SAMT

SUSTAINABILITY ASSESSMENT METHODS AND TOOLS TO SUPPORT DECISION-MAKING IN THE PROCESS INDUSTRIES

Sustainable Process Industry through Resource and Energy Efficiency

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Deliverable 3.2

Future research needs and input for standardization

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Abstract / Executive summary:

The aim of the SAMT project (2015-2016) is to review and make recommendations about the most potential methods for evaluating sustainability and therein the energy and resource efficiency in the process industry. SAMT will collect, evaluate and communicate the experiences of leading industrial actors from cement, oil, metal, water, waste and chemical industry and review the latest scientific developments within the field of sustainability assessment. SAMT is a coordination and support action that will promote the cross-sectorial uptake of the most promising methods and tools by conducting case studies, organizing workshops and producing recommendations for further implementation of the best practices in sustainability assessment.

This report is the second of the three final reports that together summarise the main findings and conclusions of the SAMT project. The aim of the report is to summarise future research and standardisation needs identified during the project focusing on those highlighted by industrial experts. The conclusions are based on a review and evaluation of existing methods and tools, interviews and group discussions with industrial sustainability experts and sustainability researchers, case studies and workshops.

To improve the integration of sustainability assessment methods in decision making the following future research needs were identified:

- Simplified LCA based methods and tools for regular use within companies
- Comprehensive assessments integrating different aspects of sustainability to support decision-making
- Hybrid methods and tools for cross-sectorial and sectorial assessments
- Methods and tools for addressing specific elements of circular concepts and regional or local impacts
- Assessing and communicating positive aspects within the LCA framework
- Support for method and tool selection in different decision-making contexts

Some of the topics are regarded relevant for standardisation. In most cases this can be done by improving and updating current standards related to the sustainability assessment and life cycle thinking. The topics to be standardised include harmonisation of approaches for economic and social assessments within the LCA framework, guidelines for streamlined/simplified LCA, data exchange formats and specific elements required by the circular economy concepts.

The other two of the final reports are SAMT deliverable D3.1 ‘Sustainability assessment methods and tools for cross-sectorial assessment’ and SAMT deliverable D3.3 ‘Sustainability assessment in the process industry – Future actions and development needs’.

KEY WORDS:

Sustainability assessment, life cycle assessment, decision-making, process industry, standardisation, research and development

Contents

1 Introduction

1.1 Background

Sustainability assessment methods are needed for various industrial sectors to support sustainable technology development, decision-making and to evaluate the impacts of existing solutions, products and technologies. Ideally, sustainability assessment methods should address the environmental, economic and social aspects of technologies and cover the whole life cycle of the solutions. The assessment methods should provide robust knowledge to support decision-making, and allow comparability of the results. However, addressing all those aspects within one tool or assessment method is challenging, or even impossible. While there are aspects and indicators that are common to all process industries, sector specific methods, tools, or indicators are often required to address the specific features of each industrial sector in a fair and transparent way.

The SPIRE Public –Private Partnership (PPP)[1] brings together several sectors of process industry: cement, ceramics, chemicals, engineering, minerals and ores, non-ferrous metals, and water. All SPIRE sectors can be considered as resource and energy intensive and thus improving resource and energy efficiency are urgent issues for improving the sustainability and competitiveness of the sectors. Within the Horizon 2020 work programme, the specific and common goals listed for the SPIRE sectors are:

- A reduction in fossil energy intensity of up to 30% from current levels by 2030.
- A reduction of up to 20% in non-renewable, primary raw material intensity compared to current levels by 2030.
- A reduction of greenhouse gas emissions by 20% below 1999 levels by 2020, with further reductions up to 40% by 2030.

For the SPIRE sectors, sustainability assessment methods are crucial for evaluating the current state and the achievement of the goals related to resource and energy efficiency. For evaluating the overall resource and energy efficiency of the SPRIRE sectors as a whole, tools and indicators that are applicable for cross-sectorial assessment are required.

At the moment, several tools, assessment methods and indicators exist, but they differ in their goal and scope and are intended for different kind of use within companies, by consumers or by authorities to support policy planning and evaluation. Additionally, different methods and tools are focused for different levels of assessment: product, company, industry or society. Thus the problem is not so much the existence of proper methods and tools but rather the lack of understanding and knowledge on how they should be applied and in which context. Thorough understanding of the underlying mechanisms and calculation principles incorporated in the tool in question is often required to make a trustworthy assessment. Furthermore, it should be recognised which of the existing methods and tools are suitable for analysing resource and energy efficiency within the process industries and across the different sectors of the industry.

[1] SPIRE stands for Sustainable Process Industry through Resource and Energy Efficiency. For more information see: www.spire2030.eu

The SAMT project will respond to the need for cross-sectorial sustainability assessment methods by bringing together representatives of several process industry sectors, namely cement, metal, oil, water, waste and chemical industry, and collecting and evaluating the current best practices from each industrial sector, together with the latest research know-how related to sustainability assessment methods and recent activities in standardisation within the field.

SAMT is funded by the Horizon 2020 work program SPIRE.2014-4: Methodologies, tools and indicators for cross-sectorial sustainability assessment of energy and resource efficient solutions in the process industry.

1.2 Some definitions

In this report we use consequently the terms 'method', 'tool', and 'indicator'. The definitions applied here were first defined in the context of the first SAMT deliverable D1.1, and slightly updated for the second SAMT deliverable D1.2. The definitions are as follows:

- **Method:** set of instructions describing how to calculate a set of indicators and how to asses them. Methods include official standards.
- **Tool:** working and calculation platform that assists with the implementation of a method. A tool is usually software but it could also be, for example, a paper-based check-list.
- **Indicator:** a quantitative or qualitative proxy that informs on performance, result, impact, etc. without actually directly measuring it. For example, a low carbon footprint indicates a low environmental impact for the category climate change, but it does not measure the impact, it refers to greenhouse gas emissions, i.e. the environmental pressure.

Those definitions are by no means "official" but the ones we use in this project to avoid confusion. These terms are indeed used differently by many stakeholders in the scientific community, in policy, in the industry etc. For more information, please see SAMT D1.1.

1.3 Aim of this report

This report is the second outcome of WP3 that aims to provide recommendations for cross-sectorial assessment, future actions and standardization related to sustainability assessment. The aim of the report is to summarise future research needs identified during the SAMT project. The focus of the report is on research needs that have been highlighted by the industrial experts participating in the study. These are aspects that are expected to promote the uptake of sustainability assessment methods among the process industries and also to increase harmonisation of the methods and approaches applied across different sectors. In addition, the report presents the conclusions from a review of existing standards related to sustainability assessment and proposes potential new topics for future standardisation.

The report summarizes and synthesizes the findings from the first two work packages of the SAMT project (WP1 and WP2). The findings of this report are based on further analysis of the results related to:

- review of existing methods, tools and standards for sustainability assessment (SAMT D1.1)
- interviews with industrial sustainability experts (SAMT D1.2)
- evaluation of selected sustainability assessment methods (SAMT D2.1)

- testing of selected methods using a case study approaches (SAMT D2.2 & annexes 1, 2, 3).
- group work and discussions held during the three open workshops and internal project meetings.

