



**International
Standard**

ISO 50100

**Energy management systems and
energy savings — Decarbonization
— Requirements with guidance for
use**

*Management de l'énergie et économies d'énergie —
Décarbonation — Exigences et recommandations d'utilisation*

**First edition
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ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

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Foreword

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

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

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

This document was prepared by Technical Committee ISO/TC 301, *Energy management and energy savings*.

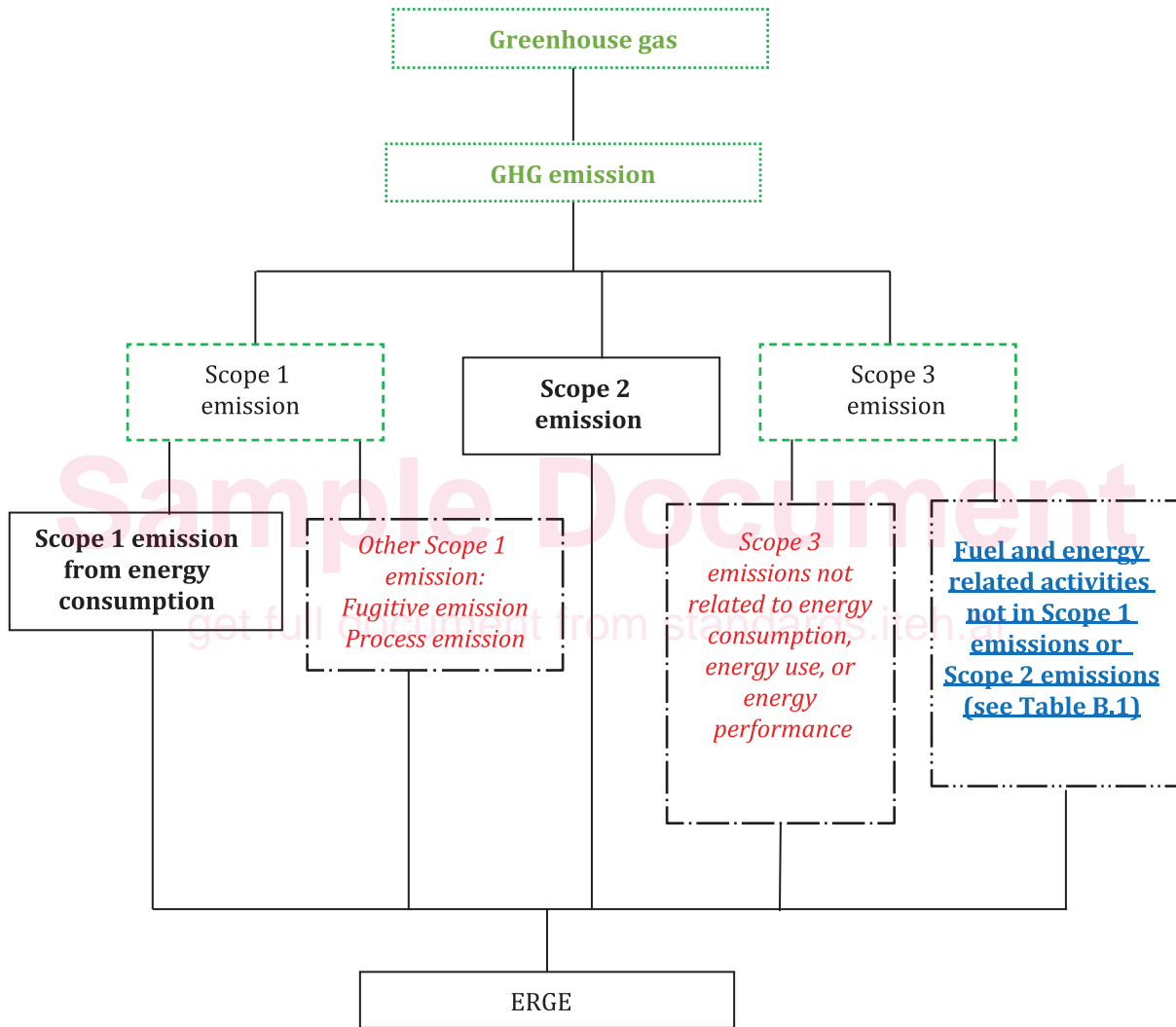
Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

0.1 Importance of decarbonization

Nearly 75 % of global anthropogenic greenhouse gas (GHG) emissions are from the generation and consumption of energy.^[1] This document is designed to help organizations of all types and sizes to reduce their energy-related GHG emissions (noted as ERGE in this document) in line with the organization’s related targets. [Figure 1](#) illustrates the relationship between greenhouse gas and ERGE.

