ZCB GUIDELINE

CERTIFICATION OUTLINE

ZCB COUNCIL

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This guideline explains the concept of certification for Zero Carbon Building (ZCB), which was launched at the Zero Carbon Smart Building Center on September 01, 2023, and includes evaluation method and preparation guideline so that it can be prepared and certified according to an appropriate procedure.

ZCB Certification is a system that certifies carbon neutrality performance in the entire life cycle by evaluating carbon emitted in the entire life cycle and carbon avoiding performance for various carbon reducing activities to contribute to the realization of carbon neutrality in the building sector and to contribute to carbon neutrality and green growth in response to the climate change crisis.

The Zero Carbon Smart Building Center conducts various research, education, and technology development and exchanges related to zero carbon building through various construction-related academic societies and public-private cooperation in order to develop a sustainable carbon-neutral society as an educational and research institute.

We hope that ZCB Certification will raise awareness of carbon neutrality, induce voluntary participation in a carbon-neutral society, and contribute to the realization of carbon neutrality in the sustainable building sector through low emissions and optimal reductions rather than high emissions and high reductions.

2023 - 09 - 01

Zero Carbon Smart Building Center

Overview 01

1. Zero Carbon Building Certification Overview

Since the Kyoto Protocol to the Climate Change Convention was adopted in 1997, the world has been making efforts to reduce the environmental impact and greenhouse gas. In particular, the construction industry, which is characterized by significant energy consumption and waste generation, accounts for more than 40% of carbon emissions in the total industry, so research and development on carbon neutrality to preserve the global environment is vital and challenging.

As not only carbon emitted in the operation process but also embodied carbon emitted in the production, transportation, construction, dismantling, and disposal of building materials account for more than 25% of the total carbon emissions, it is necessary to establish a carbon-neutral performance evaluation and management system from the perspective of the entire life cycle in the building sector.

Advanced environmental countries such as USGBC in the United States, BRE in the United Kingdom, CAGBC in Canada, and ILFI in Australia have established and operated a carbon-neutral performance evaluation and management system in terms of the entire life cycle of buildings led by private institutions.

A systematic integrated system that can quantitatively evaluate and manage the carbon-neutral performance of buildings should be developed for the sustainable development of smart cities, including achieving the national carbon-neutral goal of 2050 and responding to the climate change crisis.

In response to these environmental and social demands for global carbon neutrality, the ZCB Center (Zero Carbon Smart Building Center) began Korea's first Zero Carbon Building Certification (ZCB Certification) on September 1, 2023 by integrating various technologies, data, and know-how. The ZCB Certification aims to contribute to the realization of the 2050 carbon-neutral goal, and certification is granted through the Zero Carbon Building Index (ZCBI), which is the carbon-neutral achievement rate (%) to induce gradual carbon emitted minimization and carbon avoided maximization.

The ZCB Certification is operated by operation organization for efficient, educational and international popularization and certification organization professional, transparent, and fair review based on certification standards and documentation guidelines.
Zero Carbon Building Council (ZCBC) was established as the operation organization which 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).

ZCBC includes educational and research groups in various fields such as architecture, facilities, materials, construction, structure, and energy to efficiently operate the certification system such as education, research, technology development, and international exchange.

The certification organization consisted of Korea Conformity Laboratories (KCL), Korean Testing Certification Institute (KTC) and Zero Carbon Building Center (ZCB Center) having experts in various fields such as architecture, construction, urban, materials, machinery, and electronics for fair and transparent certification screening and technology exchange and development to guarantee professional and transparent review of carbon neutrality performance.

ZCB Certification plans to designate a certification system and a sustainable operation and through training professional manpower and operation to induce voluntary participation and raise social awareness of carbon neutrality.

Zero Carbon Building Certification Operation System

Zero Carbon Building Council (ZCBC)

(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))

Korea Conformity Laboratories (KCL)
Korean Testing Certification Institute (KTC)
Zero Carbon Building Center (ZCB Center)

The concept of Zero Carbon Building Design is defined that the carbon neutrality in the entire life cycle of the building sector can be comprehensively considered by including Cradle to Grave from the design stage to the disposal stage and extending the evaluation to the Pre-Life Cycle and the Beyond the Life Cycle.

• Zero Carbon Building Design

1) Carbon Passive Design

- Passive carbon avoiding activities are passively affected by various technical and institutional improvements, such as energy reduction design plans, improved insulation performance and heat source facility efficiency, or reduced raw material consumption due to improved material performance, such as high-performance concrete development.

