



Standard method and online tool for assessing and improving the energy efficiency of waste water treatment plants

H2020-EE-2014-3-MarketUptake

Deliverable 5.2 Standardization landscape

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Dissemination Level

PU	Public	
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	X
CO	Confidential, only for members of the consortium (including the Commission Services)	

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1. Executive summary

The Spanish Association for Standardization and Certification (AENOR), as a European Standardization Body, is part of the coordination and support action ENERWATER and provides support regarding the standardization tasks included in the project. In order to fulfil this commitment, this deliverable D5.2 ‘Standardization landscape’ has been prepared under the direction of AENOR to provide the partners with information about the state of the art in standardization, including published standards and standards under development which can be interesting for the project objectives.

This deliverable should also provide ENERWATER members basic information to help decide further steps in the standardization process for the project results and inputs for the activities developed in other WPs.

The analysis will also identify the standardization technical committees (TCs) which could be useful for the project. A strategy for the communication with them will be elaborated, considering:

- which of them can be the most relevant.
- to what extent the relationship should be established.
- an initial planning of activities.

Following this strategy, a bidirectional relationship will be created with two main objectives:

- Use the standardization system as a fast and much focused dissemination tool to the market stakeholders.
- Monitor the TCs works and propose the future elaboration of standards based on the results of ENERWATER.

2. Introduction

2.1. Project presentation overview

ENERWATER coordination and support action is funded by European Commission under Programme H2020-EU 3.3.7. Started on 1st of March 2015, the project will run for three years. It brings together 9 partners from 4 different European countries (Germany, Italy, United Kingdom and Spain). With regard to the range of partner core activities, the consortium includes 4 Universities, 1 SME, 3 water utilities and 1 non profit organization. This composition represents a broad background and expertise which should promote the implementation of the developments and achievements of the project.

The main objective of ENERWATER is to develop, validate and disseminate an innovative standard methodology for continuously assessing, labelling and improving the overall energy performance of Wastewater Treatment Plants (WWTPs). ENERWATER will devote important efforts to ensure that the method is widely adopted.

Subsequent objectives are to impulse dialogue towards the creation of a specific European legislation following the example of recently approved EU directives, to achieve EU energy reductions objectives for 2020, ensuring effluent water quality, environmental protection and compliance with the WFD.

These actions should bring European Water Industry a competitive advantage in new products development and a faster access to markets by facilitating evidence of reduction therefore fostering adoption on new technologies.

2.2. Methodology of the document

This document presents the standardization activity found relevant for the ENERWATER project. In order to structure the search, a list of key concepts related to the project goals was identified to act as starting point for the identification of standardization areas.

The study covers European standardization developed by the European Committee for Standardization (CEN) and the European Committee for Electrotechnical Standardization (CENELEC) and International standardization developed by the International Organization for Standardization (ISO).

The document also describes the Technical Committees (TC) responsible for the elaboration of the identified standards which could be useful for the dissemination of the project and the development of tasks 5.3 and 5.4.

However, it should be noted that the standardization landscape may vary during the project lifetime and therefore a more detailed roadmap for future standardization activities of the project (what, how, where, etc) is not feasible at this initial stage, and will be assessed in deliverable D5.4.

2.3. Short introduction about standardization

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. Standards are developed and defined through a process of sharing knowledge and building consensus among technical experts nominated by interested parties and other stakeholders - including businesses, consumers and environmental groups, among others. These experts are organized in Technical Committees (TCs), which are subdivided in Subcommittees (SCs) or Working Groups (WGs). These TCs are included in the structure of the Standardization Organizations (National, European and International, with the respective mirror committees) and work following their internal regulations.

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 issues), IEC (electrotechnical issues) and ITU (telecommunications) at International level, or CEN, CENELEC and ETSI at European level in the same way.

There are also different kinds of standardization documents. The most widespread is the standard, which has a different code depending on the organization under it was developed; e.g. EN for European Standards, ISO or IEC for International standards. Other types of documents are Technical Specifications (TS), Technical Reports (TR) and Workshop Agreements (CWA). Further Amendments to the standards are identified by adding A1, A2, etc. at the end of the standard code.

At European level, all the members of CEN and CENELEC shall adopt EN standards as national standards and have to withdraw any existing national standard which could conflict with them. A summary of the characteristics of the different standardization documents could be found in the following table 1.

Table 1. Characteristics of different standardization documents

Type	International code	European code	National code	Main characteristics
Standard	ISO IEC	EN	UNE, NF, BS, DIN, etc. When adopting: UNE-EN, NF-EN, UNE-ISO, NF-ISO, etc.	Elaboration: 3 years 2 steps of member approval European: compulsory national adoption Revision: every 5 years
Technical Specification	ISO/TS IEC/TS	CEN/TS CLC/TS	When adopting: UNE-CEN/TS, NF-CEN/TS, UNE-ISO/TS, NF-ISO/TS, etc.	Elaboration: 21 months 1 step of member approval or internal approval in TC European: optional national adoption Revision: at 3 years (upgrading to EN or deletion)
Technical Report	ISO/TR IEC/TR	CEN/TR CLC/TR	When adopting: UNE-CEN/TR, NF-CEN/TR, UNE-ISO/TR, NF-ISO/TR, etc.	Elaboration: free timeframe Internal approval in TC European: optional national adoption No revision required
Workshop Agreement	IWA	CWA	Variable	Elaboration: free timeframe (usually few months) Internal approval in the Workshop European: optional national adoption Revision: at 3 years (upgrading to EN or deletion)

There is also an agreement established between European and International Organizations (e.g. CEN and ISO) in order to avoid duplication of efforts and promote global relevance of standards, which allows to adopt or develop in parallel each other's standards with the same content and code. National standards could also be proposed as a base for new European or International standards. The following figure 1 shows the tracks of the standards.

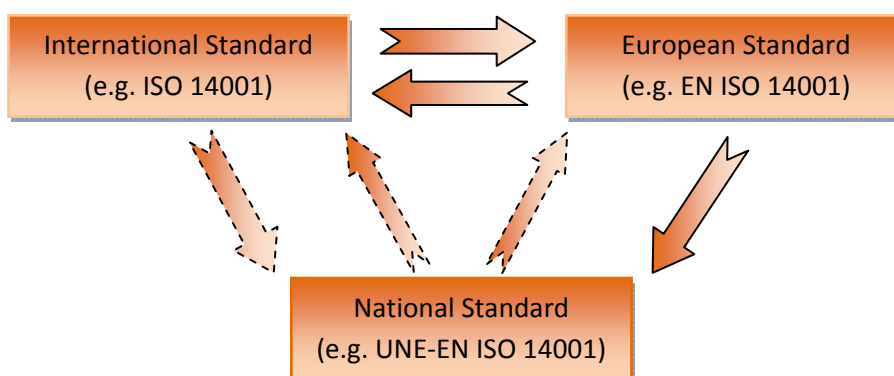


Figure 1: Possible tracks of standards adoption

Therefore, the code of any standard is the combination of the above mentioned issues, and could be explained as shown in figure 2:

