Assessment framework for environmental impact of ICT

itu.int/ITU-T/climatechange/ess

Acknowledgements

This document is part of the ITU Toolkit on Environmental Sustainability for the ICT sector which was edited by Jyoti Banerjee (Fronesys) and Cristina Bueti (ITU).

This document was researched and written by Yong-Woon Kim (ETRI), Tom Baumann (GHG Management Institute/ClimateCHECK), Hans Otto Scheck and Susanna Kallio (Nokia Siemens Networks).

Special thanks are due to the contributory organizations of the Toolkit on Environmental Sustainability for the ICT Sector for their helpful review of a prior draft.

Additional information including the full list of contributory organizations can be found at: www.itu.int/ITUT/climatechange/ess/index.html

If you would like to provide any additional information, please contact Cristina Bueti at tsbsg5@itu.int.

Assessment framework for environmental impacts of the ICT sector

Table of contents

Assessment framework for environmental impacts of the ICT sector

Executive summary

There are a number of standards and guidelines to manage energy, GHG and waste aspects for ICT products, organizations, and projects. They have been created by various standards development organizations (SDOs). Some of them are sector-neutral and some of them are sector-specific.

This document summarizes the scope and purposes of the different energy and GHG management standards and guidelines. In particular, it examines the relationships between assessment targets and assessment criteria in order to understand:

- their application;
- their inter-dependencies;
- where they are complementary;
- where they supplement each other, and
- how they might be competitive.

The initial task is to map and review all the relevant standards and guidelines. Nine different sources of standards are examined, including:

- ISO TC 207
- GHG Protocol
- ITU-T
- IEC TC 111
- BSI
- EC-JRC handbooks
- JRC-IES methodologies
- ETSI
- IAASB

This review is used to map all the standards and guidelines across two dimensions. One dimension covers *assessment targets*, including product, organization, project, city and country. The second dimension covers *assessment criteria*, including inventory, carbon footprint, LCA, ICT enablement accounting, product eco-design, labelling, and validation/verification.

The resulting mapping of the standards provides insight to organizations on how they can use the various standards and guidelines to create their own sustainability assessment framework.

The toolkit

This assessment framework document is part of a set of documents that together form the Toolkit on environmental sustainability for the ICT sector. The toolkit is the result of an ITU-T initiative, carried out together with over fifty partners, which provides detailed support on how ICT companies can build sustainability into the operations and management of their organizations. The documents in the toolkit cover the following:

- *Introduction to the toolkit*
- *Sustainable ICT in corporate organizations*, focusing on the main sustainability issues that companies face in using ICT products and services in their own organizations across four main ICT areas: data centers, desktop infrastructure, broadcasting services and telecommunications networks.
- *Sustainable products*, where the aim is to build sustainable products through the use of environmentally-conscious design principles and practices, covering development and manufacture, through to end-of-life treatment.
- *Sustainable buildings*, which focuses on the application of sustainability management to buildings through the stages of construction, lifetime use and de-commissioning, as ICT companies build and operate facilities that can demand large amounts of energy and material use in all phases of the life cycle.
- *End-of-life management*, covering the various EOL stages (and their accompanying legislation) and provides support in creating a framework for environmentally-sound management of EOL ICT equipment.
- *General specifications and key performance indicators*, with a focus on the matching environmental KPIs to an organization's specific business strategy targets, and the construction of standardized processes to make sure the KPI data is as useful as possible to management.
- *Assessment framework for environmental impacts*, explores how the various standards and guidelines can be mapped so that an organization can create a sustainability framework that is relevant to their own business objectives and desired sustainability performance.

Each document features a discussion of the topic, including standards, guidelines and methodologies that are available, and a check list that assists the sustainability practitioner make sure they are not missing out anything important.

1 Introduction

This document reviews environmental management standards and guidelines of ISO TC 207, ITU-T SG 5, IEC TC 111, BSI, ETSI, EC-JRC, IAASB and WRI/WBCSD, and establishes an assessment framework for energy/greenhouse gas intensity and environmental impacts of the ICT sector according to various assessment criteria and assessment targets.

The assessment framework focuses on helping the ICT sector understand:

- the various environmental management standards and guidelines that could apply to it;
- the purpose and scope of these standards and guidelines;
- the interaction of these standards and guidelines when applied to the same assessment target and criteria, and
- the relationships between the standards and guidelines when viewed as part of an assessment framework table.

1.1 Objectives

This assessment framework aims to provide:

- an overall view of most assessment targets and assessment criteria, and
- a description of the relationships between assessment targets and assessment criteria to help understand:
  - ◊ their application;
  - ◊ their inter-dependencies;
  - ◊ where they are complementary;
  - ◊ where they supplement each other;
  - ◊ how they might be competitive.

A single diagram cannot include all these views. However a table can be used as a way of describing them, and the table's matrix format is shown in Figure 1.

Figure 1: Matrix of inter-relationships between standards regarding assessment criteria

Assessment criteria	Products	Organizations	Projects
Inventory			
Carbon footprint			
LCA			
ICT enablement accounting			
Labelling			
Product eco-design			
Validation and verification			

Most of the ISO, ITU-T, IEC, BSI, ETSI, EC-JRC, WRI/WBCSD and IAASB and assessment methodology standards and guidelines are included in Figure 2: Inter-relationships between standards and guidelines in the assessment framework, which focuses on assessment targets and assessment criteria.

1.2 Target audience

This document provides an overall perspective on energy and GHG assessment standards and guidelines for ICT elements, such as goods, networks, services, organizations, projects, facilities and wastes, to the following target audience:

- Designers and developers of ICT goods, including manufacturers of ICT goods
- Management of environment and sustainability functions in telecommunication service providers, ICT service providers, and ICT organizations
- Management of environment and sustainability functions of non-ICT organizations who want to account for improvements in environmental impacts enabled through the use of ICT.

2 Review of relevant standards and guidelines

This section reviews relevant standards and guidelines to the assessment framework in summary. Detailed information is available in each standard and guideline.

2.1 ISO TC 207 standards

ISO TC 207 has developed various base standards for the assessment of environmental impacts of every industry sector. Most of its standards may be classified into the following three categories: environmental labels and declarations; life cycle assessment, and the management of greenhouse gases.

ISO TC 207 has developed the following standards on environmental labelling and declarations:

- ISO 14021:1999, "Environmental labels and declarations – Self-declared environmental claims (Type II environmental labelling)" specifies requirements for self-declared environmental claims, including statements, symbols and graphics, regarding products. It further describes selected terms commonly used in environmental claims and gives qualifications for their use. This international standard also describes a general evaluation and verification methodology for self-declared environmental claims, including specific evaluation and verification methods for the selected claims in this standard. Self-declared environmental claims may be made by manufacturers, importers, distributors, retailers or anyone else likely to benefit from such claims. Such claims made in regard to products may take the form of statements, symbols or graphics on product or package labels, or in product literature, technical bulletins, advertising, publicity, telemarketing, as well as digital or electronic media, such as the Internet.
- ISO 14024:1999, "Environmental labels and declarations – Type I environmental labelling – Principles and procedures" establishes the principles and procedures for developing Type I environmental labelling programmes, including the selection of product categories, product environmental criteria and product function characteristics, and for assessing and demonstrating compliance. This international standard also establishes the certification procedures for awarding the label. Type I labels are awarded to products by a third party, either governmental or private organizations. Products meeting a set of predetermined criteria earn the label. Criteria are established for distinct product categories by the labelling body and deal with multiple environmental aspects of the product. These labels are sometimes directed at specific types of products, such as the Environmental Choice label[1] for paints and surface coatings, or Energy Star for lighting and appliances. These labels indicate that a

[1] Environmental Choice recognizes genuine moves made by manufacturers to reduce the environmental impact of their products, and provides an independent guide for consumers who wish to purchase products that are better for the environment. See www.environmentalchoice.org.nz.

product is environmentally preferable, in order to increase the demand for environmentally preferable products. These labels are usually represented by a logo on the product or product packaging.