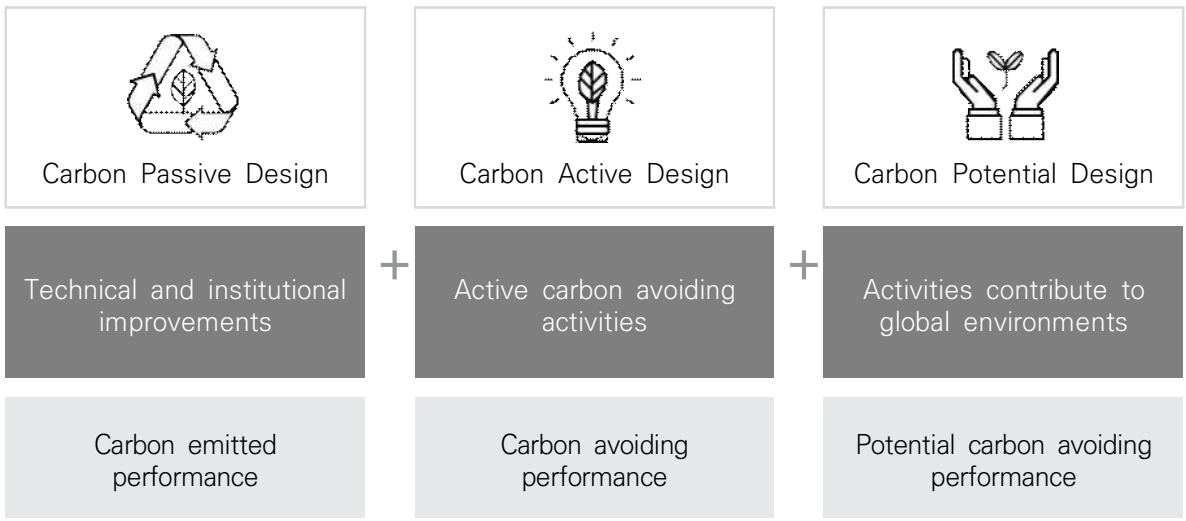
2) Carbon Active Design

- Active carbon avoiding activities realize carbon neutrality, including low-carbon materials, low-carbon construction methods, operation of eco-friendly construction equipment, installation of new and renewable energy and carbon sinks in the land, application of carbon capture utilization and storage technology (CCUS), external reduction projects and carbon credits.

3) Carbon Potential Design

- Potential carbon avoiding activities potentially contribute to other similar global environments, such as reuse, remodeling of key structural units, recycling of construction waste due to the use of circulating resources, and the use of carbon-reducing sites after the life cycle.

Carbon Avoiding Activities Based on Three Elements of Zero Carbon Building Design



ZCB Certification can improve awareness of carbon neutrality and induce voluntary participation, resulting in environmental effects by improved environmental performance, economic effects by promotion and investment in carbon-neutral buildings, and social effects on decarbonization to various construction-related industries such as construction materials and transportation.

• Expected Effect of ZCB Certification

1) Environmental effect

- Reduction of environmental impacts such as energy, resources, construction, and greenhouse gas
- Quantitative reduction and management of embodied and operational carbon emissions
- Development of low-carbon materials and eco-friendly equipment, improvement of energy performance, reduction of waste, reusing resources, and promotion of carbon absorption, capture, and offsetting

2) Economic effect

- Advertisement for Zero Carbon Building certified building and increase of building value
- Lower building maintenance cost by reducing building energy consumption
- Reducing and managing greenhouse gas by carbon neutral performance evaluation results