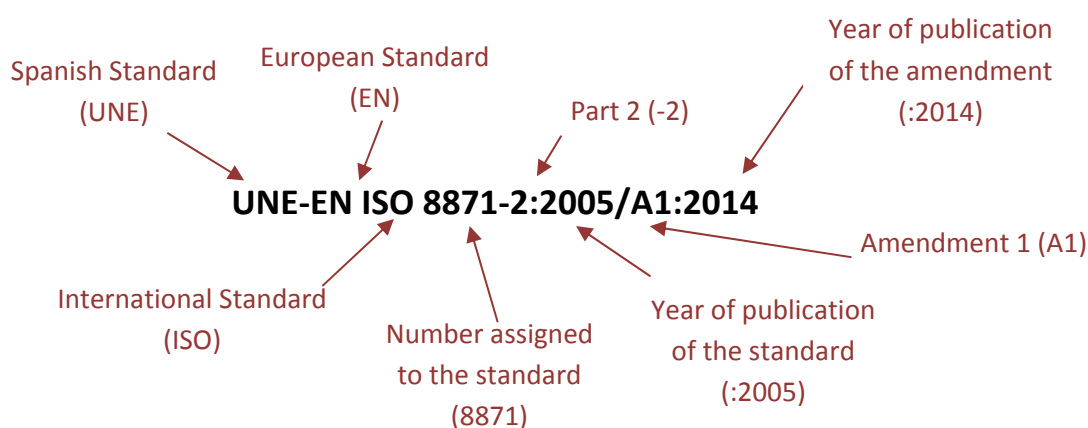


Figure 2: Example of identification of elements in the code of a standard

2.4. Abbreviations and acronyms

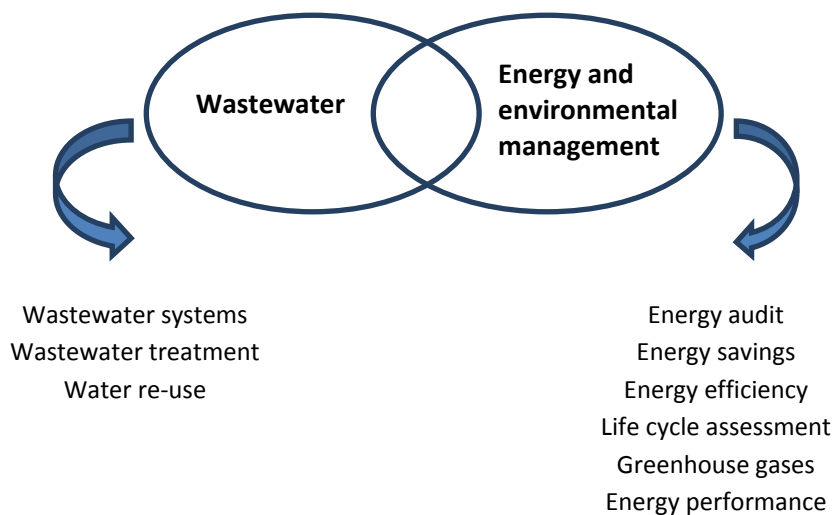
The main abbreviations and acronyms related to standardization are listed below:

AENOR	Spanish Association for Standardization and Certification
CEN	European Committee for Standardization
CENELEC (CLC)	European Committee for Electrotechnical Standardization
CWA	CEN or CENELEC Workshop Agreement
EN	European Standard
ISO	International Organization for Standardization; International Standard
IEC	International Electrotechnical Commission; International Standard
JWG	Joint Working Group
NMC	National Mirror Committee
NSB	National Standardization Body
SC	Subcommittee
TC	Technical Committee
TR	Technical Report
TS	Technical Specification
WG	Working Group

3. Standardization landscape related to ENERWATER

As referred in subclause 2.2, based on the general context of the ENERWATER project and the tasks to develop in the different WPs, some keywords have been selected as starting point to make the search of the normative documents which could be of interest for all the partners.

Two sets of terms have been taken into consideration, one related to waste water and the other to general aspects of energy and environmental management:



NOTE: Some other keywords like sewage, labelling, etc. were also used to make the search but no satisfactory results for the project have been found.

For each keyword, the following relevant technical committees and the published standards and work in progress under their responsibility have been identified and detailed below. For additional information, the scopes of the published documents have been included in an annex.

3.1. Wastewater systems

CEN/TC 165, Waste water engineering

This TC develops functional standards, standards for performance and installation in the field of wastewater engineering for systems and components. Standards for design, calculation, construction, commissioning, operation and maintenance in the field of wastewater engineering, from the point of origin (with the exception of the product standards for sanitary appliances*) up to the point of disposal, including treatment plants and use of treated wastewater for purposes other than agricultural irrigation.

* flushing cisterns, urinals, kitchen sinks, basins bidets, baths, (including whirlpool baths) and shower trays.

Terms related to wastewater are included in:

Reference	Title
EN 1085:2007	Wastewater treatment - Vocabulary
EN 16323:2014	Glossary of wastewater engineering terms

CEN/TC 165 is divided into several WGs two of which are dealing with WWT Plants:

- CEN/TC 165/WG 40 Wastewater treatment plants > 50 PT
 CEN/TC 165/WG 41 Small type sewage treatment plants (< 50 inhabitants)

Considering only the published standards from WG 40:

Reference	Title
EN 12255-1:2002	Wastewater treatment plants - Part 1: General construction principles
EN 12255-3:2000	Wastewater treatment plants - Part 3: Preliminary treatment
EN 12255-4:2002	Wastewater treatment plants - Part 4: Primary settlement
EN 12255-5:1999	Wastewater treatment plants - Part 5: Lagooning processes
EN 12255-6:2002	Wastewater treatment plants - Part 6: Activated sludge process
EN 12255-7:2002	Wastewater treatment plants - Part 7: Biological fixed-film reactors
EN 12255-8:2001	Wastewater treatment plants - Part 8: Sludge treatment and storage
EN 12255-9:2002	Wastewater treatment plants - Part 9: Odour control and ventilation
EN 12255-10:2000	Wastewater treatment plants - Part 10: Safety principles
EN 12255-11:2001	Wastewater treatment plants - Part 11: General data required
EN 12255-12:2003	Wastewater treatment plants - Part 12: Control and automation
EN 12255-13:2002	Wastewater treatment plants - Part 13: Chemical treatment - Treatment of wastewater by precipitation/flocculation
EN 12255-14:2003	Wastewater treatment plants - Part 14: Disinfection
EN 12255-15:2003	Wastewater treatment plants - Part 15: Measurement of the oxygen transfer in clean water in aeration tanks of activated sludge plants
EN 12255-16:2005	Wastewater treatment plants - Part 16: Physical (mechanical) filtration

At the time of publication of this deliverable, all the ongoing projects of this TC that might be applicable to the ENERWATER project have been identified.

