, including their contribution to climate change (mitigation), but also now introduces the importance of resilience and adapting to our changing world (e.g. impacts on the organization from the changing climate). This combination of stewardship responsibility along with organizational response and resilience, is a principle that can be increasingly integrated into organizational management systems (not just environmental management systems).

The direct and indirect effects of climate change upon organizations range from carbon taxation to severe weather impacts. It is imperative that organizations address these impacts on their activities strategically and operationally. Many organizations have a form of MSS, whether based on ISO 14001 or not. Such systems form a ready opportunity to start, renew or continue their journey towards climate action.

MSS can help organizations address climate change impacts, risks and opportunities, for example through processes governed by the management system. Management systems can provide a framework for making decisions on activities of workers, the additional stakeholders involved, and the systematic strategies for identifying and managing climate change and related sustainability issues.

All ISO MSS are based on the same high-level structure, identical core text, as well as common terms and definitions. This common structure allows for climate change issues to be addressed in many MSS (not just environmental MSS such as ISO 14001). The subjects of relevant clauses include the following.

— The context of the organization, which determines why the organization is here: As part of the answer to this question, the organization can identify internal and external issues (such as climate change) that can impact on its intended outcomes, as well as all interested parties and their requirements. It also needs to document its scope and set the boundaries of the management system — all in line with the business objectives.

  NOTE 1 The clause is subdivided as follows: Understanding the organization and its context; Understanding the needs and expectations of interested parties; Determining the scope of the specific management system; the specific management system.

— Planning, which brings risk-based thinking to the front and again climate change will be relevant in many MSS. Once the organization has highlighted risks and opportunities, it needs to stipulate how these will be addressed through planning. The planning phase looks at what risks are addressed, by whom, how and when (and can include risks and dependencies related to climate change). This proactive approach replaces preventative action and reduces the need for corrective actions later on. Particular focus is also placed on the objectives of the management system. These should be measurable, monitored, communicated, aligned to the policy of the management system and updated when needed.

NOTE 2 The clause is subdivided as follows: Actions to address risks and opportunities; the specific management system objectives and planning to achieve them.

CCM and ACC interactions will increasingly be relevant to different MSS clauses, in particular (but not limited to) the "Context of the organization" and "Planning" clauses discussed above. Revisions to MSS should consider such climate change interactions and dependencies to ensure the MSS is both relevant and future-proof.

While the high-level structure cannot be changed in the development of an MSS, subclauses and discipline-specific text can be added. In this way, further climate change considerations can also be addressed.

Figure 7 provides an illustration for integrating ACC considerations into a revised MSS. In addition, Clause D.1 provides examples of how MSS clauses (e.g. in ISO 14001) can be used to address climate change.

NOTE 3 Management systems are typically characterized by the "Plan-Do-Check-Act" (PDCA) model.

High Level Structure of MSS — *Clause*	*Related clause*	***Possible intervention points*** *Consider inclusion of adaptation actions*
1. Scope	Can be relevant	Should any mention of specific climate change adaptation/mitigation requirements be included? Will be there an advantage to include adaptation/mitigation issues here?
2. Normative references	Can be relevant	Any specific adaptation/mitigation references to add as normative? Any industry standards on addressing climate change adaptation/mitigation?
3. Terms and definitions	Can be relevant	Any adaptation/mitigation terms used to be added?
4. Context of the organization	4.1 Understanding the organization + its context 4.3 Determining the scope of the management system 4.4 The management system	What does the organization do that will be affected by climate change (directly or indirectly)? Needs and expectation of interested parties? Establish scope and boundaries considering context, interactions, longer term, system thinking and lifecycle. Implement, embedded, continually improve the MS.
5. Leadership	5.1 Leadership and commitment 5.2 Policy 5.3 Roles, responsibilities and authorities	What is the organizational policy related to climate change? Who will be responsible? Consider within the policy –environment? resilience? Responsibility? Opportunity to review roles and to consider need for skills (ensure correct climate change skills in mitigation and adaptation).
6. Planning	6.1 Actions to address risks and opportunities 6.2 Management system objectives and planning to achieve them	What risks and opportunities might be related to climate change (aspects). Integrate into risk management or develop. What are the long term and medium term plans? Consider climate change in those plans. Develop new plans if needed with objectives and targets for climate change.
7. Support	7.1 Resources 7.2 Competence 7.3 Awareness 7.4 Communication 7.5 Documented information	What are the training needs, capacity on adaptation/mitigation issues, technical competencies in analysis of effects and impact to the system. Also wider resourcing e.g. technology/collaboration Develop awareness of climate change policy, approach and roles/contributions.
8. Operation	8.1 Operational planning and control	Which operations need to be developed in either mitigation or adaptation context? Integrate and operationalize actions to address climate change considerations. This can extend widely for example through the supply chain, through product design, through capital investment, etc.
9. Performance evaluation	9.1 Monitoring, measurement, analysis and evaluation 9.2 Internal audit 9.3 Management review	What are the monitoring requirements for relevant climate change parameters (mitigation and adaptation)? Audit the climate change related performance. Integrate climate change performance consideration within the management review.
10. Improvement	10.1 Nonconformity and corrective action 10.2 Continual improvement	Continual improvement process should include consideration of future impacts of climate change to the organization and the MS as well as to the organizations mitigation approach.

Figure 7 — Possible intervention points for considering climate actions in a management system standard

8.8 Other aspects for consideration

8.8.1 Organizational inventories

Product, sectoral and energy management standards can support organizational inventories of GHG emissions. Standards developers should consider the effect of the standard on the accounting of GHG emissions.

National level accounting of GHG emissions is conducted according to the Tier methodology provided in the IPCC Guidelines for National Greenhouse Gas Inventories[35]. National level accounting is carried out typically by countries who are members of the UNFCCC. Member countries report national inventories of GHG emissions to the UNFCCC. The most developed countries report annually, while developing countries report on a less regular timetable.

GHG emissions accounting can also be performed at the organizational level. Most organizations who report do so annually, often in a company "sustainability report" or through some other disclosure method such as via a reporting portal operated by a third party. GHG emissions reporting at the organizational level is performed within an organizational boundary and a defined operational boundary. This type of accounting, specifications for which are given in ISO 14064-1, usually addresses both the "direct" and "indirect" emissions of the organization. Direct emissions are those that issue from combustion of fossil fuels, industrial processes, and fugitive sources. Indirect emissions, on the other hand, occur when an organization imports electricity, steam, heat or cooling from a source outside its operational boundaries, usually by purchase. These emissions are "indirect" because the reporting organization is not directly responsible for generating them. Instead, they are the final user of the energy that has been generated by a provider, such as a utility company, that lies outside the organization's operational boundaries. In addition, indirect emissions include emissions associated with the organization's supply chain (upstream emissions), and emissions associated with the use and end-of-life phases of an organization's products (downstream emissions). Organizations can influence their indirect emissions through contract requirements and compensation measures.