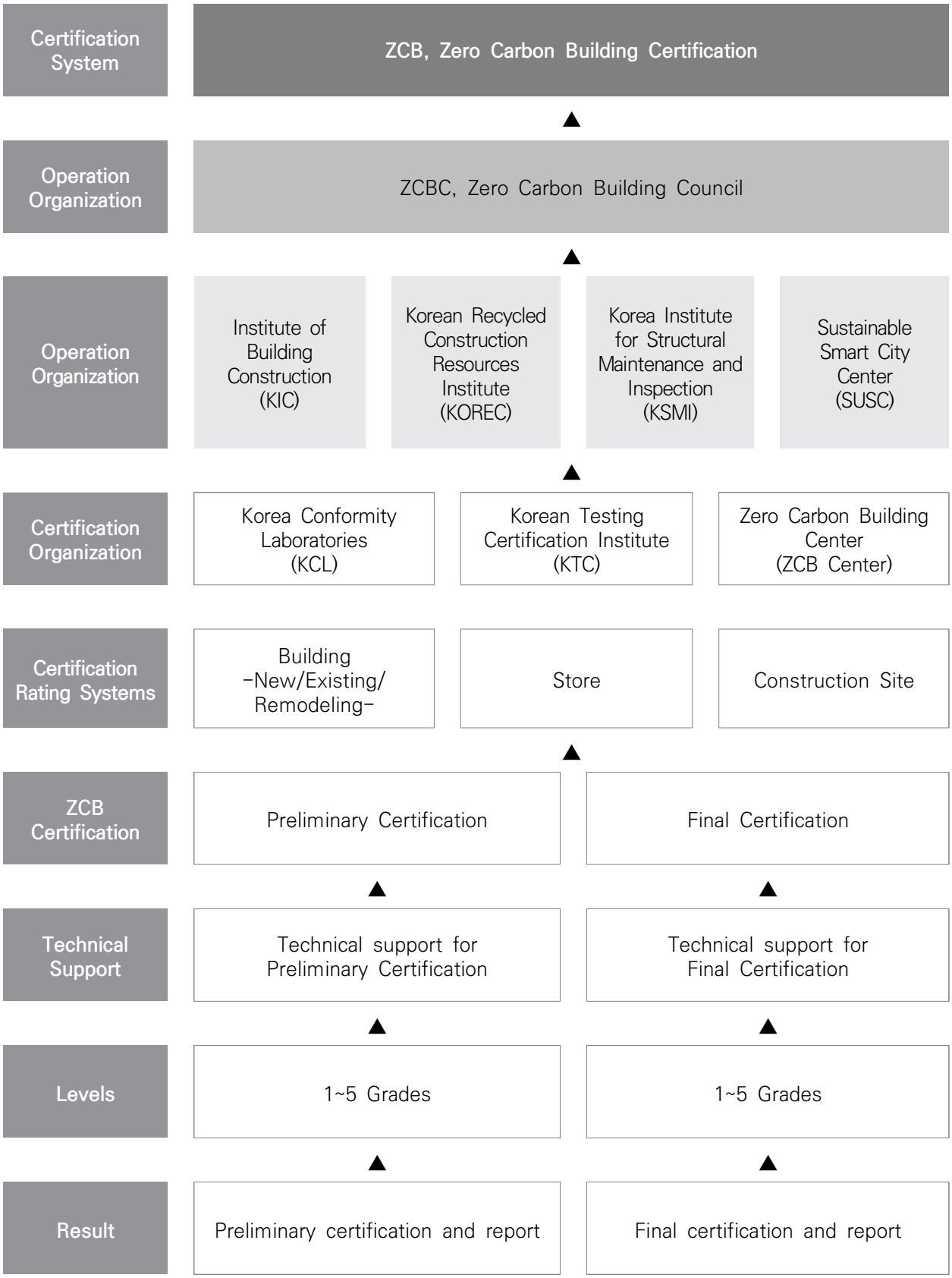
3) Social effect

- Promotion of low-carbon technologies such as design plans, material manufacturing, transportation, construction method and equipment
- Leading regulatory responses related to greenhouse gases
- Social awareness and voluntary participation increase of zero carbon building

ZCB Certification Expected Effect

 Environment	Decarbonization encouragement and promotion of energy, transportation, and waste by reducing environmental impacts and greenhouse gas emissions throughout the whole process
 Economy	ZCB-certified building promotion and building value increase Reducing building maintenance costs and greenhouse gas management
 Society	Raising awareness and voluntary participation of zero carbon buildings Leading regulatory responses related to greenhouse gases

ZCB Certification System



Evaluation Method 02

2. Zero Carbon Building Certification Evaluation Method

The results of ZCB Certification evaluation are derived through the Zero Carbon Building Index (ZCBI), which is the ratio (%) of carbon avoided to carbon emitted in the entire process according to the system boundary for each certification category.

• ZCBI Calculation Formula

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

- ZCBI (%)
- Life Cycle Carbon Emitted (kgCO2e)
- Life Cycle Carbon Avoided (kgCO2e)

The total carbon emitted means the total carbon emissions in the entire process of the building sector, and the sum (+) of the carbon emitted in the previous stage, production stage, construction stage, operation stage, and disposal stage according to ISO 14040s (Life Cycle Assessment) is evaluated.