This document outlines the requirements and provides guidance for organizations to develop a pathway that transitions their energy consumption to meet their ERGE targets.



Key

- Boxes of solid lines with black font are ERGE
- .- Boxes in dash single dot line with red italics are outside the scope of this document
- .-.- Boxes in dash double dot line with blue underlined text can be optionally included in ERGE
- Boxes in dotted lines provide context

Figure 1 — Illustration of energy-related greenhouse gas emissions (ERGE)

0.2 Achieving decarbonization

To achieve decarbonization, as established by the Paris Agreement^[2] and Nationally Determined Contributions (NDCs)^[3], organizations across all sectors must take action and implement actions to reduce

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the energy consumption of their energy uses and switch to the consumption of low or zero-carbon emission energy types (e.g. energy with a lower GHG emission factor).

This document provides organizations with a comprehensive decarbonization process for ERGE that can be integrated into the organization's operations. This process is based on a decarbonization plan leading to specific ERGE reduction actions producing demonstrable results.

Processes to manage energy have been shown to effectively reduce energy consumption^[4]. ISO 50001:2018^[5] is an example of an energy management system (EnMS) that can serve as the foundation for reducing GHG emissions from energy consumption. While this document is not a management system standard, the processes it outlines can be effectively integrated with an EnMS or any other management system that includes requirements to quantifiably improve energy performance. [Annex A](#) shows the relationship between this document and ISO 50001:2018, which complement each other to enable an organization to achieve a performance-based decarbonization strategy.

This document is designed to work with the existing GHG quantification documents (e.g. ISO 14064-1,^[6] GHG Protocol,^[7] etc.).

This document enables an organization to make claims regarding:

- its plan to meet ERGE targets (validation);
- its achievement of ERGE targets based on historical data (verification);
- both its plan and achievement of ERGE targets.

NOTE ISO 14068-1:2023^[8] sets out the requirements for claims around the achievement of carbon neutrality, and ISO 14060^[9] for being on a pathway to net zero.

0.3 Benefits

This document provides a systematic approach to developing a pathway for transitioning an organization's energy consumption to reduce ERGE in order to help organizations:

- a) align internal systems, processes and input from interested parties to more effectively reduce ERGE;
- b) improve the availability and quality of data and information shared internally and with interested parties;
- c) create a culture for reducing ERGE, involving leveraging synergies across different means such as EnMS, energy efficiency, renewable energy and technology improvements;
- d) provide internal and external interested parties assurance that the organization has established one or more clear and transparent Scope 1 ERGE and Scope 2 ERGE targets;
- e) develop ERGE reduction action plans implemented over time, resulting in achievement of the organizational decarbonization strategy;
- f) demonstrate achievement of past ERGE targets and the ability to achieve future ERGE targets.

0.4 Compatibility

This document contains requirements and can be used to assess conformity for repeatable and reproducible results related to ERGE.

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Energy management systems and energy savings — Decarbonization — Requirements with guidance for use

1 Scope

This document specifies requirements and provides guidance that enable an organization to reduce its energy-related greenhouse gas (GHG) emissions (ERGE).

This document is applicable:

- a) to any organization regardless of its type, size, complexity, geographical location, organizational culture or the products and services it provides;
- b) to energy-related Scope 1 emissions and Scope 2 emissions;
- c) irrespective of the quantity, use or types of energy consumed.

This document requires demonstration of absolute ERGE reduction aligned with ERGE target(s).

[Annex A](#) provides information on the relationship between ISO 50001:2018 and this document.

[Annex B](#) provides information on GHG emissions and GHG emission factors.

[Annex C](#) provides guidance related to the decarbonization planning.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

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

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

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

3.1 Terms related to organization

3.1.1

organization

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

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

[SOURCE: ISO 50001:2018, 3.1.1, modified — “targets” replaced “objectives” in the definition.]

3.1.2

top management

person or group of people who directs and controls an *organization* (3.1.1) at the highest level

Note 1 to entry: Top management is empowered to delegate authority and provide resources within the organization.

[SOURCE: ISO 50001:2018, 3.1.2, modified — Note 2 to entry and Note 3 to entry deleted.]