The report at hand is the second of the three final reports that together summarise the main findings and conclusions of the SAMT project. Applicability of the evaluated sustainability assessment methods and tools for sectorial and cross-sectorial assessments is discussed in D3.1 which also synthesises some of the main findings of the project and discusses available methods in the light of identified industrial needs. The third report, D3.3 'Sustainability assessment in the process industry – Future actions and development needs' presents a roadmap and vision for developing consistent sustainability assessment methods in the process industry by 2030. In addition to the roadmap, the report includes an implementation plan in which concrete steps for moving towards the vision are proposed.

2 Identified future research needs

According to the SPIRE work programme, one of the expected impacts from the SAMT project and the other two projects funded from the SPIRE-2014-4 call was to identify research needs for achieving a set of environmental, social and economic sustainability indicators suitable for the process industry. As part of the SAMT project, existing life cycle based sustainability assessment methods and tools were reviewed and evaluated, and most potential and interesting methods were selected for further testing within practical case studies. The focus of the project has been on industrial practices and development needs, especially considering the ability of different methods to support decision-making, and to evaluate sustainability and resource and energy efficiency. Information on industrial best practices and development needs has been collected via expert interviews, group discussions, open project workshops and case studies.

While specific research needs related to evaluated sustainability assessment methods have been discussed in the context of several SAMT deliverables, the aim of this chapter is to present an overview of the research topics considered important from industrial point of view. Proposed future research topics were categorised under six main themes that include:

- Simplified LCA-based methods and tools for regular use within companies
- Comprehensive assessments integrating different aspects of sustainability to support decision-making
- Hybrid methods and tools for cross-sectorial and sectorial assessments
- Methods and tools for addressing circular concepts and regional or local impacts
- Assessing and communicating positive aspects within the LCA framework
- Support for method and tool selection in different decision-making contexts.

A brief summary and overview of the identified research needs is presented in the following chapters, together with some further explanations and findings from literature. Identified research themes include several sub-topics that were considered important for addressing the research theme in question. For each of the research theme, examples of similar and successful developments identified by project partners have been included. In addition, specific needs that the research topics could help to address have been proposed. In the end of the chapter, cross-cutting themes that should be considered in the context of all of the abovementioned research topics are discussed. These are communication and visualisation of results, and applicability of the methods for the use of small and medium sized enterprises (SME's).

2.1 Simplified assessments

Simplified LCA based methods and tools for regular use within companies
Specific challenge: - Agreement on harmonized principles and approaches for the assessment - Access to site specific or primary data and possibility to modify pre-defined assumptions - Automatization of high number of calculations (including tools for data collection & handling) - Limited simulation capabilities (possibility of building what-if scenarios and alike) - Handling and communicating uncertainty - Interpretation and utilisation of results within a business context, e.g. for strategic decision making - Limit the complexity and costs of the assessments, in particular among SMEs **Examples of recent developments:** - Industrial applications and in-house tools: EPD calculator developed by the cement sector, Eco-Efficiency Manager developed by BASF **Need:** - Internal decision-making, research and development

Time and resource demands related to life cycle based assessments have been acknowledged regularly in the LCA related literature. A proposal for defining different levels for LCA methodologies, and for developing a simplified LCA method was made for example by UNEP in 1999, based on a study in which means for improving adoption of LCA worldwide were proposed (Clark & de Leeuw 1999). Even though the interest towards LCA has increased and the method has developed and matured during the last 20 years (see e.g. Guinee et al. 2011), the need to develop simplified methods is still topical, and among the actions for which urgent action would be hoped for.

Development of simplified methods is a research topic that was prioritised by the industrial experts participating in the SAMT project, since regularly; there is a need to lighten the assessment process to be able to include it in daily activities (SAMT D1.2). Different studies presenting and evaluating simplified approaches for LCA or eco-design have been published (See e.g. Moberg et al. 2014; Hocshorner & Finnveden 2003) but generally agreed guidelines or approaches for simplified assessments would be hoped for. Potential fields of application for the simplified assessments could be especially product development and procurement (see also Hochshorner & Finnveden 2003).

According to SAMT findings, simplified assessments would be especially useful for internal decision-making and communication within companies. It was also noted that simplified methods alone would not be sufficient, but they could and should be used in parallel with the information received from earlier studies and more comprehensive assessments. As a conclusion, to agree on a framework for simplified assessments, one of the recommendations from SAMT project relates to including guidelines for simplified LCA as a new working item proposal under ISO TC 207.

2.2 Comprehensive assessments

Comprehensive assessments integrating different aspects of sustainability to support decision-making
Specific challenge: - Harmonisation of principles related to normalization and weighting - Transparency of the integration step, possibility to trace back and identify impacts of choices made - Further development & integration of social assessments **Examples of recent developments:** - ISO 14008 Monetary value of environmental impacts - Roundtable for Social metrics and WBCSD guidelines for social LCA **Need:** - Internal decision-making, internal & external communication

The need to extend the scope of environmental life cycle assessment towards life cycle sustainability assessment (LCSA) that would include environmental, economic and social aspects has been discussed in several studies (See e.g. Guinee et al. 2011; Sala et al. 2013; Finkbeiner et al. 2014). The importance of further developing the LCSA methodology was highlighted also by the MEASURE project, which focused on life cycle sustainability and resource efficiency aspects as applied by the European process industry (Kralisch et al. 2016). Further development needs especially regarding the social life cycle assessment methods and related tools and databases have been highlighted by all the three SPIRE-4 projects, namely SAMT, STYLE and MEASURE.

Previously, the CALCAS project (Co-ordination Action for innovation in Life Cycle Analysis for Sustainability), which was funded as part of the 6th Framework Programme, concluded that substantial research is needed for making the LCSA framework operational for today's LCA practitioners. The CALCAS project highlighted the need to develop LCSA as an interdisciplinary framework that could help answering questions at different levels (products, sectors, economies) and address environmental, economic and social aspects, and ideally also the interlinkages between them (Guinee et al. 2011). The findings of the SAMT project are in line with these previous recommendations. However, the findings from the SAMT project point out that in order to enable the implementation of the comprehensive LCSA methods in industry, a lot of work remains to be done in harmonising and simplifying the implementation, modelling and interpretation phases.

