ZCB GUIDELINE

EXISTING BUILDING



ZCB COUNCIL

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ZCB Certification Principles 01

1. ZCB Certification Principles

Zero Carbon Building Certification (ZCB Certification) applies the following principles.

1.1 General

Applying the principles is a basic requirement to ensure that information of greenhouse gas (GHG) is accurate and fair. The following principles are essential and provide guidance on the application of the basic matters for the requirements of ZCB Certification.
[KS I ISO 14064-2:2019, Principle 3.1] [KS I ISO 14067:2018, Principle 5.1]

1.2 Perspectives

Quantification of carbon-neutral performance for GHG emitted and avoided takes into account all stages of the entire building process, including raw material extraction, design, production, transportation/delivery, use and disposal.
[KS I ISO 14067:2018, Principle 5.2]

1.3 Functional Or Declared Units

The evaluation of carbon-neutral performance for GHG emitted and avoided is organized around functional unit (CO2e) or declared unit (CO2e/㎡), and the results are calculated according to these functional or declared units.
[KS I ISO 14067:2018, Principle 5.3]

1.4 Iterative Approach

When conducting carbon emitted and avoided assessments in the four stages of LCA (defining goals and scope, LCI, LCIA, and interpretation of the entire process), an iterative approach is taken. The iterative approach contributes to the study of carbon emitted and avoided and the consistency of the results.
[KS I ISO 14067:2018, Principle 5.4]

1.5 Priority For Scientific Approaches

Decision-making in carbon-neutral performance assessment is based on natural science. If this is not possible, other scientific approaches included in valid international agreement within the geographical scope consistent with the objectives of certification will be used. Decisions based on eligible values are possible only when natural scientific basis is not existent or justified based on other scientific approaches or international agreements.
[KS I ISO 14067:2018, Principle 5.5]

1.6 Relevance

The selection of data and methods shall be appropriate for evaluating the amount of GHG emitted and avoided generated from the evaluated product system.
[KS I ISO 14067:2018, Principle 5.6]

1.7 Completeness

It includes carbon-neutral performance for all relevant GHG emitted and avoided that make a partial or significant contribution to the evaluated product system. It also includes all relevant information that supports the criteria and procedures. The critical level is determined by the exclusion criteria.
[KS I ISO 14064-2:2019, Principle 3.3] [KS I ISO 14067:2018, Principle 5.7]

1.8 Consistency

Carbon-neutral performance assessments of GHG emitted and avoided allow for meaningful comparisons to greenhouse gas-related information as assumptions, methods, and data are applied in the same way to reach conclusions based on target and scope definitions.
[KS I ISO 14064-2:2019, Principle 3.4] [KS I ISO 14067:2018, Principle 5.8]

1.9 Agreement

Methodologies, standards, and guidance documents already internationally recognized and adopted in product categories are applied to improve comparability between carbon emitted and avoided within a specific product category.
[KS I ISO 14067:2018, Principle 5.9]

1.10 Accuracy

Quantification of carbon-neutral performance for carbon emitted and avoided is accurate, verifiable, relevant, and non-misleading. Bias and uncertainty are limited as much as possible.
[KS I ISO 14064-2:2019, Principle 3.5] [KS I ISO 14067:2018, Principle 5.10]

1.11 Transparency

Carbon-neutral performance information is disclosed sufficiently and appropriately so that the applicant can make decisions with confidence. All relevant issues are addressed and documented publicly, comprehensive, and understandable. All relevant assumptions and appropriate references to the methodology and data sources used are provided. All estimates are explained and avoid bias to suggest what ZCB authentication wants to represent.
[KS I ISO 14064-2:2019, Principle 3.6] [KS I ISO 14067:2018, Principle 5.11]

1.12 Duplication Prevention

Once allocations for the same GHG emitted and avoided are made once, redundant calculation of GHG emitted and avoided within the research product system are prevented.
[KS I ISO 14067:2018, Principle 5.12]

1.13 Appropriateness

GHG sources, sinks, storages, data and methodologies that meet the demand of the applicant are adopted.
[KS I ISO 14064-2:2019, Principle 3.2]

1.14 Conservativity

Conservative assumptions and procedures are used to avoid overestimating GHG emitted and avoided.
[KS I ISO 14064-2:2019, Principle 3.7]

Term Definition 02

2. Term Definition

The definition of the main terms used in these guidelines shall be as follows.

2.1 Zero Carbon Building (ZCB) Certification

Certification of a building that contribute to reducing net carbon emissions by utilizing various carbon avoiding activities and low-carbon technologies to minimize the amount of carbon emitted, released or leaked in the entire process according to the Zero Carbon Building Index (ZCBI)

2.2 Zero Carbon Building Index

Percentage of carbon avoided by carbon reduction, absorption, capture, offset, and low-carbon technologies to carbon emitted within the entire process of production, construction, transportation, operation, maintenance, disposal, etc. of materials

2.3 Greenhouse gas (GHG)

A natural or artificial gas component in the atmosphere that absorbs and emits radiant heat at a specific wavelength among infrared spectra radiated by the Earth's surface, atmosphere, and clouds. GHGs include carbon dioxide (CO2), methane (CH4), nitrogen dioxide (N2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF6), the six major GHGs defined in the Kyoto Protocol
[KS I ISO 14064-2:2019, Definition 2.1]

2.4 Zero Carbon Performance

Environmental performance of the total amount of carbon emitted into the atmosphere and the amount of carbon avoided during the designated period of the entire product process according to the system boundary, such as material production, construction, transportation, operation, maintenance, and disposal

2.5 Low Carbon Technology Certification

If the applicant applies for certification of GHG avoiding for carbon-neutral performance such as low-carbon materials, construction methods, and technologies, and if the methodology for calculating GHG avoided is clearly presented through deliberation by the Certification Steering Committee, it is recognized as low-carbon technology