ISO/TC 224, *Service activities relating to drinking water supply systems and wastewater systems - Quality criteria of the service and performance indicators*

This TC deals with the standardization of a framework for the definition and measurement of service activities relating to drinking water supply systems and wastewater systems.

The standardization includes the definition of a language common to the different stakeholders, the definition of the characteristics of the elements of the service according to the consumers' expectations, a list of requirements to fulfil for the management of a drinking water supply system and a wastewater system, service quality criteria and a related system of performance indicators, without setting any target values or thresholds.

However, it is excluded the design and construction of water supply and wastewater systems, or maintenance techniques; the limits of acceptability for drinking water quality and wastewater discharged in the receiving body and the analytical methods.

Selection of published standards

Reference	Title
ISO 24510:2007	Activities relating to drinking water and wastewater services -- Guidelines for the assessment and for the improvement of the service to users
ISO 24511:2007	Activities relating to drinking water and wastewater services -- Guidelines for the management of wastewater utilities and for the assessment of wastewater services

Work in progress

Reference	Title
ISO/AWI 20325	Service activities relating to drinking water supply and wastewater systems -- Guidelines for Stormwater management in Urban Areas
ISO/PRF 24518	Activities relating to drinking water and wastewater services -- Crisis management of water utilities
ISO/WD TS 24520	Service activities relating to drinking water supply systems and wastewater systems -- Crisis management -- Good practice for technical aspects
ISO/FDIS 24521	Activities relating to drinking water and wastewater services -- Guidelines for the management of basic onsite domestic wastewater services
ISO/CD 24523	Service activities relating to drinking water supply systems and wastewater systems -- Guidelines for benchmarking of water utilities
ISO/AWI 24526	Water Efficiency Management Systems -- Requirements with Guidance for Use

3.2. Water re-use**ISO/TC 282, *Water re-use***

This TC focuses its activity on the standardisation of water re-use of any kind and for any purpose. It covers both centralised and decentralised or on-site water re-uses, direct and indirect ones as well as intentional and unintentional ones. It includes technical, economic, environmental and societal aspects of water re-use. Water re-use comprises a sequence of the stages and operations involved in uptaking, conveyance, processing, storage, distribution, consumption, drainage and other handling of wastewater, including the water re-use in repeated, cascaded and recycled ways.

At the time of publication of this deliverable, this TC has not any published standard. However there are some standards under development which could be of interest for the project:

Work in progress

Reference	Title
ISO/AWI 20670	Water Re-Use – Terminology
ISO/CD 20426	Risk and performance evaluation of water re-use systems -- Guidelines for health risk assessment and treatment for water re-use
ISO/AWI 20468	Guidelines for performance evaluation of treatment technologies for water re-use systems
ISO/AWI 20760-1	Water Reuse in Urban Areas -- Guidelines for Centralized Water Reuse System - Part 1: Design Principle of a Centralized Water Reuse System
ISO/AWI 20760-2	Water Reuse in Urban Areas -- Guidelines for Centralized Water Reuse System - Part 2: Management of a Centralized Water Reuse System

3.3. Energy management

At European level, there are three CEN/CLC Joint Working Groups operating in the area of energy management whose work could serve as reference for ENERWATER project. There are also some ISO/TC providing documents in this field.

3.3.1. Energy Audits

CEN/CLC JWG1, Energy Audits

This JWG specifies the process requirements, the common methodology and the deliverables for carrying out an energy audit in relation to energy performance. It takes into account all forms of establishments and organizations, and all forms of energy and uses of energy. The JWG also specifies the competence requirements of the energy auditors.

Selection of published standards

Reference	Title
EN 16247-1:2012	Energy audits - Part 1: General requirements
EN 16247-3:2014	Energy audits - Part 3: Processes
EN 16247-5:2015	Energy audits - Part 5: Competence of energy auditors

It has not been identified any standard under development of interest for the project.

3.3.2. Energy management systems

CEN/CLC JWG3, Energy management and related services - General requirements and qualification procedures

JWG3 was created to elaborate EN standards in the energy management and related services field.

Selection of published standards

Reference	Title
EN ISO 50001:2011	Energy management systems - Requirements with guidance for use (ISO 50001:2011)
EN 16231:2012	Energy efficiency benchmarking methodology

For the time being, CEN/CLC JWG3 has no plans to develop new standards in this area.

ISO/TC 242, Energy management

This international committee works in the field of energy management, including for example: energy efficiency, energy performance, energy supply, procurement practices for energy using equipment and systems, and energy use as well as measurement of current energy usage, implementation of a measurement system to document, report, and validate continual improvement in the area of energy management.

Selection of published standards

Reference	Title
ISO 50001:2011	Energy management systems - Requirements with guidance for use
ISO 50004:2014	Guidance for the implementation, maintenance and improvement of an energy management system
ISO 50006:2014	Energy management systems -- Measuring energy performance using energy baselines (EnB) and energy performance indicators (EnPI) -- General principles and guidance
ISO 50015:2014	Energy management systems -- Measurement and verification of energy performance of organizations -- General principles and guidance

No projects of interest have been identified.

3.3.3. Energy savings; energy efficiency

CEN/CLC/JWG 4, Energy efficiency and saving calculation

Standards from this JWG focus on common methods of calculation of energy consumption, energy efficiencies and energy savings and on common measurement and verification of protocol and methodology for energy use indicators.

Published standard

Reference	Title
EN 16212:2012	Energy Efficiency and Savings Calculation, Top-down and Bottom-up Methods

In its work programme there is not any available reference.

ISO/TC 257, Evaluation of energy savings

This TC takes over the standardization in the field of energy savings through general technical rules and specific methodologies for the calculation of energy savings in projects, organizations and regions, and guidance on measurement, verification and assessment of data quality as it relates to these calculations.

For the time being, this international committee have not published any standard. However, there are several projects under development to be mentioned:

Work in progress

Reference	Title
ISO/DIS 17743	Energy savings -- Definition of a methodological framework applicable to calculation and reporting on energy savings
ISO 17742	Energy efficiency and savings calculation for countries, regions and cities
ISO/DIS 17747	Determination of energy savings in organizations
ISO/DIS 17741	General technical rules for measurement, calculation and verification of energy savings of projects
ISO/AWI 20619	Calculation methods for energy savings

3.4. Environmental management

In this field the standardization work is mainly developed at international level. Although there is no specific CEN/TC for environmental management issues, the ISO standards referenced below have been adopted identically as European standards (EN-ISO).

3.4.1. Life cycle assessment

ISO/TC 207/SC 5, *Life cycle assessment*

The work of ISO/TC 207/SC 5 cover the life cycle assessment (LCA) as one of the techniques developed to better understand and address the possible environmental impacts associated with products, processes and organizations.

The standards of this subcommittee dealing with the principles and guidelines for life cycle analysis are listed next.