8.8.2 GHG project monitoring

GHG "projects" are activities that cause GHG emission reductions or GHG removal enhancements compared to a specified GHG baseline beyond business as usual. A GHG project typically is distinguished from mere conservation efforts that an organization can undertake to reduce its GHG emissions, such as by taking steps not to waste energy or to recycle paper, glass and aluminium. GHG projects are formalized emission reduction/enhancement activities that are closely monitored and compared to a hypothetical alternative baseline scenario. When pursued in accordance with a defined methodology or protocol, GHG projects can generate emission reductions that are recognized by a third party and can be monetized through the issuance and sale of verified emission reduction units. A GHG project targeting GHG "removal enhancement" is a GHG project that increases the amount of CO_2 removed from the atmosphere, such as through enhanced forestry management or reforestation.

8.8.3 Per unit of product "footprints"

It is sometimes useful to quantify the total amount of GHG emissions and removals associated with a specific good or service (e.g. an event). The sum total of such values is normally referred to as a "carbon footprint of a product" (CFP). Standards developers considering per-unit-of-product GHG emissions and removals should recognize that values of the CFP can vary depending upon the quantification approach used and the applied system boundary of the CFP study. A partial CFP results when the system boundary does not include the entire life cycle of the product (or service) system under study. Knowledge of CFPs and partial CFPs provides a basis for reducing the carbon intensity of a product in all or some stages of its life cycle.

In some cases, the CFP can be based on secondary data from industry averages, while in other cases, the CFP can be localized to and based upon a specific manufacturing or processing site, and is consequently constructed with primary data based on the unit processes from that site.

Both approaches have legitimate purposes. The former can be utilized when the goal of the quantification of the CFP is to set a benchmark for evaluating relative performance. Standards developers or the users of standards can want to know what the "average" CFP is within a "sector", so that users of a particular product standard can subsequently evaluate the CFP for any particular supplier's product in that context. On the other hand, a standards writer or standards user can want to know that the GHG emissions attributable to the CFP have been localized to a particular production process or manufacturer of a product. This approach is particularly useful when evaluating the claim of any particular supplier for comparative purposes, and calls for the evaluation of site-specific data. CFP product category rules have an important role in facilitating the comparability of CFPs.

Such claims related to the carbon footprint of a product that attempt to localize the CFP to a particular manufacturing production process can use secondary industry average data for some portion of upstream emissions and for emissions associated with the use stage and the end-of-life stage of the life cycle of the product system studied. This suggests that it is most likely that only a partial CFP that is based on “gate-to-gate” emissions at a particular manufacturing location can actually be based solely on primary data.

NOTE 1 ISO 14067 describes principles, requirements and guidelines for the quantification and reporting of the carbon footprint of a product (CFP).

NOTE 2 ISO 14026 describes principles, requirements and guidelines for footprint communications for products addressing areas of concern relating to the environment.

8.8.4 Role of verification in monitoring and evaluation

Verification can play an important role in monitoring and evaluating GHG mitigation actions. Verification can be performed by a first party, a second party, or a third party. ISO 14064-3 is widely used as a methodological approach to determine, with reasonable or limited assurance, the accuracy of quantified GHG information and data.

Standards developers should note that monitoring and evaluation is also of relevance to ACC.

Standards developers should take into account ISO/IEC 17007 requirements when drafting normative documents suitable for use in conformity assessment.

Annex A
(informative)

Using systems thinking to set boundaries for climate change adaptation[3)]

A.1 Systems thinking — The concept

Systems thinking is about understanding the complex, nonlinear and interconnected system in which an organization operates. Many large organizations are complex, adaptive systems in themselves, meaning that the elements that make up an organization (for example, emergency response, transport pool, supply chain, finance, procurement teams) have a complex set of interactions that are dynamic and so do not always interact in the same or a consistent way. Organizations require techniques for managing these interactions effectively. This makes the organization adaptive in nature so that it responds according to the needs or circumstances at the time.

A.2 Systems thinking — Benefits

Systems thinking can help users to consider the full set of interactions and interdependencies affecting their organization, including influences within and from outside the context within which the organization operates. The approach can be used to set boundaries around adaptation activity such that the organization filters out elements less relevant to its activities, products and services while still understanding the importance of these elements. The organization will be left with tasks within a defined boundary, or scope, which results in a manageable set of adaptation activities.

Systems thinking can help to identify positive and negative feedback loops that can attenuate or exacerbate the impacts of change. Similarly, systems thinking can help to identify unintended consequences of decisions or actions before they are implemented.

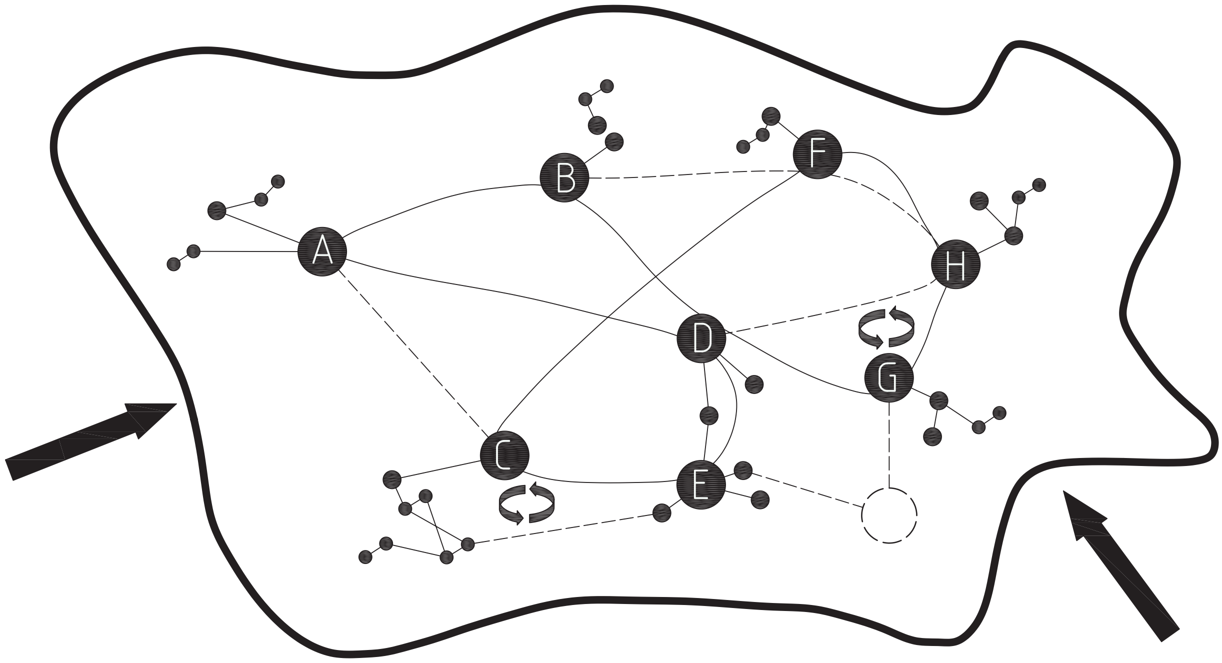
In other words, organizations can use systems thinking to identify, define and refine those activities that really matter and can be controlled by interventions. In this way, manageable boundaries can be set which make adaptation more achievable.