• Carbon Emitted Calculation Formula (kgCO2e)

$$Carbon\ Emitted = {}_{P1-P4}CE + {}_{A1-A3}CE + {}_{A4-A5}CE + {}_{B1-B7}CE + {}_{C1-C4}CE$$

- $_{P1-P4}$CE (P1-P4 Carbon Emitted) : Previous stage
- $_{A1-A3}$CE (A1-A3 Carbon Emitted) : Production stage
- $_{A4-A5}$CE (A4-A5 Carbon Emitted) : Construction stage
- $_{B1-B7}$CE (B1-B7 Carbon Emitted) : Operation stage
- $_{C1-C4}$CE (C1-C4 Carbon Emitted) : Disposal stage

Carbon avoided in the entire process refers to the amount of carbon avoiding activities (kgCO2e), and the sum (+) of carbon reduction (CR), absorption (CA), collection (CC), and offset (CO) in the previous stage, production stage, construction stage, operation stage, disposal stage, and subsequent stage is evaluated. In addition, when applying for low-carbon technology certification (LCTC) for carbon neutrality, it will be reviewed whether carbon avoided can be recognized through deliberation by the Certification Steering Committee formed in accordance with ZCB certification operating regulations.

• Carbon Avoided Calculation Formula (kgCO2e)

$$Carbon\,Avoided = CR + CA + CC + CO + LCTC$$

- CR: Carbon Reduction
- CA: Carbon Absorption
- CC: Carbon Capture
- CO: Carbon Offset
- LCTC: Low Carbon Technology Certification

• Obtaining ZCBI Example

1) [ZCBI denominator] Minimization of carbon emitted

- Passive carbon avoiding activities affected by technical and institutional improvements such as reducing raw materials, energy-reducing design plans, improving insulation, and the efficiency of heat source facilities by applying high-performance construction materials.

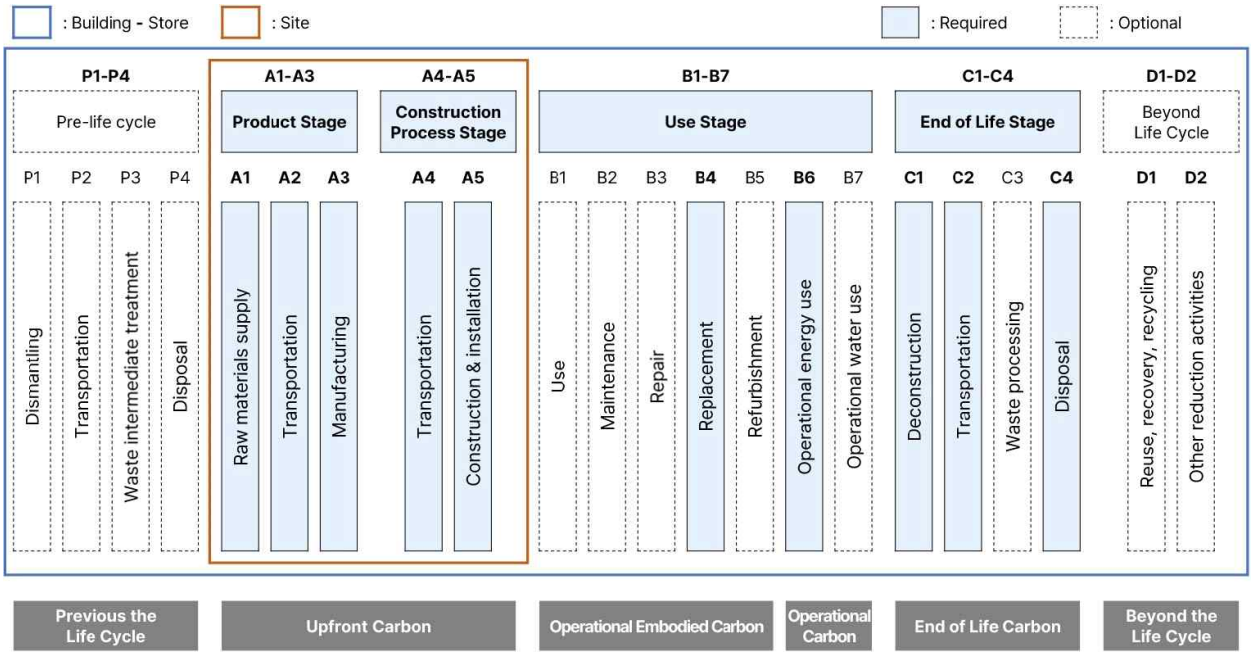
2) [ZCBI molecules] Maximization of carbon avoided