Selection of published standards

Reference	Title
ISO 14040:2006	Environmental management -- Life cycle assessment -- Principles and framework
ISO 14044:2006	Environmental management -- Life cycle assessment -- Requirements and guidelines
ISO 14045:2012	Environmental management -- Eco-efficiency assessment of product systems -- Principles, requirements and guidelines
ISO 14046:2014	Environmental management -- Water footprint -- Principles, requirements and guidelines
ISO/TS 14071:2014	Environmental management -- Life cycle assessment -- Critical review processes and reviewer competencies: Additional requirements and guidelines to ISO 14044:2006
ISO/TS 14072:2014	Environmental management -- Life cycle assessment -- Requirements and guidelines for organizational life cycle assessment

At the time of publication of this deliverable, under the responsibility of ISO/TC 207/SC 5, there is only a technical report under development which describes examples on how to apply ISO 14046.

3.4.2. Greenhouse gases

ISO/TC 207/SC7, *Greenhouse gas management and related activities*

This technical body develops standards intended to manage and mitigate GHG emissions and to improve adaptation to the effects of climate change. This includes quantification, reporting and verification of GHG emissions applicable to organizational level, verification bodies or emissions reduction at project level.

Selection of published standards

Reference	Title
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 14064-2:2006	Greenhouse gases -- Part 2: Specification with guidance at the project level for quantification, monitoring and reporting of greenhouse gas emission reductions or removal enhancements
ISO/TR 14069:2013	Greenhouse gases -- Quantification and reporting of greenhouse gas emissions for organizations -- Guidance for the application of ISO 14064-1
ISO/TS 14067:2013	Greenhouse gases -- Carbon footprint of products -- Requirements and guidelines for quantification and communication

Work in progress

Reference	Title
ISO/NP 14080	Guideline -- good practice framework, principles and guidance for GHG methodologies

3.5. Energy performance

One of the objectives of ENERWATER project is to evaluate the energy performance of WWTPs in order to classify them in several categories. Since there is no specific normative document applicable to this kind of plants, it was considered that existing horizontal standards relating to energy performance of buildings could serve as a reference for the study that the partners have to perform.

In this sense, the following standards have been identified:

Reference	Title
EN 15217:2007	Energy performance of buildings - Methods for expressing energy performance and for energy certification of buildings
EN 15459:2007	Energy performance of buildings - Economic evaluation procedure for energy systems in buildings
EN 15603:2008	Energy performance of buildings - Overall energy use and definition of energy ratings

4. Other documents of interest

Outside of work developed by the officially recognized European and International Standardization Organizations, other documents might be of interest to the project. Some of them are listed and briefly described below:

- **Waste Water Collection and Treatment Services – Product Category Rules according to ISO 14025:2006 (Version 1.01 2013:14) – EPD®System.**

This is a Product Category Rules (PCR) document developed in the framework of the International EPD® System, operating in accordance with ISO 14025:2006 - Environmental labels and

declarations -- Type III environmental declarations -- Principles and procedures, and the following international standards:

- ISO 9001, Quality management systems
- ISO 14001, Environmental management systems
- ISO 14040, LCA - Principles and procedures
- ISO 14044, LCA - Requirements and guidelines

The International EPD® System is a system of voluntary environmental declarations applicable to any type of goods and services. The rules and requirements of the system are defined in the General Programme Instructions, available at the website: www.environdec.com.

A PCR is defined in ISO 14025 as a set of specific rules, requirements and guidelines for developing Type III environmental declarations for one or more product categories. This PCR document specifies the rules for the underlying life cycle assessment (LCA) and sets minimum requirements on EPDs for a specific product group that are more detailed than the standards and the General Programme Instructions.

This document provides Product Category Rules (PCR) for the assessment of the environmental performance of Sewerage and Sewage Treatment Services and General Waste Collection Services and the declaration of this performance by an EPD.

— **BEF & VSA. 2010 Manual Energy in WWTP. Federal Bureau of Energy (BEF) & Association Swiss Wastewater- and Water protection professionals (VSA), Bern, Switzerland.**

This book offers a systematic approach of improving the energy consumption of a waste water treatment plant. It describes a rough analysis and a fine analysis of a treatment plant and when to use which. For each individual treatment step or machine a detailed description of the theoretical optimal values is given, as well as concrete measures of how to reach these. It mainly deals with electrical power, but also has some chapters about heat and biogas production.

— **DWA (2013) Energy check and energy analysis – Measures for energy optimisation of waste water treatment plants, factsheet DWA-M 216. DWA, Hennef, Germany.**

This DWA concept describes 2 methods of assessing the energy efficiency of a waste water treatment plant (WWTP). It deals with electricity as well as heat. In both the methods values for kWh/(inhabitant*a) are used where one inhabitant is considered with 120 g CSB per day.

The Energy Check is meant as quick-check to see how a WWTP performs in comparison with the rest of Germany. This is done by comparing annual energy data with a frequency distribution with given KPIs. The frequency distribution contains hundreds of WWTPs from Germany. Apart from the aeration, all values are total WWTP values.

The Energy Analysis is a more thorough assessment and should ultimately lead to optimization measures. Whereas the energy check relies on annual values of the WWTP as a whole, the energy analysis requires a more detailed set of data.

For example a list with all energy consumers should be made together with estimates (or even better: measurements) of its annual consumption. By calculating actual consumption values for parts of the WWTPS and comparing these with ideal-values and considering the local circumstances (i.e. differences in altitude), energy optimization potential is identified.

— **Reference document on Best Available Techniques (BREFs BAT) – Environmental Protection Agency:**

- BREF for Energy Efficiency (02.09)

- BREF on Economic and Cross Media Effects (07.06)
- BREF on General Principles of Monitoring (07.03)

BREF or 'BAT reference document' means a document, resulting from the exchange of information organized pursuant to Article 13 of the Industrial Emissions Directive (IED) (2010/75/EU). BREFs are drawn up for defined activities and describing, in particular, applied techniques, present emissions and consumption levels, techniques considered for the determination of best available techniques as well as BAT conclusions and any emerging techniques, giving special consideration to the criteria listed in Annex III to Directive 2010/75/EU.

BREFs are the main reference documents used by the EPA when issuing operating permits/licenses for the IED activities specified in the First Schedule of the EPA Act 1992.

The list of reference documents is available at website: <http://eippcb.jrc.ec.europa.eu/reference>.

— **Spanish standard draft PNE 178101-1, Smart cities. Infrastructures. Public Service Networks. Part 1: Water Networks.**

The UNE 178101 series of standards defines metrics applicable to the public services networks, in order to provide the best services to the citizens whilst providing maximum efficiency and easy integration within the environment, in the Smart and sustainable Cities framework. Part 1 defines metrics applicable to the drinking water and wastewater public service networks of a city.

— **Italian Technical Report UNI-CEI/TR 11428:2011, Energy management - Energy audits - General requirements for the energy audit service**

This technical report specifies the requirements, common methodology and deliverables for energy audits. The energy audit is undertaken in order to make available a description of the situation of the global energy system under investigation, defining possible actions to improve energy efficiency and quantify the energy savings resulting.