A.3 Interconnections, dependencies and interdependencies

Thinking about interconnected relationships in a system is crucial for understanding how an organization might be able to intervene in the system to influence the sustainable management of resources in its portfolio of activities, products and services (see Figure A.1). For example, in the case of services, this might include identifying all the interdependencies involved in bringing the service to customers, as well as the ways in which the changes in climate will impact service delivery over time.

NOTE Dependencies are one-way interconnections, meaning that organization A depends upon a product or service from organization B, but not the other way around; whereas interdependencies are two-way interconnections, meaning that organizations A and B depend upon each other. An example of the latter would be how an electricity power station depends upon rail transport for its supply of biomass, and the rail transport system depends upon electricity for its control and traction systems.

3) This annex is reproduced from ISO 14090:2019, Annex A.



Key

A	an organization: one part of a system
	key actors or stakeholders: e.g. regulators, suppliers, communities, NGOs, technology providers, clients
	external factors: e.g. environmental constraints, policy and regulation, consumer preferences, advances in technology
	feedback loops: e.g. new communication channels, new relationships, customer feedback, recycling or reuse of products and materials, wider social value
	system boundary: e.g. geographical/place based, sector, market
	relationship link: e.g. formal (contractual, transactional) and informal (knowledge exchange, business support, community relationships)
	systematic intervention: new inputs, changing the total output of the system, e.g. standards or rating schemes, policy changes, product or service innovation, business model innovation, increase access to solutions, reshape supply, create user demand, implement new platforms

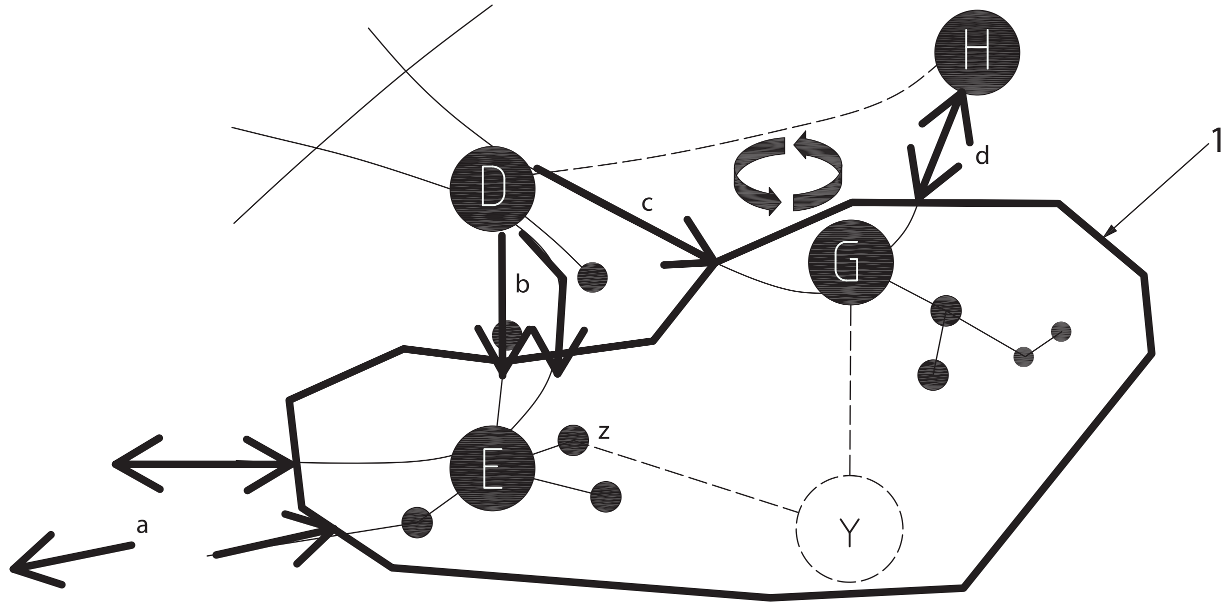
Figure A.1 — Systems concept showing a general systems concept with interventions highlighted

A.4 Mapping and identifying boundaries and sub-systems

Figure A.1 shows how eight organizations A to H are interconnected by relationships and have key actors or interested parties. A boundary has been drawn around the whole system showing external factors as outside of the boundary. An intervention is depicted between organizations G and E that would have come about through an adaptation plan.

Figure A.2 takes systems thinking to a more granular level. It depicts a filtered system that encompasses organizations G and E as a sub-system. This is a sub-system of the system shown in Figure A.1, however, it is a system in its own right. It has its own external factors and so (inter) dependencies on external organizations shown by arrows; arrow a from organization C from Figure A.1, arrows b from organization D in Figure A.1, arrow c from organization B and arrow d from organization H. The dotted area Y is an intervention between an actor within organization E called z and G.

This is an example of how a large system of systems (see Figure A.1) can be reduced further to a smaller system of systems (see Figure A.2).



Key

1 sub-system boundary

Figure A.2 — System of systems concept showing a filtered system based upon Organizations E and G

Hence, the sub-system in Figure A.2 has a boundary and can be looked at as a quasi-independent grouping that could be examined (for example, for its influence on adaptation) on its own; however, users of this map will recognize that decisions, or climate and weather-related impacts, in this sub-system can impact other sub-systems because of the (inter) dependencies apparent shown by arrows a and d.

A.5 Practical examples for Figure A.2

Table A.1 shows some broad illustrations explaining the systems mapping that organizations might make, based on the map in Figure A.2. Each illustration is not meant as an exhaustive set of explanations covering every aspect shown in Figure A.2 and is offered merely to show how the concept might be used. The systems map ordinarily needs to be drawn bespoke for every organization's situation, that used here is idealized.