- Active carbon avoiding activities, such as the application of environmental performance or low-carbon materials certified by domestic and foreign accredited agencies for carbon emissions from the process of collecting, transporting, and manufacturing raw materials
- Active carbon avoiding activities such as reducing the transportation distance to the construction site, increasing eco-friendly vehicles, low-carbon construction methods, eco-friendly construction equipment, and operating energy at the site
- Active carbon avoiding activities such as the installation of new/renewable energy facilities
- Potential carbon avoiding activities for demolition and reconstruction following reuse of main structural elements through remodeling work
- Potential carbon avoiding activities that could potentially contribute to other similar global environments, such as the regeneration, reuse, and recycling of construction waste and the use of carbon-reducing sites after the life cycle

System Boundary 03

3. System Boundary

Zero Carbon Building Certification (ZCB Certification) consists of six stages by extending the system boundary for pre-life cycle and post-life cycle while maintaining a production-construction-operation-disposal-stage system based on ISO14040s (Life Cycle Assessment).



ZCB Certification System Boundary

[P1-P4] The pre-Life Cycle Stage is applied to main structural reuse or remodeled building, and refers to a stage of partial dismantling/disposal for remodeling work. Carbon emitted in the previous stage refer to carbon emitted additionally generated for remodeling before the end of the building's life cycle. Carbon avoided in the previous stage refers to carbon avoiding activities such as low-carbon construction methods and application of eco-friendly construction equipment in the process of partially dismantling/disposal for remodeling work.

[A1-A3] The term "Product Stage" means the stage of collecting, processing, manufacturing, and transporting raw materials used in construction. The production stage includes environmental impacts arising from all processes, such as raw material extraction, transportation, manufacturing processes, etc., accompanying the production of building materials used in construction work among all types of buildings to be evaluated (temporary construction, offical construction, civil engineering, electrical construction, etc.).

[A4-A5] The Construction Stage means the stage of transporting building materials to the construction site and constructing the relevant building elements. The transportation process refers to the environmental impact of the use of vehicles used for construction work from the place of purchase or storage to the construction site, and the construction process refers to the environmental impact of energy consumption by various construction equipment or operating the site office.

[B1-B7] The term "Use Stage" means the stage from the completion of a building to the operation. It includes the environmental impact caused by the use of energy during the operation and the building materials replaced during the maintenance. It also includes the environmental impact that occurs during activities such as cleaning to maintain the condition of the building, repairing of various damaged equipment and components, alteration of the structure or external shape of a building, such as a pillar, beam, endurance wall, and main staircase.

[C1-C4] The term "End of Life Stage" means the stage of dismantling/disposing a building after the end of its life. The disposal stage includes the environmental impact that occurs in the process of dismantling the building, the transportation of waste generated, and the disposal (incineration, landfill) of waste. The environmental impact of energy consumption of dismantling equipment includes the use of vehicles to recycle sites or landfills and incineration plants of waste, the energy use in the intermediate treatment process.

[D1-D2] The Beyond Life Cycle Stage refers to the stage after the production stage, construction stage, operation stage, and disposal stage, which is the entire process defined by ISO14040s (Life Cycle Assessment), i.e., after the life cycle, the building is dismantled/disposed, and the carbon avoided amount from other carbon avoiding activities such as resource circulation such as regeneration, recycling, and reusing are evaluated. This is expected to have the effect of guarantee potential carbon avoided (Carbon Potential Aided) such as activating circulating resources or reusing carbon reduction-type sites after dismantling/disposal.

System Categories 04

4. ZCB Certification System Categories

Zero Carbon Building certification (ZCB certification) is certified through the Zero Carbon Building Index (ZCBI), a carbon-neutral achievement ratio (%), and is identified in ZCB Preliminary/Final certification.

ZCB Preliminary certification is carried out before ZCB Final certification to contribute to decision-making for ZCBI optimization by predicting carbon emitted in advance and evaluating carbon avoiding technology application plans through design narratives for each sector such as architecture, structure, landscape, machinery, electricity, and renewable.

ZCB Preliminary certification is required to be considered from the design planning stage so that it is easy to consult with owners, designers, and contractors on the application of carbon avoiding technology and the completion of ZCB Preliminary certification can be reflected in the calculation of construction narratives and construction costs.

ZCB Final certification is to evaluate carbon emitted and avoided through completion narratives and on-site inspections in each sector, including construction, structure, construction, ME, and renewable energy. Various changes that may occur such as plans, finishing materials, and device capacity, are required to be considered so that problems such as target ZCBI and certification grades can be carried out from the ground-breaking planning stage.