2.6 Greenhouse Gas Emitted

Total amount of GHG discharged to the atmosphere during the designated period of time within the entire process of production, construction, transportation, operation, maintenance, disposal, etc. according to the system boundary

[KS I ISO 14064-2:2019, Definition 2.5]

2.7 Greenhouse Gas Avoided

GHG avoided calculated through GHG avoiding activities such as GHG reduction, GHG absorption, GHG collection, and GHG offset during the designated period of the entire production process according to the system boundary, such as material production, construction, transportation, operation, maintenance, and disposal

[KS I ISO 14064-2:2019, Definition 2.7]

2.8 Baseline Scenario

Hypothesis reference cases that best reflect conditions prone to the absence of a proposed GHG project; baseline scenarios should match the duration of the project evaluated

[KS I ISO 14064-2:2019, Definition 2.19]

2.9 Global Warming Potential (GWP)

A coefficient that shows the effect of radiative forcing by converting the greenhouse gases into equivalent mass-reference units of carbon dioxide over a given period of time

[KS I ISO 14064-2:2019, Definition 2.20]

2.10 Carbon Dioxide Equivalent (CO2e)

A unit converted into carbon dioxide, etc., according to the Global Warming Potential (GWP), which expresses the contribution of global warming by type of GHG in figures.

[KS I ISO 14064-2:2019, Definition 2.21]

2.11 Certification Grade

Final grade of ZCB Certification granted according to the ZCBI throughout the production, construction, transportation, operation, maintenance, and disposal of materials

2.12 Operation Organization

It operates athe ZCB Certification system and operates to efficiently disseminate and revitalize the certification system, assign and educate certification organizations, and includes Korea Institute of Building Construction (KIC), Korean Recycled Construction Resources Institute (KOREC), Korea Institute for Structural Maintenance and Inspection (KSMI), Sustainable Smart City Center (SUSC)

2.13 Certification Organization

Korea Conformity Laboratories (KCL), Korean Testing Certification Institute (KTC) and Zero Carbon Building Center (ZCB Center) are entrusted with the certification work as organizations designated by the operation organization to perform ZCB Certification work

2.14 Zero Carbon Building Design

It is a carbon-neutral design in various areas such as architecture, structure, landscape, machinery, electricity, and renewable energy to realize carbon neutrality in the building sector, and is divided into Carbon Passvie Design, Carbon Active Design, and Carbon Potential Design

2.15 Zero Carbon Building Assessor

A person who assesses carbon-neutral performance of a building and performs tasks for reducing and managing carbon emissions and has completed education and training on carbon-neutral performance and ZCB Certification of a building from operation organization, and has been selected after testing procedures

2.16 Life Cycle

Continuous interrelated steps in the production from acquisition of raw materials to final disposal

[KS I ISO 14040:2006, Definition 3.1], [KS I ISO 14067:2018, Definition 3.1.4.2]

2.17 Life Cycle Assessment (LCA)

Techniques for aggregating and evaluating the inputs, outputs, and potential environmental impacts of a product throughout the production

[KS I ISO 14040:2006, Definition 3.2], [KS I ISO 14067:2018, Definition 3.1.4.3]

2.18 Life Cycle Inventory Analysis (LCI)

A step in the evaluation of the entire process of aggregating and quantifying inputs and outputs throughout the production

[KS I ISO 14044:2006, Definition 3.3], [KS I ISO 14067:2018, Definition 3.1.4.4]

2.19 Life Cycle Impact Assessment (LCIA)

A step in the evaluation of a whole process aimed at understanding and evaluating the magnitude and importance of the potential environmental impact of a product throughout the whole process of the production

[KS I ISO 14044:2006, Definition 3.4], [KS I ISO 14067:2018, Definition 3.1.4.5]

2.20 Life Cycle Interpretation

A phase of a full course assessment that assesses the findings of one or both of a list analysis or impact assessment in relation to the prescribed research objectives and scope to reach conclusions and recommendations

[KS I ISO 14040:2006, Definition 3.5], [KS I ISO 14067:2018, Definition 3.1.4.6]

2.21 Transparency

Public, comprehensive and understandable presentation of information

[KS I ISO 14040:2006, Definition 3.7]

2.22 Cut-off Criteria

Specifying the amount of material or energy consumption or environmental significance associated with the unit process to be excluded from the study

[KS I ISO 14040:2006, Definition 3.18]

2.23 Data Quality

Characteristics of data associated to meet requirements

[KS I ISO 14040:2006, Definition 3.19]

2.24 Functional Unit

Quantified performance as a reference unit

[KS I ISO 14040:2006, Definition 3.20]

2.25 Input

The flow of product, material, or energy into the process
[KS I ISO 14040:2006, Definition 3.21]

2.26 Output

The flow of product, material, or energy out of the process
[KS I ISO 14040:2006, Definition 3.25]

2.27 Reference Flow

The amount of output from the process within the given product system required to perform the function expressed in functional units
[KS I ISO 14040:2006, Definition 3.29]

2.28 Releases

Environmental emissions into the atmosphere, water system, and soil
[KS I ISO 14040:2006, Definition 3.30]

2.29 System Boundary

A set of criteria specifying that certain processes are part of the product system
[KS I ISO 14040:2006, Definition 3.32]

2.30 Waste

A substance or object that is disposed
[KS I ISO 14040:2006, Definition 3.35], [KS I ISO 14067:2018, Definition 3.1.4.9]

2.31 Building Work

Pure construction work excluding common construction work, civil engineering work, electrical work, facility work, landscaping work, etc. among all types of construction for new construction

2.32 Building Design Statement

Document specifying the name, specification, unit, quantity, etc. of materials prepared based on the drawings submitted when applying for preliminary certification of ZCB