Table A.1 — Illustration of how the systems map from Figure A.2 might be used by some organizations

Organization E might be a...	Actor z could be a...	Organization G might be a...	Organization D could be a...	Intervention Y might involve... to solve...
Farm	Purchaser	Local feedstock distributor	Feedstock distributor located abroad	Sourcing feedstock from D to shorten supply chains as D has a good stockpile facility
Energy transmission grid	Back-up power supply connection	Local solar energy source	Energy supply abroad	Sourcing energy from D to bolster robustness and reduce costs
Local authority	Drainage maintenance team	Drainage contractor	Central government support	Sourcing expertise from D to increase capacity
Coastal town	Coastal defence team	Other coastal towns within similar region	Regional flood authority	Setting up agreements with other like-minded towns to pool resources

Annex B
(informative)

Background information on approaches for responding to climate change

B.1 General

There are many components to consider in the phenomenon of climate change. Focusing solely on technology, markets, and policy in climate mitigation strategies is incomplete without including human and social factors, which can be a major driver for technology adoption, policy adoption and market creation.

A broad perception is needed to facilitate the development of realistic, substantive standards at each level. A polycentric approach allows a committee to develop more tailored provisions to address the various climate change issues.

B.2 Systems thinking approach

The effects of climate change are real. They influence many complex relationships within an organization regarding production processes, products and services susceptible to changes in the various climate stressors.

The potential threats posed by a changing climate cannot be combatted on only one front — they should be dealt with more holistically, with an organized approach that considers all of the relevant ramifications. In this case, where the standardization subject is operating within a dynamic wider system and where there are multiple direct and indirect interactions, the approach of systems thinking can be useful.

An overview of interconnections and interdependencies, derived from an understanding of the overall system, can help standards developers to scope and focus their considerations on priority sub-systems. This kind of thinking helps to cope with the challenge that the primary threats from climate change are in the future, but these causes stem from present, past, and future actions. Standardized solutions reducing the adverse climate change impacts and risks should consider both present and future actions; and can generally be grouped as mitigation or adaptation strategies. A mitigation strategy involves reducing GHGs through their prevention as emissions or removal from the atmosphere.

For many practical considerations, it is appropriate to develop a suite of system components that will efficiently meet the needs for considering the climate related issues.

Systems thinking views a problem not in isolation but as part of a larger system or context. Feedback is a key concept in systems thinking and corresponds to the ISO requirements to conduct a systematic review after a specific time using the standards.

B.3 Life cycle approach

As awareness about climate change increases and concerns grow, investors are demanding more transparency, and consumers are seeking greater clarity and accountability regarding climate change issues. For example, companies are increasingly receiving requests from stakeholders to measure and disclose their corporate GHG inventories, and these requests often include a company’s products and supply chain emissions. Companies need to be able to understand and manage their product-related GHG risks if they are to ensure long-term success in a competitive business environment and be prepared for any future product-related programmes and policies.

Using the life cycle approach to address climate change in standards does not mean conducting or following a complete life cycle assessment. ISO 14040 and ISO 14044 are the primary ISO standards providing requirements and guidelines for the compilation and evaluation of inputs, outputs and potential environmental impacts of a product system throughout its life cycle.

In this document, adopting a life cycle approach means applying "life cycle thinking". For example, for ACC issues, life cycle assessment is not an appropriate approach. However, the life cycle perspective can help ensure all relevant aspects of a process, service or product are considered. Applying life cycle thinking is about product sustainability operational for businesses that are aiming for continuous improvement. These are businesses that are striving towards reducing their footprints and minimizing their environmental and socio-economic burdens while maximizing economic and social values.

B.4 Risk-based approach

Coping with climate change involves making decisions in the face of uncertainty. There are uncertainties relating to the rate and geographical distribution of changes in climate variables and there are modelling uncertainties. Most importantly, however, there are uncertainties relating to how climate change will translate into climate change impacts, risks and opportunities related to materials, processes and systems and what the consequences of these impacts, risks and opportunities will mean for society. The use of a risk-based approach to adaptation allows for uncertainties to be acknowledged and embraced in the decision-making process and for climate change risks to be considered alongside and on an equal footing with other risks that are routinely managed.

Climate change risks are very particular in nature. In many cases, little can be said about their short- or long-term probability, and climate adaptation costs would increase substantially if the probabilities were determined first. In such cases, a conventional risk assessment (e.g. based on ISO 31000), which uses statistical probabilities, will not be able to draw a clear picture of the risks an organization faces due to climate change. For this reason, various approaches have been developed and partly tested in practice to assess climate change risks in particular. One solution is the use of climate impact chains that have proven in practice to be an effective instrument. By being based on a highly participatory process, they provide an opportunity to discuss in detail all relevant risk factors. In addition, they lend to both a further quantitative analysis where feasible and required and a qualitative analysis in other cases.

B.5 Precautionary approach

By placing a greater emphasis on direct measures to systematically monitor observable effects, a precautionary approach offers a way to be more responsive to harm when the first signals of it manifest themselves in the real world, however ambiguous these first signals can be. By an active search for early warnings, one can hope to significantly reduce society's exposure to uncertainty and ignorance. For the case of the thermohaline circulation (THC), German scientists have shown that a monitoring system to detect changes in THC in time to be useful for climate policy is possible by more and more frequent observations. They argue that the benefits of such an improved ocean observation system would considerably exceed the costs[44].

NOTE The IPCC Assessment Reports[32],[33] constitute a respected and peer-reviewed source of information.

Other strategies that can help in anticipating surprises include focusing on the underlying principles of surprise, which is what happens in surprise theory and systematic "thinking the unthinkable", by imagining unlikely and undesirable future events or future states of the environment. To follow reliable climate scenarios can be a better source than the information provided by the climate services centres.

B.6 Identifying climate change issues

In Table B.1 is an adaptation of Table 1 for use as a preliminary assessment as to whether a document addresses climate change issues. It has been filled in with data as an example for a standard addressing sustainable events.