- ISO 14025:2006, "Environmental labels and declarations – Type III environmental declarations – Principles and procedures" establishes the principles and specifies the procedures for developing Type III environmental declaration programmes and Type III environmental declarations, which provide environmental data about a product. These declarations are produced by the organization making the product, and are often certified by a third party. They usually take the form of brochures, rather than a simple label or logo. The declaration is typically based on a life cycle study with the use of ISO 14040 and 14044. The declaration contains quantified data from various life cycle stages of the product, including: material extraction, production, transportation, use and end-of-life disposal or recycling. The declaration may also contain qualitative data about the product and the organization. Type III declarations allow consumers to compare products based on all of their environmental impacts and make their own decision about which product is preferable. Competition among organizations on environmental grounds is encouraged by this kind of declaration.[2]

ISO TC 207 has developed the following standards on life cycle assessment (LCA):

- ISO 14040:2006, "Environmental management – Life cycle assessment – Principles and framework" describes the principles and framework for life cycle assessment including:
  a) the goal and scope definition of the LCA;
  b) the life cycle inventory analysis (LCI) phase;
  c) the life cycle impact assessment (LCIA) phase;
  d) the life cycle interpretation phase;
  e) reporting and critical review of the LCA;
  f) limitations of the LCA;
  g) relationship between the LCA phases, and
  h) conditions for use of value choices and optional elements.
- ISO 14044:2006, "Environmental management – Life cycle assessment – Requirements and guidelines" has the same specification scope with ISO 14040 but specifies requirements and provides guidelines for LCA. It includes the methodological framework for LCA and reporting of LCA results which is described in a standardized format specified in ISO/TS 14048:2002.[3]

---

[2] The ICT sector needs to refer to ISO 14025 to utilize Product Category Rules (PCR) development guidelines. The ICT sector has a variety of ICT products, e.g. laptop computers, modems, set-top boxes, facsimiles, cell phones, smart phones, and routers/switches, so no single specification can cover every type of ICT product. ISO 14025 provides guidance on developing category-specific documentation for the environmental assessment. ISO 14025 is a sector-neutral standard. As a consequence, the ICT sector needs sector-specific information to incorporate into the standard which covers "Product Category Rules (PCR)." In effect, the ICT sector may utilize ISO 14025 to specify PCRs for ICT product categories.

[3] ISO/TS 14048:2002 ("Environmental management – Life cycle assessment – Data documentation format") defines the requirements and structure of a data documentation format for the transparent and unambiguous documentation and exchange of Life Cycle Assessment (LCA) and Life Cycle Inventory (LCI) data. The use of a data documentation format permits consistent documentation of data, reporting of data collection, data calculation and data quality, through the specification and structuring of relevant information. Such a format specifies requirements on the categorization of data documentation into data fields, each with an explanatory description. The description of each data field is further specified by the structure of the data documentation format. The Technical Specification is applicable to the specification and structuring of questionnaire forms and information systems. However, it can also be applied to other aspects of the management of environmental data. It does not include requirements regarding completeness of data documentation. The data documentation format is independent of any software or database platform for implementation. The Technical Specification does not require any specific sequential, graphic or procedural solutions for the presentation or treatment of data, nor does it describe specific modelling methodologies for LCI and LCA data.

ISO TC 207 has developed the following standards on the management of greenhouse gases (GHG):

- 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” specifies detail principles and requirements for designing, developing, managing and reporting organizational or company-level GHG inventories. It includes requirements for determining organizational boundaries, GHG emission boundaries, quantifying an organization’s GHG emissions and removals, and identifying specific organization actions or activities aimed at improving GHG management. It also includes requirements and guidance on inventory quality management, reporting, internal auditing and the reporting organization’s responsibilities in verification activities. Part 1 is consistent with best practice established in the Corporate Accounting and Reporting Standard developed by the WRI/WBCSD.
- 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 and removal enhancements” focuses on GHG projects or project-based activities specifically designed to reduce GHG emissions or increase GHG removals. It includes principles and requirements for determining project baseline scenarios and for monitoring, quantifying and reporting project performance relative to the baseline scenario and provides the basis for GHG projects to be validated and verified.
- ISO 14064-3:2006, “Greenhouse gases – Part 3: Specification with guidance for the validation and verification of greenhouse gas assertions” details principles and requirements for verifying GHG inventories and validating or verifying GHG projects. It describes the process for GHG-related validation or verification, and specifies components such as validation or verification planning, assessment procedures and the evaluation of organization or project GHG assertions. ISO 14064 Part 3 can be used by organizations or independent parties to validate or verify GHG assertions.
- ISO 14065:2007, “Greenhouse gases – Requirements for greenhouse gas validation and verification bodies for use in accreditation or other forms of recognition” specifies requirements to accredit or otherwise recognize bodies that undertake GHG validation or verification using ISO 14064, or other relevant standards or specifications.
- ISO 14066:2011, “Greenhouse gases – Competency requirements for greenhouse gas validation teams and verification teams” specifies personal attributes, knowledge and skill (competency) requirements, required levels of proficiency and methods to evaluate competencies for GHG validation and verification teams by areas of competence.
- ISO 14067, “Greenhouse gases – Carbon footprint of products” specifies principles and requirements for the quantification and communication of greenhouse gases associated with the whole life-cycle (Carbon Footprint of a Product, CFP) or specific stages (partial CFP) of the life cycle of products, based on existing LCA (ISO 14040 series) and environmental claims, labels and declaration (ISO 14020 series) standards. ISO 14067 provides for the development of CFP-product category rules (CFP-PCR), or the adoption of PCRs that have been developed in accordance with ISO 14025 and that are consistent with ISO 14067. It is intended to promote the monitoring, reporting, and tracking of progress in the mitigation of GHG emissions. The carbon footprint may show quantitative comparisons between different products and affect consumers when they choose products with the lowest climate impacts. While GHG emissions are reported at global, national or company levels, ISO 14067 addresses emissions that arise from processes which constitute the life cycle of a product, in different organisations and independent from national boundaries.
- ISO/TR 14069, “Greenhouse gases – Quantification and reporting of GHG emissions for organizations (Carbon footprint of organization) – Guidance for the application of ISO 14064-1” describes guidance in the use of ISO 14064-1 to analysis the GHG inventory of organizations. Since ISO 14064-1 specifies only generic processes of the GHG inventory analysis and relevant requirements, its specification seems quite vague for applying to GHG inventory analysis. The purpose of ISO 14069 is to produce more specific guidance to ISO 14064-1.