The energy audit must inspect the Energy System (organization, company, industry or urban settlement, technology ... able to create, manage or control a power demand) object of diagnosis.

The document applies to all forms of establishments, energy and use of energy. It does not define specific energy audit requirements for buildings, industrial processes, transportation or services to community by means of grids, plants or processes.

— **Sewage Treatment Plants – Economic Evaluation of Innovative Technologies for Energy Efficiency (IWA Publishing)**

This publication focuses on the novel, energy and/or economic efficient technologies or modification of the conventional, energy demanding treatment facilities towards the concept of energy streamlining and their economic impact. The book brings together knowledge from Engineering, Economics, Utility Management and Practice and helps to provide a better understanding of the real economic value with methodologies and practices about innovative energy technologies and policies in STP.

It consists of two parts: the first part is dedicated to critical discussion of technologies aiming at enhancing the energy efficiency of STP including economic aspects as well, while the second part includes case studies demonstrating the economic impact of applying the energy efficient technologies at full scale.

Special mention to the inclusion of a chapter (chapter 3) concerning the energy management in WWTP and the aims and benefits of applying ISO 50001 in wastewater utilities.

5. Conclusions

The study of the standardization landscape at European and at International level confirms the absence of specific normative documents in the framework of energy efficiency in waste water treatment plants. Therefore, there is a good opportunity to fill this gap by raising a proposal based on the results of the project to the standardization organizations.

In a general context, not specifically linked to WWTPs, several European and International technical committees whose standardization activity can contribute to make better and more rational use of energy and to manage the energy use more efficiently, have been identified. Since these committees promote best practices and provide organizations with the tools to take decisions and design policies to optimize and improve energy efficiency of installations and systems, it is recommended for ENERWATER objectives to follow up their standardization activity and probably to keep them informed of the project achievements. The most relevant committees to take into account would be:

- CEN/CLC JWG 3 and ISO/TC 242 regarding energy management systems;
- CEN/CLC JWG 4 and ISO/TC 257 concerning evaluation of energy efficiency and energy savings;
- CEN/CLC JWG 1 on energy audits.

Concerning WWTPs, CEN/TC 165, Wastewater engineering, would be the main TC that ENERWATER partners should closely monitor and even establish a bidirectional relationship that allows a fluently interchange of information. This relationship could be formalized through the nomination of at least one ENERWATER representative in this TC.

NOTE: The participation in European or International TC shall be achieved according to the policy of the NSBs about the nomination of experts.

The close relationship with these committees will facilitate the performance of dissemination actions and the preparation of a proposal for future standardization.

At a later stage of the project when the results are closer, next standardization task (Task 5.4) will evaluate the interest and potential of these results to be part of future standards. This will be assessed by considering factors such as:

- the situation of the works of the relevant TCs at that moment,
- the possible contents of the project to be proposed and its relation with the fields of activity of the TCs involved,
- the exploitation and IP protection plans of the project, balancing confidentiality requirements and benefits of inclusion in standards for future commercialization.

With the technical contribution of ENERWATER partners and the AENOR assistance on standardization, a technical proposal should be elaborated from project results. AENOR's assistance within the consortium will ensure that this proposal fits the standardization procedures and requirements to be ready for inclusion in the futures development of new standards or into revised ones. This proposal shall be provided to the involved TCs or to the technical bureau of the relevant standardization organization and presented in the most adequate way (e.g. writing report, presentation in a TC meeting or other suitable event, organization of a joint meeting...).

The evaluation, the standardization route, the technical proposal itself and the advance reached in the consensus building process will be reported in deliverable D5.4 "Report on standardization activity".

Annex – Information on the scopes of published standards

This annex provides an overview of the scope of the published standards that have been identified in the present study.

EN 1085:2007 – Wastewater treatment - Vocabulary

The aim of this European standard is to establish a standardized terminology in the field of wastewater treatment in the three official languages of CEN: English, French and German.

The terms defined in this standard will be the basis for the elaboration of corresponding product and performance standards and can be stated more precisely in specific standards.

The terms are arranged in 9 groups: general definitions, types of wastewater and wastewater collection, wastewater quantity and quality, methods, characteristics and impact on the environment, preliminary and primary treatment, fixed film treatment, activated sludge treatment, other wastewater treatment and sludge treatment.

EN 16323:2014 – Glossary of wastewater engineering terms

This European standard harmonizes and defines general terms in the field of the collection, transport, treatment, discharge (and reuse) of wastewater and in the field of sludge treatment, utilization and disposal.

This European standard provides general basis for the terms and definitions in the preparation or revision of all standards within the field of wastewater engineering.

EN 12255 (series) – Wastewater treatment plants

This series of standards specifies the requirements and processes for wastewater treatment plants for a total number of inhabitants and population equivalents (PT) over 50. While Part 1 deals with general requirements for structures and equipment, special construction principles for elements of wastewater treatment plants are covered in other parts.

The primary application is designed for wastewater treatment plants for the treatment of domestic and municipal wastewater.

General principles of building construction, mechanical and electrical engineering are not subject of this series.

Differences in wastewater treatment throughout Europe have led to a variety of systems being developed. This series of standards gives fundamental information about the systems but has not attempted to specify all available systems.

ISO 24510:2007 - Activities relating to drinking water and wastewater services -- Guidelines for the assessment and for the improvement of the service to users

ISO 24510:2007 specifies the elements of drinking water and wastewater services of relevance and interest to users. It also provides guidance on how to identify users' needs and expectations and how to assess whether they are being met.

The following are within the scope of ISO 24510:2007:

- the definition of a language common to the different stakeholders;
- the definition of key elements and characteristics of the service to users;
- the objectives for the service with respect to users' needs and expectations;
- guidelines for satisfying users' needs and expectations;
- service to users assessment criteria;

- introduction to performance indicators;
- examples of performance indicators.

ISO 24511:2007 - Activities relating to drinking water and wastewater services -- Guidelines for the management of wastewater utilities and for the assessment of wastewater services

This International standard provides guidelines for the management of wastewater utilities and for the assessment of wastewater services.

ISO 24511:2007 is applicable to publicly and privately owned and operated wastewater utilities, but does not favour any particular ownership or operational model. It addresses wastewater systems in their entirety and is applicable to systems at any level of development (e.g. pit latrines, on-site systems, networks, treatment facilities).

The following are within the scope of ISO 24511:2007:

- the definition of a language common to different stakeholders;
- objectives for the wastewater utility;
- guidelines for the management of wastewater utilities;
- service assessment criteria and related examples of performance indicators, all without setting any target values or thresholds.

EN 16247-1:2012 - Energy audits - Part 1: General requirements

This European standard specifies the requirements, common methodology and deliverables for energy audits. It applies to all forms of establishments and organisations, all forms of energy and uses of energy, excluding individual private dwellings.