3.1.3

boundary

physical, virtual and/or organizational limits as defined by the entity for a stated purpose

EXAMPLE A process, a group of processes, a site, multiple sites under the control of an *organization* (3.1.1), an entire organization.

Note 1 to entry: The entity can be an organization, group of organizations, region(s), subset of an organization or other depending on the application.

Note 2 to entry: Physical can be equipment, systems, a building, a process, a group of processes, a site or multiple sites, under the control of an organization.

[SOURCE: ISO 50006:2023, 3.1.2, modified — Example added.]

3.1.4

interested party

stakeholder

person or *organization* (3.1.1) that can affect, be affected by, or perceive itself to be affected by a decision or activity

EXAMPLE Regulators, customers, suppliers, investors, shareholders, corporate, employees.

[SOURCE: ISO 50001:2018, 3.1.5, modified — Example added.]

3.1.5

energy management system

EnMS

management system to establish an energy policy, objectives, energy targets, action plans and process(es) to achieve the objectives and energy targets

[SOURCE: ISO 50001:2018, 3.2.2]

3.2 Terms related to requirement

3.2.1

requirement

need or expectation that is stated, generally implied or obligatory

Note 1 to entry: “Generally implied” means that it is custom or common practice for the *organization* (3.1.1) and *interested parties* (3.1.4) that the need or expectation under consideration is implied.

Note 2 to entry: A specified requirement is one that is stated, for example, in documented information.

Note 3 to entry: A relevant requirement is one that the organization has determined applies to the *decarbonization* (3.5.1) *boundary* (3.1.3) and/or decarbonization activities.

[SOURCE: ISO 50001:2018, 3.3.1, modified — Note 3 to entry added.]

3.3 Terms related to performance

3.3.1

monitoring

determining the status of a system, a process or an activity

Note 1 to entry: To determine the status, there can be a need to check, supervise or critically observe.

Note 2 to entry: In an *energy management system* (3.1.5), *monitoring* (3.3.1) can be a review of *energy* (3.4.1) data or *greenhouse gas emissions* (3.5.3) related data.

[SOURCE: ISO 50001:2018, 3.3.7, modified — “or greenhouse gas emissions related data” added to Note 2 to entry.]

3.3.2

base year

historical 12-month period identified for the purpose of comparing *energy-related greenhouse gas emissions (ERGE) reduction* (3.5.8)

Note 1 to entry: The base year can be quantified based on a specific year or averaged from several periods (e.g. several years).

Note 2 to entry: This document uses the unit of tCO₂e/year throughout, thus the period is a year. The 12-month period does not need to be a calendar year but is a contiguous 12-months.

3.3.3

reporting year

12-month period of time selected for quantification and reporting of *energy-related greenhouse gas emissions (ERGE)* (3.5.7)

Note 1 to entry: The reporting year can be quantified based on a specific year or averaged from several years.

Note 2 to entry: This document uses the unit of tCO₂e/year throughout, thus the period is a year. The 12-month period does not need to be a calendar year but is a contiguous 12-months.

3.3.4

validation

confirmation of a *claim* (3.3.6), through the provision of objective evidence, that the *requirements* (3.2.1) for a specific intended future use or application have been fulfilled

Note 1 to entry: Objective evidence can come from real or simulated sources.

Note 2 to entry: Validation is considered to be a process to evaluate the reasonableness of the assumptions, limitations, and methods that support a claim about the outcome of future activities.

Note 3 to entry: Validation is applied to claims regarding an intended future use based on projected information (confirmation of plausibility).

[SOURCE: ISO/IEC 17029:2019, 3.2, modified — Note 4 to entry deleted.]

3.3.5

verification

confirmation of a *claim* (3.3.6), through the provision of objective evidence, that specified *requirements* (3.2.1) have been fulfilled

Note 1 to entry: Verification is considered to be a process for evaluating a claim based on historical data and information to determine whether the claim is materially correct and conforms with specified requirements.

Note 2 to entry: Verification is applied to claims regarding events that have already occurred or results that have already been obtained (confirmation of truthfulness).

[SOURCE: ISO/IEC 17029:2019, 3.3, modified — Note 3 to entry deleted.]

3.3.6

claim

information declared by the *organization* (3.1.1)

Note 1 to entry: The claim is the object of conformity assessment by *validation* (3.3.4) and/or *verification* (3.3.5).

Note 2 to entry: The claim can represent a situation at a point in time or can cover a period of time.