2.2 GHG Protocol standards

WRI/WBCSD has developed the following standards under the GHG Protocol initiative:

- The GHG Protocol Corporate Standard, "A Corporate Accounting and Reporting Standard" (referred to as the Corporate Standard) provides standards and guidance for companies and other types of organizations preparing a GHG emissions inventory. This standard covers the accounting and reporting of the six greenhouse gases covered by the Kyoto Protocol. The standard, and related guidance, was designed with the following objectives to:
  - ◊ help companies prepare a GHG inventory that represents a true and fair account of their emissions, through the use of standardized approaches and principles;
  - ◊ simplify and reduce the costs of compiling a GHG inventory;
  - ◊ provide business with information that can be used to build an effective strategy to manage and reduce GHG emissions;
  - ◊ provide information that facilitates participation in voluntary and mandatory GHG programmes;
  - ◊ increase consistency and transparency in GHG accounting and reporting among various companies and GHG programs.

This standard is consistent with ISO 14064-1, as stated above.

- "Corporate Value Chain (Scope 3) Accounting and Reporting Standard – Supplement to the GHG Protocol corporate accounting and reporting standard" (referred to as the Scope 3 Standard) complements and builds upon the Corporate Standard to promote additional completeness and consistency in the way companies account for and report on indirect emissions from value chain activities. The Corporate Standard classifies a company's direct and indirect GHG emissions into three "scopes," and requires that companies account for and report all scope 1 emissions (i.e. direct emissions from owned or controlled sources) and all scope 2 emissions (i.e. indirect emissions from the generation of purchased energy consumed by the reporting company). The Corporate Standard gives companies flexibility in whether and how to account for scope 3 emissions (i.e. all other indirect emissions that occur in a company's value chain). Often, the majority of total corporate emissions come from scope 3 sources, which means many companies have been missing out on significant opportunities for improvement. This is the reason why the Corporate Value Chain Accounting and Reporting Standard was developed. This standard provides requirements and guidance for companies and other organizations to prepare and publicly report a GHG emissions inventory that includes indirect emissions resulting from value chain activities (i.e. scope 3 emissions). The primary goal of this standard is to provide a standardized step-by-step approach to help companies understand their full value chain emissions impact in order to focus company efforts on the greatest GHG reduction opportunities, leading to more sustainable decisions about companies' activities and the products they buy, sell, and produce.
- "The GHG Protocol for project accounting" (referred to as the Project Protocol) provides specific principles, concepts, and methods for quantifying and reporting GHG reductions – i.e. the decreases in GHG emissions, or increases in removals and/or storage – from climate change mitigation projects (GHG projects). This standard aims to:
  - ◊ provide a credible and transparent approach for quantifying and reporting GHG reductions from GHG projects;
  - ◊ enhance the credibility of GHG project accounting through the application of common accounting concepts, procedures, and principles, and
  - ◊ provide a platform for harmonization among different project-based GHG initiatives and programmes.
- "Product Life Cycle Accounting and Reporting Standard" (referred to as the Product Standard) provides requirements and guidance for companies and other organizations to quantify and publicly report an inventory of GHG emissions and removals associated with a specific product during its life cycle. The

primary goal of this standard is to provide a general framework for companies to make informed choices to reduce GHG emissions from the products (goods or services) they design, manufacture, sell, purchase, or use. In the context of this standard, public reporting refers to product GHG-related information reported publicly in accordance with the requirements specified in the standard. This standard builds on the framework and requirements established in the ISO LCA standards and PAS 2050, with the intention of providing additional specifications and guidance to facilitate the consistent quantification and public reporting of product life cycle GHG inventories. In other words, this Product Standard corresponds to an LCA methodology and is supplementary to ISO LCA standards.

- "ICT Sector Guidance to support the GHG Protocol Product Standard" is sector guidance for the carbon footprinting of ICT products (including goods and services) based on the Product Standard. Focusing on the three areas of desktop managed services, telecommunications networks, and remote collaboration, this ICT sector guidance deals with:
  - ◊ overview section providing general guidance;
  - ◊ guidance related to ICT infrastructure (covering areas such as networks, data centers, hardware and software);
  - ◊ guidance related to ICT Service Applications (this refers to a combination of infrastructure guidance and, in some cases, the enablement effect of the ICT application), and
  - ◊ supporting default data, secondary emissions factors, references and glossary;
  - ◊ the goal of this standard is the same to that of IEC/TR 62725. That is, there are two competitive standards for the same targets.

2.3 ITU-T standards

ITU-T has developed the following methodology standards:

- ITU-T L.1410, "Methodology for environmental impact assessment of ICT goods, networks and services" is based upon ISO LCA standards. This standard aims at:
  - ◊ providing ICT specific requirements, in addition to those of ISO LCA standards;
  - ◊ ensuring a minimum quality of LCA studies of ICT goods, networks and services;
  - ◊ ensuring the credibility of LCAs of ICT goods, networks and services;
  - ◊ increasing the transparency and facilitating the interpretation of LCA studies of ICT goods, networks and services;
  - ◊ facilitating communication of LCA studies of ICT goods, networks and services, and
  - ◊ providing a methodology for telecommunication operators and service providers to assess the environmental load of one or more services which are carried by their ICT networks.
- ITU-T L.1420 (02/2012), "Methodology for energy consumption and greenhouse gas emissions impact assessment of information and communication technologies within organisations" provides a methodology to assess GHG emissions and energy consumptions generated from the use of ICT in non-ICT organizations, based on ITU-T L.1410. Also this standard provides a supplement to ISO 14064-1 and the GHG Protocol Corporate Standard for ICT organizations intending to assess their own organizational energy consumption and GHG related impacts.
- ITU-T L.1430, "Methodology for environmental impact assessment of ICT projects" specifies principles, concepts, requirements and methods with guidance for quantifying, monitoring and reporting GHG emission reductions or removal enhancements, and/or energy consumption savings and/or energy efficiency improvements from an ICT project as a supplement to ISO 14064-2 and the Project Protocol. This standard provides requirements and guidance for:
  - ◊ planning an ICT project and its baseline scenario;
  - ◊ identifying and selecting GHG sources, sinks and storages relevant to the ICT project and baseline scenario;
  - ◊ identifying and selecting energy consumption sources, generators and storages relevant to the ICT project and baseline scenario;

- managing data quality;
- monitoring, quantifying, documenting and reporting ICT project performance, and
- validating and/or verifying the ICT project plan and/or report.

- ITU-T L.1440, "Methodology for environmental impact assessment of ICT within cities" recommends ways in which ICT may be used to reduce the rate of GHG accumulation in the atmosphere by optimizing the use of energy. This work is still in the initial stages, as of the beginning of 2012.
- ITU-T L.1450, "Methodology for environmental impact assessment of ICT within countries" focuses on how ICT may be used across nations to reduce the rate of GHG accumulation in the atmosphere by optimizing use of energy. This work is still in the initial stages, as of the beginning of 2012.