It defines the attributes of a good quality energy audit. It states the requirements for energy audits and corresponding obligations within the energy auditing process. It recognizes that there are differences in approach to energy auditing in terms of scopes, aims and thoroughness, but seeks to harmonise common aspects of energy auditing in order to bring more clarity and transparency to the market for energy auditing services. The energy audit process is presented as a simple chronological sequence; this does not preclude however repeated iterations of certain steps.

This standard does not deal with the energy audit programme/scheme properties (such as programme administration, training of energy auditors, quality control issues, etc.).

This European standard covers the general requirements common to all energy audits. Specific energy audit requirements will complete the general requirements in separate parts dedicated to energy audits for buildings, industrial processes and transportation.

EN 16247-3:2014 - Energy audits - Part 3: Processes

This European standard specifies the requirements, methodology and deliverables of an energy audit within a process. These consist of:

- a) organizing and conducting an energy audit;
- b) analysing the data from the energy audit;
- c) reporting and documenting the energy audit findings.

This part of the standard applies to sites where the energy use is due to process. It shall be used in conjunction with and is supplementary to EN 16247-1, Energy audits - Part 1: General requirements. It provides additional requirements to EN 16247-1 and shall be applied simultaneously.

A process could include one or more production lines, offices, laboratories, research centers, packaging and warehouse sections with specific operational conditions and site transportation. An energy audit could include the whole site or part of a site.

EN 16247-5:2015 - Energy audits - Part 5: Competence of energy auditors

This European Standard specifies the competence requirements of the energy auditor.

It can be used to specify energy auditor qualification schemes at a national level; used by organizations undertaking energy audits to appoint a suitably competent energy auditor and used by organizations, in conjunction with EN 16247-1, EN 16247-2, EN 16247-3 and EN 16247-4, to ensure a good level of quality of the energy audits.

This European Standard also recognizes that all the competence required can reside in the energy auditor or a team of energy auditors. It seeks to harmonize training, skills and experience needed by the energy auditor(s) to bring adequate quality to energy auditing services. The requirements included in this standard should enable the energy auditor to understand the organization's aims, needs and expectations concerning the energy audit.

EN ISO 50001:2011 - Energy management systems - Requirements with guidance for use (ISO 50001:2011)

ISO 50001:2011 specifies requirements for establishing, implementing, maintaining and improving an energy management system, whose purpose is to enable an organization to follow a systematic approach in achieving continual improvement of energy performance, including energy efficiency, energy use and consumption.

This International standard specifies requirements applicable to energy use and consumption, including measurement, documentation and reporting, design and procurement practices for equipment, systems, processes and personnel that contribute to energy performance.

It applies to all variables affecting energy performance that can be monitored and influenced by the organization. ISO 50001:2011 does not prescribe specific performance criteria with respect to energy. It has been designed to be used independently, but it can be aligned or integrated with other management systems.

ISO 50001:2011 is applicable to any organization wishing to ensure that it conforms to its stated energy policy and wishing to demonstrate this to others, such conformity being confirmed either by means of self-evaluation and self-declaration of conformity, or by certification of the energy management system by an external organization.

ISO 50001:2011 also provides informative guidance on its use.

EN 16231:2012 – Energy efficiency benchmarking methodology

This European Standard specifies requirements and provides recommendations for energy efficiency benchmarking methodology. The purpose of energy efficiency benchmarking is to establish the relevant data and indicators on energy consumption, both technical and behavioural, qualitative and quantitative in comparing performance between or within entities.

Energy efficiency benchmarking can be either internal (within a specific organisation) or external (between organisations including competitors). This standard describes how to establish the boundaries of what is being benchmarked, including for example facilities, activities, processes, products, services and organisations.

This European Standard provides guidance on the criteria to be used in order to choose the appropriate level of detail for the data collection, processing and reviewing which suits the objective of the benchmarking.

It does not itself state specific performance requirements with respect to energy use. For all activities related to the continual improvement cycle (such as the Plan-Do-Check-Act methodology) reference shall be made to management systems in the organisation.

ISO 50004:2014 - Guidance for the implementation, maintenance and improvement of an energy management system

This international standard provides practical guidance and examples for establishing, implementing, maintaining and improving an energy management system (EnMS) in accordance with the systematic approach of ISO 50001. The guidance in ISO 50004:2014 is applicable to any organization, regardless of its size, type, location or level of maturity.

It includes practical help boxes designed to provide the user with ideas, examples and strategies for implementing an EnMS. However, it does not provide guidance on how to develop an integrated management system.

While the guidance in ISO 50004:2014 is consistent with the ISO 50001 energy management system model, it is not intended to provide interpretations of the requirements of ISO 50001.

ISO 50006:2014 - Energy management systems -- Measuring energy performance using energy baselines (EnB) and energy performance indicators (EnPI) -- General principles and guidance

ISO 50006:2014 provides guidance to organizations on how to establish, use and maintain energy performance indicators (EnPIs) and energy baselines (EnBs) as part of the process of measuring energy performance. EnPIs and EnBs are two key interrelated elements of ISO 50001 that enable the measurement, and therefore management of energy performance in an organization.

In order to effectively manage the energy performance of their facilities, systems, processes and equipment, organizations need to know how energy is used and how much is consumed over time. An EnPI is a value or measure that quantifies results related to energy efficiency, use and consumption in facilities, systems, processes and equipment. Organizations use EnPIs as a measure of their energy performance.

The EnB is a reference that characterizes and quantifies an organization's energy performance during a specified time period. The EnB enables an organization to assess changes in energy performance between selected periods. The EnB is also used for calculation of energy savings, as a reference before and after implementation of energy performance improvement actions.

This International Standard includes practical help boxes designed to provide the user with ideas, examples and strategies for measuring energy performance using EnPIs and EnBs.

The guidance in ISO 50006:2014 is applicable to any organization, regardless of its size, type, location or level of maturity in the field of energy management.

ISO 50015:2014 - Energy management systems -- Measurement and verification of energy performance of organizations -- General principles and guidance

The purpose of this International Standard is to establish a common set of principles and guidelines to be used for measurement and verification (M&V) of energy performance and energy performance improvement of the organization. M&V adds value by increasing the credibility of energy performance and energy performance improvement results. Credible results can contribute to the pursuit of energy performance improvement.

This International Standard can be used irrespective of the type of energy used.

This International Standard can be used in several organizational contexts:

- by organizations with or without existing energy management systems, such as ISO 50001;
- for the M&V of energy performance or energy performance improvement;
- for all or part of an organization.

This International Standard can be used by organizations of any size, M&V practitioners, or any interested parties, in order to apply M&V to the reporting of energy performance results. The principles and guidance in this International Standard can be used independently or in conjunction with other standards and protocols.

This International Standard does not specify calculation methods; rather, it establishes a common understanding of M&V and how M&V could be applied to different calculation methods. These principles and guidelines are applicable irrespective of the M&V method used.

EN 16212:2012 - Energy Efficiency and Savings Calculation, Top-down and Bottom-up Methods

This European standard provides a general approach for energy efficiency and energy savings calculations with top-down and bottom-up methods. It covers the following topics:

- the methodology and general rules of calculation;
- terminology and definitions;
- parameters and data, including data quality and data sources.