2.33 Construction Statement

Document submitted by the construction company at the time of the construction contract specifying the material name, specification, unit, quantity, etc. required for each process

2.34 Internal Data

Data generated based on the building subject to evaluation and directly collected and managed by measuring or calculating inputs such as raw materials and auxiliary materials, energy, fuel, utilities, and emissions and waste generated from the new building

2.35 External Data

Domestic and international authorized environmental evaluation data excluding internal data, the industry average overall evaluation data, and other overall evaluation data

2.36 Environmental Impact

Positive or negative, full or partial environmental changes resulting from the environmental aspects

[KS I ISO 14001:2015, Definition 3.2.4]

2.37 Characterization Factor

Factors derived from the characterization model used to convert the results of the allotted list of processes into a general unit of the impact category index

[KS I ISO 14040:2006, Definition 3.37]

2.38 Impact Category

Distinguishing representing important environmental issues for which the results of the full course list analysis will be allocated

[KS I ISO 14040:2006, Definition 3.39], [KS I ISO 14067:2018, Definition 3.1.4.8]

2.39 Impact Category Indicator

Quantitative Indication of Impact Categories

[KS I ISO 14040:2006, Definition 3.40]

2.40 Completeness Check

The process of verifying that the information obtained during the entire evaluation phase is sufficient to reach a conclusion consistent with the objective and scope definition

[KS I ISO 14040:2006, Definition 3.41]

2.41 Consistency Check

The process of verifying that assumptions, methods, and data are consistent with the purpose and scope definition applied through research and performed before reaching the conclusion

[KS I ISO 14040:2006, Definition 3.42]

2.42 Sensitivity Check

The process of verifying that the information obtained from the sensitivity analysis is appropriate for reaching the conclusion and making recommendation

[KS I ISO 14040:2006, Definition 3.43], [KS I ISO 14067:2018, Definition 3.1.4.7]

Registration 03

3. Existing Building Certification Registration

3.1 Application for Certification

3.1.1 Rating System

The certification of existing building in the Zero Carbon Building (ZCB) Certification (hereinafter referred to as the certification of existing building) shall be subject to refurbishment or existing buildings under Article 2 (1) 8 and 10 of the Building Act. Provided that the applicant intending to apply for a rating system type excluded in the certification system, the rating system of certification may be determined in consultation with the certification organization.

3.1.1.1 Building Type

The use of existing building certification shall be subject to existing building of residential and non-residential buildings under attached Table 1 of the Enforcement Decree of the Building Act among buildings under Article 2 (1) 2 of the Building Act. Provided that dormitories referred to in section 2 (d) of attached Table 1 of the Enforcement Decree of the Building Act shall be evaluated as non-residential building.

3.1.1.2 Existing Building Recognition

The certification of existing building is for existing buildings that have been planned or whose use period has elapsed less than five years after approval for operation.

3.1.2 Application for Certification

The applicant who intends to apply for certification of existing building shall access the ZCB Certification website (http://www.zcb.or.kr) and pay the certification review or technical support fee to the head of the operation organization.

3.1.2.1 Application for Preliminary Certification

The applicant may apply for preliminary certification of existing building with the contents reflected in the design documents and the building that has obtained the preliminary certification shall obtain final certification.

3.1.2.2 Application for Technical Support

The applicant who intends to apply for ZCB Certification may apply for preliminary review and technical support for the following requirements and technologies through the ZCB Certification website (http://www.zcb.or.kr) before applying for certification.

1) Carbon emitted and carbon avoided
2) Zero Carbon Building Index (ZCBI)
3) Solution to guarantee ZCBI
4) Carbon avoiding technologies
5) Other review requests

3.1.3 Certification Expiration

The valid period of the certification shall be five years from the date of issuance. In case of the preliminary certification, if the final certification is issued, it shall be until the date of issuance of final certificate, and if the approval for operation is completed, it shall be until the date of completion of the approval for operation.

3.1.4 Re-certification

The applicant requesting re-certification due to changes in purpose of certification, expiration of certification, etc. shall consult with the certification organization for requesting re-certification. If the certificate is reissued according to the result of re-certification, the previously issued certification will be canceled.

3.1.5 Certification Review & Technical Support Fees

If the applicant applies for certification or support of ZCB Certification technology, he/she shall pay the certification review or technical support fee to the head of the operation organization within 30 days from the date of application. The scope of refund and the refund of fees shall be as follows: (if there is a prior consultation with the operation organization or the certification organization or a separate contract document, the relevant conditions shall be followed.

1) After applying for certification or receiving technical support: 90%
2) After certification review or technical support review: 50%
3) After completion of certification or technical support: 0%

3.2 Submission Documents

The applicant who applies for certification shall submit the required documents and optional documents as the following sections to the certification organization. All documents shall be submitted by the designer for the preliminary certification, and the contractor or supervisor for the final certification. If it is impossible to submit the confirmation of each partner, it shall be submitted the owner's confirmation instead.

3.2.1 Required Documents

The documents that must be submitted for the preliminary/final certification quantitative evaluation of carbon emitted. For the preliminary certification, a design approval or implementation plan documents shall be submitted. For the final certification, completion documents shall be submitted.

1) Architectural: Design overview, layout, floor plan, section, window schedule and plan
2) Structural: Structural general information, schedule and plan
3) Mechanical: Equipment schedule, HVAC system plan and diagram
4) Electrical: Lighting floor plan, lighting equipment schedule and receipt
5) Bill of quantity: Design or construction details

〈Remark 1〉 If the design or construction details are not available, the evaluation is based on the approximate volume data calculated through the reliable calculation methodology. The approximate volume calculation methodology and data source must be submitted to the certification organization.