ZCB Certification Categories

Categories	ZCB Preliminary Certification	ZCB Final Certification
Purpose	• ZCB preliminary certificate issuance • ZCBI pre-review	• ZCB final certificate issuance • Update based on changes (if any)
Submission / Completion	• Design planning stage / permission stage	• Construction planning stage / completion stage • Operation stage
Result	• ZCB preliminary certificate • ZCB certification report	• ZCB certificate and plaque • ZCB certification report

ZCB Certification rating system includes building, store and construction site. Building system includes new building, existing building, and remodeling building according to the operation period of the building and the building type.

- New building shall be subject to buildings under Article 2-1-2 of the Building Act, buildings newly planned or less than five years after operation approval.

- Existing building shall be subject to buildings under Article 2-1-2 of the Building Act, buildings have been in operation for at least five years after remodeling or operation approval.

- Remodeling building shall be subject to buildings under Article 2-1-10 of the Building Act, buildings less than five years after remodeling plan or operation approval after remodeling.

- Store shall apply to type 1 neighborhood living facilities, type 2 neighborhood living facilities, sales facilities, and similar shops and stores in Article 2-2 of the Building Act.

- Construction site shall be construction sites for new construction, expansion, renovation, reconstruction, etc. under subparagraph 8 of the same paragraph for buildings under Article 2-1 and 2 of the Building Act, construction sites are planned to commence or have not been more than one year after completion.

ZCB Certification Rating Systems

Rating Systems	Subcategories	Contents
Building	New building	Buildings newly planned or less than five years after operation approval
	Existing building	Buildings in operation for more than five years or remodeling has been planned
	Remodeling building	Buildings less than five years after remodeling plan or operation approval after remodeling
Store	-	A shopping mall or store planning or operating in a building
Construction Site	-	Construction sites planning to commence or less than one year after completion

Procedure 05

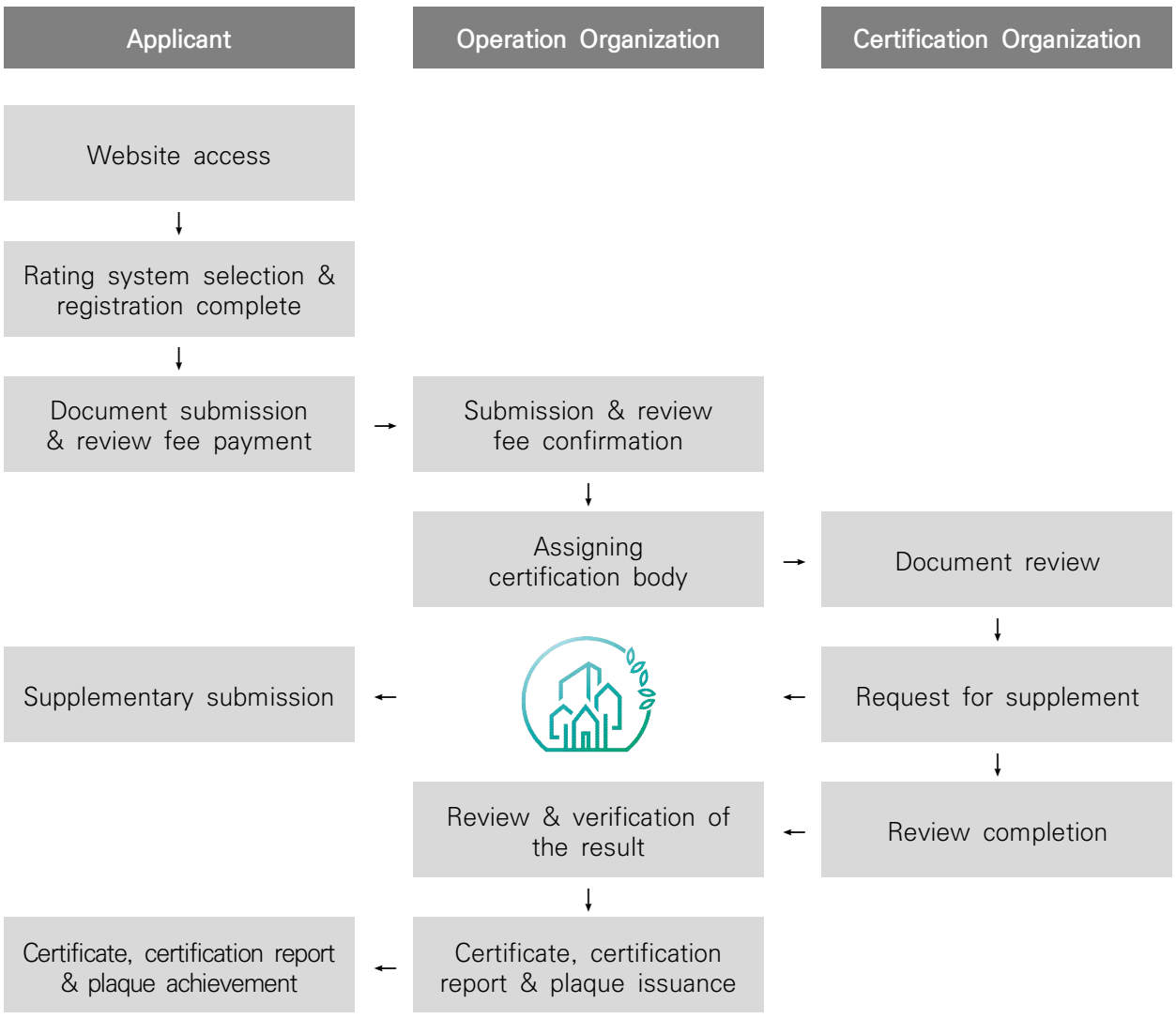
5. Procedures For Certification & Technical Support