Table B.1 — Example of Table 1 for the preliminary scoping of climate change (CC) issues/topics related to a sustainable events standard

Column A	Column B	Column C	Column D	Column E	Column F
CC issues/ topics relevant to the standard and/or its related TAP	**CC issue/ topic is specifically addressed in the standard or NWIP (Y/N/NA)[a]**	**CC issue/topic is typically addressed when the standard is used (Y/N/NA)[a]**	**Explanation as to how the standard/NWIP addresses CC issues (either specifically or when used)**	**Does the standard/ related TAP impact the issue or receive impacts from the issue? (Y/N/NA)[a]**	**Explanation of context where CC is a potential consideration**
Any general reference to CC (or aspects of CC)	Y (See various clauses)		There is passing reference to GHGs (example of significant issue that can be addressed in the MSS)		
Direct or indirect GHG emissions (e.g. from energy use, fuels, fugitive emissions)	N	Y — See 6.x.x Annex Y	Events have the potential to generate significant direct and indirect GHG emissions. Direct = on-site/venue energy generation or emissions from owned/ operated plant (e.g. gas boilers) and vehicles Indirect = purchased electricity Other Indirect = goods/ services sourced for event including merchandise, catering, uniforms, etc., business travel, third-party transportation (e.g. logistics, event specific spectator transport), waste management		Standard is not explicit on the issues to be addressed or the solutions to such issues — CC/GHG emissions identified as potentially relevant issues to consider
Quantification/ measurement of GHGs	N	Y — See 6.x 9.x	Required to monitor, measure, analyse and evaluate all objectives and targets set in relation to significant issues (e.g. GHG emissions)		Standard is not explicit on what should be measured or monitored
GHG removals (sequestration)	N	N		Unlikely to be applicable and typically is not something that an event organizer, supplier or venue would do	

[a] Y/N/NA: Yes/No/Not Applicable.

Table B.1 *(continued)*

Column A	Column B	Column C	Column D	Column E	Column F
CC issues/ topics relevant to the standard and/or its related TAP	**CC issue/ topic is specifically addressed in the standard or NWIP (Y/N/NA)[a]**	**CC issue/topic is typically addressed when the standard is used (Y/N/NA)[a]**	**Explanation as to how the standard/NWIP addresses CC issues (either specifically or when used)**	**Does the standard/ related TAP impact the issue or receive impacts from the issue? (Y/N/NA)[a]**	**Explanation of context where CC is a potential consideration**
Land use or land use change (in particular soils, forestry, peatland, impacts upon "carbon sinks")	N	Y — See 6.x.x Annex Y	Can be relevant for events involving development and operation of indoor and outdoor sites/venues		Standard is not explicit on the issues to be addressed or the solutions to such issues — biodiversity and natural preservation identified as potentially relevant issues to consider
Vulnerability or resilience to CC impacts	N	Y — See 6.x.x Annex Y	Potential for climatic impacts to be identified as a risk and significant issue for some events which can be impacted by extreme weather		Standard is not explicit on the issues to be addressed or the solutions to such issues
Adaptation to climate change	N	Y — See 6.x.x Annex Y	Potential for ACC to be identified as a significant issue for events which take place in extreme temperatures or locations at risk of extreme weather		Standard is not explicit on the issues to be addressed or the solutions to such issues
Communication or claims concerning CC	N	Y — See 7.x	Standard requires appropriate communication on significant issues (e.g. GHG emissions), steps taken to address such issues as well as key progress		Standard is not explicit on specific topics to communicate
Audit, certification, verification relating to CC	N	Y — See 9.x 9.x.x	Standard requires arrangements for managing/addressing significant issues (e.g. GHG emissions) to be subject to internal audit and management review		Standard is not explicit on assurance of specific topics

[a] Y/N/NA: Yes/No/Not Applicable.

Table B.1 *(continued)*

Column A	Column B	Column C	Column D	Column E	Column F
CC issues/ topics relevant to the standard and/or its related TAP	**CC issue/ topic is specifically addressed in the standard or NWIP (Y/N/NA)[a]**	**CC issue/topic is typically addressed when the standard is used (Y/N/NA)[a]**	**Explanation as to how the standard/NWIP addresses CC issues (either specifically or when used)**	**Does the standard/ related TAP impact the issue or receive impacts from the issue? (Y/N/NA)[a]**	**Explanation of context where CC is a potential consideration**
Skills and competencies relating to CC	N	Y — See 7.x	Standard requires all individuals with responsibility for aspects of the management system to be competent including those carrying out tasks relating to objectives and targets (e.g. managing or measuring GHG emissions)		Standard is not explicit on competencies relating to CC
Technology developments relevant to CC	N				Standard is not explicit on the issues to be addressed or the solutions to such issues
Other important developments of significance to CC such as carbon trading, environmental financing, investments and legal claims (loss and damage)	N	Y — See 6.x.x 6.x	Standard requires appropriate objectives, targets and plans to be in place for managing/ addressing identified significant issues (e.g. GHG emissions) which can include the use of market-based instruments		No explicit reference in standard

[a] Y/N/NA: Yes/No/Not Applicable.

B.7 Timescales and future considerations

Standards developers consider timescale dynamics over the short and long term and the consequence of climate change and its social, environmental and economic impacts for the subject of their standards. Standards developers should take into consideration changes in future climate, legal requirements, forthcoming low carbon economy challenges and ACC challenges.

Timescale dynamics over the short and long term are important when considering climate change and the implications for any standard.

The physical science is clear that atmospheric GHG emissions are at critical levels, therefore increasing the significance of further emissions within the short term (over the next decade). This has implications for policy makers to escalate policies and action for both mitigation and adaptation. Reference is sometimes made to the diminishing "carbon budgets" available.

Many of the implications are estimated in the IPCC Special Report[34]. This report maps out four pathways if global warming is to be restricted to 1,5 °C, with different combinations of land use and technological change. Reforestation is essential to all, as are shifts to electric transport systems and greater adoption of carbon capture technology. Carbon pollution would need to be cut by 45 % by 2030 — compared with a 20 % cut under the 2 °C pathway — and come down to zero by 2050, compared with 2075 for 2 °C. Standards developers should consider this timescale dynamic and its associated social and economic implications. As an example, the IPCC estimate that carbon prices will need to be three to four times higher than for a 2 °C target (noting that overall costs of delaying policy intervention would be significantly higher longer term).

A further relevant development for standards developers is to consider risk approaches over time.

B.8 Task Force on Climate Related Financial Disclosures (TCFD)

The Task Force on Climate Related Financial Disclosures (TCFD) initiative by the G20 Financial Stability Board has developed recommendations and guidance for voluntary climate-related financial disclosures that can provide decision-useful information to lenders, insurers, and investors. The TCFD members include both users and preparers of disclosures from across the G20 constituency covering a broad range of economic sectors and financial markets. The following are central within the TCFD recommended approach to assessing risk and to related organizational disclosures.

— Scenario analysis: A method to help understand the future and to help inform actions that can enhance resilience and flexibility to the future state. Use of scenario analysis for assessing climate-related risks and opportunities and their potential implications is an increasing activity. Its outcomes will be of interest to standards developers.