〈Remark 2〉 In the mechanical and electrical sectors, it is evaluated by a program designed to comprehensively evaluate heating, cooling, hot water supply, lighting, and ventilation in accordance with international standards such as ISO 52016 or a result of certification based on building energy efficiency level certification and zero energy building certification standards.

〈Remark 3〉 If the applicant do not have mechanical, electrical documents or evaluation results according to **Remark 2**, he/she shall submit a statement of monthly energy use, such as power and/or gas, corresponding to 12 months or more of the building evaluated.

3.2.2 Optional Documents

The documents that can be submitted for the preliminary/final certification quantitative evaluation of carbon emitted. For the preliminary certification, a design approval or implementation plan documents can be submitted. For the final certification, completion documents can be submitted.

In case of the carbon avoided, it can be evaluated based on the submitted data on carbon reduction, carbon absorption, carbon capture, carbon offset, and low-carbon technology certification in the entire life cycle of the building, and the applicant shall submit the following documents to the certification organization to evaluate the carbon avoided of the building and guarantee the ZCBI.

1) Architectural:	Insulation plan, envelope development, window and door test report, insulation test report
2) Material:	Interior finishing material schedule, material schedule, environmental performance and low-carbon material schedule
3) Landscape:	General information on landscape, plan, biological area ratio calculation map
4) Construction:	Construction material procurement plan or specification, construction equipment operation plan or specification, site office energy use plan or specification, construction process carbon reduction plan or confirmation, disposal process plan
5) Energy:	High efficiency energy equipment (hvac, lighting systems) certificate, lighting density statement, illumination simulation
6) Renewable energy:	Documents related to new/renewable energy such as solar, fuel cells, and geothermal systems, certificates of high efficiency energy equipment and pre-use inspection report
7) Eco-friendly certification:	Building energy saving design review or implementation review, evidence document for each green building certification item, building energy efficiency rating certificate and evaluation certificate, energy report, zero energy building certificate
8) Offsetting:	Voluntary carbon credit purchase plan or receipt, export/import plan for new/renewable energy production, or contract for new/renewable energy business
9) Others:	Other carbon avoiding evidence document, low-carbon technology certification, application document

〈Remark 1〉 If the applicant do not have document in the construction and energy sectors or the evaluation and certification results, a statement of monthly energy use, corresponding to 12 months or more of the building shall be submitted.

Guideline 04

4. Guideline

4.1 Overview

4.1.1 Rating Overview

Basic information on the target for the evaluation, information on the location, layout, floor plan, dimension, number of floors, function, structure, total floor area, etc. shall be clearly provided.

4.1.2 Evaluation Criteria

The certification of existing building rating system shall be applied to existing residential and non-residential buildings which the age is less than five years after approval of operation.

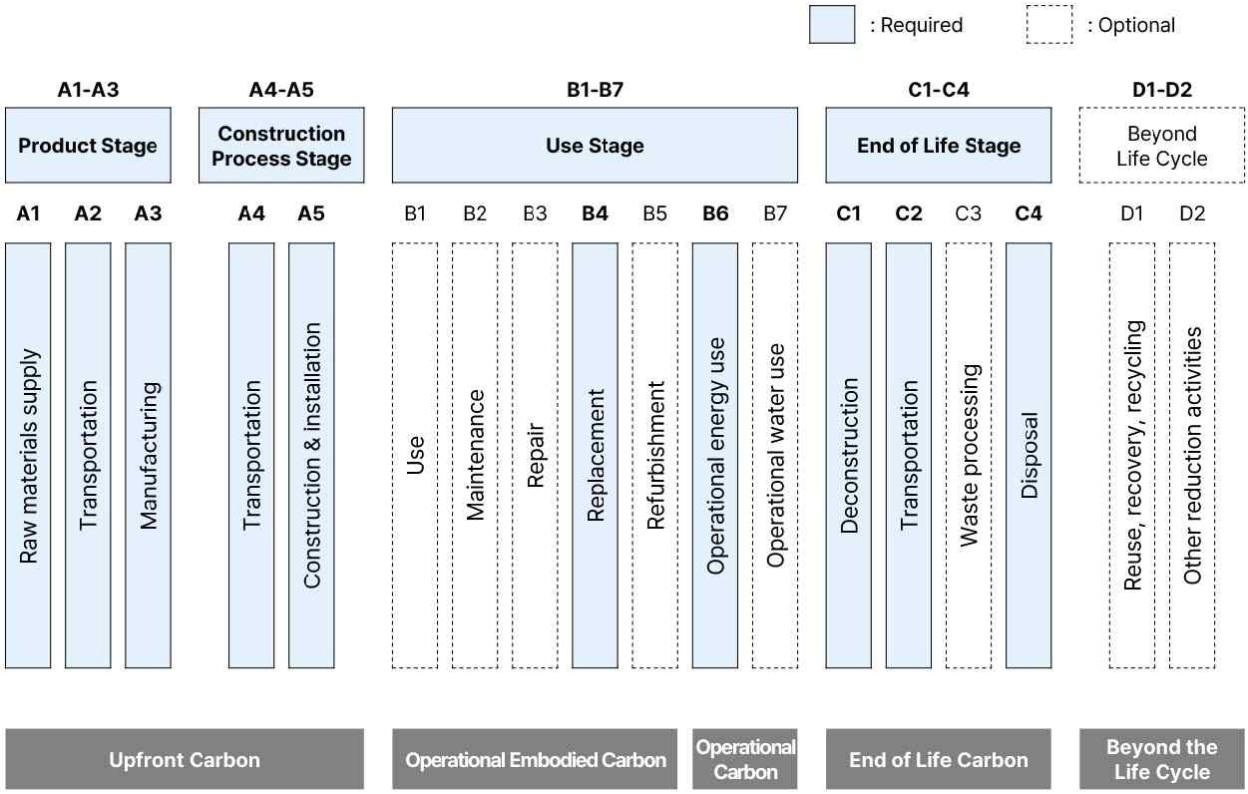
The functional unit is a quantification of the building function similar to physical unit, and in this guideline, "area (m2) of a building" is the functional unit. The input of material and energy source within the life period of the building is evaluated. The evaluation period is 50 years, and it is assumed that the same amount of energy is consumed annually.

