IEC TS 62282-9-101

Edition 1.0 2020-10

TECHNICAL SPECIFICATION

colour inside

Fuel cell technologies –
Part 9-101: Evaluation methodology for the environmental performance of fuel cell power systems based on life cycle thinking – Streamlined life-cycle considered environmental performance characterization of stationary fuel cell combined heat and power systems for residential applications

IEC TS 62282-9-101:2020-10(en)

IEC Central Office
3, rue de Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

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ELECTROTECHNICAL
COMMISSION

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FOREWORD

The main task of IEC technical committees is to prepare International Standards. In exceptional circumstances, a technical committee may propose the publication of a Technical Specification when

- the required support cannot be obtained for the publication of an International Standard, despite repeated efforts, or
- the subject is still under technical development or where, for any other reason, there is the future but no immediate possibility of an agreement on an International Standard.

Technical Specifications are subject to review within three years of publication to decide whether they can be transformed into International Standards.

IEC TS 62282-9-101, which is a Technical Specification, has been prepared by IEC technical committee 105: Fuel cell technologies.

The text of this Technical Specification is based on the following documents:

Draft TS	Report on voting
105/787/DTS	105/799A/RVDTS

Full information on the voting for the approval of this Technical Specification can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 62282 series, published under the general title *Fuel cell technologies*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

This part of IEC 62282 introduces a simplified evaluation method for assessing the life-cycle considered environmental performance of stationary fuel cell power systems for residential applications that can be complemented with a supplementary heat generator or a thermal storage system.

As a response to the aggravation of global environmental issues in recent years, corporate environmental management is increasingly required in order to enhance the environmental performance of products and communicate this information to consumers. For that purpose, when developing new or improved products, manufacturers should pursue environmentally conscious designs and evaluate their efforts by taking a life cycle perspective.

Past life cycle assessment (LCA) studies of stationary fuel cell power systems for residential applications have shown that two environmental aspects are important in their life cycle (so-called hot spots). One is greenhouse gas (GHG) emissions during operation and the other is the consumption of metals, minerals and fossil fuels (so-called abiotic resources) contributing to their depletion during manufacturing and operation.

This document provides guidance on how to perform a targeted life cycle considered evaluation of these predominant environmental impacts, specific to the characteristics of stationary fuel cell power systems for residential applications that can be complemented with a supplementary heat generator or a thermal storage system.

FUEL CELL TECHNOLOGIES –

Part 9-101: Evaluation methodology for the environmental performance of fuel cell power systems based on life cycle thinking – Streamlined life-cycle considered environmental performance characterization of stationary fuel cell combined heat and power systems for residential applications

1 Scope

This part of IEC 62282 provides a streamlined methodology to assess major environmental impacts of stationary fuel cell power systems for residential applications. The fuel cell power systems can be complemented with a supplementary heat generator and/or a thermal storage system such as a hot water tank. The analysis can include the import of electricity from the grid or the export to the grid. The analysed systems are intended to meet the electricity and heat demand of a given household.

NOTE This document intends to provide a streamlined life-cycle approach. A more comprehensive life cycle assessment (LCA) for environmental product declaration (EPD) is described in IEC TS 62282-9-102[1].

This document provides a set of specific rules, requirements and guidelines based on life cycle thinking for the description of relevant environmental impacts of fuel cell power systems that can be complemented with a supplementary heat generator or a thermal storage system. This document also provides guidance on how to communicate these environmental impacts to consumers.

This document covers the following two environmental aspects:

– greenhouse gas (GHG) emissions in the use stage; and
– utilization of abiotic resources.

This document focuses on residential applications, but can also be used to assess systems in commercial applications such as small retailers or service shops.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 62282-3-201:2017, *Fuel cell technologies – Part 3-201: Stationary fuel cell power systems – Performance test methods for small fuel cell power systems*

IEC 62282-3-400:2016, *Fuel cell technologies – Part 3-400: Stationary fuel cell power systems – Small stationary fuel cell power system with combined heat and power output*

[1] Under preparation. Stage at the time of publication IEC APUB 62282-9-102:2020.

