

# Guidelines for Assessing the Contribution of Products to Avoided Greenhouse Gas Emissions

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## 1. Introduction

### 1.1. Background

Recently, some efforts are being made in Japan to guide the assessment of the contributions to reduce greenhouse gas emissions, particularly in industries such as the chemical industry and the electrical/electronics industry. Local governments, such as Kawasaki City and Shiga Prefecture in Japan, have started to guide and support various actors in quantifying the contributions to reduce greenhouse gas emissions as part of their environmental management policy. Throughout the world, there is a growing interest in the calculation of avoided greenhouse gas emissions; the International Council of Chemical Associations (ICCA) and the World Business Council for Sustainable Development (WBCSD) chemicals Chemical Sector project, Reaching Full Potential, have published guidelines for calculating avoided greenhouse gas emissions, while the Greenhouse Gas Protocol is looking to the development of such methods.

The scope of these guidelines released by industry associations applies to some specific industry sectors. There is little consistent and consensual methodology for the calculation of greenhouse gas reduction contributions, including the allocation of contribution to the relevant actors. In this context, the Working Group on Assessing the Contribution to Avoided Emissions has been established by the Institute of Life Cycle Assessment, Japan to identify general principles of methodologies for assessing the contribution to reduce greenhouse gas emissions by reviewing existing guidelines of industries and local governments and organizing the way of thinking about calculating and assessing such contributions.

### 1.2. Goal of the Guidelines and scope of application

The Guidelines are intended to guide companies and organizations in calculating and assessing the contribution of their products, materials and components (“targets”) to avoided greenhouse gas emissions through the life cycle in comparison with a baseline, such as product(s) manufactured by the company or organization in the past.

The target impact category in the Guidelines is set as climate change. Seven types of greenhouse gases are selected as relevant elementary flow to climate change, based on the consensus of the 17th session of the UNFCCC Conference of the Parties (COP17) and the 7th Session of the Conference of the Parties serving as the Meeting of the Parties (CMP7): carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O), hydrofluorocarbons (HFCs), perfluorinated carbons (PFCs), sulfur hexafluoride (SF<sub>6</sub>), and nitrogen trifluoride (NF<sub>3</sub>). However, if a reason is clearly stated, the assessment

specific to one or more of these greenhouse gases may be implemented. The latest version of impact factors given in the assessment report by the Intergovernmental Panel on Climate Change (IPCC) should be used. In addition, if significant influences are expected in terms of issues of impact categories other than global warming, then a note on those influences should be added in the report.

### 1.3. Relationship with existing standards and guidelines

The following international standards and guidelines were referred to in creating the Guidelines.

- ISO14040: Environmental management – *Life Cycle Assessment* – Principles and framework (2006)
- ISO14044: Environmental management – *Life Cycle Assessment* – Requirements and guidelines (2006)
- L.1410: Methodology for the assessment of the environmental impact of information and communication technology goods, networks and services (2012)
- IEC TR62726: Guidance on quantifying greenhouse gas emission reductions from the baseline for electrical and electronic products and systems (2014)

Those existing guidelines listed below were reviewed to organize the way of thinking about calculating and assessing the contribution to avoided greenhouse gas emissions.

- World Business Council for Sustainable Development / World Resources Institute, The GHG Protocol for Project Accounting (2005)
- The City of Kawasaki, The calculation guidelines for outside contributions (2012)
- Shiga Prefectural Government, Guideline for quantifying the contribution to avoided emissions by products and services (2013)
- International Council of Chemical Associations / World Business Council for Sustainable Development Chemicals, *Addressing the Avoided Emissions Challenge* (2013)
- Green IT Promotion Council, GIPC Survey and Estimation Committee Report FY2008-2012--Contribution of Green IT to Realization of a Low Carbon Society-- (2013)

### 1.4. Assumed situations for applying the Guidelines

The Guidelines are developed based on anticipating them being applied by those companies and organizations producing final products or components that are expected to contribute to the reduction of greenhouse gas emissions. These companies or

organizations can use the results of the assessment internally for their product development, as well as externally for communication including publication in CSR reports, etc. The Guidelines are also intended to provide guidance to national and local governments as well as industry groups in the development of their guidelines and institutions regarding the contribution to avoided greenhouse gas emissions.