The general approach is applicable for energy savings in buildings, cars, appliances, industrial processes, etc.

This European standard covers energy consumption in all end-use sectors. The standard does not cover energy supply, e.g. in power stations, as it considers only final energy consumption.

This European standard deals with savings on energy supplied to end-users. Some forms of renewable energy "behind-the-meter" (e.g. from solar water heating panels) reduce supplied energy and therefore can be part of the calculated energy savings. Users of the standard should be aware that this renewable energy behind the meter can also be claimed as energy generated.

The standard is meant to be used for ex-post evaluations of realized savings as well as ex-ante evaluations of expected savings.

It provides saving calculations for any period chosen. However, short data series may limit the possible periods over which savings can be calculated.

The standard is not intended to be used for calculating energy savings of individual households, companies or other end-users.

ISO 14040:2006 - Environmental management -- Life cycle assessment -- Principles and framework

ISO 14040:2006 describes the principles and framework for life cycle assessment (LCA) including: definition of the goal and scope of the LCA, the life cycle inventory analysis (LCI) phase, the life cycle impact assessment (LCIA) phase, the life cycle interpretation phase, reporting and critical review of the LCA, limitations of the LCA, the relationship between the LCA phases, and conditions for use of value choices and optional elements.

This International standard covers life cycle assessment (LCA) studies and life cycle inventory (LCI) studies. It does not describe the LCA technique in detail, nor does it specify methodologies for the individual phases of the LCA.

The intended application of LCA or LCI results is considered during definition of the goal and scope, but the application itself is outside the scope of this International Standard.

This International Standard is not intended for contractual or regulatory purposes or registration and certification.

ISO 14044:2006 - Environmental management -- Life cycle assessment – Requirements and guidelines

ISO 14044:2006 specifies requirements and provides guidelines for life cycle assessment (LCA) including: definition of the goal and scope of the LCA, the life cycle inventory analysis (LCI) phase, the life cycle impact assessment (LCIA) phase, the life cycle interpretation phase, reporting and critical review of the LCA, limitations of the LCA, relationship between the LCA phases, and conditions for use of value choices and optional elements.

ISO 14044:2006 covers life cycle assessment (LCA) studies and life cycle inventory (LCI) studies.

The intended application of LCA or LCI results is considered during the goal and scope definition, but the application itself is outside the scope of this International Standard.

This International Standard is not intended for contractual or regulatory purposes or registration and certification.

ISO 14045:2012 - Environmental management -- Eco-efficiency assessment of product systems -- Principles, requirements and guidelines

This International standard describes the principles, requirements and guidelines for eco-efficiency assessment for product systems including:

- a) the goal and scope definition of the eco-efficiency assessment;
- b) the environmental assessment;
- c) the product-system-value assessment;
- d) the quantification of eco-efficiency;
- e) interpretation (including quality assurance);
- f) reporting;
- g) critical review of the eco-efficiency assessment.

Its key objectives are to:

- 1) establish clear terminology and a common methodological framework for eco-efficiency assessment;
- 2) enable the practical use of eco-efficiency assessment for a wide range of product (including service) systems;
- 3) provide clear guidance on the interpretation of eco-efficiency assessment results;
- 4) encourage the transparent, accurate and informative reporting of eco-efficiency assessment results.

Requirements, recommendations and guidelines for specific choices of categories of environmental impact and values are not included. The intended application of the eco-efficiency assessment is considered during the goal and scope definition phase, but the actual use of the results is outside the scope of ISO 14045:2012.

ISO 14046:2014 - Environmental management -- Water footprint -- Principles, requirements and guidelines

ISO 14046:2014 specifies principles, requirements and guidelines related to water footprint assessment of products, processes and organizations based on life cycle assessment (LCA).

The result of a water footprint assessment is a single value or a profile of impact indicator results.

Whereas reporting is within the scope of ISO 14046:2014, communication of water footprint results, for example in the form of labels or declarations, is outside the scope of ISO 14046:2014.

Specific requirements and guidelines for organizations are also given in this standard.

This International Standard is expected to benefit organizations, governments and other interested parties worldwide by providing transparency, consistency, reproducibility and credibility for assessing and reporting the water footprint of products, processes or organizations.

A water footprint assessment conducted according to this International Standard:

- is based on a life cycle assessment (according to ISO 14044);
- is modular (i.e. the water footprint of different life cycle stages can be summed to represent the water footprint);
- identifies potential environmental impacts related to water;
- includes relevant geographical and temporal dimensions;
- identifies quantity of water use and changes in water quality;
- utilizes hydrological knowledge.

A water footprint assessment can assist in:

- a) assessing the magnitude of potential environmental impacts related to water;
- b) identifying opportunities to reduce water related potential environmental impacts associated with products at various stages in their life cycle as well as processes and organizations;
- c) strategic risk management related to water;
- d) facilitating water efficiency and optimization of water management at product, process and organizational levels;
- e) informing decision-makers in industry, government or non-governmental organizations of their potential environmental impacts related to water (e.g. for the purpose of strategic planning, priority setting, product or process design or redesign, decisions about investment of resources);
- f) providing consistent and reliable information, based on scientific evidence for reporting water footprint results.

A water footprint assessment alone is insufficient to be used to describe the overall potential environmental impacts of products, processes or organizations.

The water footprint assessment according to this International Standard can be conducted and reported as a stand-alone assessment, where only impacts related to water are assessed, or as part of a life cycle assessment, where consideration is given to a comprehensive set of environmental impacts and not only impacts related to water.

In this International Standard, the term “water footprint” is only used when it is the result of an impact assessment.

The specific scope of the water footprint assessment is defined by the users of this International Standard in accordance with its requirements.

ISO/TS 14071:2014 - Environmental management -- Life cycle assessment -- Critical review processes and reviewer competencies: Additional requirements and guidelines to ISO 14044:2006

This Technical Specification includes additional specifications to ISO 14040:2006 and ISO 14044:2006. It provides requirements and guidelines for conducting a critical review of any type of LCA study and the competencies required for the review.

ISO/TS 14071:2014 provides:

- details of a critical review process, including clarification with regard to ISO 14044:2006;

- guidelines to deliver the required critical review process, linked to the goal of the life cycle assessment (LCA) and its intended use;
- content and deliverables of the critical review process;
- guidelines to improve the consistency, transparency, efficiency and credibility of the critical review process;
- the required competencies for the reviewer(s) (internal, external and panel member);
- the required competencies to be represented by the panel as a whole.

ISO/TS 14071:2014 does not cover the applications of LCA.

ISO/TS 14072:2014 - Environmental management -- Life cycle assessment -- Requirements and guidelines for organizational life cycle assessment

This Technical Specification provides additional requirements and guidelines for an effective application of ISO 14040 and ISO 14044 to organizations. It details:

- the application of Life Cycle Assessment (LCA) principles and methodology to organizations,
- the benefits that LCA can bring to organizations by using LCA methodology at organizational level,
- the system boundary,
- specific considerations when dealing with LCI, LCIA, and interpretation, and
- the limitations regarding reporting, environmental declarations, and comparative assertions.