Note 3 to entry: The claim should be clearly identifiable and capable of consistent evaluation or measurement against specified *requirements* (3.2.1) by a validation or verification body.

Note 4 to entry: The claim can be provided in the form of a report, a statement, a declaration, a *decarbonization* (3.5.1) plan or consolidated data.

[SOURCE: ISO/IEC 17029:2019, 3.1, modified — “organization” replaced “client” in the definition. “decarbonization plan” replaced “project plan” in Note 4 to entry.]

3.3.7

energy performance

measurable result(s) related to *energy efficiency* (3.4.3), *energy use* (3.4.4), and *energy consumption* (3.4.2)

Note 1 to entry: Energy performance can be measured against the *organization's* (3.1.1) objectives, energy targets and other energy performance *requirements* (3.2.1).

Note 2 to entry: Energy performance is one component of the performance of the *energy management system* (3.1.5).

[SOURCE: ISO 50001:2018, 3.4.3]

3.3.8

energy performance improvement

improvement in measurable results of *energy efficiency* (3.4.3) or *energy consumption* (3.4.2) related to *energy use* (3.4.4), compared to the energy baseline

[SOURCE: ISO 50006:2023, 3.1.11]

3.4 Terms related to energy

3.4.1

energy

electricity, fuels, steam, heat, compressed air and other similar media

Note 1 to entry: For the purposes of this document, energy refers to the various types of energy, including renewable, which can be purchased, stored, treated, used in an equipment or in a process, or recovered.

[SOURCE: ISO 50001:2018, 3.5.1]

3.4.2

energy consumption

quantity of *energy* (3.4.1) applied

Note 1 to entry: *Energy consumption* can be represented in volume (e.g. litres of fuel), mass, weight units or energy units (e.g. GJ, kWh).

[SOURCE: ISO 50006:2023, 3.1.5]

3.4.3

energy efficiency

ratio or other quantitative relationship between an output of process and an input of *energy* (3.4.1)

EXAMPLE Conversion efficiency, energy required/energy used, output/input, theoretical energy used to operate/energy used to operate.

Note 1 to entry: The output of a process can be products, services or energy.

Note 2 to entry: Both input and output should be clearly specified in terms of quantity and quality and should be measurable.

[SOURCE: ISO 50006:2023, 3.1.6]

3.4.4

energy use

energy end-use

application of *energy* (3.4.1)

EXAMPLE Ventilation, lighting, heating, cooling, transportation, process, data storage.

Note 1 to entry: Energy use is based on “what the energy is used for” as compared to *energy consumption* (3.4.2) which is based on “how much energy is used”.

Note 2 to entry: This application can be from any energy type including renewables.

[SOURCE: ISO 50006:2023, 3.1.7]

3.5 Terms related to global warming and climate change

3.5.1

decarbonization

reduction of emissions of carbon dioxide(CO₂) and other *greenhouse gas* (3.5.2) into the atmosphere

3.5.2

greenhouse gas

GHG

gaseous constituent of the atmosphere, both natural or 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

Note 1 to entry: The *GHG emissions* (3.5.3) included are those identified by the Kyoto Protocol^[5] as amended by the latest Intergovernmental Panel on Climate Change (IPCC) Assessment Report^[24]. The three GHGs most commonly associated with *ERGE* (3.5.7), are carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O). The remaining GHGs are perfluorocarbons (PFCs), hydrofluorocarbons (HFCs), sulfur hexafluoride (SF₆), nitrogen trifluoride (NF₃).

[SOURCE: ISO 14064-1:2018, 3.1.1, modified — Note 1 to entry revised. Note 2 to entry deleted.]

3.5.3

greenhouse gas emission

GHG emission

release of *greenhouse gas* (3.5.2) into the atmosphere

[SOURCE: ISO 14050:2020, 3.9.8]

3.5.4

Scope 1 emission

direct GHG emission

greenhouse gas (GHG) emission (3.5.3) from sources owned or directly controlled by the *organization* (3.1.1)

EXAMPLE

- process emissions, (such as CO₂ that arises from the breakdown of calcium carbonate (CaCO₃) during cement manufacture);
- emissions from stationary combustion;
- emissions from mobile combustion;
- fugitive emissions (such as methane emissions from coal mines and refrigerant leaks).

Note 1 to entry: This document uses the concepts of equity share or control (financial or operational) to establish energy-related Scope 1 emission responsibility.