All evaluations are based on the considered building, and carbon emitted is evaluated based on a baseline and reasonable estimation, and carbon avoided is evaluated based on internal and external data collected from each stage of the life cycle.

4.1.3 System Boundary

The system boundary of existing building certification is divided into product stage (A1-A3), construction process stage (A4-A5), use stage (B1-B7), end of life stage (C1-C4), and beyond life cycle stage (D1-D2).

Among the mentioned stages, the required evaluation must be included, and the optional evaluation can be provided by the assessor as additional information.



Existing Building System Boundary

4.1.3.1 Product Stage (A1-A3)

The product stage includes the environmental impact of all processes, such as raw material extraction, transportation, manufacturing processes, accompanying the production of materials used in construction among all types of building (common and temporary construction, civil engineering, electrical and facility construction, landscaping, etc.).

4.1.3.2 Construction Process Stage (A4-A5)

The construction process stage includes the transportation of materials used in the building and the environmental impact that occurs in construction.

4.1.3.2.1 Transportation (A4)

Transportation refers to the environmental impact of the use of vehicles to deliver materials used in construction from the shop or storage to the construction site.

4.1.3.2.2 Construction & Installation (A5)

The construction refers to the environmental impact of energy consumption of various construction equipment or operation of the site office.

4.1.3.3 Use Stage (B1-B7)

The use stage includes the environmental impact caused by the use of energy during the life of the building and the materials replaced during the maintenance.

4.1.3.3.1 Use (B1)

Use refers to the environmental impact that is directly released or absorbed by the building materials during the life of the building.

4.1.3.3.2 Maintenance (B2)

Maintenance refers to the environmental impact that occurs in activities (cleaning, etc.) by occupants during the life of the building.

4.1.3.3.3 Repair (B3)

Repair refers to the environmental impact that occurs in the process of repairing various equipment and parts of the building, which is unexpected during the life of the building.

4.1.3.3.4 Replacement (B4)

Replacement refers to the environmental impact from the production and transportation of the materials that are periodically replaced to restore the building gradually aging.

4.1.3.3.5 Refurbishment (B5)

Refurbishment refers to the environmental impact that occurs in the process of repairing, changing, or expanding the structure or the shape of the building such as pillars, beams, internal walls, and main stairs.

4.1.3.3.6 Operational Energy Use (B6)

Operational energy use refers to the environmental impact from the annual primary energy consumption of heating, cooling, hot water supply, lighting, and ventilation to maintain the indoor environment comfort.

4.1.3.3.7 Operational Water Use (B7)

Operational water use refers to the environmental impact of water resource used by occupants during the life of the building.

4.1.3.4 End-of-Life Stage (C1-C4)

The end-of-life stage includes the environmental impact that occurs in the process of dismantling buildings, the transportation material waste, and the disposal (incineration, landfill).

4.1.3.4.1 Deconstruction (C1)

The deconstruction refers to the environmental impact of energy consumption of equipment used for dismantling the building.

4.1.3.4.2 Transportation (C2)

The transportation of material waste refers to the environmental impact of the vehicles delivering material waste during the dismantling process to recycling sites, landfills, and incineration plants.

4.1.3.4.3 Waste Processing (C3)

The waste treatment process refers to the environmental impact of the energy consumption in the intermediate treatment process before the final disposal of waste generated during the dismantling process.

4.1.3.4.4 Disposal (C4)

The disposal refers to the environmental impact of incineration or landfill of waste that cannot be recycled among building material waste.

4.1.3.5 Beyond Life Cycle (D1-D2)

Beyond life cycle includes potential environmental impact contributing beneficially to the global environment by resource circulation and other carbon avoiding activities, such as dismantling and recycling, reusing, and recovering of building material waste after disposal.

4.1.4 Data Categories

The data categories are divided into inputs and outputs. Inputs can be divided into raw materials, auxiliary materials, and energy, and outputs can be divided into products, by-products, emissions, and waste. For the evaluation of the entire building process, quantitative data should be collected for each sub-stage in the system boundary. The collected data is used to quantify the inputs and outputs of the measured, calculated, or estimated.

4.1.5 Data Quality Requirements

The data used in the existing building certification shall be divided into internal and external data, and divided into regional, temporal, and technical scopes and described in the evaluation result.

4.1.5.1 Internal Data

In principle, the regional scope of internal data shall be on-site data (measured values, calculated values, etc.) collected from the considered building and the temporal scope shall be the time of preliminary or final certification. The technical scope shall be based on the design details and construction details of the building, the energy efficiency level certificate of the building (preliminary certificate of energy efficiency level in the case of preliminary certification), the quantity information and energy consumption information of building through energy simulation, etc.

Monthly energy usage data on electricity, gas, district heating, district cooling, etc. is based on official domestic data such as Korea Electric Power Corporation, Korea Gas Corporation, Samcheon-ri City Gas Corporation, and Korea District Heating Corporation.

4.1.5.2 External Data

The regional scope of external data should prefer the domestically established and authorized data, and the temporal scope should prefer the most recently established data, and the technical scope should applies the same or similar building materials and energy sources.

4.1.6 Assumption & Restriction

The certification report shall describe the assumption and restriction used in the evaluation, including calculation methods, data gaps, and baseline for construction process, use, and end-of-life stages.