2.4 IEC TC 111 standards

IEC TC 111 has dealt with the following items:

- IEC/TR 62725, "Analysis of quantification methodologies for greenhouse gas emissions for electrical and electronic products and systems" provides guidance to understand methodologies to evaluate carbon footprint of products, by quantifying greenhouse gas emissions for electrical and electronic products and systems based on life-cycle thinking (LCT). This technical report is applicable to any type of electrical and electronic products, which are new or modified (e.g. reconditioned, upgraded, etc.). It is intended to be used by those involved in design and development of electrical and electronic products, and their supply chains regardless of industry sectors, regions, types, activities and sizes of organizations. It may also be used as guidance to prepare a Product Category Rule (PCR) of each product category in the sector of electrical and electronic products and systems.
- IEC/TR 62726, "Guidance on quantifying greenhouse gas emission reductions from the baseline for electrical and electronic products and systems" is a Technical Report which addresses GHG reductions contributed by the supply of electric and electronic products. Consequently, it aims at providing practical guidance for the quantification of carbon reduction effects achieved by an electric and electronic product-related GHG project, with reference to ISO 14064-2 and the Project Protocol of WRI/WBCSD.
- IEC 62430:2009, "Environmentally conscious design for electrical and electronic products" aims at the reduction of adverse environmental impacts of a product throughout its entire life cycle. This can involve balancing the environmental aspects of the product with other factors, such as its intended use, performance, cost, and quality, and choosing methods to meet legal and regulatory requirements in the most environmentally friendly way. Environmentally conscious design is not a separate design activity; rather, it is an integral part of the existing design process.

2.5 BSI standard

BSI released the following standard to support the carbon footprinting of products:

- PAS 2050:2011, "Specification for the assessment of the life cycle greenhouse gas emissions of goods and services" builds on existing ISO LCA methods by specifying requirements for the assessment of GHG emissions within the life cycle of goods and services. These requirements further clarify the implementation of these standards in relation to the assessment of GHG emissions of goods and services, and establish particular principles and techniques, including:
  - cradle-to-gate and cradle-to-grave GHG emissions assessment data as part of the life cycle GHG emissions assessment of goods and services;
  - the scope of greenhouse gases to be included;
  - criteria for global warming potential (GWP) data;
  - treatment of emissions and removals from land use change and biogenic and fossil carbon sources;
  - treatment of the impact of carbon storage in products and offsetting;

- ◊ requirements for the treatment of GHG emissions arising from specific processes, and,
- ◊ data requirements and accounting for emissions from renewable energy generation.

BSI published the following standard to facilitate carbon neutrality in various entities (e.g. organizations, governments, communities, families, and individuals):

- PAS 2060:2010, "Specification for the demonstration of carbon neutrality," specifies a consistent set of measures and requirements for entities to demonstrate carbon neutrality for a product, service, organization, community, event or building.

2.6 EC-JRC handbooks

In March 2010, the Joint Research Centre of the European Commission (EC-JRC) released the International Reference Life Cycle Data System (ILCD) Handbook[4] to provide practical guidance on how to conduct a Life Cycle Assessment, in order to calculate a product's total environmental impact in terms of GHG emissions, resources consumed and the pressures on the environment and human health that can be attributed to it. Consisting of a number of separate handbooks, the ILCD Handbook is based on, and conforms to, ISO LCA standards (ISO 14040 and ISO 14044) which provide the indispensable framework for Life Cycle Assessment (LCA). The ISO LCA framework, however, offers the individual practitioner a range of choices, which can affect the legitimacy of the results of an LCA study. While flexibility is essential in responding to the large variety of questions addressed, further guidance is needed to support consistency and quality assurance. As a result, the ILCD Handbook has been developed to provide guidance for consistent and quality-assured LCA data and studies. The ILCD Handbook is a series of technical documents providing guidance for good practice in LCA in business and government as follows:

- ILCD Handbook: Analysis of existing Environmental Impact Assessment methodologies for use in Life Cycle Assessment
- ILCD Handbook: General guide for Life Cycle Assessment – Detailed guidance
- ILCD Handbook: General guide for Life Cycle Assessment – Provisions and action steps
- ILCD Handbook: Framework and requirements for Life Cycle Impact Assessment models and indicators
- ILCD Handbook: Review schemes for Life Cycle Assessment
- ILCD Handbook: Specific guide for Life Cycle Inventory data sets
- ILCD Handbook: Reviewer qualification for Life Cycle Inventory data sets.

2.7 JRC-IES methodologies

The Institute for Environment and Sustainability (IES) is one of the seven scientific institutes of the European Commission's Joint Research Centre (JRC). As of June 2012, it is developing the following two methodologies:

- Environmental footprint of products[5]: it aims at providing a methodology for the calculation of the environmental footprint of products (including carbon footprint). This methodology will be developed building on the ILCD Handbook, as well as other existing methodological standards and guidance documents.
- Environmental footprint of organizations[6]: it aims at providing technical guide for the calculation of the environmental footprint of organizations (including carbon). As with the product footprint

---

4 EC-JRC, "ILCD (International Reference Life Cycle Data System) Handbook: General guide for Life Cycle Assessment – Detailed guidance", http://lct.jrc.ec.europa.eu/pdf-directory/ILCD-Handbook-General-guide-for-LCA-DETAIL-online-12March2010.pdf.

5 Refer to http://ec.europa.eu/environment/eussd/product_footprint.htm.

6 Refer to http://ec.europa.eu/environment/eussd/corporate_footprint.htm.

methodology, this too will build on the ILCD Handbook, as well as other existing methodological standards and guidance documents.

2.8 ETSI standard

The European Telecommunications Standards Institute Environmental Engineering (ETSI EE) group developed the following methodology standard:

- ETSI TS 103 199 (2011-11), "Environmental Engineering; Life Cycle Assessment (LCA) of ICT equipment, networks and services; General methodology and common requirements" aims to:
  - ◊ harmonize the LCAs of ICT equipment, networks and services;
  - ◊ increase the quality of the LCA by adding ICT specific requirements to those of ISO 14040 and ISO 14044;
  - ◊ facilitate communication of LCAs of ICT equipment, networks and services, and
  - ◊ increase the credibility of LCAs of ICT equipment, networks and services.

Since this standard refers to the ISO LCA standards as normative references, it establishes generic and specific requirements for LCA of ICT equipment, networks and services. In effect, it provides practical guidance for an LCA study. This goal is identical to that of ITU-T L.1410-Part 1, which means there are two standards which are similar and compatible.

2.9 IAASB standard

The International Auditing and Assurance Standards Board (IAASB) is developing the International Standard on Assurance Engagements (ISAE) 34107, as follows:

- ISAE 3410, "Assurance Engagements on Greenhouse Gas Statements," defines two levels of assurance on GHG statements: Reasonable Assurance and Limited Assurance. The assurance procedures covered in the standard include inspection, observation, confirmation, recalculation, re-performance, analytical procedures, and inquiry. This standard corresponds to ISO 14064-3.

3 Assessment framework

This assessment framework explores a summary view of most assessment targets and assessment criteria, and also describes their relationships in order to identify:

- how to apply them;
- where they are competitive with each other;
- their inter-dependencies;
- where they are complementary;
- where they supplement each other, and
- how they might be competitive.

3.1 Assessment targets

ISO TC 207 identified only three assessment targets: product, organization and project. Additionally ITU-T SG 5 identified two more assessment targets: cities and countries.

[7] IAASB, "ISAE 3410, Assurance Engagements on Greenhouse Gas Statements," IFAC, January 2011, www.ifac.org/publications-resources/proposed-international-standard-assurance-engagements.

3.1.1 Product

ISO 14040 includes the definition of "product"[8] as "any goods or service[9]". But ITU-T, with its expertise in telecommunications, identified "networks" and "services" as additional assessment targets. Thus, in ITU-T's definition, "product" covers any goods, networks and services.