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Note 2 to entry: Scope 1 emissions do not include those occurring from natural ecosystems owned or controlled by the organization that are not under management or remain in a natural state and have not been modified.

Note 3 to entry: Scope 1 emissions for governance organizations operating at a regional level refer to GHG emissions from sources located inside the *boundary* (3.1.3) of that region. More information on Scope 1 emissions is provided in the GHG Global Protocol for Community-Scale Greenhouse Gas Inventories, An Accounting and Reporting Standard for Cities Version 1.1.

Note 4 to entry: A source is a human-based activity or process that releases a *GHG* into the atmosphere.

[SOURCE: IWA 42:2022, 3.2.3, modified — Example and Notes 4 to entry added. Notes 1 and 3 to entry modified.]

3.5.5

Scope 2 emission

indirect GHG emission from purchased energy

greenhouse gas emission (GHG) (3.5.3) from the generation of purchased electricity, heat, cooling or steam consumed by the *organization* (3.1.1)

Note 1 to entry: Purchased electricity is brought into the organizational *boundary* (3.1.3).

Note 2 to entry: Scope 2 emissions can include other purchased energy sources brought into the organizational *boundary* (e.g. compressed air).

[SOURCE: IWA 42:2022, 3.2.4, modified — Note 1 to entry deleted. New Notes 1 and 2 to entry added.]

3.5.6

Scope 3 emission

indirect GHG emission

greenhouse gas (GHG) emission (3.5.3) that is a consequence of the *organization's* (3.1.1) activities but arises from sources that are not owned or directly controlled by the organization

EXAMPLE Extraction and production of purchased materials, transportation of purchased fuels, use of sold products and services.

Note 1 to entry: Scope 3 emissions include all attributable value chain GHG emissions not included in *Scope 1 emissions* (3.5.4) or *Scope 2 emissions* (3.5.5).

[SOURCE: IWA 42:2022, 3.2.5, modified — Example added. Note 2 to entry deleted.]

3.5.7

energy-related greenhouse gas emission

ERGE

Scope 1 emissions (3.5.4) from *energy consumption* (3.4.3) and *Scope 2 emissions* (3.5.5)

Note 1 to entry: The *organization* (3.1.1) may include *Scope 3 emissions* (3.5.6) associated with the organization's energy consumption.

Note 2 to entry: ERGE units are in absolute tCO₂e/year.

3.5.8

energy-related greenhouse gas emission reduction

ERGE reduction

E_R

quantified decrease in *ERGE* (3.5.7)

[SOURCE: ISO 14064-2:2019, 3.1.7, modified — “energy-related” added to term. Symbol added. “ERGE” replaced “GHG emissions between a baseline scenario and the GHG project” in the definition.

3.5.9

greenhouse gas emission factor

GHG emission factor

coefficient relating *greenhouse gas emission* (3.5.2) activity data with *greenhouse gas emissions* (3.5.3)

Note 1 to entry: In this document, “GHG activity data” relate to *energy consumption* (3.4.2).

Note 2 to entry: An *organization* (3.1.1) can use multiple GHG emission factors depending on energy type.

[SOURCE: ISO 14050:2020, 3.9.20, modified — Notes 1 and 2 to entry added.]

3.6 Abbreviated terms

CCUS	carbon capture, utilization and storage
CEMS	continuous emissions monitoring system
EnMS	energy management system
ERGE	energy-related greenhouse gas emission
GHG	greenhouse gas
GWP	global warming potential
IEA	International Energy Agency
IPCC	Intergovernmental Panel on Climate Change
NDCs	Nationally Determined Contributions
tCO ₂ e	tonne CO ₂ equivalent
UNFCCC	United Nations Framework Convention on Climate Change

3.7 Symbols

E_A	interim ERGE target for ERGE
E_{AS1}	interim ERGE target for Scope 1 ERGE
E_{AS2}	interim ERGE target for Scope 2 ERGE
E_{AS3}	interim ERGE target for Scope 3 ERGE
E_{AT}	interim ERGE target for total ERGE
E_{BS1}	base-year ERGE for Scope 1 ERGE
E_{BS2}	base-year ERGE for Scope 2 ERGE
E_{BS3}	base-year ERGE for Scope 3 ERGE
E_{BT}	base-year ERGE for total ERGE
E_M	quantified ERGE at a point in time used to compare to ERGE targets, monitored ERGE
E_{MS1}	quantified Scope 1 ERGE at a point in time used to compare to Scope 1 ERGE targets, monitored Scope 1 ERGE