3 Terms and definitions

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

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

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

3.1
life cycle
consecutive and interlinked stages of a product system, from raw material acquisition or generation from natural resources to the final disposal

[SOURCE: ISO 14040:2006, 3.1]

3.2
life cycle assessment
LCA
compilation and evaluation of the inputs, outputs and the potential environmental impacts of a product system throughout its life cycle

[SOURCE: ISO 14040:2006, 3.2]

3.3
life cycle thinking
LCT
consideration of all relevant environmental aspects of a product during its entire life cycle

[SOURCE: IEC 62430:2019, 3.2.3, modified – The second preferred term "life cycle perspective" and the notes to entry have been deleted.]

3.4
foreground system
element of the life cycle of a product that is specific to it

Note 1 to entry: The foreground system notably comprises the manufacturing, use and end-of-life of the product

3.5
elementary flow
material or energy entering the system being studied that has been drawn from the environment without previous human transformation, or material or energy leaving the system being studied that is released into the environment without subsequent human transformation

[SOURCE: ISO 14040:2006, 3.12]

3.6
primary data
information determined by direct measurement, estimation or calculation of the foreground system

3.7
secondary data
information obtained from sources other than primary data (3.6)

Note 1 to entry: Sources can include reports, websites, books, databases, journal articles, broadcasts, etc.

[SOURCE: ISO 14064-1:2018, 3.2.4, modified – "data" replaced with "information", Note 1 to entry replaced with a new note 1 to entry.]

3.8
global warming potential
measure of the globally-averaged radiative forcing arising from the emissions of a particular greenhouse gas relative to that of CO_2

3.9
abiotic resource depletion
extraction of ores, minerals, stones, rocks or fossil fuels (including peat) from the place of their natural occurrence and subsequent use with the effect that they become scarcer

3.10
fuel cell power system
generator system that uses one or more fuel cell stack(s) to generate electric power and heat

[SOURCE: IEC 60050-485:2020, 485-09-01, modified – "module" replaced with "stack".]

3.11
supplementary heat generator
non-preferential heat source providing peak load

[SOURCE: IEC 62282-3-400:2016, 3.1.22]

3.12
electric efficiency
ratio of the average net electric power output produced by a fuel cell power system to the average fuel power input supplied to the fuel cell power system

Note 1 to entry: The lower heating value (LHV) is assumed unless otherwise stated.

[SOURCE: IEC 60050-485:2020, 485-10-02, modified – "average" added before "net electric power output" and "total enthalpy flow" replaced with "average fuel power input".]

3.13
heat recovery efficiency
ratio of the average recovered thermal power output of a fuel cell power system to the average total power input supplied to the fuel cell power system

[SOURCE: IEC 60050-485:2020, 485-10-04, modified – "recovered heat flow" replaced with "the average recovered thermal power output"; "total enthalpy flow" replaced with "average total power input" and Note 1 to entry deleted.]

3.14
overall energy efficiency
ratio of total usable power output (net electric power and recovered thermal power) to the average total power input supplied to the fuel cell power system

[SOURCE: IEC 60050-485:2020, 485-10-05, modified – second preferred term "total thermal efficiency" deleted; "energy flow" replaced with "power output"; in brackets, "heat flow" replaced with "thermal power"; "total enthalpy flow" replaced with "average total power input" and Note 1 to entry deleted.]

4 Framework for evaluation process

4.1 General

This document evaluates two environmental impacts of fuel cell power systems with or without a supplementary heat generator: global warming and abiotic resource depletion. Global warming due to GHG emissions is assessed for the use stage. The utilization of abiotic resources is assessed for the stages "manufacturing" and "use".

NOTE The reason behind selecting environmental impact categories and life cycle stages is as follows: global warming can be taken as a proxy for environmental performance during the use stage, while abiotic resource depletion is used to characterize the environmental performance regarding raw material acquisition.

4.2 Life cycle stages

The life cycle stages considered in this document are manufacturing (acquisition and utilization of abiotic resources, including for replaced components during the use stage) and use (GHG emissions, and utilization and acquisition of abiotic resources) as shown in solid rectangles in Figure 1.