ISO/TS 14072:2014 applies to any organization that has interest in applying LCA. It is not intended for the interpretation of ISO 14001 and specifically covers the goals of ISO 14040 and ISO 14044.

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

Part 1 of ISO 14064 details principles and requirements for designing, developing, managing and reporting organization- or company-level GHG inventories. It includes requirements for determining GHG emission boundaries, quantifying an organization's GHG emissions and removals, and identifying specific company actions or activities aimed at improving GHG management. It also includes requirements and guidance on inventory quality management, reporting, internal auditing and the organization's responsibilities for verification activities.

ISO 14064-2:2006 - Greenhouse gases -- Part 2: Specification with guidance at the project level for quantification, monitoring and reporting of greenhouse gas emission reductions or removal enhancements

ISO 14064-2:2006 specifies principles and requirements and provides guidance at the project level for quantification, monitoring and reporting of activities intended to cause greenhouse gas (GHG) emission reductions or removal enhancements. It includes requirements for planning a GHG project, identifying and selecting GHG sources, sinks and reservoirs relevant to the project and baseline scenario, monitoring, quantifying, documenting and reporting GHG project performance and managing data quality. It provides the basis for GHG projects to be validated and verified.

This part of ISO 14064 does not specify requirements for validation/verification bodies or validators/verifiers in providing assurance against GHG assertions or claims by GHG projects. Such requirements may be specified by the authority of the applicable GHG programme or can be found in ISO 14064-3.

ISO/TR 14069:2013 - Greenhouse gases -- Quantification and reporting of greenhouse gas emissions for organizations --Guidance for the application of ISO 14064-1

This Technical Report describes the principles, concepts and methods relating to the quantification and reporting of direct and indirect greenhouse gas (GHG) emissions for an organization. It provides guidance for the application of ISO 14064-1 to greenhouse gas inventories at the organization level, for the quantification and reporting of direct emissions, energy indirect emissions and other indirect emissions.

ISO/TR 14069:2013 describes for all organizations, including local authorities, the steps for:

- establishing organizational boundaries, in accordance with either a control approach (financial or operational) or an equity share approach;
- establishing operational boundaries, by identifying direct emissions and energy indirect emissions to be quantified and reported, as well as any other indirect emissions the organization chooses to quantify and report; for each category of emission, guidance is provided on specific boundaries and methodologies for the quantification of GHG emissions and removals;
- GHG reporting: guidance is provided to promote transparency regarding the boundaries, the methodologies used for the quantification of direct and indirect GHG emissions and removals, and the uncertainty of the results.

ISO/TS 14067:2013 - Greenhouse gases -- Carbon footprint of products -- Requirements and guidelines for quantification and communication

This Technical Specification specifies principles, requirements and guidelines for the quantification and communication of the carbon footprint of a product (CFP), based on International Standards on life cycle assessment (ISO 14040 and ISO 14044) for quantification and on environmental labels and declarations (ISO 14020, ISO 14024 and ISO 14025) for communication.

Requirements and guidelines for the quantification and communication of a partial carbon footprint of a product (partial CFP) are also provided.

ISO/TS 14067:2013 is applicable to CFP studies and different options for CFP communication based on the results of such studies.

Where the results of a CFP study are reported according to ISO/TS 14067:2013, procedures are provided to support both transparency and credibility and also to allow for informed choices.

ISO/TS 14067:2013 also provides for the development of CFP-product category rules (CFP-PCR), or the adoption of product category rules (PCR) that have been developed in accordance with ISO 14025 and that are consistent with ISO/TS 14067:2013.

ISO/TS 14067:2013 addresses only one impact category: climate change.

Offsetting is outside of the scope of ISO/TS 14067:2013.

EN 15217:2007 - Energy performance of buildings - Methods for expressing energy performance and for energy certification of buildings

This European Standard specifies:

- a) overall indicators to express the energy performance of whole buildings, including heating, ventilation, air conditioning, domestic hot water and lighting systems. This includes different possible indicators;

- b) ways to express energy requirements for the design of new buildings or renovation of existing buildings;
- c) procedures to define reference values;
- d) ways to design a procedure for building energy certification.

The standard can be applied to a group of buildings, if they are on the same lot, if they are serviced by the same technical building systems and if no more than one of them has a conditioned area of more than 1 000 m².

This European Standard provides different options at different levels. When this European Standard is used to set up national or regional methods for expressing energy performance and/or for energy certification of buildings, the choices between the options is not made by the individual user, but by authorized national or regional bodies.

EN 15459:2007 - Energy performance of buildings - Economic evaluation procedure for energy systems in buildings

This standard provides a calculation method for the economical issues of heating systems and other systems that are involved in the energy demand and energy consumption of the building. This standard applies to all types of buildings.

The fundamental principles and terminology are explained in this standard. The main items of the standard are:

- definitions and structure of the types of costs, which shall be taken into account for calculation of the economical efficiency of saving options in buildings;
- data needed for definition of costs related to systems under consideration;
- calculation method(s);
- expression of the result of the economic calculation;
- informative annexes indicating default values of e.g. lifetime, costs for repair, costs for maintenance, in order to introduce default values for calculations.

This standard is applicable to calculation of economic performance of energy saving options in buildings (e.g. insulation, better performing generators and distribution systems, efficient lighting, renewable sources, combined heat and power).

The scope of this standard is to standardise:

- required inputs;
- calculation methods;
- required outputs

for economic calculations of energy systems related to the energy performance of buildings.

EN 15603:2008 - Energy performance of buildings - Overall energy use and definition of energy ratings

The purpose of the standard is to:

- a) collate results from other standards that calculate energy use for specific services within a building;
- b) account for energy generated in the building, some of which may be exported for use elsewhere;
- c) present a summary of the overall energy use of the building in tabular form;
- d) provide energy ratings based on primary energy, carbon dioxide emission or other parameters defined by national energy policy;
- e) establish general principles for the calculation of primary energy factors and carbon emission coefficients.

This standard defines the energy services to be taken into account for setting energy performance ratings for planned and existing buildings, and provides for this:

- f) method to compute the standard calculated energy rating, a standard energy use that does not depend on occupant behaviour, actual weather and other actual (environment or indoor) conditions;
- g) method to assess the measured energy rating, based on the delivered and exported energy;
- h) methodology to improve confidence in the building calculation model by comparison with actual energy use;
- i) method to assess the energy effectiveness of possible improvements.

This European standard is applicable to a part of a building (e.g. flat), a whole building, or several buildings. It is up to national bodies to define under which conditions, for which purposes and for which types of buildings the various ratings apply.

This standard handles the energy performance of a building as a whole. The assessment of the energy performance of specific technical building systems is handled in the appropriate part of EN 15241, prEN 15243 and EN 15316 series.