— Transition risks relating to the mitigation agenda: These are risks that organizations (and users of standards) will all face as economies transition towards low and zero carbon futures states. For example, these can include constraints on emissions, imposition of carbon tax, water restrictions, land use restrictions or incentives, and market demand and supply shifts.

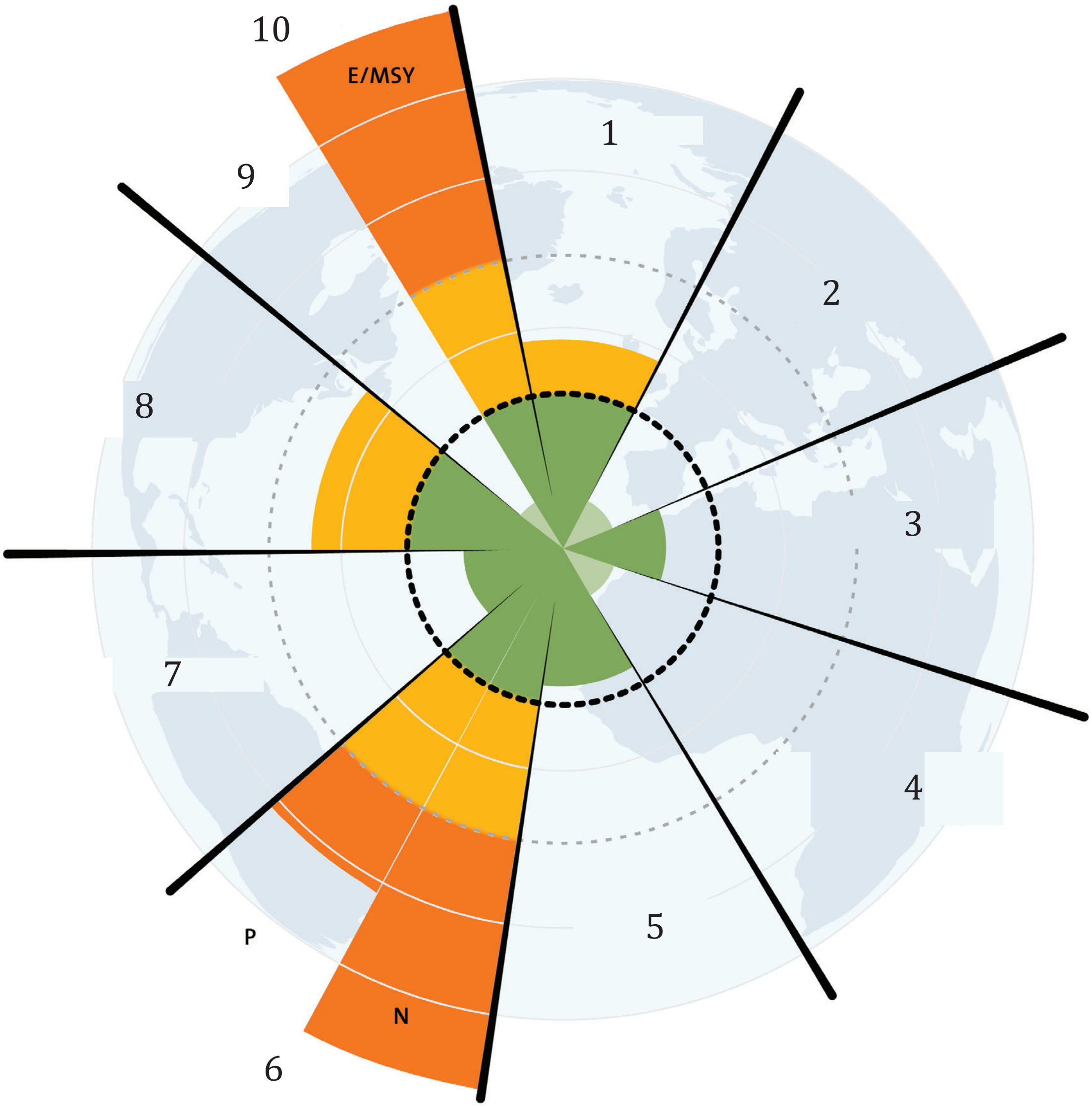
— Physical risks relating to the adaptation agenda: These include disruption of operations, supply chains, damage and destruction of property.

— New opportunities relating to both adaptation and mitigation, for example opportunities from weather and climatic changes at the local level (e.g. introducing new crops at local level) access to new markets and new technology associated with economic transitions (e.g. CCS technology).

Annex C
(informative)

Planetary boundary conditions

The concept of planetary boundaries describes a framework within which humanity needs to live in order to continue to develop and thrive for generations to come. Climate change, freshwater consumption, land use change and loss of biodiversity are examples of planetary boundaries. Crossing these boundaries can generate irreversible environmental changes, while respecting them significantly reduces risks. Planetary boundaries can be broken down in order to select measures that can be addressed at a regional, community organizational level, while taking into account the specific situation. As mentioned above, climate change issues (CO_2 concentration in the atmosphere <0,035 % and/or a maximum change of +1 W m^{-2} in radiative forcing) are explicitly identified as a planetary boundary. Within this background, the concept of planetary boundaries represents a useful approach to reducing risks. Developers of standards related to climate change should make use of this approach. They should take the concept of planetary boundaries as a source providing a sound basis for considering the interrelationships between adaptation and mitigation. To derive synergies or avoid trade-offs (in the meaning of goal conflicts) from this concept helps to develop a useful standard on ACC. Figure C.1 presents the planet boundaries as described by the Stockholm Resilience Centre.



Key

1	climate change
2	novel entities (not yet quantified)
3	stratospheric ozone depletion
4	atmospheric aerosol loading (not yet quantified)
5	ocean acidification
6	biogeochemical flows
7	freshwater use
8	land-system change
9	BII (not yet quantified)
10	biosphere integrity
green	below boundary (safe)
yellow	in zone of uncertainty (increasing risk)
orange	beyond zone of uncertainty (high risk)

NOTE Source: Stockholmresilience.org — J. Lokrantz/Azote based on Steffen et al. 2015.

Figure C.1 — Planetary boundaries

Annex D
(informative)

Adaptation to climate change and climate change mitigation: Examples and supporting information

D.1 Climate change and ISO 14001 environmental management systems

Figure D.1 schematically sets out the link between key clauses in ISO 14001:2015 and CCM and ACC. It is intended to help users of ISO 14001 to show how they can address climate change challenges through their management system.

ISO 14001 deals with the need to adapt to any change in environmental conditions and include matters such as the need to adapt to other environmental consequences that are not due to climate change, for example loss of ecosystem services and biodiversity.