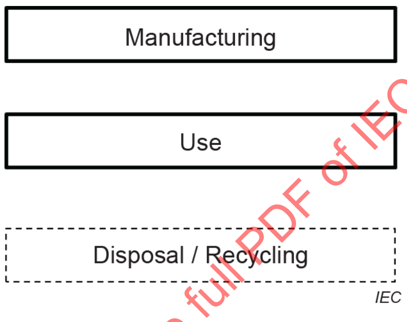

Figure 1 – Life cycle stages (prioritized stages in solid-lined boxes)

NOTE Transportation is not depicted in Figure 1, but can be included in the assessment.

4.3 Functional unit

The functional unit is defined as the satisfaction of the demand of electricity and heat in a typical household for a representative year including seasonal variations.

It shall be documented whether or not the analysed fuel cell power system is complemented with a supplementary heat generator or a thermal storage system.

Ten years of operation shall be evaluated (target duration). The fuel cell power system that can be complemented with a supplementary heat generator or a thermal storage system shall be characterized in such a way that the technical characteristics of the first ten years of its operation (notably efficiency degradation) are taken into account.

The demand shall be specific to the geographic region where the fuel cell power systems are operated. The systems that can be complemented with a supplementary heat generator or a thermal storage system are operated. Typical demands are shown in Annex A.

Any replacement of components, which are expected during the 10-year operation period, such as fuel cell stacks or fuel processing systems, shall be taken into account. Such replacements are considered as part of manufacturing as the primary concern of components resides in their production.

If the component(s) (e.g. parts of the fuel cell power system, supplementary heat generator or thermal storage system, if applicable) operates for longer than ten years, the elementary flows and related environmental impacts that these component(s) represent shall be spread equally over their lifetime. Only the first ten years shall be taken into account.

4.4 Product system

The evaluated fuel cell power system to provide the functional unit (4.3) shall be described. The system analysed consists of a fuel cell power system that can be complemented with a supplementary heat generator, a thermal storage system or electricity from the grid (Figure 2).