2.3 Sectorial and cross-sectorial assessments

Hybrid methods and tools for cross-sectorial and sectorial assessments[2]
Specific challenge: - Assessing impacts on a sector or economy - Assessing impacts of circular use of resources and raw materials, considering that most hybrid methods and IO datasets neglect end-of-life phases - Extending scope from micro-level evaluations to macro-level assessment (e.g. impacts of new technology at plant level vs. impacts of technology diffusion within or across sectors) **Examples of recent developments:** - EE-IO[3] - LCAA[4] - LCA/PEM[5] **Need:** - Evaluating impacts of research and innovation actions and circular economy, policy planning & evaluation

To achieve an understanding of a potential contribution of an individual product on the assessed sector or economy, some form of economic modelling, or hybrid methods combining LCA with economic models and/or environmentally extended input-output tables would be required in the context of environmental and economic impact assessments. The interviews and discussions held during the project indicate that hybrid models at the moment seem not like realistic or implementable methods for the industry. At the moment, implementation of these methods requires a lot of resources and might be realistic only in the context of large-scale research projects, when there is a chance for both, extensive data gathering and tool building. However, these hybrid approaches are considered promising especially for assessing the circular economy objectives and resource use or recycling in a larger scale, and for the purposes of policy planning and evaluation. (See also SAMT D3.1).

Sala et al. (2013) underline that although specific, product level information is useful for many kinds of decision-making situations, whenever political consequences are derived from life cycle results, or political decisions affect life cycle studies, the effects need to be considered also at other scales of the analysis, considering the effects also at sectorial or economy levels.

[2] Hybrid methods combine the standard or classical form of LCA and IO, with the aim of combining the strengths of each method. It is called a ”hybrid method” because it combines bottom-up LCA inventory analysis based on a stacking method with top-down input–output table inventory analysis (Nakamura & Nansai, 2015).

[3] IO is concerned with quantitatively capturing the interdependences among different sectors of the economy via the flow of inputs and outputs at high levels of sectoral resolution. Interdependences emerge because sectors require each other’s outputs as inputs (Nakamura & Nansai, 2015).

[4] Activity Analysis is the economic equivalent to LCA. It is a partial economic analysis modelling that aims at the characterization of industry or a sector in economic terms. LCAA combines both approaches, providing a mathematical format suitable for the representation of an entire vertical production chain both in economic and environmental terms (Freire et al., 2002)

[5] Equilibrium models are closely related to IO models. Still, opposed to LCA and IO, equilibrium models are based on a set of economic assumptions based on a top-down conceptualization of the economic system. The main assumption is perfect substitution based on price mechanisms.

2.4 Circular concepts and regional or local impacts

Methods and tools for addressing circular concepts and regional or local impacts
Specific challenge - Integrating impacts on biodiversity within the standard LCA framework - Assessing impacts of circular use of resources & recycling and understanding the implications of such impacts for local economies and the environment - Considering compatibility of SIA and EIA and other methods (developed for addressing local impacts) with the LCA framework - Addressing local economic and social impacts over the entire value chain of goods and services - Availability of local data & characterization factors **Example of recent development:** - Water footprint (ISO14046) with regional characterisation factors , World Impact+ method **Specific need:** - Policy planning, Internal decision-making, internal & external communication

Biodiversity is one of the topics that has been of increasing interest from the stakeholder side, thus creating interest for including it in environmental assessment methods already applied by the industry (such as LCA). A few attempts to develop indicators for this purpose have been made, but more development and understanding is needed in order to cover different aspects and the variety of ecosystems sufficiently. (For a review of available approaches and existing challenges, see Finkbeiner et al. 2014)

Indicators related to biodiversity are included in the new Product Environmental Footprint (PEF) framework, which has been under development since 2005 by the European Commission. Within the PEF framework, biodiversity is addressed using the land use-specific criteria developed to assess the coverage of land use inventory flows, following the International Reference Life Cycle Data System (ILCD). PEF development has put focus on assessing land use impact models at midpoint level. At endpoint, a similar process has been followed in a parallel review conducted by the UNEP-SETAC Life Cycle Initiative task force on land use impact on biodiversity. PEF recommends this initiative could be adopted for hotspots analysis, for assessing impact to biodiversity due to land use (as additional environmental information). In future, this may help including biodiversity aspects in the context of LCA, but the method needs further development before it can be implemented in product specific comparative studies.

Recently, the need for localised data and characterisation factors has been successfully addressed in the context of water footprint, and at the moment, after years of active development efforts related to water footprint standard (ISO14046) and related methods, it is possible to conduct water footprint calculations using available database data and regionalised characterisation factors (SAMT D2.2, Annex 2, WF case study). In addition to different environmental impact categories, local and regional impacts and data are required when conducting economic and social assessments. The possibility to combine LCA methods with already existing and well-developed methods to evaluate local impacts (such as social impact assessment SIA, and environmental impact assessment EIA) could be an interesting option for developing the life cycle based assessment methods further.

Calculations and assessments of the specific elements within the concept of circular economy require harmonised approach and guidance, and a gap in existing standards was identified. Different aspects of circularity include both local and global impacts.

2.5 Positive impacts

Assessing and communicating positive aspects within the LCA framework
Specific challenge: - Measuring created benefits (such as societal value or increased well-being) - Agreement on harmonized principles (e.g. definition of the baseline) and verification **Examples of recent developments:** - Development of the handprint concept that describes positive impacts **Specific need:** - Internal & external communication

The need to evaluate and communicate positive aspects was highlighted in several occasions throughout the project. This could be an important motivator for implementing sustainability assessment methods, as highlighting positive impacts could be an effective means for motivating people to get engaged with sustainability questions. However, it was emphasised that harmonised approaches and generally accepted guidelines and means of verification would be required, in order to avoid any attempts for greenwashing. Traditionally, life cycle based methods and characterization models have been focused on negative impacts to the environment (Finkbeiner et al. 2014), but the extension of sustainability assessment towards multidimensional assessment that includes social and economic aspects creates even more need for including positive aspects, such as societal value and well-being to the assessment (See also Sala et al. 2013). Handprint is a new concept that has been proposed as a means to describe positive aspects using life cycle based assessment methods, but currently, no agreement exists on how to measure it.

2.6 Support for method and tool selection

Support for method and tool selection in different decision-making contexts
Specific challenge: - Providing open access, balanced and up-to-date information of available methods, tools and databases and their compatibility - Finding the best available methods to support decision-making in different contexts, taking into account requirements for successful implementation (e.g. data availability & resource demands) - Finding appropriate tools to aid implementation of the methods and data handling, and increasing uptake of information within enterprises **Examples or recent developments** - In-house tools for sustainability assessment - Strategic-LCA **Specific need:** - Internal decision-making, internal & external communication

One of the challenges faced during the evaluation of the methods was that since sustainability assessment methods are applied for many different purposes, it is difficult to find a method that would cover all needs. A challenge pointed out by the industrial experts was that it is difficult to find enough information about

available methods and tools. Thus there would be a need for easily accessible and up-to-date information on methods and tools available and suitable for different purposes, and also about the requirements for implementing them in practice (e.g. data needs and available tools).