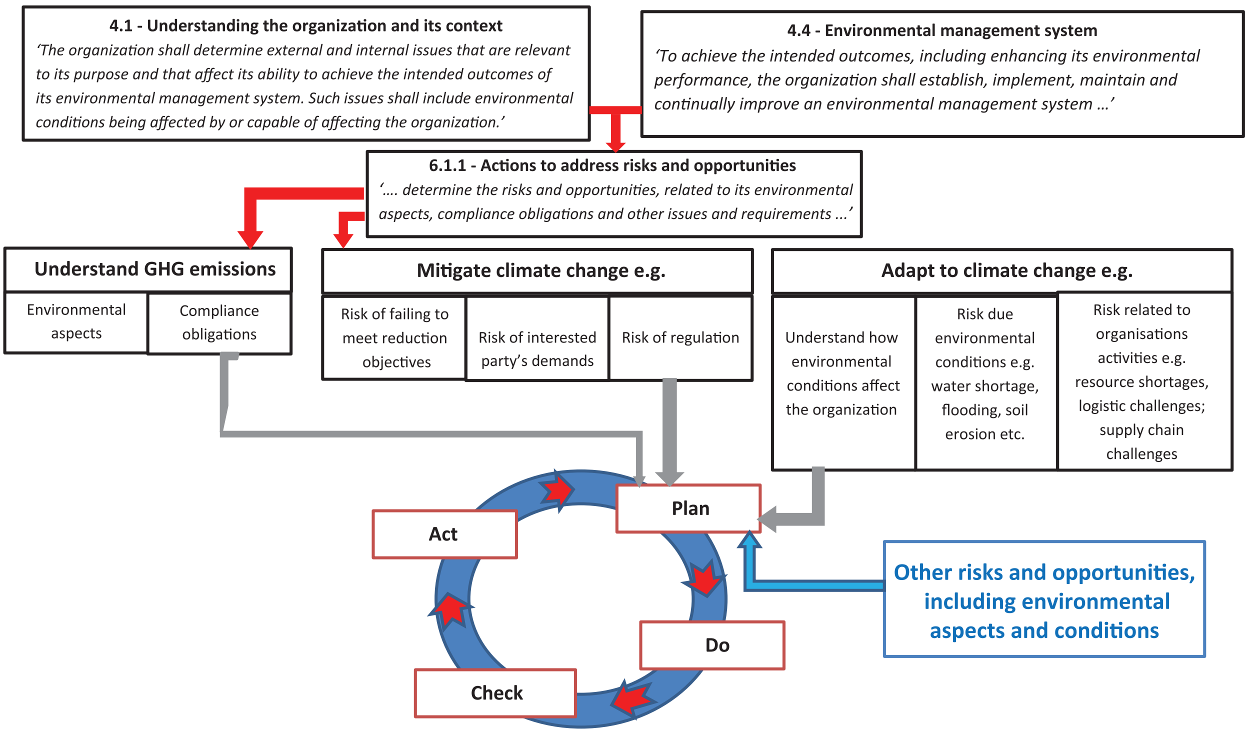
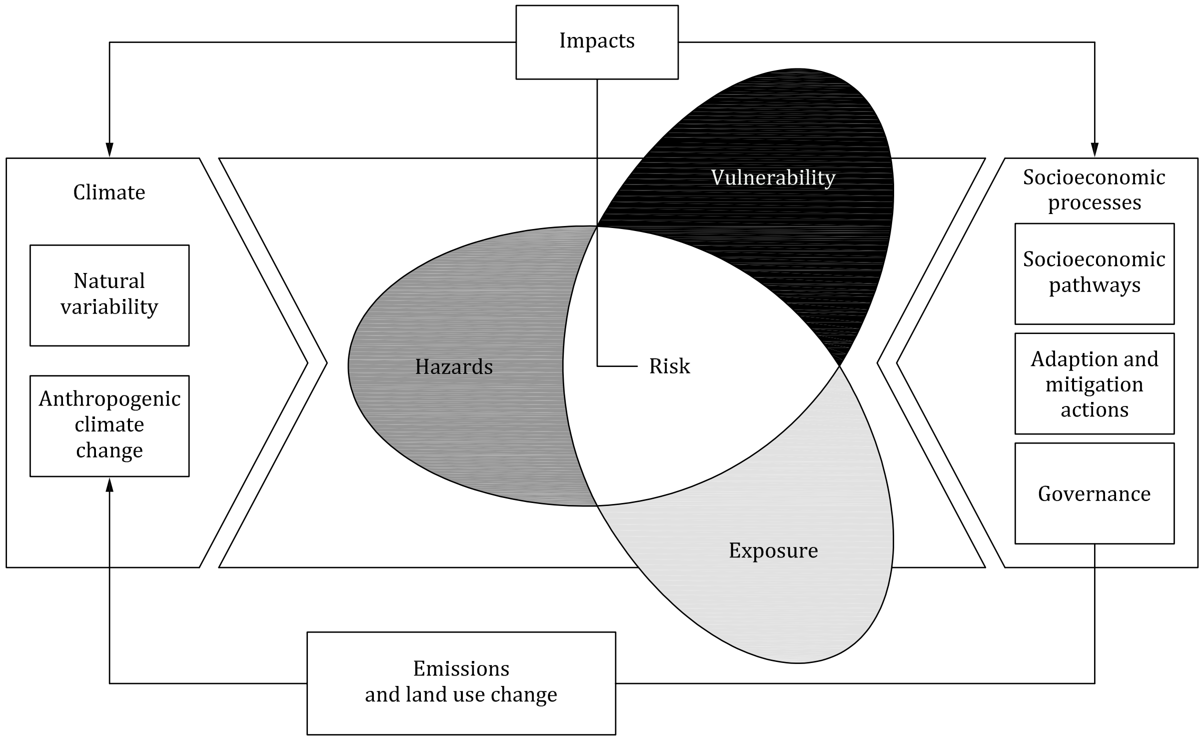


Figure D.1 — ISO 14001:2015 and climate change

D.2 Climate change risks from the IPCC Fifth Assessment Report

The IPCC Fifth Assessment Report[33] provides a focus on the assessment and management of risks from climate-related impacts as a result of the interaction of climate-related hazards (including hazardous events and trends) with vulnerable human and natural systems. This is illustrated in Figure D.2 where interactions between the climate system (left) and socioeconomic processes including adaptation and mitigation actions (right) are drivers of hazards, exposure, and vulnerability.



NOTE Source: IPCC Fifth Assessment Report[33], Figure 19-1.