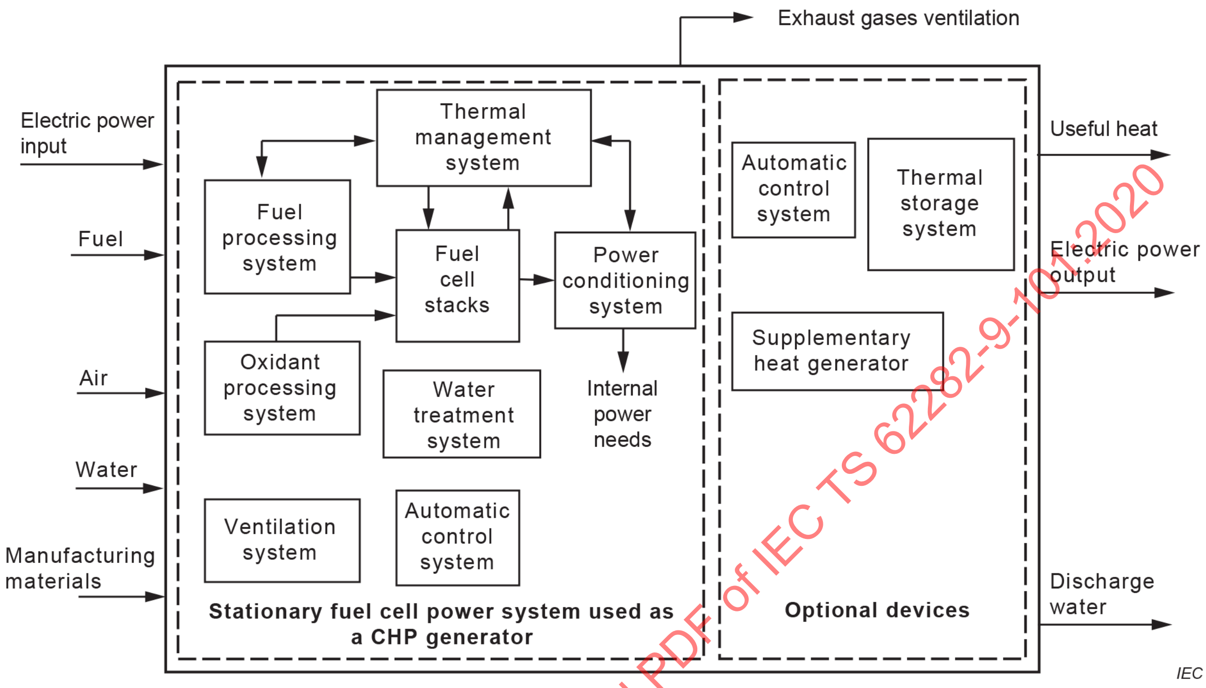

Figure 2 – Configuration of a fuel cell power system that can be complemented with a supplementary heat generator or thermal storage system covered by this document

4.5 Inputs, outputs and related environmental impact categories

The relevant inputs, outputs and environmental impact categories to be assessed for the prioritized life cycle stages (see 4.2) in accordance with this document are shown in Figure 3.

For the manufacturing and use stages, this document considers as inputs the raw materials used in the fuel cell power system that can be complemented with a supplementary heat generator and a thermal storage system. These are assessed in terms of abiotic resource depletion (see 5.3).

For the use stage, the electricity from the grid and the fuel shall be taken as inputs, while surplus electricity (i.e. beyond demand), waste heat and GHG emissions resulting from the operation are included as outputs. GHG emissions associated with electricity and fuel supply shall be taken into account. GHG emissions are assessed in terms of global warming (see 5.2).

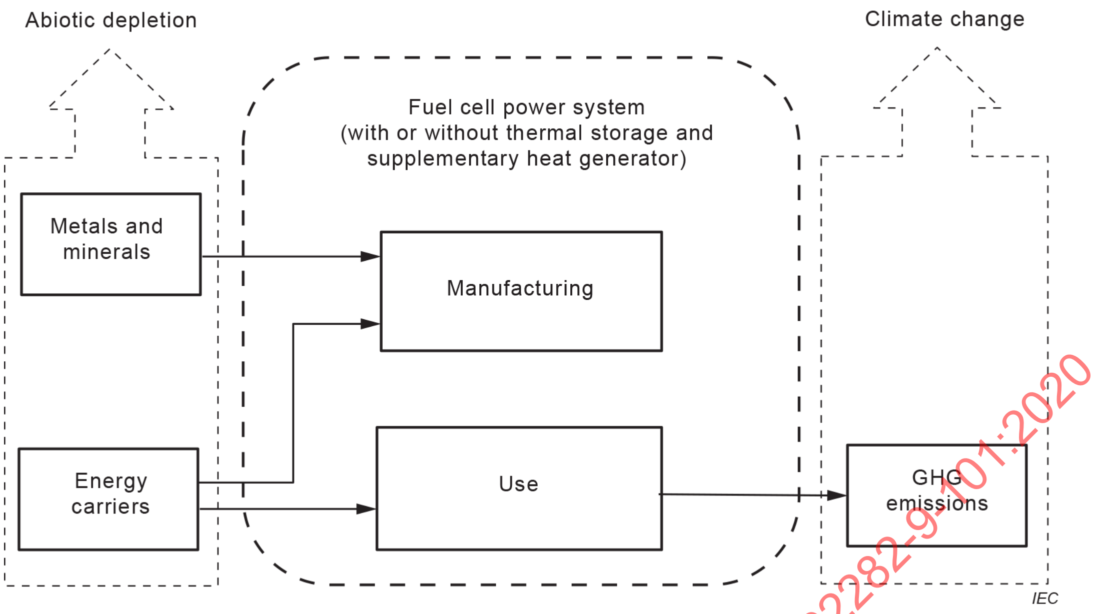

Figure 3 – System boundaries, elementary flows and environmental impact categories assessed in this document

4.6 Types and quality of data, and information sources

For the manufacturing stage, primary data shall be used for the amounts of materials used for manufacturing the fuel cell stacks and fuel processing system (including the supplementary heat generator or thermal storage system, if any). Secondary data may be used for the manufacturing stage of components other than the fuel cell stacks and fuel processing system (including the supplementary heat generator or thermal storage system, if any).