• ZCB Certification Process

An applicant who intends to obtain the ZCB Certification shall submit documents and pay review fee to the operation body after applying for certification via the ZCB Certification website (www.zcb.or.kr).

The operation organization shall assign a certification organization to do the review and issue a certificate, a certification plaque, and a certification report (preliminary and/or final) after verification by the operation body on the result of the review.

ZCB Certification Process



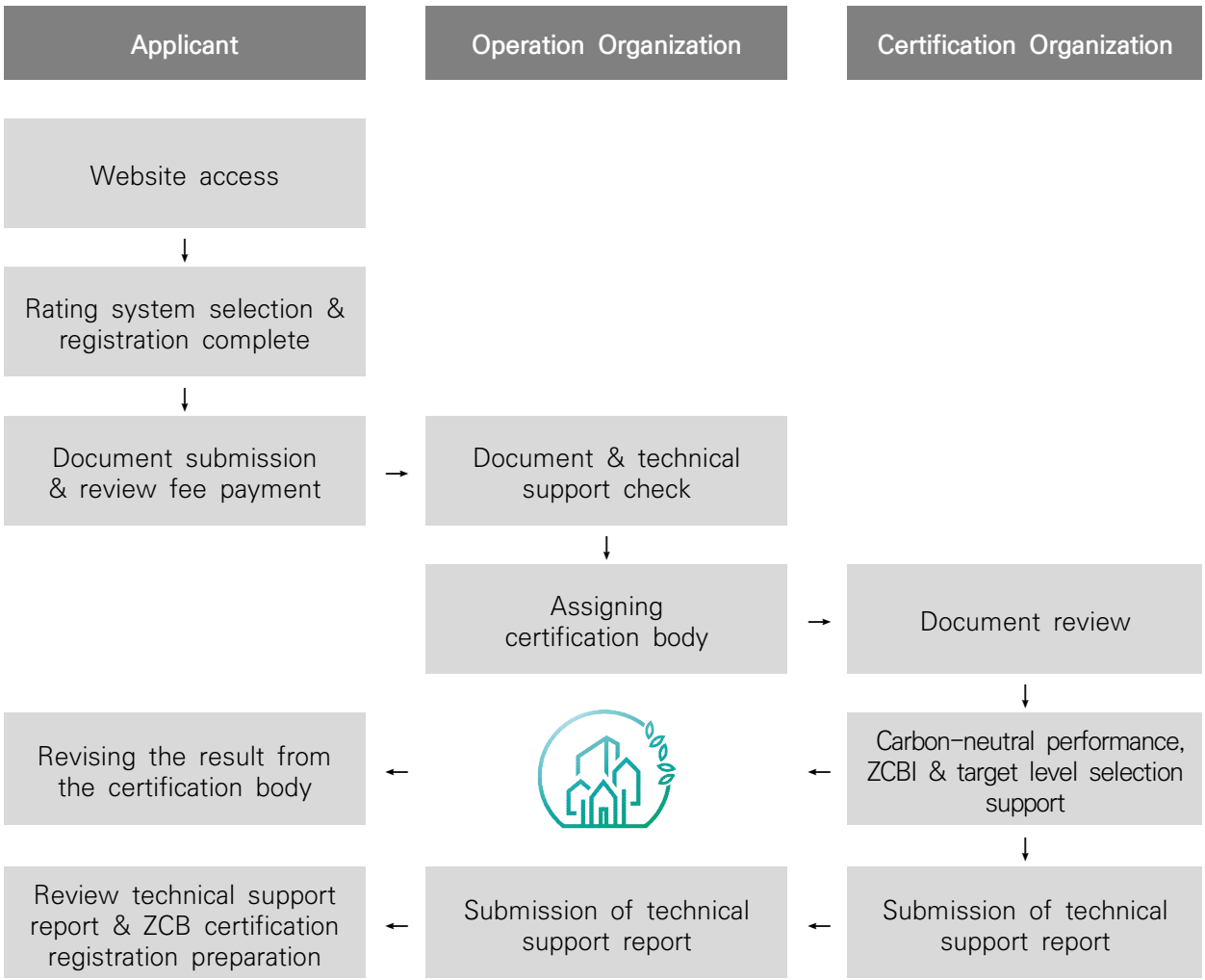
• Technical Support Process

Applicants can predict carbon-neutral performance in advance and apply for technical support for carbon avoiding technologies before applying for certification.

In order to apply for technical support, the documents requested for review and technical support shall be submitted to the operation body after applying for technical support via the ZCB certification website (www.zcb.or.kr).

The operation organization shall assign a certification organization to provide the service to the applicants for technical support based on operating regulations and certification guidelines to make clear decisions on carbon avoiding technologies, etc. and to guarantee the achievement of the ZCB Certification in the future.

Technology Support Process



Achievement 06

6. ZCB Certification Achievement

• ZCB Certification Levels

Carbon neutrality pursued by ZCB Certification refers to low emissions and optimal reductions rather than high emissions and high reductions by minimizing carbon emitted and maximizing carbon avoided in the entire life cycle for the purpose of realizing carbon neutrality in stages.

Accordingly, the ZCB Certification derives the final evaluation result as the Zero Carbon Building Index (ZCBI) for carbon-neutral performance in the entire process and divides it into five grades according to the final ZCBI.