4.2 Data Collection & Calculation

4.2.1 Cut-off Criteria

Cut-off criteria should be set to minimize the impact on evaluation result.

In the new building certification, the top 99% (the bottom 1% can be excluded) should be included based on the cumulative mass contribution of building materials, and details of the cut-off criteria should be included in the evaluation result.

Building materials shall include at least ten major building materials such as ready-mixed concrete, cement, stone, aggregate, rebar, steel frame, wood, and glass. If the proposed building materials are not used as major building materials, they shall be excluded from the evaluation.

If the contribution of carbon emitted among building materials that do not correspond to the top 99% based on cumulative mass contribution has a significant impact on the evaluation result, it should be included in the total carbon emitted.

4.2.2 Data Collection Method

4.2.2.1 General

In principle, data for the new building certification shall be on-site data (measured and calculated values, etc.) collected from the building. If the data is not available, appropriate general data shall be used based on the reference.

When data is collected from a public source, the source must be mentioned. If these data have a significant impact on the evaluation results, details of the relevant data collection process, the timing of the data collection, and additional information related to the data quality indicators should be mentioned. In addition, descriptions of each unit process should be recorded to reduce the risk of erroneous interpretation, such as duplicate calculations when verifying or reusing the collected data.

4.2.2.2 Collection of Carbon Emitted Internal Data

To verify the data collected for the evaluation of carbon emitted, all documents shall be accompanied by a confirmation from the designer in the preliminary certification, and a confirmation from the contractor or supervisor shall be attached in the final certification. If it is impossible to submit a confirmation from the designer, contractor or supervisor, it shall be a confirmation from the owner of the building instead.

4.2.2.2.1 Product Stage (A1-A3)

To evaluate carbon emitted in the product stage, data on the type and quantity of building materials used in construction should be collected.

Data collection is based on design details in the preliminary certification, and data on the type and quantity of building materials shall be collected based on construction details.

〈Remark 1〉 If it is impossible to collect data on the type and quantity of building materials used in construction, the evaluation is based on the approximate quantity data calculated through reliable quantity calculation methodology. In case of using the approximate quantity calculation data, information related to the source, details, collection timing, and data quality indicators of the collected data should be mentioned.

4.2.2.2.2 Construction Process Stage (A4-A5)

1) Transportation (A4)

To assess carbon emitted during the transportation, data on the type of vehicles and transportation distances for each building material in construction should be collected by referring to document such as construction standard product counting.

The transportation distance is assumed to be 30 km collectively from the manufacturing site to the construction site in accordance with the principle of consistency.

2) Installation & Construction (A5)

To assess carbon emitted during the construction, the types of construction equipment used for construction and energy consumption used in site offices should be collected by referring to specification.

For the energy consumption data during the construction process, data on similar buildings are collected by referring to specification.

4.2.2.2.3 Use Stage (B1-B7)

1) Replacement (B4)

To evaluate the carbon emitted of replacement, data on the repairing period, repairing rate, delivering vehicle and transportation distance for each building material should be collected.

The repairing period and repairing rate for each building material shall be collected by referring to the standards for establishing a long-term repairing plan in attached Table 1 of the Enforcement Rules of the Multi-Family Housing Management Act, and data shall be collected for delivering vehicles and transportion distance in the same section as "4.2.2.2.2 Construction Process Phase (A4-A5)".

2) Operational Energy Use (B6)

To evaluate carbon emitted of operational energy use, it is necessary to collect annual primary energy consumption data calculated by a program (energy simulation) designed to comprehensively evaluate heating, cooling, hot water, lighting, and ventilation of the building according to international standard such as ISO 52016.

The annual primary energy consumption data achieves certificate (preliminary certification) and energy simulation data above the equivalent level according to building energy efficiency rating certification and zero energy building certification criteria.

The operational energy use period of a new building is assumed to be 50 years collectively in accordance with the principles of consistency.

4.2.2.2.4 End-of-Life Stage (C1-C4)

1) Deconstruction (C1)

To evaluate carbon emitted during the deconstruction, it is necessary to collect the equipment capacity, fuel efficiency data, and the amount of building materials waste.

The capacity and fuel efficiency data of the dismantling equipment are collected by referring to specification, etc., and it is assumed that the amount of building materials waste generated during the deconstruction is the same as the amount of building materials input in the product stage.

2) Transportation (C2)

To evaluate carbon emitted of the transportation of building materials waste, data on the recycled volume, landfill volume, incineration volume, type of vehicle, and transportation distance from the site to recycling sites, landfills, and incineration plants should be collected by referring to specification.

The recycled volume, landfill volume, incineration volume of building materials waste shall be calculated by referring to the type and quantity data of construction materials collected in the "4.2.2.2.1 Product Stage", and the recycled rate, landfill rate, and incineration rate by building materials properties in the construction waste recycling statistical survey report or specification.

Vehicle data on construction waste transportation is collected by referring to construction standard calculations or specification, and the transportation distance from the site to the recycling site, landfill site, and incineration plant is assumed to be 30 km collectively to guarantee consistency.

3) Disposal (C4)

To evaluate the carbon emitted of the disposal of building material waste, data on the incinerated or landfill quantity should be collected.

The incinerated or landfill quantity shall be calculated by referring to the type and quantity data of construction materials collected in the "4.2.2.2.1 Product Stage", the generation and disposal status of waste in the construction waste recycling statistical survey report or specification.

4.2.2.3 Collection of Carbon Avoided Internal Data

To verify the data collected for the evaluation of carbon avoided, a confirmation from the designer shall be attached in the preliminary certification, and a confirmation from the contractor or supervisor shall be attached in the final certification. If it is impossible to submit a confirmation from the designer, contractor or supervisor, it shall be a confirmation from the owner of the building instead.