3.1.2 Organization

ISO 14064-1 defines "organization" as a company, corporation, firm, enterprise, authority or institution, or part or combination thereof, whether incorporated or not, public or private, that has its own functions and administration. This definition is valid in other standards and guidelines.

3.1.3 Project

Here a "project" is referred to as a GHG project which is defined by ISO 14064-2 as an activity or activities that alter the conditions identified in the baseline scenario which cause GHG emission reductions or GHG removal enhancements. Based on this definition, ITU-T has defined "ICT project" as a GHG project using mainly ICT goods, networks and services, aiming at GHG emission reductions or GHG removal enhancements, and/or a GHG project using mainly ICT goods, networks and services, aiming at energy consumption savings and energy efficiency improvement.

3.1.4 City and country

Two further methodologies, ITU-T L.1440 and L.1450, aim at providing relevant methodologies to assess impacts from the use of ICT goods, networks and services on cities or countries, exploiting the ways ICT can help save energy consumption and improve energy efficiency.

3.2 Assessment criteria

The standards and guidelines of various standards development organizations (SDOs) may be classified into the following assessment criteria:

- **Inventory**: this is a type of inventory developed for a variety of GHG sources and sinks in order to account for the total GHG emissions of an organization. This terminology applies usually to organizations. But, in this instance, GHG projects for GHG reductions and removal enhancements are also located in the inventory area of the assessment framework table, as GHG reductions and removal enhancements should be quantified from a GHG inventory supported by various project activities.
- **Carbon footprint**: defined as the total sum of GHG emissions and GHG removals during the life cycle phases of a product. It may be expressed as net global warming impact in CO2e. In this definition, carbon footprinting is based on a life cycle assessment.
- **Life cycle assessment (LCA)**: a methodology for compilation and evaluation of the inputs, outputs and potential environmental impacts of a product system throughout its life cycle. A life cycle assessment

---

[8] The product can be categorized as services, software, hardware or processed materials.

[9] Services have tangible and intangible elements. Provision of a service can involve, for example, the following:
- an activity performed on a customer-supplied tangible product (e.g. automobile to be repaired);
- an activity performed on a customer-supplied intangible product (e.g. the income statement needed to prepare a tax return);
- the delivery of an intangible product (e.g. the delivery of information in the context of knowledge transmission), and
- the creation of ambience for the customer (e.g. in hotels and restaurants).

Software consists of information and is generally intangible and can be in the form of approaches, transactions or procedures. Hardware is generally tangible and its amount is a countable characteristic. Processed materials are generally tangible and their amount is a continuous characteristic.

applies to a particular product, defined broadly to include goods, networks or services. It deals with all the stages of a product's life from raw material extraction through materials processing; transportation in all the phases; production; use; repair and maintenance, and disposal or recycling. By this life cycle assessment, an inventory of all relevant energy and material inputs and environmental releases (i.e. outputs) is compiled; potential impacts associated with identified inputs and releases are evaluated, and then the assessment results may help manufacturers recognize where are weak points along with all the life cycle stages in terms of GHG emission and energy consumption. Through such LCA work, manufacturers can carry out improvements where a product proves to be weak. The assessment of the entire life cycle stages of a product may be the base of other environmental impacts assessment.

- **ICT enablement accounting**: accounting for the positive impacts enabled by using ICT and the negative impacts caused by using ICT.
- **Product eco-design**: the requirements and procedures to integrate environmental aspects into design and development processes of products, including the combination of products, and the materials and components from which they are made. It requires manufacturers to demonstrate how they have integrated life cycle thinking into the product design and development process in order to minimize the significant environmental impacts of the product across its life cycle stages.
- **Labelling by evaluation**: this covers any claims which indicate environmental aspects of a product. An environmental label may take the form of a statement, symbol or graphic on a product or package label, in product literature, in technical bulletins, in advertising or in publicity, amongst other things.
- **Validation and verification**: the process by which GHG assertions may be evaluated against agreed validation and verification criteria. Typically, validation is an ex-ante process and verification is an ex-post process.

3.3 Assessment framework

3.3.1 Overall assessment framework

The assessment standards and guidelines for environmental impacts of products, organizations and projects, as discussed above, may be analysed for their inter-relationships using the following assessment framework:

Figure 2: Inter-relationships between standards and guidelines in the assessment framework

Criteria	Products	Organizations	Projects	Properties
Inventory	-	ISO 14064-1	ISO 14064-2	General procedure and requirements
	-	ISO 14069	-	Practice guidance for ISO 14064-1
	-	ITU-T L.1420	-	Sectoral guidance for ISO 14064-1 and the Corporate Standard
	-	Environmental footprint of organizations	-	General procedure and requirements
	-	-	ITU-T L.1430	Sectoral guidance for ISO 14064-2 and the Project Protocol
	-	-	IEC/TR 62726	

Criteria	Products	Organizations	Projects	Properties	
	-	GHG Protocol corporate accounting (Scope 1 and Scope 2) and reporting standard (called Corporate Standard)	GHG Protocol for project accounting (called Project Protocol)	General procedure and requirements	
	-	GHG Protocol corporate value chain (Scope 3) accounting and reporting standard (called Scope 3 Standard)	-	Life cycle assessment (LCA) required	General procedure and requirements; and a supplement to the Corporate Standard
Carbon footprint	ISO 14067 and Part of ISO 14025 (Product Category Rules)	-	-		General procedure and requirements
	GHG Protocol product accounting and reporting standard (called Product Standard)	-	-		General procedure and requirements
	Environmental footprint of products	-	-		General procedure and requirements
	ICT sector guidance to support the GHG Protocol Product Standard	-	-		ICT-sector guidance to support ICT and EE products; not complementary but competitive
	IEC 62725	-	-		
LCA	ISO 14040	-	-		General procedure and requirements
	ISO 14044	-	-		
	ILCD Handbook	-	-		Practice guidance for ISO 14040 and 14044
	PAS 2050	-	-		Practice guidance for and supplement to ISO 14040 and 14044
	ITU-T L.1410 Part 1	-	-		ICT-sector guidance for ISO 14040 and 14044; Compatible and complementary each other
	ETSI TS 103 199	-	-		

Criteria	Products	Organizations	Projects	Properties	
ICT enablement accounting	ITU-T L.1410 Part 2				General procedure and requirements; not complementary but competitive
Labelling	ISO 14025 (Type III)	-	-		General procedure and requirements, and 3rd party evaluation required
	ISO 14021 (Type II)	-	-	General procedure and requirements, and self-declaration purpose	
	ISO 14024 (Type I)	-	-	Life cycle thinking (LCT) required[10]	General procedure and requirements, and 3rd party evaluation required
Product eco-design	IEC/TR 62430	-	-		General procedure and requirements
Validation and verification	-	ISAE 3410	-	3rd party evaluation required	Validation/ verification procedure and requirements
	ISO 14064-3				
	ISO 14065				Evaluation for validation and verification bodies
	ISO 14066				Competency evaluation for validation and verification teams

[NOTE 1] Where "-" means there are no relevant standards.