## 2. Definition of the “contribution to avoided emissions”

In the Guidelines, the “contribution to avoided emissions” is defined as the “quantified amount of contribution of the target product to reduced greenhouse gas emissions through the whole life cycle of final product(s) which achieve the reduction effects on environmental loads, in comparison to a baseline amount”. Please see Section 3.5 for a detailed definition of “baseline”.

## 3. Calculating the “contribution to avoided emissions”

### 3.1. Calculation method

The “contribution to avoided emissions” can be calculated by multiplying three quantities listed below. Note that the avoided greenhouse gas emissions per functional unit (1) shall be calculated in compliance with ISO14040:2006 and ISO14044:2006.

- (1) The net reduction amount of greenhouse gas emissions per functional unit of final product(s) which achieve the reduction effects, relative to a baseline based on life cycle assessment (see Section 3.6)
- (2) The amount of final product(s) in use (sold) that is/are expected to achieve the reduction effects (see Section 3.7)
- (3) The contribution ratio of the target to the reduction (see Section 3.8)

If the amount of final product(s) in use (sold) is difficult to be tracked and identified, including the case of new product(s) that has/have not yet been launched onto the market, the contribution to avoided emissions per functional unit may be used as a substitution without multiplying the amount of final product(s) in use (sold). However, in that case, the calculated results should be clearly noted as the contribution to avoided emissions “per functional unit”.

### 3.2. Defining the scope

The scope of the assessment shall be clarified when the calculation is implemented. In

addition, the reason for implementing the assessment as well as the recipients and ways of reporting should be clarified.

### 3.3. Defining the target product(s)

In the Guidelines, the product(s) that is/are targeted for calculating the avoided emissions is defined as the “target product(s)”. While in some cases the target product(s) is/are the final product(s) which achieve the reduction effects, in other cases the target product(s) may be a component(s) that provides a part of the functionality of final product(s) which achieve the reduction effects (examples are shown below). The Guidelines may be applicable to either of these cases.

- Final product(s) which achieve the reduction effects per se, e.g. cars and refrigerators
- Component(s) that provides a part of the functionality of final product(s) which achieve the reduction effects, e.g. tires of vehicles and refrigerant of refrigerators

### 3.4. Functional unit of final product(s) which achieve the reduction effects

#### 3.4.1. Identifying final product(s) which achieve the reduction effects

It shall be clarified whether the target product achieves the reduction effects per se, or the target product is a component that provides a part of the functionality of final product(s) which achieve the reduction effects. Final product(s) shall be identified, especially for the case where the target product is a component of final product(s) which achieve the reduction effects.

In the case where the target product is used as a component of multiple final products which achieve the reduction effects, the calculations should be performed for each of the final product(s) which achieve the reduction effects. However, if it is difficult to calculate the avoided emissions for all of the multiple final products, representative product(s) may be chosen for the assessment. In that case, the reason for that choice shall be clearly shown.

#### 3.4.2. Functional unit

The functional unit of final product(s) which achieve the reduction effects shall be set for the assessment. The functional unit quantifies the performance of final product(s) based on the identified function(s) of final product(s) which achieve the reduction effects. The durations and regions in which final product(s) is/are used shall also be specified as functional unit. The duration of use of final product(s) should be set with reference to the legal durable years, the physical lifetime, and the replacement time of final

product(s).

### 3.5. Defining the baseline

The contribution to avoided emissions shall be calculated by hypothesizing the case where the target product is absent and comparing greenhouse gas emissions in such case with those in the case where the target is used. The product that is assumed to be used in the absence of the target product(s) is defined as the “product for comparison” in the Guidelines. If the product for comparison is a final product which achieve the reduction effects, the product for comparison per se can be determined as the “baseline”. If the product for comparison is a component that provides a part of the functionality of the final product(s) which achieve the reduction effects, the final product(s) that incorporates the product for comparison is determined as the “baseline”. Functional unit for both systems of final product(s) which achieve the reduction effects and the baseline shall be absolutely identical. Note that the disclosure of the results to the public could be comparative assertion in some cases depending on the definition of the baseline. Comparative assertion to the public shall comply with ISO14044:2006.