4.2.2.3.1 생산단계 (A1-A3)

To evaluate the carbon avoided in the product stage, data on the type and quantity of building materials that have obtained domestic and international environmental certification should be collected.

Building materials that have obtained domestic and international environmental certification shall be accompanied by a certificate or report of the relevant organization and if there is an expiration date in the certificate or report, the expiration date shall be valid based on the completion date of the building.

〈Remark 1〉 If only few materials obtained domestic and international environmental certification, the materials that have not obtained environmental certification are excluded from carbon avoided evaluation.

〈Remark 2〉 If materials that have obtained environmental certification are applied but data such as material type and quantity cannot be collected, the evaluation is based on the approximate quantity data calculated through reliable quantity calculation methodology. When using the approximate quantity calculation data, information related to the source, details, collection timing, and data quality indicators of the collected data should be mentioned.

4.2.2.3.2 Construction Process Stage (A4-A5)

1) Transportation (A4)

To evaluate the carbon avoided of the transportation, it is necessary to collect data on the type of delivering vehicle and transportation distance for each building material in the construction.

The actual vehicle data for each building material shall be collected, and the transportation distance is based on the distance between the manufacturing site and the construction site.

2) Construction & Installation (A5)

To evaluate the carbon avoided during the construction, it is necessary to collect data on energy consumption of construction equipment and site offices.

Energy consumption data during the construction should be collected through construction narratives or confirmation, site office operation narratives or confirmation.

〈Remark 1〉 If the building is subject to the carbon target management system or the carbon emitted trading system, construction equipment and site office energy source can be applied.

4.2.2.3.3 Use Stage (B1-B7)

1) Replacement (B4)

To evaluate the carbon avoided of replacement, data on the repairing period, repairing rate, delivering vehicle, and transportation distance for each building material should be collected.

The data on the repairing period or repairing rate of building materials that have obtained domestic and international certification should be collected. The actual vehicle data for each building material should be collected and the transportation distance is considered based on the distance between the construction site and the manufacturing site.

2) Operational Energy Use (B6)

To evaluate the carbon avoided, data issued by an accredited agency describing the capacity, efficiency, and output of new/renewable energy facilities for solar, fuel cells, and geothermal heat used in the building should be collected.

If it is impossible to collect data on the capacity, efficiency, and output of new/renewable energy facilities, it is necessary to collect data on the annual primary energy production calculated by a program (energy simulation) designed to comprehensively

evaluate heating, cooling, hot water, lighting, and ventilation of the building in accordance with international standards such as ISO 52016.

The annual primary energy production data achieves certificate (preliminary certification) and energy simulation data above the equivalent level according to building energy efficiency rating certification and zero energy building certification criteria.

If it is possible to collect data on the intrinsic carbon emitted of the new/renewable energy facilities, it is considerable by subtracting the intrinsic carbon emitted from the primary energy production.

To evaluate the carbon absorption of carbon sinks, data on the specification and types of tree planted on site should be collected.

〈Remark 1〉 If the primary energy production from new/renewable energy facilities is exported rather than used by the building, a new/renewable energy production export plan or a new/renewable energy generation business contract must be attached.

〈Remark 2〉 If the primary energy production from off-site new/renewable energy facilities is imported and used in the building, a plan for importing new/renewable energy or a new/renewable energy generation business contract must be attached.

〈Remark 3〉 If a carbon credit of voluntary carbon market is purchased, it must be purchased from a domestic and international accredited organization and a purchase plan or purchase receipt must be attached.

〈Remark 4〉 The carbon absorption amount of trees shall be subject to the annual carbon absorption amount after planting, and the carbon absorption amount during the tree growing process shall be excluded.

4.2.2.3.4 End-of-Life Stage (C1-C4)

If it is possible to clearly collect data on the end-of-life stage, the collected data shall be applied. However, this data can be replaced with potential carbon avoided data by utilizing specification such as statistical survey report, taking into account the difficulty of collecting data after the life cycle of the building, etc.

1) Deconstruction (C1)

To evaluate carbon avoided during the deconstruction, it is necessary to collect the capacity of equipment, fuel efficiency data, and the amount of building material waste.

If it is possible to collect data such as the capacity and fuel efficiency data of the dismantling equipment, the collected data are applied.

2) Transportation (C2)

To evaluate carbon avoided of the transportation of building material waste, data on the recycled volume, landfill volume, incineration volume, type of vehicle, and transportation distance from the site to recycling sites, landfills, and incineration plants should be collected by referring to specification.

The recycled volume, landfill volume, incineration volume shall use the data collected in the "4.2.2.2.1 Product Stage", such as the recycling rate, landfill rate, incineration rate, and transportation plan from the site to the recycling site, landfill, and incineration plant.

3) Disposal (C4)

To evaluate the carbon avoided of the disposal of building material waste, data on the incinerated or landfill quantity should be collected.

The incinerated or reclaimed quantity of building material waste shall be calculated by referring to the type and quantity data of construction materials collected in the "4.2.2.2.1 Product Stage", the generation and disposal status of waste in the construction waste recycling statistical survey report or specification.

4.2.2.4 Collection of External Data

The difference of the entire process database depends on the construction method of the building, the national and regional environment, etc. Therefore, the entire process database should be selected in the order of regional, temporal, and technical correlation according to the data selection criteria, and information on the used entire process data (name, construction method, area, year, source, etc.) should be presented in the evaluation result.

1) National authorized data
2) Industry average data
3) Other data

The domestic database includes the national LCI database of the Ministry of Environment and the Ministry of Trade, Industry and Energy, the LCI database of building materials of the Ministry of Land, Infrastructure and Transport, and the EcoInvent of Switzerland in case of international.