When considering the ability to evaluate resource and energy efficiency, which are among the priorities of the SPIRE PPP, the findings from the SAMT project pointed out that almost all of the evaluated 14 life cycle based methods are capable of providing relevant information for assessing resource efficiency, but a method for comprehensive assessment of resource efficiency is still lacking. Current methods are able to increase understanding of different aspects and impacts related to resource use, but in order to have a comprehensive view; a combination of different methods is required (SAMT D2.1, Lopez et al. 2015). Similarly, the MEASURE project concluded that several gaps and challenges in sustainability and resource efficiency assessment still exist. These include for example how resources are defined, and how to define the ratio between benefits and impacts from resource user. Further confusion relates to the fact that some methods consider only abiotic resources, while others consider both abiotic and biotic resources. (Kralisch et al. 2016; Finkbeiner et al. 2014)

In future, an agreement of preferred methods and harmonized principles for resource efficiency assessment would be needed to clarify the situation. The diversity between approaches and definitions used in different methods for assessing resource use and resource efficiency was acknowledged by the industrial experts participating in our study. To be able to follow the latest developments and understand the differences between different assessment methods and their underlying assumptions, support for selecting most suitable assessment method for each purpose is required. This need for support and un-biased, up-to-date information concerns resource efficiency aspects and other sustainability aspects alike.

Carbon footprint is a life cycle based method that is currently applied and implemented across different process industry sectors (SAMT D1.2). Carbon footprint can be considered as a success story of a sustainability assessment method that has been integrated to support decision-making in different contexts, often with the help of specific in-house tools developed for this purpose. However, in order to address energy efficiency or sustainability more comprehensively, other methods or indicators would need to be assessed together carbon footprint. Thus a challenge for future research would be how to improve the applicability of other methods in order to facilitate their integration as part of daily decision-making, aside with carbon footprint?

2.7 Communication and visualisation

In addition to the more specific topics included in table 1, an overarching theme essential for successful implementation of sustainability assessment methods is visualisation and communication of the results. To be able to support decision-making, results from sustainability assessments have to be communicated to several persons and different stakeholder groups that might not be experts in sustainability assessments. Visualisation of the results was considered crucial for making the results understandable and more easily interpreted. This is a topic that needs to be constantly considered and improved, alongside method and tool development.

The findings from our method evaluation pointed out that there is room for improvement regarding visualisation of the results of all the methods included in our study (SAMT D2.1). In addition, effective and informative visualisation is even more important for potential new methods that could be of interest for industrial use. This was strongly emphasized as part of our expert interviews (see SAMT D1.2). Ideally, the outcomes of sustainability assessments should be delivered in a way that makes them usable for a variety of goals within the enterprise, ranging from strategic decision making to business-to-business and business-to-consumer communication, and taking into account the specific interests of the target group in question.

2.8 Needs of SME's

Another topic, not directly addressed within the table relates to considering future development needs from the point of view of small and medium sized enterprises (SME's). Industrial experts who participated to the SAMT project represented mainly large companies, and thus the SME point of view was not included in the studies. However, this is a topic that was considered important by all partners, and that was addressed also in several of the discussions held during the open project workshops. It was considered that improving overall sustainability of different process industry sectors requires methods and tools that are adaptable also for the SME's that operate in various roles in different parts of the value chains. However, developing harmonised guidelines for simplified methods, developing tools that would simplify the data collection process and providing support for method and tool selection are topics that would benefit also the SME's and hopefully lower the barriers for implementing the methods in future.

Big companies are in key role for increasing knowledge of relevant and implementable methods within different sectors and product value chains, and promoting implementation of these methods and tools across the value chains. Discussions with suppliers and other value chain actors were considered to be helpful in data collection, and among the proposed best practices for implementing sustainability assessments throughout the value chains.

3 Standardisation related to life cycle based sustainability assessment

3.1 Overview on standardisation

One of the final recommendations from the SAMT project relates to proposing new topics for standardisation activities. As stated in SAMT D1.1, standards are voluntary technical documents that set out requirements for a specific item, material, component, system or service, or describe in detail a particular method, procedure or best practice. Standardisation is one of the means to enhance harmonisation within the field of sustainability assessment methods and sustainability communication, in which global consensus is searched for.

In addition, standards are a pillar for the introduction of new technologies and innovations in the market. The standards carry to the user's level the sometimes theoretical and intangible results of research, development and innovation projects. All stakeholders within the value chain of the subject are involved in the process of standardization. This ensures the technical competence of the participating experts, the consensus among the different stakeholders and the recognition of the published document.

A standard will ensure that products, services, verification and assessment methods will be compatible, interchangeable and comparable. Standards also disseminate knowledge in industries where products and processes supplied by various providers must interact with one another. Standardization is a voluntary cooperation among industry, consumers, public authorities, researchers and other interested parties for the development of technical specifications based on consensus.

The standardization bodies operate at National (AENOR, AFNOR, BSI, DIN, etc.), Regional (CEN, CENELEC, ETSI) or International (ISO, IEC, ITU) level. Sometimes there are different standardization bodies at the same level, but covering different fields. This is the case of ISO (general), IEC (electrical) and ITU (telecommunications) at International level, or CEN, CENELEC and ETSI at European level in the same way.

There are several types of documents developed by the European and International standardization bodies. The most common documents include:

Standard (EN/ISO/IEC): Full consensus of all the member countries. Usually requires 3 years for its elaboration. Revised every 5 years. In Europe its adoption at national level is mandatory.

Technical Specification (TS): Full consensus of all the member countries involved in its elaboration. Usually takes 21 months for its elaboration. Revised at 3 years. Its national adoption is voluntary.

Technical Report (TR): Informative document not subjected to periodic revision but is recommended to ensure that they remain valid. Faster elaboration than standards and technical specifications.

Workshop Agreement (CWA/IWA): Consensus limited to all the organizations involved in its elaboration. Its elaboration can be reduced to 12-18 months. It shall be revised at 3 years. Its national adoption is voluntary.

Taking into account SAMT objectives, the ongoing standardization work are under the umbrella of ISO and CEN. In relation to the new proposals for standardization, the relevant standardization body should be ISO. This is due to the global approach that sustainability aspects demands.

3.2 Process followed for the detection of standardization needs

Figure 1 describes the process followed to define the standardization needs to be considered in the future.