ZCB Certification Levels

Levels		ZCBI
ZCB 1st Grade		100% or higher
ZCB 2nd Grade		75% or more and less than 100%
ZCB 3rd Grade		50% or more and less than 75%
ZCB 4th Grade		25% or more and less than 50%
ZCB 5th Grade		Less than 25%

ZCB Certification Logos

• ZCB Certification Result

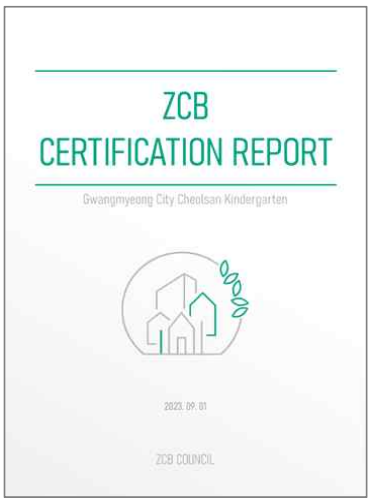
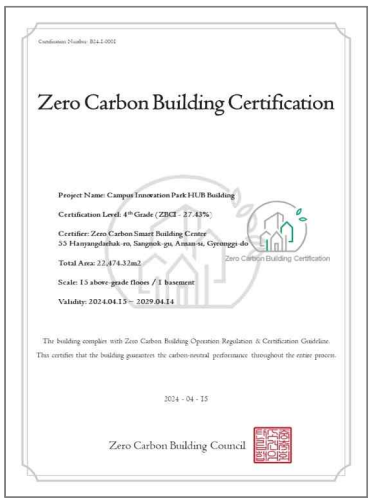
The operation organization issues a preliminary certificate and a certification report for preliminary certification after the final review of the certification organization, and in the case of final certification, a certificate, a plaque, and a final certification report.

The certificate shall be issued by the Zero Carbon Building Council (ZCBC), which is the operation organization, and the certificate shall include general information of the rating system (new building, existing building, remodeling building, store, or construction site) as well as the certification organization conducting the review. The valid period of certification shall be five years.

The certification plaque is issued when the final ZCB Certification is completed, and the applicant can request the material (wood, acrylic, stainless-gold, silver) and the shape (square, rectangular, circular), etc.

The certification report shall be issued by the certification organization conducting the review. The certification report shall include detailed information of the rating system (new building, existing building, remodeling building, store, or construction site), the result of the evaluation of carbon-neutral performance (carbon emitted and avoided), ZCBI and certification level, etc.

ZCB Certification Result

Certification Report	Certificate	Plaque
		

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Zero Carbon Building Certification