Carbon absorption sources are divided into the carbon absorption amount of the on-site tree species and the building materials. Carbon absorbers must be selected in the order of regional, temporal and technical correlation as they vary depending on the type, standard, etc. To calculate the carbon absorption amount of tree species, annual carbon absorption data according to the type, specification, and receipt of tree species should be collected, and to calculate the carbon absorption of material, data on the type, specification, and carbonation mechanism of material should be collected.

1) Calculation data of carbon absorption per year by tree type, specification, and receipt of carbon sinks
2) Carbonation mechanism data such as carbon absorbent material type, specification, ingredient, water concentration, etc

Carbon capture data shall be applied in the entire process from the product stage to the end-of-life stage of the building for carbon capture, utilization, and storage technology. The applicant shall present information on the collected carbon capture data (technical name, collection, utilization, storage method, calculation formula, development year, etc.), and the operation organization shall determine whether to apply it.

4.2.3 Data Quality Assessment

The data quality assessment checks whether the collected internal and external data meet the "4.1.5 data quality requirements".

4.2.4 Data Calculation

The calculation of the data is made through the environmental emission coefficient by applying the collected data and the entire process database.

Based on the ZCB Certification guidelines and evaluation system, this is calculated through the "BEST (Building Evaluation Simulation Tool)," a ZCB certification dedicated tool that supports the evaluation of carbon emitted and avoided and quantitatively calculates the ZCBI for carbon-neutral performance.

For the principles and structures used to perform ZCB Certification, refer to the following data.

- ISO 14040:2006 Environmental management - Life cycle assessment - Principles and framework
- ISO 14044:2006 Environmental management - Life cycle assessment - Requirements and guidelines
- ISO 14064-2:2019 Greenhouse gases - Part 2 - Specification with guidance at the project level for quantification, monitoring and reporting of greenhouse gas emission reductions or removal enhancements
- ISO 14067:2018 Greenhouse gases - Carbon footprint of products - Requirements and guidelines for quantification
- ISO 21931-1:2010 Framework for methods of assessment of the environmental performance of construction works - Part1: Buildings
- EN 15643-2:2011 Sustainability of construction works - Assessment of buildings - Part2: Framework for the assessment of environmental performance
- EN 15804:2012 Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products
- The British standards PAS 2050:2011 Specification for the assessment of life cycle greenhouse gas emissions of goods and services, and PAS 2060:2010- Specification for the demonstration of carbon neutrality

4.3 Verification Result

Zero Carbon Building (ZCB) Certification results are derived from specialized results for the impact category, including global warming (greenhouse gases), and should be expressed as the Zero Carbon Building Index (ZCBI), which is the ratio of carbon avoided in the entire building process.

$$ZCBI(\%) = \frac{Carbon\ Avoided}{Carbon\ Emitted} \times 100$$

- ZCBI (%)
- Life Cycle Carbon Emitted ($kgCO_{2e}$)
- Life Cycle Carbon Avoided ($kgCO_{2e}$)

4.3.1 Verification

The operation organization must finally verify the result of the certification organization's review for the building that has been evaluated. Verification must include data quality verification, cut-off calculation verification, and sensitivity analysis for evaluation programs on internal and external data collected, such as design details or construction details, in accordance with the ZCB Certification guidelines.

4.3.2 Certificate & Certification Plaque

The operation organization shall grant ZCB) Certification grade to building that has been reviewed and verified according to the result of ZCBI, and issue a preliminary certificate in case of preliminary certification and a final certificate and a plaque for final certification. The applicant shall notify the operation organization in advance of the result of certification when using them for publishing and posting the certification plaque at the entrance or the main lobby, etc.

4.3.3 Certification Report

Certification report may be expressed in document or audiovisual material, and all evaluation results shall include the following information to be traceable and transparent.

4.3.3.1 ZCB Certification Overview

1) Overview of building location, layout, floor plan, dimension, number of floors, function, floor area, structure type, heating method, landscape area, etc
2) Evaluation criteria: functional unit, reference flow
3) System boundary: System boundary chart, description of the stages and sub-stages of the entire process, establishment of required and optional evaluation criteria
4) Data collection: data categories, data quality requirements
5) Assumption and restriction: Scenarios for data calculation, data gap, product stage, construction process stage, use stage, end-of-life stage, and beyond life cycle stage

4.3.3.2 Data Collection & Calculation

1) Cut-off criteria: Cut-off rule and cumulative mass contribution evaluation results
2) Data collection for product stage: name, volume, ratio, data quality, LCI DB name, applied material DB name, emission coefficient contribution, etc
3) Data collection for construction process stage: material transportation, transportation distance, emission and contribution, specification, energy source, workload, etc
4) Data collection for use stage: primary energy consumption, emissions by repaired parts, primary energy production, carbon absorption, carbon capture, storage and utilization technology collection, carbon credit purchases, and offset by export/import of new/renewable energy
5) Data collection in the end-of-life stage: equipment related to the dismantling of buildings, equipment and transportation distance related to the transportation of building material waste, emissions and contributions related to recycling, etc

4.3.3.3 ZCB Certification Evaluation Result

1) Carbon emitted: Analysis value and contribution by step-by-step process
3) Carbon avoided: Analysis value and contribution by step-by-step process
3) ZCBI: carbon avoided ratio (%) for the entire building
4) Certification grade: 1 to 5 certification grades according to the ZCBI
5) Attached data: Evidence and confirmation related to carbon emitted and avoided, such as construction, structure, landscape, machinery, electricity, renewable energy, etc., related to the calculation of ZCBI by stage

This guideline describes the Zero Carbon Building Certification developed by the Zero Carbon Smart Building Center, is intended for efficient certification evaluation and operation. Unauthorized distribution and copying for other purposes are strictly prohibited, Any violation may be handled by law and regulation.

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