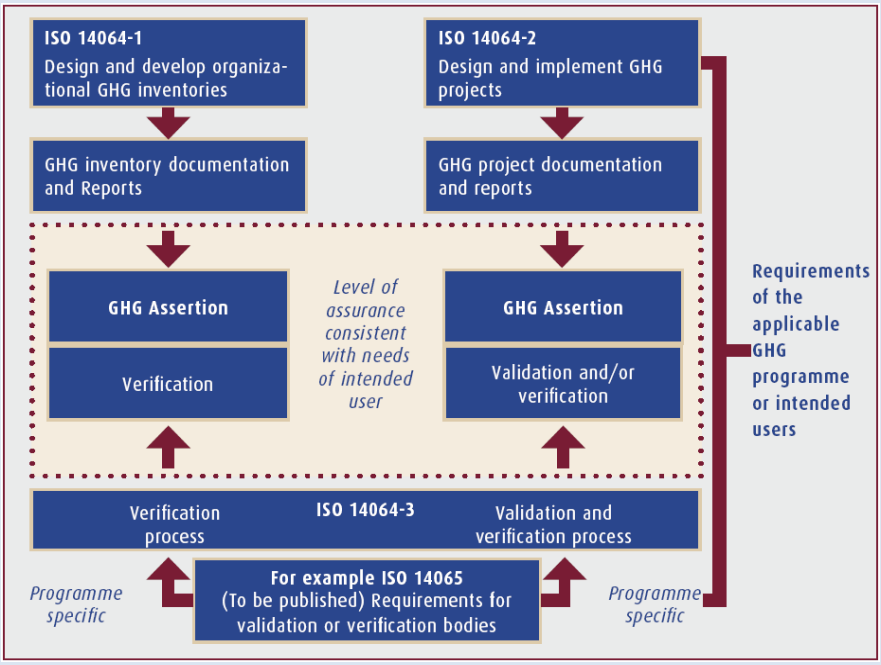
[NOTE 2] Various combination cases may be derived from the above table. Identified features and properties using any combination are valid. For example, ISO 14044 is an LCA methodology which applies to products, covers the entire life cycle of a product and specifies the general assessment procedure and execution requirements.

3.3.2 Standards map of ISO 14064-1, 14064-2, 14064-3, 14065 and 14066

The following diagram, published as part of ISO TC 207, shows the relationships between relevant standards.

[10] IEC 62430:2009 is based on the Life Cycle Thinking (LCT) which provides consideration points of all relevant environmental aspects during the entire life cycle of products (refer to http://lct.jrc.ec.europa.eu/index_jrc for detailed information on the LCT).

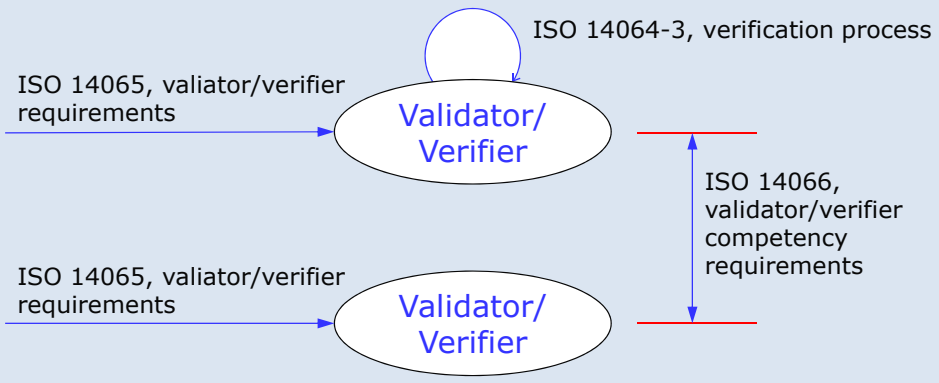
Figure 3: Relationships between standards in ISO TC 207



For example, an organization uses ISO 14064-1 to develop and report its GHG inventory and a project initiator would use ISO 14064-2 to quantify and report GHG reductions and removal enhancement for a GHG project.

The relationship between validation and verification standards is shown below:

Figure 4: Relationships between validation and verification standards



ISO 14064-3 specifies principles and requirements and provides guidance for those conducting or managing the validation and/or verification of GHG assertions.

ISO 14065 specifies principles and requirements for GHG validators and verifiers that undertake validation and/or verification of GHG assertions.

ISO 14066 specifies personal attribute, knowledge and skill (competency) requirements, required levels of proficiency and methods to evaluate competencies for GHG validators and/or verifiers by areas of competence.

3.3.3 Standards map of GHG standards and programmes in terms of type, compliance, voluntary, and geographic scope

ISO released an introductory report, "GHG schemes addressing climate change: How ISO standards help." Clause 5 of the report describes an overview of GHG standards and programmes with a comparison table for type, compliance, voluntary and geographic scope. This table depicts another view of the assessment framework as follows:

Figure 5: Compliance and geographical scope of standards and guidelines

Standards/programmes and their scope		Type	Compliance	Voluntary	Geographic scope
National GHG emissions	UNFCCC	programme	X		International
Organization/ entity-wide GHG emissions	EU ETS	programme	X		European
	ISO 14064-1	standard		X	International
	GHG Protocol, Corporate Standard	standard		X	International
	Chicago Climate Exchange	programme		X	Mostly US
Corporate disclosure on climate change	Climate Disclosure Standards Board	standard		X	International
	Carbon Disclosure Project Questionnaire	guidelines		X	International
	PAS 2060 Carbon Neutrality	guidelines		X	UK, international
GHG offset projects	Clean Development Mechanism	programme	X		Non-Annex 1
	Joint Implementation	programme	X		Annex 1
	Regional Greenhouse Gas Initiative	programme	X		North-east US
	ISO 14064-2	standard		X	International
	GHG Protocol, Project Protocol	standard		X	International
	Climate Action Reserve	programme		X	Mostly US
	Voluntary Carbon Standard	programme		X	International
	Gold Standard	programme		X	International
	Chicago Climate Exchange	programme		X	Mostly US
	Climate Community and Biodiversity Standards	co-benefit add-on		X	International
	Social Carbon	co-benefit add-on		X	Non-Annex 1
	American Carbon Registry	programme		X	Mostly US
	Alberta Offsets System	programme		X	Alberta, Canada
	Pacific Carbon Trust	programme	X		British Columbia, Canada

Standards/programmes and their scope		Type	Compliance	Voluntary	Geographic scope
Product-specific/ supply-chain GHG emissions	PAS 2050	standard		X	UK, international
	ISO 14067	standard		X	international
	GHG Protocol, Scope 3 Standard	standard		X	international
Validation and verification (auditing) of GHG emissions and reduction claims	ISO 14064-3	Standard		X	international
	ISO 14065	standard		X	international
	ISO 14066	standard		X	international
	ISAE 3000	standard		X	international
	ISAE 3410	standard		X	international
	Validation and Verification Manual CDM	guidance document	X		Non-Annex 1
	Validation and Verification Manual IETA	guidance document		X	Non-Annex 1

The standards and programmes above are briefly explained in the ISO report. Comparison factors are quoted as follows:

- **Programmes** are defined as GHG schemes, including compliance and voluntary programmes, under which GHG emissions or emissions reductions can be certified by third parties, and may be traded. As a result, programmes usually have bodies that certify projects, verifiers, and specific protocols and/or programmes that are accredited under that programme. Under a compliance regime, entities are required by law to report and/or reduce their GHG emissions. Such compliance regimes include, but are not limited to, cap-and-trade systems, such as the Kyoto Protocol and the European Union Emissions Trading System (EU ETS). However, other standards and programmes are used by companies and institutions on a purely voluntary basis. The motivation for reporting GHG emissions and purchasing carbon offsets varies: it may be driven by corporate public relations or a code of ethics, a desire to go beyond what is mandated in terms of emission reductions, or to prepare for expected compliance action, such as the future introduction of a cap-and-trade system. As demand is driven by purely voluntary action, the voluntary markets for carbon offsets are much smaller than the compliance markets, such as the Clean Development Mechanism (CDM), a flexibility mechanism defined in the Kyoto Protocol. The distinction between programmes and standards can be confusing, since several of the programmes call themselves “standards”, such as the Voluntary Carbon Standard or the Gold Standard.
- **Standards** in the context of the table in Figure 5: Compliance and geographical scope of standards and guidelines include protocols, methodologies and guidance, and provide guidance and/or specifications on GHG quantification, monitoring, reporting and assurance. “International Standards” are those produced by ISO following specific principles and procedures. Most standards typically stand alone and do not have a body directly associated with them that accredits projects, protocols and/or verifiers. Typically, standards themselves do not have registration and enforcement systems to track and ensure legal ownership as is necessary, for example, in the case of emissions reductions from offset projects. The choice of a standard is typically voluntary, as long as it is not part of a compliance programme. That means an organization can decide which standard to use for its GHG emissions inventory or to implement an offset project, if it is not under a mandatory scheme of a compliance programme. Nevertheless, if a company chooses a particular standard under which to implement its GHG management system, that standard may state the requirements in a legally binding way (e.g. “the project proponent “shall” use a third-party auditor”) or as a recommendation or guideline (e.g. “the project proponent “should” use a third party auditor”).

- **Co-benefits** refer to environmental and social benefits that can be achieved in addition to carbon reductions. Standards that ensure such co-benefits are usually used in offset markets.
- **Guidance documents** provide specific process guidelines on how to apply a standard or a protocol. The use itself of such guidance documents can be voluntary or mandatory. For example, the CDM provides numerous mandatory guidance "methodological tools" such as the "Tool for the assessment and demonstration of additionality".
- **Geographic scope** refers to situations where activities are implemented under that programme or standard. For example, CDM activities and approved methodologies for offset projects are applied in Non-Annex 1 Countries unless adopted by the Voluntary Carbon Standard (VCS) programme for application in other jurisdictions.

4 Conclusions

For the ICT organization that wishes to manage its energy and GHG performance, there are a number of different sources of standards and guidelines it can draw upon. The difficulty in using these standards is understanding how they fit together, and how an organization can create its own sustainability assessment framework based on these standards.

What this document does is provide the insight that the way to understand how these various standards and guidelines fit an organization's purposes (or not, as the case may be) is through the use of two separate dimensions: the assessment targets that an organization might choose to meet, and the assessment criteria that an organization uses to better understand its performance.

What we find is that the standards and guidelines that are extant, when mapped using these dimensions, show up as meeting different needs of organizations. However, they also emerge as inter-related, inter-dependent, complementary, supplementary or even just competitive with each other.

This means there is no single assessment framework that meets the needs of ICT organizations around the world. Instead, each organization needs to map the standards and guidelines to their own requirements, in terms of business strategy and environmental performance, in order to create an assessment framework that meets their own business challenges, and is right for them.

5 Glossary

Additionality	criterion applied to GHG or ICT projects, stipulating that GHG emission reductions and/or removal enhancements should only be quantified if the project activity (or the same technologies or practices it employs) would not have been implemented in its baseline scenario and/or the project activity emissions are lower than baseline emissions. In effect, GHG/ICT projects shall be those that are intended only for GHG emission reductions and/or removal enhancements without regulatory enforcement and economic advantages. For example, if a technology employment project is caused by regulation, its GHG emission reductions do not have to be taken into account. However, if a project reduces emissions more than would have occurred in the absence of the project, it can be considered as additional. As a result, its GHG emission reductions can be rewarded with an economic incentive program like GHG emission allowances within GHG emission trading systems.
Annex 1 countries	Defined in the International Climate Change Convention as those countries taking on emissions reduction obligations: Australia; Austria; Belgium; Belarus; Bulgaria; Canada; Croatia; Czech Republic; Denmark; Estonia; Finland; France; Germany; Greece; Hungary; Iceland; Ireland; Italy; Japan; Latvia; Liechtenstein; Lithuania; Luxembourg; Monaco; Netherlands; New Zealand; Norway; Poland; Portugal; Romania; Russian Federation; Slovakia; Slovenia; Spain; Sweden; Switzerland; Ukraine; United Kingdom; USA. [The Corporate Protocol]
baseline scenario	a hypothetical reference case that best represents the conditions most likely to occur in the absence of a proposed GHG project[11] [ISO 14064-2]
carbon dioxide equivalent (CO2e)	unit[12] for comparing the global warming impact of a GHG to carbon dioxide [ISO 14064-2]
Certified Emission Reductions (CERs)	A unit of emission reduction generated by a CDM project. CERs are tradable commodities that can be used by Annex 1 countries to meet their commitments under the Kyoto Protocol [The Corporate Protocol]
Certification	procedure by which a third party gives written assurance that a product, process or service conforms to specified requirements [ISO 14024]
Clean Development Mechanism (CDM)	mechanism established by Article 12 of the Kyoto Protocol for project-based emission reduction activities in developing countries. The CDM is designed to meet two main objectives: to address the sustainability needs of the host country and to increase the opportunities available to Annex 1 Parties to meet their GHG reduction commitments. The CDM allows for the creation, acquisition and transfer of Certified Emission Reductions (CERs) from climate change mitigation projects undertaken in non-Annex 1 countries. [The Corporate Protocol]
direct GHG emissions	Emissions from sources that are owned or controlled by the reporting company [The Corporate Protocol]
energy consumption source	physical unit or process that consumes energy [ITU-T L.1430]
energy generator	physical unit or process that generates energy [ITU-T L.1430]

[11] The baseline scenario concurs with the GHG project timeline.

[12] The carbon dioxide equivalent is calculated using the mass of a given GHG multiplied by its global warming potential.

energy storage	physical unit or component that has the capability to store or accumulate energy produced by an energy generator or energy captured from an energy consumption source [ITU-T L.1430]
environmental aspect	element of an organization's activities or products that can interact with the environment [ISO 14021]
environmental claim[13]	statement, symbol or graphic that indicates an environmental aspect of a product, a component or packaging [ISO 14021]
environmental impact	any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organization's activities or products [ISO 14021]
environmental label; environmental declaration	claim which indicates the environmental aspects of a product or service [ISO 14025]
global warming potential (GWP)	a relative measure of how much heat a greenhouse gas traps in the atmosphere [ISO 14064-2]
greenhouse gas[14] (GHG)	gaseous constituent of the atmosphere, both natural and anthropogenic, that absorbs and emits radiation at specific wavelengths within the spectrum of infrared radiation emitted by the Earth's surface, the atmosphere, and clouds [ISO 14064-2]
greenhouse gas assertion	declaration or factual and objective statement made by the responsible party [ISO 14064-2]. The GHG assertion may be presented at a point in time or may cover a period of time. When provided by a responsible party, it should be clearly identifiable, capable of consistent evaluation or measurement against suitable criteria by a validator or verifier. The GHG assertion could be provided in the form of a greenhouse gas report or GHG project plan.
greenhouse gas emission	total mass of a GHG released to the atmosphere over a specified period of time [ISO 14064-2]
greenhouse gas emission reduction	calculated decrease of GHG emissions between a baseline scenario and the project [ISO 14064-2]
GHG programme; GHG program	a generic term for: (1) any voluntary or mandatory, government or non-government initiative, system, or program that registers, certifies, or regulates GHG emissions; or (2) any authorities responsible for developing or administering such initiatives, systems or programs. [The Project Protocol]
greenhouse gas project (GHG project)	an activity or activities that alter the conditions identified in the baseline scenario which cause GHG emission reductions or GHG removal enhancements [ISO 14064-2]
greenhouse gas project proponent	individual or organization that has overall control and responsibility for a greenhouse gas project [ISO 14064-2]
greenhouse gas removal	total mass of a GHG removed from the atmosphere over a specified period of time [ISO 14064-2]