For the use stage, primary data shall be used for the total amount of electricity from the grid and the fuel used in the fuel cell power system and, if applicable, in the supplementary heat generator. Secondary data may be used for electricity and fuel supply chains.

5 Estimation methods

5.1 General remarks on life cycle impact assessment (LCIA)

Databases within LCA software typically provide elementary flows (e.g. CO_2 or CH_4 emissions or use of platinum or chromium) that have been classified (i.e. assigned to impact categories such as climate change or abiotic resource depletion). LCIA methods exist for both impact categories, providing so called characterization factors. Characterization factors allow all elementary flows contributing to the same impact category to be expressed in the same unit. The LCA practitioner shall be responsible for ensuring that the elementary flows are correctly linked with corresponding characterization factors. This also applies to elementary flows that have been added by the LCA practitioner during data collection.

If a characterization factor is missing for an elementary flow in the inventory and the elementary flow is known to contribute to an impact category, its potential importance should be checked by the LCA practitioner. If the contribution from the elementary flow is found to be potentially significant, efforts should be made to estimate the missing characterization factor. If this is not possible, this potentially relevant, but missing characterization factor shall be documented. The potential influence of the missing factor shall be considered in the interpretation of the results and documented as a limitation of the analysis.

5.2 Global warming in the use stage

5.2.1 Required data

When assessing GHG emissions during the use stage, the following parameters are required:

a) electric efficiency, averaged over the target duration, taking account of degradation. The way in which degradation has been taken into account shall be documented and justified;

NOTE At the time of writing this document, there is no standardized method to assess fuel cell performance degradation. A future edition of IEC 62282-3-201 might provide such a method.

b) heat recovery efficiency, averaged over the target duration;

c) external electric energy needed in addition to the electricity produced by the fuel cell in order to satisfy the electricity demand as defined in the functional unit (see 4.3);

d) heat from the supplementary heat generator needed in addition to the heat produced by the fuel cell in order to satisfy the heat demand as defined in the functional unit (see 4.3);

e) GHG emission intensity of the fuel used in the fuel cells including fuel supply;

f) GHG emission intensity of the fuel used when operating the supplementary heat generator;

g) GHG emissions associated with electricity production in the grid including those from the fuel supply chains, and also considering transmission losses;

h) the rated power output of the fuel cell power system;

i) the share of the thermal demand covered by the fuel cell power system alone.

Some of these parameters depend on the fuel used. The fuel(s) for the assessment shall be chosen according to the fuel prevailing in the geographic region in which the fuel cell power system that can be complemented with a supplementary heat generator is used. The compositions of the fuel shall be documented.

5.2.2 Input data

5.2.2.1 Demand for electric power

The operational condition of a fuel cell power system that can be complemented with a supplementary heat generator or a thermal storage system shall be determined using typical demands for electric power by taking into account regional climate and residential characteristics.

By default, one of the electricity demands described in Annex A that is appropriate for the assessment shall be selected. If Annex A does not provide an appropriate electricity demand, a different electricity demand may be selected or defined. A justification for the use of the selected or defined electricity demand shall be provided. The selected electricity demand should be published by a national or international energy-related authoritative institution.

5.2.2.2 Demand for heat

In order to determine the operational condition of fuel cell power systems that can be complemented with a supplementary heat generator or a thermal storage system, typical demands for heat shall be used considering regional climate and residential characteristics.

By default, one of the heat demands described in Annex A that is appropriate for the assessment shall be selected. If Annex A does not provide an appropriate heat demand, a different heat demand may be selected or defined. A justification for the use of the selected or defined heat demand shall be provided. The selected heat demand should be published by a national or international energy-related authoritative institution.

5.2.2.3 Global warming potentials (GWP)

GWP values for a 100-year time horizon from the Intergovernmental Panel on Climate Change (IPCC) shall be used.

5.2.3 Determination of necessary parameter values

5.2.3.1 General

The test conditions described in Clause 11 of IEC 62282-3-201:2017 shall apply to a stationary fuel cell power system without a supplementary heat generator for performance testing.

The general test conditions described in 5.4.1 of IEC 62282-3-400:2016 shall apply to a stationary fuel cell power system without a supplementary heat generator for performance testing.