The following is a list of possible choices for the product for comparison.

- Product(s) with the highest market share
- Product(s) that is/are publicly acknowledged as the average of the product category
- Previous version of the product(s) of the same company
- Product(s) that can be fitted for standard values that are determined based on legislations or regulations
- Product(s) before new technologies are developed

When defining the baseline, the grounds for the definition of the baseline shall be clearly shown.

### 3.6. Calculation of emissions per functional unit

#### 3.6.1. Defining the boundary of the assessment

To assess the contribution of avoided greenhouse gas emissions, the calculated results through the entire life cycle should be compared between the cases of final product(s) which achieve the reduction effects and the baseline. The names and number of life cycle stages may be defined corresponding to the characteristics of final product(s) which achieve the reduction effects.

A life cycle flow diagram indicating the main processes in the product system should

be created in order to understand differences of the life cycles between final product(s) which achieve the reduction effects and the baseline.

### 3.6.2. Data collection and data quality

Data collection and data quality shall comply with ISO14040:2006 and ISO14044:2006. Different secondary data shall not be used for those processes that are common to final product(s) which achieve the reduction effects and the baseline.

### 3.6.3. Simplified calculation approach

If there are any absolutely identical processes between final product(s) which achieve the reduction effects and the baseline, calculation for such identical processes may be omitted. Calculation of greenhouse gas emissions for processes that are not identical but very similar between final product(s) which achieve the reduction effects and the baseline may also be omitted on the condition that only a minor or negligible difference for the entire life cycle between those similar processes can be found. Such a specially-designed approach for the calculation of greenhouse gas emissions is defined as a “simplified calculation approach” in the Guidelines.

When applying a simplified calculation approach, the ratio of avoided emissions relative to the baseline shall not be disclosed to the public for the purpose of declaration. This is because the assessment based on a simplified calculation approach represents only a comparison along a limited part, not the whole of the life cycle. This can result in a higher ratio of avoided emissions compared to the full assessment through the entire life cycle.

### 3.7. Identifying the amount of final product(s) in use (sold)

The reduction of greenhouse gas emissions can be achieved only after final product(s) is/are actually in use. Therefore, the amount of final product(s) in use (sold) during a specified time period intended for the assessment needs to be identified.

If it is difficult to acquire data on the sales volume, the production volume or the shipping volume may be substituted. The countries or regions in which the final product(s) which achieve the reduction effects is used should be identified to clearly define the calculation method.

When calculating the expected avoided emissions in future by newly developed products, an anticipated volume of sales in future scenarios may be substituted. In that case, the details of such defined scenarios for future sales shall be explained. Note, however, that actual sales records shall be used for the calculation of avoided emissions of final product(s) sold in the past.

### 3.8. Defining the contribution ratio

Avoided emissions throughout the life cycle of final product(s) are the results of efforts by various stakeholders related to the value chain. Avoided emissions of a final product that achieves the reduction effects need to be attributed to individual target product(s), based on their contribution ratio determined. In that sense, those stakeholders deserved to share avoided emissions should be identified depending on their contribution to avoided emissions. While in some cases all stakeholders through the life cycle (e.g. including retailers, sales and advertising agents) can be selected if the avoided emissions are accomplished by all of them, in other cases only some of them that are relevant to the manufacturing stage of final product(s) which achieve the reduction effects may be determined as contributors if such reduction of emissions is attributable to the manufacturing processes. As a basis for allocation of avoided emissions to stakeholders, the extent of technological contribution to such reduction or the value added from components and services in the production of final product(s) which achieve the reduction effects may be used.

In existing guidelines for the calculation of avoided emissions, a determination of the contribution ratio based on the consensus among stakeholders or independent original criteria determined by the evaluators themselves are also accepted. Reference information of these existing guidelines is available in the section “References” of the Guidelines.