Figure D.2 — Climate change risks

D.3 Climate change adaptation checklists

D.3.1 General

The lists provided in this annex are not intended to be exhaustive lists of considerations and are only examples of what should be analysed. The standards developer should seek further expertise on ACC issues related to the standard being developed.

NOTE All tables/considerations in this annex are taken from CEN/CENELEC Guide 32:2016, with some minor modifications.

D.3.2 Direct and indirect climate change impacts

The questions in Table D.1 can be used to check if the standard under development is affected by climate change impacts.

Table D.1 — Considerations for direct climate change impacts

No.	Impact of climate change
1	Does the production or service delivery depend on the supply of water (high volumes or specific quality), energy, agricultural or forestry products?
2	Is the climate or water a key input into the production process?
3	Does production or service provision involve any outdoor activities?
4	Are there any climate, weather or temperature or humidity sensitive production processes, such as those reliant on cooling, water use or energy supply?
5	Is the standard for a test method that is sensitive to temperature or humidity?
6	Is the effectiveness of the product affected by the weather or climate?
7	Does the weather or climate influence what properties are required of the product?
8	Are disposals or reprocessing activities likely to be weather or temperature sensitive?

If the answer is Yes to any of the above questions, then ACC considerations are likely to be relevant to the development of the standard.

If the answer is No to the above questions, then the questions in Table D.2 should be used to evaluate if there can be indirect impacts of climate change on the standard.

Table D.2 — Considerations for indirect climate change impacts

No.	Impact of climate change
1	Does the product rely on the supply of specific raw materials or inputs from a specific region?
2	Is production or service provision likely to rely on staff occupying premises where health, safety and comfort can be compromised by weather?
3	Is the service life of the product more than 10 years including its reuse? Is reusability important?
4	Does your standard deal with transportation or is transport involved in any stage of the life cycle?

If the answer is Yes to any of the above questions, then ACC considerations can be relevant to the development of the standard.

Any decision should be documented and an explicit reason should be provided, e.g. is this required or can we omit it?

If the answer is No to all of the above questions, then ACC considerations are not likely to be relevant to the development of the standard.

D.3.3 Examples of climate change adaptation provisions

Tables D.3 to D.8 provide examples of climate change considerations for every stage of the product life cycle.

Table D.3 — Acquisition stage related examples

Examples of provisions in standards	Choices, limitations or mutual benefits
	Any change in raw materials: — can affect quality, emissions, energy use at any life cycle stage; — can affect the costs of making the product and taking it to market; — can have implications for resource scarcity or end-of-life options. NOTE These apply to all of the following examples.
Give preference to materials that can be sourced from more than one place.	A choice between social objectives and resilience occurs where the production/export of the material with only one source is essential to support livelihoods.
For agricultural products, consider different ingredients or new climate resilient varieties.	The limit to this is where the more vulnerable ingredients or varieties are vital for sustaining a poor rural community. Changing raw material qualities and increased costs for raw material due to poorer harvests.
Design for flexibility so that adjustments can be made later on as more information becomes available.	Reorganization measures for existing products, processes and buildings, especially for historical buildings, cannot be carried out without any limitations.
Give preference to materials without climate sensitive production processes.	
Give preference to materials, the extraction of which will not increase the vulnerability of the area of origin.	
Provide suitable information for the producer, e.g. information about boundary conditions.	

Table D.4 — Production stage related examples

Examples of provisions in standards	Choices, limitations or mutual benefits
Encourage use of water efficient process equipment.	There can be choices to make between water efficiency and energy efficiency, quality or costs as well as with sensitivity to temperature or other weather variables.
Avoid designs that require weather or temperature sensitive production processes or equipment.	There can be choices to be made between temperature/weather sensitivity and water or energy efficiency, quality or costs.
Choose materials that can be easily stockpiled, i.e. those that do not degrade quickly and can be easily stacked.	
Design aids and recommendations, such as maps including information about driving rain zones, should be updated with projected climate information for appropriate future time periods, where this is available.	The limit to this is where the right kind of future climate information is not available.

Table D.5 — Service provision related examples

Examples of provisions in standards	Choices, limitations or mutual benefits
Ensure buildings can function and provide thermal comfort in a changing climate.	There can be choices to be made between water efficiency and energy efficiency, quality or costs.
Put in place remote working arrangements.	There can be choices to be made between quality or costs, e.g. of providing associated information and communications equipment.
Put in place flexible working arrangements.	There can be choices to be made between quality.
Use business continuity plans and procedures to minimize the impact of a disruption when it occurs including plans for recovery.	
Give preference to equipment that is not weather sensitive.	There can be choices to be made between quality or costs.
Design aids and recommendations, such as maps including information about driving rain zones, should be updated with projected climate information for appropriate future time periods, where this is available.	The limit to this is where the right kind of future climate information is not available.
Include different design approaches depending on the geographical factors of area of use and provide relevant supporting information, e.g. maps.	

Table D.6 — Use stage related examples

Examples of provisions in standards	Choices, limitations or mutual benefits
Choose materials that are more robust, heat resistant, porous, waterproof (depending on the context).	Any change in raw materials or design: — can affect quality, emissions, energy use at any life cycle stage; — can affect the costs of making the product and taking it to market; — can have implications for resource scarcity or end-of-life options; — will have implications for the functioning and vulnerability of the whole system.
Design for resilience/resistance, e.g. changed dimensions.	
Design for durability including improved reparability and maintainability.	
Optimize the design life.	This will have implications for resource efficiency.
Design for portability so it can be moved and kept safe from weather hazards, e.g. smaller, lighter, movable, easily assembled/ disassembled, can be controlled remotely, own power source.	
Inclusion of information for users, e.g. operating instruction that take into account climate change impacts and risks.	Uncertainties with respect to climate change and knowledge gaps.
Include different design approaches depending on the geographical factors of area of use and provide relevant supporting information, e.g. maps.	

Table D.7 — End-of-Life stage related examples

Examples of provisions in standards	Choices, limitations or mutual benefits
Development of a systematic evaluation procedure for cases of damage.	No known limitations or decision conflicts/ No example provided.
Assess that products at end-of-life will not be negatively affected by climate change in their reuse, recycling, recovery, disposal or decommissioning and look for new/alternative end-of-life options if necessary.	

Table D.8 — Transportation stage related examples

Examples of provisions in standards	Choices, limitations or mutual benefits
Traffic planning (not through vulnerable regions).	Longer delivery routes can lead to delay and higher costs.
Consider the location of raw material production (see acquisition).	
Choose the most resilient way of transport.	Choose the optimum between resilience and reduction of GHG emissions.
Choose new/ alternative ways of packaging.	Balance between waste and GHG emissions.

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