5.2.3.2 Electric efficiency

Electric efficiency, η_{el} expressed in per cent, of the fuel cell power system shall be calculated with the following equation:

$$\eta_{el} = \frac{P_n}{P_{fin}} \times 100\ \% \tag{1}$$

where

η_{el} is the electric efficiency (%);

P_n is the average net electric power output (kJ/s);

P_{fin} is the average fuel power input (kJ/s).

The electric efficiency shall be documented. One may want to add further documentation requirements.

5.2.3.3 Heat recovery efficiency

Heat recovery efficiency, η_{th} expressed in per cent, shall be calculated by the following equation:

$$\eta_{th} = \frac{P_{HR}}{P_{fin}} \times 100\ \% \tag{2}$$

where

η_{th} is the heat recovery efficiency (%);

P_{HR} is the average recovered thermal power (kJ/s), i.e. without any heat losses;

P_{fin} is the average fuel power input (kJ/s).

The heat recovery efficiency shall be documented together with the average heat recovery fluid temperatures, T_{HR1} and T_{HR2}, measured during the efficiency tests.

5.2.3.4 Overall energy efficiency

The overall energy efficiency, η_{total} expressed in per cent, shall be calculated as follows:

$$\eta_{total} = \eta_{el} + \eta_{th} \tag{3}$$

where

η_{total} is the overall energy efficiency (%);

η_{el} is the electric efficiency (%);

η_{th} is the heat recovery efficiency (%).

The overall energy efficiency shall be documented. One may want to add further documentation requirements.

5.2.3.5 Estimation of electric and heat recovery efficiency up to ten years of operation

From an LCA point of view, the treatment of electric efficiency degradation of fuel cell power systems is necessary, as described in 4.3.

The estimation of electric efficiency (see 5.2.3.2) and heat recovery efficiency (see 5.2.3.3) for ten years of operation shall be based on tests. An estimation method from IEC 62282 (all parts) shall be used, once available.

5.2.4 Calculation

5.2.4.1 General

Global warming due to GHG emissions shall be assessed in terms of global warming potential (GWP) expressed in CO_2-equivalents. Emissions of individual GHG shall be computed by multiplying the fuel consumption representative for the lifetime of the fuel cell power system by a corresponding emission intensity. Then these emissions shall be multiplied by the corresponding GWP (see 5.2.2.3). If the fuel cell power system cannot meet the demands of electricity and hot water, the additional electricity from the grid and/or fossil fuel for the supplementary heat generator and the thermal storage system, if applicable, shall be included in the calculation. Note that these emission intensities are based on the ones obtained for the area in which the fuel cell power system is installed.

5.2.4.2 Calculation of total GHG

The total GHG emissions for the target duration shall be calculated as:

$$GHG_{total}\left[\frac{NEP_{FC}}{\eta_{el\ FC}} \times 100 \times GHG_{fuel\ \ FC} + NEI \times GHG_{el\ \ G} + \frac{STED}{\eta_{th\ S}} \times 100 \times GHG_{fuel\ \ S}\right] \tag{4}$$

where

NEP is the total annual net electricity production of the fuel cell, FC (kW · h_{el} per year);

NEI is the net annual electricity import from the grid (total electricity demand – electricity produced by the fuel cell) (kW · h_{el} per year);

STED is the annual supplementary thermal energy demand (kW · h_{th} per year);

NOTE STED is zero when the supplementary heat generator is not used.

η_{el} is the electric efficiency of the fuel cell, FC, in % (kW · h_{el} per kW · h_{fuel}), representative for the target duration (see 5.2.3.5);

η_{th} is the heat recovery efficiency of the supplementary heat generator, S, in % (kW · h_{th} per kW · h_{fuel}), representative for the target duration (see 5.2.3.5);

GHG_{fuel} is the GHG emission intensity of the fuel used in the fuel cell, FC, or the supplementary heat generator, S (g CO_{2-eq} per kW · h_{fuel});

GHG_{el} is the GHG emission intensity of the electricity grid, G, in the geographical region where the fuel cell power system is operated, accounting for any losses and other inefficiencies between electricity production and consumption in the household (g CO_{2-eq} per kW · h_{el});

GHG_{total} is the total GHG emissions (g CO_{2-eq}).