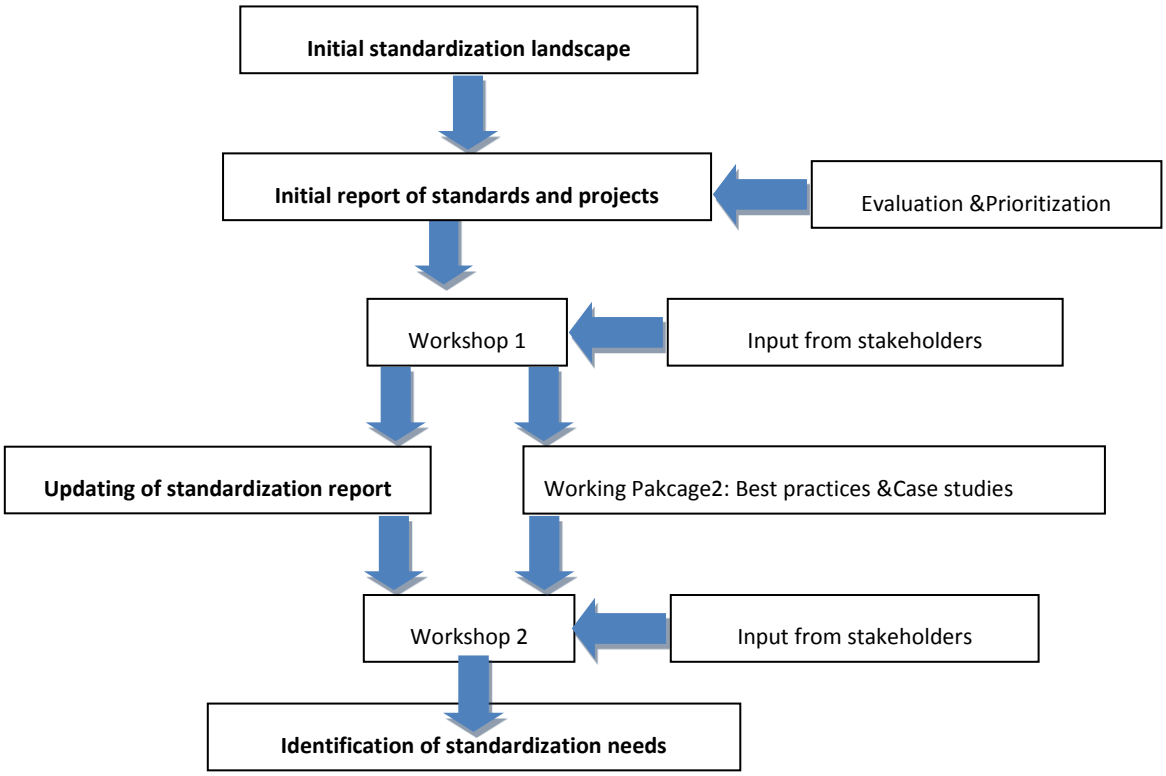

Figure 1 Process for identification of standardisation needs

- **Initial standardization landscape:**

In order not to duplicate efforts, take profit of the work already done and also to have initial input information on existing practices, the first step was to compile published standards and ongoing projects of standards in relation with sustainability.

Sustainability as a whole implies a wide range of aspects that cover the environmental, economic and social aspects, from management systems to specific product standards, through a huge list of subjects as life-cycle, waste, design or social responsibility. All this lead to an initial standardization landscape of 864 published standards and 134 projects of standard in development.

- **Initial report of standards and projects**

As result of the previous point, it was necessary to perform an initial prioritization in consultation with the project partners.

First, the standards were classified by:

- General topic: Sustainability, Environmental, Safety.
- Subject: Life-cycle, Hazardous substances, Eco-design, Design, Energy efficiency, Environmental aspects, Sustainability, Management, Waste management, Environmental management, Environmental declaration.
- Sector: General, Construction, Bio-bases products, Electrotechnical, Industry, Energy, Transport, Software engineering, Mechanical

After consultation, only horizontal or general standards were considered and some relevant sector specific ones were maintained. As a result, an initial report including 57 standards and 16 projects was prepared as part of SAMT D1.1. Two of the initial conclusions included in the report were that:

"There is a gap of horizontal standards, sector independent, addressing sustainability in general and not only focusing on a specific aspect"

"There are no standards defining or specifying indicators linked to sustainability"

- **Updating of the standardization report**

Additional input from stakeholders was received after the Workshop 1.

Work Package 2 dealt with the evaluation and selection of most potential assessment methods and best practices: best practices solutions (tools, methods and indicators for sustainability assessment) and case studies (analysis of best practices in comparison with currently used technologies). This part was not addressed to standardization aspects; nevertheless, it revealed some additional relevant questions dealing with de usability and soundness of the existing standards and the use of particular private or in-house methods and tools, which implies a gap in standardization.

In addition, during this period some of the initiatives discussed in the Deliverable 1.1 progressed to the publication stage and new initiatives started. One of the most relevant publications was the revision and publication of the new ISO 14001:2015 Environmental management systems – Requirements with guidance for use.

- **Identification of standardization needs**

Taking into account the findings of the previous stages and tasks, this document compiles and highlights the main results about future standardization needs and introduces potential future proposals related to life cycle based sustainability assessment methods.

3.3 Review of existing standards

The list of most relevant existing standards and projects in development can be found in Table 1 and Table 2 of Chapter 5 – Appendix.

Standards related to sustainability and sustainability assessments are being prepared under several ISO Technical Committees. The most relevant ISO Technical Committees which have standards or active projects related to sustainability assessment are:

- ISO/TC 59 *Building and civil engineering works*

  This Technical Committee is not directly involved in general horizontal sustainability matters, as its scope is the standardization in the field of building and civil engineering works. Nevertheless, it has a long experience in developing standards for the construction sector on sustainability, accessibility and usability of buildings as well as rules for addressing the economic, environmental and social impacts and aspects related to sustainable development.

- ISO/TC 207 *Environmental management*

  - SC 1 *Environmental management systems*
  - SC 2 *Environmental auditing and related environmental investigations*
  - SC 3 *Environmental labelling*
  - SC 4 *Environmental performance evaluation*
  - SC 5 *Life cycle assessment*
  - SC 7 *Greenhouse gas management and related activities*

  In addition, there are specific Working Groups directly reporting to the plenary working on terminology, material flow costs accounting, land degradation and desertification and environmentally conscious design.

- ISO/TC 251 *Asset management*

  This Technical Committee is developing the ISO 55000 series related with asset management, applicable to all types and sizes of organizations.

- ISO/TC 260 *Human resource management*

  This Technical Committee has no Subcommittees, Working Groups report directly to the plenary. It is developing standards related with the management of human resources, and some relevant works on human governance, sustainable employability and diversity inclusion are planned to be developed.

- ISO/PC 277 *Sustainable procurement*

This Project Committee is working in ISO 20400, near to be published, that will provide a guideline for integrating sustainability into the procurement processes of an organization.

- ISO/PC 278 *Anti-bribery management systems*

  This Project Committee has recently (October 2016) published ISO37001:2016. This standard specifies requirements and provides guidance for establishing, implementing, maintaining, reviewing and improving an anti-bribery management system.

- ISO/PC 283 *Occupational health and safety management systems*

  This Project Committee is developing ISO 45001. This project standard is will enable an organisation to integrate, in addition to health and safety issues, other complementary aspects as worker wellness/wellbeing.

- ISO/TC 301 *Energy management and energy savings*

  This Technical Committee has been established in 2016 with the object of standardize in the field of energy management and energy savings. It has no Subcommittees, but Working Groups reporting directly to the plenary.

In addition, in 2016 the Project Committee ISO/PC 309 *Organizational governance* has been established. Its scope covers the standardization of organizational governance, including aspects of accountability, direction and control – which may include principles of governance, anti-bribery, conflict of interest, due diligence, whistleblowing, compliance, remuneration structures and external reporting, amongst others.