[13] An environmental claim may be made on product or packaging labels, through product literature, technical bulletins, advertising, publicity, telemarketing, as well as through digital or electronic media such as the Internet.

[14] GHGs include carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulfur hexafluoride (SF6).

greenhouse gas removal enhancement	calculated increase in GHG removals[15] between a baseline scenario and the project [ISO 14064-2]
greenhouse gas sink	physical unit or process that removes a GHG from the atmosphere [ISO 14064-2]
greenhouse gas source	physical unit or process that releases a GHG into the atmosphere [ISO 14064-2]
greenhouse gas storage	physical unit or component of the biosphere, geosphere or hydrosphere with the capability to store or accumulate a GHG removed from the atmosphere by a greenhouse gas sink or a GHG captured from a greenhouse gas source [ISO 14064-2] The total mass of carbon contained in a GHG storage at a specified point in time could be referred to as the carbon stock of the storage. A GHG storage can transfer greenhouse gases to another GHG storage. The collection of a GHG from a GHG source before it enters the atmosphere and storage of the collected GHG in a GHG storage could be referred to as GHG capture and storage.
ICT project	GHG project using mainly ICT goods, networks and services, contributing to GHG emission reductions or GHG removal enhancements, and/or a GHG project using mainly ICT goods, networks and services, contributing to energy consumption savings and energy efficiency improvement [ITU-T L.1430]
indirect GHG emissions	Emissions that are a consequence of the operations of the reporting company, but occur at sources owned or controlled by another company [The Corporate Protocol]
Inventory	A quantified list of an organization's GHG emissions and sources [The Corporate Protocol]
life cycle	consecutive and interlinked stages of a product system, from raw material acquisition or generation from natural resources to final disposal [ISO 14040]
life cycle assessment (LCA)	compilation and evaluation of the inputs, outputs and the potential environmental impacts of a product system throughout its life cycle [ISO 14040]
life cycle inventory analysis (LCI)	phase of life cycle assessment involving the compilation and quantification of inputs and outputs for a product throughout its life cycle [ISO 14040]
life cycle impact assessment (LCIA)	phase of life cycle assessment aimed at understanding and evaluating the magnitude and significance of the potential environmental impacts for a product system throughout the life cycle of the product [ISO 14040]

[15] GHG removal enhancement corresponds to quantified GHG removal achieved by an activity or set of activities intended for GHG capture and closure. The usage of ICT may result in some GHG removals.

Product	any goods or service [ISO 14040] [NOTE 1] The product can be categorized as follows: • services (e.g. transport); • software (e.g. computer program, dictionary); • hardware (e.g. engine mechanical part); • processed materials (e.g. lubricant). [NOTE 2] Services have tangible and intangible elements. Provision of a service can involve, for example, the following: • an activity performed on a customer-supplied tangible product (e.g. automobile to be repaired); • an activity performed on a customer-supplied intangible product (e.g. the income statement needed to prepare a tax return); • the delivery of an intangible product (e.g. the delivery of information in the context of knowledge transmission); • the creation of ambience for the customer (e.g. in hotels and restaurants). Software consists of information and is generally intangible and can be in the form of approaches, transactions or procedures. Hardware is generally tangible and its amount is a countable characteristic. Processed materials are generally tangible and their amount is a continuous characteristic.
product category rules (PCR)	set of specific rules, requirements and guidelines for developing Type III environmental declarations for one or more product categories [ISO 14025]
Scope 1	A reporting organization's direct GHG emissions [The Corporate Protocol]
Scope 2	A reporting organization's emissions associated with the generation of electricity, heating/cooling, or steam purchased for own consumption [The Corporate Protocol]
Scope 3	A reporting organization's indirect emissions other than those covered in scope 2 [The Corporate Protocol]
Validation	systematic, independent and documented process for the evaluation of a greenhouse gas assertion in a GHG project plan against agreed validation criteria[16] [ISO 14064-2]
Verification	systematic, independent and documented process for the evaluation of a greenhouse gas assertion against agreed verification criteria[17] [ISO 14064-2]

[16] In some cases, such as in first-party validations, independence can be demonstrated by the freedom from responsibility for the development of GHG data and information.

[17] In some cases, such as in first-party verifications, independence can be demonstrated by the freedom from responsibility for the development of GHG data and information.

6 Bibliography

Baumann, T., and Kollmuss, A., "GHG schemes addressing climate change: How ISO standards help," ISO, January 2011, www.iso.org/iso/pressrelease.htm?refid=Ref1390

BSI, "PAS 2060:2010, Specification for the demonstration of carbon neutrality", 2010, BSI, http://shop.bsigroup.com/en/ProductDetail/?pid=000000000030198309

Draft Recommendation ITU-T L.1430, Methodology for environmental impacts assessment of Information and Communication Technology projects

EC-JRC, "ILCD (International Reference Life Cycle Data System) Handbook: General guide for Life Cycle Assessment – Detailed guidance", http://lct.jrc.ec.europa.eu/pdf-directory/ILCD-Handbook-General-guide-for-LCA-DETAIL-online-12March2010.pdf

GHG Protocol Initiative, "A Corporate Accounting and Reporting Standard," World Resources Institute and World Business Council for Sustainable Development, 2004

GHG Protocol Initiative, "The GHG Protocol for Project Accounting," World Resources Institute and World Business Council for Sustainable Development, 2005

IAASB, "ISAE 3410, Assurance Engagements on Greenhouse Gas Statements," IFAC, January 2011, www.ifac.org/publications-resources/proposed-international-standard-assurance-engagements

ISO 14021:1999, Environmental labels and declarations – Self-declared environmental claims (Type II environmental labelling)

ISO 14024:1999, Environmental labels and declarations – Type I environmental labelling – Principles and procedures

ISO 14025:2006, Environmental labels and declarations – Type III environmental declarations – Principles and procedures

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

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

Stephens, A., "Overview of initiative to develop ICT Sector Guidance to support the GHG Protocol Product Standard", The GHG Protocol Initiative, March 2011, www.ghgprotocol.org/files/ghgp/Overview%20GHG%20Protocol%20ICT%20Sector%20Guidance%2010MAR2011.pdf

September 2012

About ITU-T and Climate Change: **itu.int/ITU-T/climatechange/**

E-mail: **greenstandard@itu.int**

Printed in Switzerland
Geneva, 2012
Photo credits: Shutterstock®