5.2.4.3 GWP of input fuel

GWP for 100 years shall be widely used. The related characterization factors are provided as part of the Intergovernmental Panel on Climate Change (IPCC) reports. All GHG emission intensities of input fuel shall be used to obtain its CO_2 equivalent value.

For the GWP of a fuel consisting of different substances (mixed fuel), the characterization factor is calculated on the basis of its individual components. The GWP of a mixed fuel is calculated as a weighted average, derived from the sum of the weight fractions of the individual components multiplied by their respective GWP, including substances covered. The GHG emission intensity (GHG_{fuel}) of a mixed fuel for the fuel cell power system and/or the supplementary heat generator, shall be calculated in accordance with a mass fraction of each gaseous component and a heating value of the mixed fuel. In addition, the emissions of upstream processes (indirect emissions) shall be taken into account as a CO_2 equivalent. Both direct and indirect emissions are included in GHG_{fuel}.

NOTE 1 The carbon content in the mixed fuel is assumed to accomplish complete combustion (direct emissions).

The GHG_{fuel} of a fuel cell power system using a mixed fuel shall be calculated as follows:

$$GHG_{fuel} = \sum_{j} \frac{Xm_j \times GWP_j \times 1000}{Q} \tag{5}$$

where

GHG_{fuel} is the GHG emission intensity of the fuel used in the fuel cell, FC, or the supplementary heat generator, S (kg CO_{2-eq} per kW · h_{fuel});

Xm_j is the mass fraction (weight %);

GWP_j is the GWP of the j-th substance in the fuel (kg-CO_{2-eq}/g);

Q is a heating value of the mixed fuel (kW · h_{fuel}/kg);

Furthermore, GHG_{el} of a mixed fuel origin is calculated as a CO_2 equivalent in the same way.

NOTE 2 The GHG emissions for fuel substances of GHG_{fuel} or GHG_{el} can be obtained from LCA databases.

5.3 Abiotic resource depletion potential (ADP)

5.3.1 General

Abiotic resource depletion is adopted for the impact assessment during manufacturing and operation.

Abiotic resource depletion encompasses both the use of non-renewable (such as minerals, metals and fossil fuels) and renewable abiotic resources. For the purposes of this document, only the depletion of non-renewable resources shall be taken into account.

If data on non-renewable abiotic resources cannot be obtained with reasonable effort, it shall be documented and reported for which processes, materials, energy uses, etc. data is missing.

5.3.2 Calculation of the total ADP

The characterization factor of abiotic resource depletion potential (ADP) is derived for each extraction of elements and is a relative measure with the depletion of the element of antimony as the reference. In this method, the LCI results of extraction of elements (in kg) or fossil fuels (in kg, m^3 of natural gas or MJ of fossil energy) is multiplied by the characterization factor (in kg-Sb eq. per kg, per m^3 of natural gas or per MJ of fossil energy extracted) to obtain an indicator value (in kg-Sb eq.).

NOTE See also the method in the Handbook on Life Cycle Assessment (Operational Guide to the ISO Standards).

$$\mathrm{ADP_{total}} = \sum_{\mathrm{k}} \mathrm{ADP_k} \times m_\mathrm{k} \tag{6}$$

where

$\mathrm{ADP_{total}}$ is the total abiotic resource depletion potential (ADP) (kg-Sb eq.);

$\mathrm{ADP_k}$ is the abiotic resource depletion potential of resource k (kg-Sb eq. per kg, per m^3 of natural gas or per MJ of fossil energy extracted);

m_k is the quantity of resource k extracted (kg, m^3 of natural gas or MJ of fossil energy).

6 Communication and verification

6.1 General

This document may be utilized for the purpose of communicating to consumers the two types of environmental impacts of fuel cell power systems that can or cannot be complemented with a supplementary heat generator or a thermal storage system (6.2). A verification should be conducted (6.2.4).