3.4 Conclusions related to standardisation

Based on the information collected from the review of existing standards and working processes, the analysis of the existing methods and tools performed during the project, the information provided by the workshops and the comments provided by the partners, the main conclusions from the SAMT project regarding standardisation are as follows:

Need of standardization:

- There are different standardized methods and tools, and the ones most used are those related to Life Cycle Assessment. In addition, a big amount of non-standardized 'self-made' tools and applications, tailored for companies specific needs are in use. Although some of them might follow principles of available standards, this variety causes difficulties in obtaining repeatable, compatible and comparable results. In order to overcome this problem, harmonization of methodologies, processes, approaches and tools would benefit all sectors and stakeholders.

- SME's have special needs and minor resources to conduct sustainability assessments. In order to allow their involvement simplified methods, harmonized approaches and easy access to average data would be needed.

- The environmental pillar is the most evolved one of the three sustainability pillars and the traditional works on standardization have focused on this topic. From two years now, the economic pillar has also been included as a priority as corporate governance related standards are being developed. There is a necessity to promote standardization works addressing the social questions related to social life cycle assessment. Until now, available standards related to social aspects have focused on supply chain management and health and safety related issues.

- The multi-criteria assessment of environmental, economic and social aspects together is not mature. As a first step, having standards covering indicators for the three aspects individually is necessary in order to gain experience and data. This can be followed by a standardised method for an overall assessment covering all the three dimensions.

- The concept of circular economy has been introduced and is increasingly applied. However, the currently used assessment methods lack specific elements of circularity.

Approach of the standards:

- The standards should be useful for decision making taking into account different sustainability aspects.

- Sustainability provides added value to the companies and the standards should facilitate to highlight this added value.

- Each company is different. The standards have to help them to introduce sustainability aspects in their processes: finding solutions not creating problems.

- It is essential to approach the standardization works within circular economy.

3.5 Proposals for future standardisation

Based on the analysis of existing standards and identified future research and development needs, proposals for potential future standards development, and reviews of existing standards related to sustainability assessment methods were prepared. Proposed topics include:

- Guidelines for simplified/streamlined LCA
- Data documentation and exchange formats
- Harmonisation of approaches for economic and social assessments
- Inclusion of circular economy aspects

Proposals related to standardisation are presented in table 1.

Table 1 Proposals for future standardisation activities related to sustainability assessment methods

Guidelines for streamlined/simplified LCA
Guidelines for simplified LCA would be required in order to harmonise existing approaches. There is a need for lighter assessment process that could be integrated within daily decision-making, and used for internal communication purposes. - a new working item proposal under ISO TC 207 including guidance for simplified LCA is recommended The guidelines should include : - principles for preparing a simplified assessment based on existing knowledge and previous studies - instructions for handling uncertainty - guidance for communicating about the results
Data documentation and exchange formats
The experiences from the SAMT case studies (SAMT D2.2) showed that sharing inventory or impact data across different software platforms and database versions is currently challenging, since different software tools are not entirely compatible with the exchange formats available. This finding is in line with the conclusions reported by the Joint Research Centre (JRC), stating that existing LCI datasets are mismatched at different levels, representing a major limitation to the combined use of LCI datasets from different sources, and electronic data exchange among practitioners and tools. The situation hampers a clear and unambiguous understanding of LCA studies and their efficient review (EC 2013). - The findings from the SAMT project underline the importance of improving the interoperability among ELCD/ILCD DN and existing LCA software packages, and support further development activities related to development of the ILCD format as a global standard format, as proposed by EC (2013) - ISO/TS 14048:2002 Environmental management -- Life cycle assessment -- Data documentation has been the starting point for the creation of the ILCD format. - A review of the ISO/TS 14048:2002, considering the possibility to improve interoperability of different datasets and software packages is proposed. The document was last reviewed in 2013.
Towards an LCSA standard: Harmonisation of approaches for economic and social assessments within the LCA framework
The definition of relevant standards for the economic and social LCAs entails developing consensus on aspects like: - The selection of a functional unit that is equally relevant for the social and economic spheres - The establishment of consistent –but flexible– system boundaries for the economic and social spheres that is nonetheless compatible with the one defined for the environmental dimension - The access, collection, handling, managing and exchanging of economic and social data - The establishment of specific allocation criteria - The definition of stable impact categories and subcategories - The definition of consistent characterization models, including the definition of normalization and weighting criteria, rules and methods The economic, social and environmental spheres of sustainability should be integrated within a consistent LCA framework. On top of the abovementioned aspects, addressing the integration challenge will entail finding consensus on: - The relevance and convenience of producing synthetic scores that inform simultaneously on the three sustainability spheres - The generation of guidance regarding the provision of meaningful visualization products - The definition of agreed mechanisms to communicate –and implicitly to deal with– trade-offs between the three spheres Relevant TC: ISO/TC 207 Environmental management, SC5 Life cycle management

Circular economy aspects
Current standards lack guidance on specific aspects of circular economy like renewability and circularity. - ISO 14040-44 and related standards should be improved and updated to provide a clear methodological approach for handling questions relevant for "closing the loop" models. - Relevant questions include for example circularity, re-use and utilisation of waste streams.

4 Conclusions and recommendations

The main research needs identified during the SAMT project were summarised under the following themes:

- Simplified LCA-based methods and tools for regular use within companies
- Comprehensive assessments integrating different aspects of sustainability to support decision-making
- Hybrid methods and tools for cross-sectorial and sectorial assessments
- Methods and tools for addressing regional or local impacts
- Assessing and communicating positive aspects within the LCA framework
- Support for method and tool selection in different decision-making contexts.

Many of the topics are already well-known by the LCA-community, but however still valid and important. Compared to results presented by previous studies and projects, SAMT findings highlight especially the need for simplified assessments, assessing positive impacts and providing support for method and tool selection. These are topics that are considered essential for increasing knowledge and uptake of sustainability assessment methods by the process industries, and for mainstreaming the use of life cycle based sustainability assessment methods as part of industrial decision-making. In addition to promoting the uptake of methods, these topics are considered important for harmonising the use the methods. In the long run, developments within these topics and harmonised principles could improve comparability of the assessments, especially if transparency related to reporting can be improved simultaneously, without jeopardising confidential information.

Although several new guidance documents and standards have recently been published or are currently under development, there is also need for further standardisation. Potential new working items related to development of guidelines for simplified LCA and harmonisation of economic and social assessments are proposed. In addition, a review of the existing ISO/TS 14048:2002 Data documentation format is proposed, and a review of ISO14040-44 to include aspects relevant for the circular economy is recommended.

To conclude, life cycle based sustainability assessment methods and life cycle thinking are already well implemented in many kinds of activities within the different process industry sectors. However, there is room for further improvement and mainstreaming the use of the methods, and especially in integrating the methods in different processes where information is produced for decision-support on a daily basis. For this purpose, the methods need to be flexible and adaptable, taking into account different decision-making contexts and local characteristics, and allow different levels of assessment, from simplified to comprehensive.