A method used for determining the contribution ratio and the basis shall be clarified when the calculated results of avoided emissions are used for communication.

In the case where the contribution ratio cannot be quantitatively determined, qualitative explanations about how the target product(s) contributes to the avoided emissions through the life cycle of final product(s) which achieve the reduction effects shall be provided in communication as additional information, along with the calculated results of avoided emissions.

### 3.9. Sensitivity analysis and uncertainty analysis

Sensitivity analyses and uncertainty analyses should be implemented to confirm how much the results of calculated avoided emissions could change.

## 4 Reporting

The ways for communicating the calculation results of avoided emissions to stakeholders will depend on the scope of the assessment. The following items should be commonly included in reports for third parties.

- Scope of the assessment
- Definition of the target product
- Identification of final product(s) which achieve the reduction effects
- Functional unit, including product lifetime and the temporal and spatial scope of the assessment
- Definition of the baseline, including the reason for the definition
- Boundary of the assessment
- Details of the simplified calculation approach (if adopted)
- Methods for data collection
- Data quality
- Amount of final product(s) in use (sold), including a specified time period while the target product(s) is/are in use
- Contribution ratio and the way of the determination
- Calculated results of the contribution to avoided emissions
- Interpretation
- Critical review

## 5 Critical review and verification

Generally, a critical review or verification of the reports should be performed. The verification process is not necessarily limited to that by a third party.

## 6 Terminology

### **Value chain:**

A chain consisting of a sequence of values related to products and organizations from the stage of raw material procurement through the use of the product(s) to the disposal. Consumers using the product(s) are included in the value chain.

### **Target product(s):**

The product(s) that is/are targeted for calculating the avoided emissions.

### **Product(s) for comparison:**

The product(s) that would be used if the target product were not developed or in use.

### **Final product(s) which achieve the reduction effects:**

Final product(s) that is/are expected to achieve the reduction in greenhouse gas emissions. If the target product is a final product per se, it represents the final product which achieves the reduction effects.

### **Baseline:**

In the case that the target product is a final product which achieve the reduction effects, the baseline is the “product for comparison”. In the case that the target product is a component providing a part of the functionality of final product(s) which achieve the reduction effects, the baseline is final product(s) that incorporates the product for comparison. The functional unit of the baseline shall be identical to that of final product(s) which achieve the reduction effects.

### **Amount of final product(s) in use (sold):**

The amount of final product(s) that has been sold and used within a specified time period.

### **Specified time period while the target is in use:**

The duration of time period intended for the assessment of avoided emissions of the target product after the final product(s) has/have started to be sold.

**Contribution ratio:**

The allocation ratio for calculating the amount of avoided emissions attributable to the target product(s) depending on its contribution.

**Simplified calculation approach:**

The calculation methodology that allows omission of identical processes from the calculation of greenhouse gas emissions on the condition that only a minor or negligible difference in greenhouse gas emissions between processes of final product(s) which achieve the reduction effects and the baseline can be seen.

## References

[1] Green IT Promotion Council, GIPC Survey and Estimation Committee Report FY2008-2012 -Contribution of Green IT to Realization of a Low Carbon Society- (2013), pp.265-317 (in Japanese)

URL: <http://home.jeita.or.jp/greenit-pc/activity/reporting/110628/pdf/survey01.pdf>

[2] Japan Electronics and Information Technology Industries Association (JEITA), Electronic Components Board, Subcommittee on Electronic Components Technology Environment, and Semi-Conductor Board (JSIA), Semiconductor Environment Committee, “A calculating method to estimate semiconductors and electronic components contribution to other industries’ CO<sub>2</sub> reduction”, 54p (in Japanese)

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[3] The City of Kawasaki, The calculation guidelines for outside contributions, pp.18-21 (in Japanese)

URL: <http://www.city.kawasaki.jp/300/cmsfiles/contents/0000044/44994/guidline.pdf>

[4] The International Council of Chemical Associations (ICCA) and the World Business Council of Sustainable Development (WBCSD), Addressing the Avoided Emissions Challenge, pp.26-33

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