6.2 Communication

6.2.1 General

When communicating the environmental impacts of a fuel cell power system that can or cannot be complemented with a supplementary heat generator or a thermal storage system, the manufacturer shall do his utmost to avoid misleading the public or specific customers. The manufacturer shall clearly communicate the limitation of the assessment. At least it shall be communicated that upstream emissions for extracting, transporting and processing the minerals and fuels are not included, and that only two impact categories are considered (climate change and abiotic resource depletion) while other categories of environmental impact are neglected (local air pollution, acidification, eutrophication, etc.). The manufacturer shall consider the intended audience when communicating the information derived from this study.

To ensure that the manufacturer presents the results of this study in a way that is accurate, clear, specific and unambiguous, and to ensure that the audience understands the content, the manufacturer shall:

– ensure the communication (including imagery) is, in its entirety, a truthful and accurate representation of the obtained results or what is likely to occur in practice. Even if literally true, the claim shall be formulated in such a way that it is not easily misinterpreted nor omits any significant information,

– where necessary, use supplementary information, which is clear, and complementary, to qualify the communication,
– include a) to g) in the LCA:
  a) identification and description of the organization making the declaration;
  b) description of the product including an indication of whether or not the fuel cell power system is complemented with a supplementary heat device;
  c) product identification (e.g. model number);
  d) date of publication and period of validity of the communication;
  e) additional environmental information;
  f) statement that environmental declarations from different programmes may not be comparable;
  g) information on where explanatory material may be obtained.

The environmental impacts of a fuel cell power system that can or cannot be complemented with a supplementary heat device quantified in accordance with this document shall only be communicated to consumers in the regions for which the region-specific data (e.g. emission intensities and energy demands) are applicable.

When communicating environmental impacts quantified in accordance with this document, the two environmental impacts of fuel cell power systems shall be included, that is, global warming and abiotic resource depletion, which are associated with GHG emissions in the use stage and utilization of abiotic resources in the manufacturing and use stage, respectively. It shall be communicated whether or not the fuel cell power system in question is complemented with a supplementary heat generator or a thermal storage system. A technical description of these systems that is adequate for business to consumer communication shall be provided.

NOTE See IEC TR 62725:2013, 9.2.

6.2.2 Communication relating to a fuel cell power system alone

In addition to what is stated in 6.2.1, the text of

Figure 4 shall be used when communicating the environmental performance of a fuel cell power system alone, to the consumer. The parts in brackets (< >) shall be specified.

Environment-related information

The following environment-related information concerns the product <brand name> from the manufacturer <company name> with a rated capacity of <...> kW electric. The product is a fuel cell power system.

The results have been obtained for a typical energy demand of a <two-storey house for 4 people with a total floor area of 120 m^2 in Tokyo, Japan or …> in accordance with the Technical Specification IEC TS 62282-9-101. The heating and electricity demands correspond to <…> and <…> kW·h per year, respectively. The information provided below has been verified by an expert from <verification company … > independent of the manufacturer.

The results for GHG emissions of this product have been obtained based on general assumptions. These assumptions and especially the GHG emission intensity of the electricity grid do not necessarily reflect the real situation in which the product will be used. The GHG emission intensity of the electricity grid corresponds to <Japanese average electricity mix, or the European average mix or a given country's renewable mix or …>. It amounts to <…> (t $CO_{2\text{-eq}}$ per kW·h_{el}).

The fuel assumed to be used in the fuel cell is <hydrogen from … or natural gas or …>. The fuel for the fuel cell is assumed to be supplied by means of <hydrogen produced by natural gas steam reforming in China and imported to ….>.

The potential user of this product is invited to compare its environmental performance with comparable products if the information provided is in accordance with the same Technical Specification (IEC TS 62282-9-101).

GHG emissions during the use phase and the fuel supply of the product amount to <….> kg CO_2-equivalents for both the heating and electricity demands specified above.

The use of minerals, metals and fossil fuels during the manufacturing and the use phase of the product amounts to <…> kg antimony-equivalents for both the heating and electricity demands specified above.

Figure 4 – Communication relating to a fuel cell power system

6.2.3 Communication relating to a fuel cell power system with a supplementary heat generator and thermal storage

In addition to what is stated in 6.2.1, the text of

Figure 5 shall be used when communicating the environmental performance of a fuel cell power system with a supplementary heat generator and thermal storage system, to the consumer. The parts in brackets (< >) shall be specified.