Ideally, information from environmental, economic and social aspects should be processed in a consistent manner, allowing integration of the results in a meaningful way. Barriers for implementation and cooperation should be lowered with the help of tools that could be applied for data collection and

handling, and improving the interoperability of different softwares and datasets. Since one method is unable to address all potential needs, support for finding suitable methods and tools would be needed.

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SAMT project deliverables:

- SAMT D1.1 Overview of existing sustainability assessment methods and tools, and of relevant standards (2015). Responsible authors and organisations: Mathieu Saurat & Michael Ritthoff, Wuppertal Institute for climate, environment and energy; Luz Smith, AENOR.

- SAMT D1.2 Description of current industry practice and definition of the evaluation criteria (2015). Responsible authors and organisations: Mathieu Saurat & Michael Ritthoff, Wuppertal Institute for climate, environment and energy; Hanna Pihkola, VTT Technical Research Centre of Finland; Aritz Alonso & Arantza Lopez, Tecnalia.
- SAMT D2.1 Best practice solutions: Methods for sustainability assessment within the process industries (2015). Responsible authors and organisations: Arantza López, Lara Mabe, Beatriz Sanchez, Carlos Tapia and Aritz Alonso, Tecnalia.
- SAMT D2.2 Case Study Report: Analysis of best practice solutions in comparison with currently used techniques (2016). Responsible authors and organisations: Carlos Tapia, Aritz Alonso, Ales Padró, Raul Hugarte, Marco Bianchi, Arantza López (Tecnalia); Hanna Pihkola, Elina Saarivuori (VTT); Michael Ritthoff (Wuppertal Institute); Peter Saling (BASF); Kianga Schmuck (Bayer); Ywann Penru, Pascal Dauthuille (SUEZ); Alexander Martin Roeder, Martin Jenke (CEMEX); Jostein Søreide (Hydro); Annamari Enström, Sari Kuusisto (Neste).
    - Annex 1 Integrated case study
    - Annex 2 Water footprint case study
    - Annex 3 Simulation case study

All SAMT deliverables are available at www.spire2030.eu/samt

6 Appendix – Existing standards

7 Table 1 - List of existing standards

EUROPEAN STANDARD	INTERNATIONAL STANDARD	TITLE	TECHNICAL COMMITTEE	COMMENTS
	IWA 9:2011	Framework for managing sustainable development in business districts	ISO	
	ISO Guide 17:2016	Guide for writing standards taking into account the needs of micro, small and medium-sized enterprises	ISO	
	ISO Guide 64:2004	Guide for addressing environmental issues in product standards	ISO	
	ISO Guide 82:2014	Guidelines for addressing sustainability in standards	ISO	
	ISO 13065:2015	Sustainability criteria for bioenergy	ISO	
EN ISO 14001:2015	ISO 14001:2015	Environmental management systems - Requirements with guidance for use (ISO 14001:2015)	ISO/TC 207	
EN ISO 14004:2016	ISO 14004:2016	Environmental management systems - General guidelines on principles, systems and support techniques (ISO 14004:2004)	ISO/TC 207	
	ISO 14005:2010	Environmental management systems -- Guidelines for the phased implementation of an environmental management system, including the use of environmental performance evaluation	ISO/TC 207	Approved the revision of the standard
EN ISO 14006:2011	ISO 14006:2011	Environmental management systems - Guidelines for incorporating ecodesign (ISO 14006:2011)	ISO/TC 207	Approved the revision of the standard
EN ISO 14015:2010	ISO 14015:2001	Environmental management - Environmental assessment of sites and organizations (EASO) (ISO 14015:2001)	ISO/TC 207	
EN ISO 14020:2001	ISO 14020:2000	Environmental labels and declarations - General principles (ISO 14020:2000)	ISO/TC 207	
EN ISO 14021:2016	ISO 14021:2016	Environmental labels and declarations - Self-declared environmental claims (Type II environmental labelling) (ISO 14021:1999)	ISO/TC 207	
EN ISO 14024:2000	ISO 14024:1999	Environmental labels and declarations - Type I environmental labelling - Principles and procedures (ISO 14024:1999)	ISO/TC 207	Under revision
EN ISO 14025:2010	ISO 14025:2006	Environmental labels and declarations - Type III environmental declarations - Principles and procedures (ISO 14025:2006)	ISO/TC 207	

EN ISO 14031:2013	ISO 14031:2013	Environmental management - Environmental performance evaluation - Guidelines (ISO 14031:2013)	ISO/TC 207	
	ISO 14034:2016	Environmental management -- Environmental technology verification (ETV)	ISO/TC 207	
EN ISO 14040:2006	ISO 14040:2006	Environmental management - Life cycle assessment - Principles and framework (ISO 14040:2006)	ISO/TC 207	
EN ISO 14044:2006	ISO 14044:2006	Environmental management - Life cycle assessment - Requirements and guidelines (ISO 14044:2006)	ISO/TC 207	Amendment under development
EN ISO 14045:2012	ISO 14045:2012	Environmental management - Eco-efficiency assessment of product systems - Principles, requirements and guidelines (ISO 14045:2012)	ISO/TC 207	
EN ISO 14046:2014	ISO 14046:2014	Environmental management - Water footprint - Principles, requirements and guidelines (ISO 14046:2014)	ISO/TC 207	
	ISO/TR 14047:2012	Environmental management -- Life cycle assessment -- Illustrative examples on how to apply ISO 14044 to impact assessment situations	ISO/TC 207	
	ISO/TR 14048:2002	Environmental management -- Life cycle assessment -- Data documentation format	ISO/TC 207	
	ISO/TR 14049:2012	Environmental management -- Life cycle assessment -- Illustrative examples on how to apply ISO 14044 to goal and scope definition and inventory analysis	ISO/TC 207	
EN ISO 14050:2010	ISO 14050:2009	Environmental management - Vocabulary (ISO 14050:2009)	ISO/TC 207	
EN ISO 14051:2011	ISO 14051:2011	Environmental management - Material flow cost accounting - General framework (ISO 14051:2011)	ISO/TC 207	
	ISO/TR 14062:2002	Environmental management -- Integrating environmental aspects into product design and development	ISO/TC 207	
EN ISO 14063:2010	ISO 14063:2006	Environmental management - Environmental communication - Guidelines and examples (ISO 14063:2006)	ISO/TC 207	
EN ISO 14064-1:2012	ISO 14064-1:2006	Greenhouse gases - Part 1: Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals (ISO 14064-1:2006)	ISO/TC 207	Under revision
	ISO/TR 14067:2013	Greenhouse gases -- Carbon footprint of products -- Requirements and guidelines for quantification and communication	ISO/TC 207	Approved the revision of the standard
	ISO/TS 14071:2014	Environmental management -- Life cycle assessment -- Critical review processes and reviewer competencies: Additional	ISO/TC 207	

		requirements and guidelines to ISO 14044:2006		
	ISO/TS 14072:2014	Environmental management -- Life cycle assessment -- Requirements and guidelines for organizational life cycle assessment	ISO/TC 207	
EN 16247-1:2012		Energy audits - Part 1: General requirements	CEN/CENELEC/JWG 1	
EN 16247-2:2014		Energy audits - Part 2: Buildings	CEN/CENELEC/JWG 1	
EN 16247-3:2014		Energy audits - Part 3: Processes	CEN/CENELEC/JWG 1	
EN 16247-4:2014		Energy audits - Part 4: Transport	CEN/CENELEC/JWG 1	
EN 16247-5:2015		Energy audits - Part 5: Competence of energy auditors	CEN/CENELEC/JWG 1	
	ISO 17741:2016	General technical rules for measurement, calculation and verification of energy savings of projects	ISO/TC 301	
	ISO 17743:2016	Energy savings -- Definition of a methodological framework applicable to calculation and reporting on energy savings	ISO/TC 301	
	ISO 19600:2014	Compliance management systems -- Guidelines	ISO	
	ISO 21929-1:2011	Sustainability in building construction -- Sustainability indicators -- Part 1: Framework for the development of indicators and a core set of indicators for buildings	ISO/TC 59	
	ISO/TS 21929-2:2015	Sustainability in building construction -- Sustainability indicators -- Part 2: Framework for the development of indicators for civil engineering works	ISO/TC 59	Under revision
	ISO 26000:2010	Guidance on social responsibility	ISO	
	ISO 37001:2016	Anti-bribery management systems -- Requirements with guidance for use	ISO/PC 278	
EN ISO 50001:2011	ISO 50001:2011	Energy management systems -- Requirements with guidance for use	ISO/TC 301	Under revision
	ISO 50004:2014	Energy management systems -- Guidance for the implementation, maintenance and improvement of an energy management system	ISO/TC 301	
	ISO 50047:2016	Energy savings -- Determination of energy savings in organizations	ISO/TC 301	

	ISO 55000:2014	Asset management -- Overview, principles and terminology	ISO/TC 251	
	ISO 55001:2014	Asset management -- Management systems -- Requirements	ISO/TC 251	
	ISO 55002:2014	Asset management -- Management systems -- Guidelines for the application of ISO 55001	ISO/TC 251	

8 Table 2 - List of ongoing projects [(1)]

EUROPEAN STANDARD	INTERNATIONAL STANDARD	TITLE	TECHNICAL COMMITEE	COMMENTS
	ISO/WD IWA 19	Guidance principles for the sustainable management of secondary metals	ISO	
	ISO/AWI Guide 84	Guidelines for addressing climate change in standards	ISO	
	ISO/AWI 14005	Environmental management systems -- Guidelines for the phased implementation of an environmental management system, including the use of environmental performance evaluation	ISO/TC 207	Revision of ISO 14005:2010
prEN ISO 14006	ISO/AWI 14006	Environmental management systems - Guidelines for incorporating ecodesign	ISO/TC 207	Revision of ISO 14006:2011
	ISO/AWI 14007	Environmental management -- Determining environmental costs and benefits -- Guidance	ISO/TC 207	
	ISO/CD 14008	Monetary valuation of environmental impacts from specific emissions and use ofnatural resources -- Principles, requirements and guidelines	ISO/TC 207	
	ISO/AWI 14016	Environmental management -- Guidelines on verification and validation of the environmental component of sustainability reports	ISO/TC 207	
prEN ISO 14024	ISO/DIS 14024	Environmental labels and declarations - Type I environmental labelling - Principles and procedures (ISO 14024:1999)	ISO/TC 207	Revision of ISO 14024:1999
	ISO/DIS 14026	Environmental labels and declarations -- Principles, requirements and guidelines for communication of footprint information	ISO/TC 207	
	ISO/DTS 14027	Environmental labels and declarations -- Development of product category rules	ISO/TC 207	
prEN ISO 14044/prA1	ISO 14044/DAmd1	Environmental management - Life cycle assessment - Requirements and guidelines (ISO 14044:2006)	ISO/TC 207	Amendment of ISO 14044:2006

	ISO/FDIS 14052	Environmental management -- Material flow cost accounting -- Guidance for practical implementation in a supply chain	ISO/TC 207	
	ISO/DIS 14055-1	Environmental management -- Guidelines for establishing good practices for combatting land degradation and desertification -- Part 1: Good practices framework	ISO/TC 207	
	ISO/AWI TR 14055-2	Environmental management -- Guidelines for establishing good practices for combatting land degradation and desertification -- Part 2: Regional case studies	ISO/TC 207	
	ISO/TR 14062:2002	Environmental management -- Integrating environmental aspects into product design and development	ISO/TC 207	
prEN ISO 14064-1	ISO/CD 14064-1	Greenhouse gases - Part 1: Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals (ISO 14064-1:2006)	ISO/TC 207	Revision of ISO 14064-1:2006
	ISO/ AWI 14067	Greenhouse gases -- Carbon footprint of products -- Requirements and guidelines for quantification and communication	ISO/TC 207	Revision of ISO/TR 14067:2013
	ISO/DTR 14073	Environmental management -- Water footprint -- Illustrative examples on how to apply ISO 14046	ISO/TC 207	
	ISO/WD 19991	Environmental Conscious Design (ECD) -- Principles, requirements and guidance	ISO/TC 207	
	ISO/DIS 20400	Sustainable procurement -- Guidance	ISO/PC 277	
	ISO/WD TS 21929-2	Sustainability in building construction -- Sustainability indicators -- Part 2: Framework for the development of indicators for civil engineering works	ISO/TC 59	Revision of ISO/TS 21929-2:2015
	ISO/AWI TS 26030	Sustainable development and social responsibility -- Guidance for using ISO 26000:2010 in the agri-food sector	ISO/TC 34	
	ISO/AWI 30414	Guidelines -- Human Capital Reporting for Internal and External Stakeholders	ISO/TC 260	
	ISO/AWI 30415	Diversity and inclusion	ISO/TC 260	
	ISO/DIS 45001	Occupational health and safety management systems -- Requirements with guidance for use	ISO/PC 283	

prEN ISO 50001	ISO/CD 50001	Energy management systems -- Requirements with guidance for use	ISO/TC 301	Revision of ISO 50001:2011
	ISO/FDIS 50007	Activities relating to energy services -- Guidelines for the assessment and improvement of the service to users	ISO/TC 301	
	ISO/AWI 50008	Commercial building energy data management for energy performance -- Guidance for a systemic data exchange approach	ISO/TC 301	
	ISO/AWI 50044	Energy Savings Evaluation -- Economics and financial evaluation of energy saving projects	ISO/TC 301	
	ISO/AWI 50045	Technical guidelines for evaluation of energy savings of thermal power plants	ISO/TC 301	
	ISO/CD 50046	General quantification methods for ex ante or expected energy savings	ISO/TC 301	

(1) Coding of projects: EN: European Standard prEN: project of European Standard. FprEN: final project of European Standard. prA: project of Amendment ISO: International Standard TS: Technical Specification	TR: Technical Report AWI: approved work item WD: working draft CD: committee draft DIS: draft of ISO Standard FDIS: final draft of ISO Standard DAmd: draft of Amendment