Specifications for Existing Building ZEB Feasibility Study Services (Draft)

Project Name

Existing Building ZEB Feasibility Study Services

Purpose

The purpose of this work is to investigate the actual energy use of the target facility, examine the feasibility of introducing ZEB (Net Zero Energy Building) measures, and organize the specific processes, costs, CO2 reduction effects, and other matters related to renovation plans that contribute to energy conservation, taking into account trends toward achieving carbon neutrality by 2050 (net-zero greenhouse gas emissions) in Japan and overseas.

Performance Period

From the date of contract execution until **[performance period]** (to be determined at the time of contract).

Scope of Work

Facilities Subject to Survey

The target facilities shall be existing buildings used for office purposes as described below.

Building Overview

Item	Description
Facility name	
Total floor area (m²)	
Structure / number of floors	
Year of completion	
History of major renovations	

Main Existing Equipment

Item	Equipment outline
Air conditioning	
Ventilation	
Lighting	
Hot water supply	
Elevators	
Photovoltaic power generation	

Annual Energy Consumption, Water Use, and Purchase Costs

Item	Annual purchased amount / sold amount	Annual purchase cost / sales revenue
Electricity (kWh)		
City gas (m^3)		
Kerosene (L)		
Water supply (m^3)		
Photovoltaic power generation (kWh)		

Basic Energy Survey

The current energy use status of the target facility shall be identified, and annual energy consumption and CO2 emissions shall be calculated using the Standard Input Method based on energy data and other information. In addition, the following surveys and organization of information shall be conducted.

Facility and equipment status survey: The operational status and usage status of the facility shall be confirmed through an on-site survey. Specifically, the installation status, operating status, replacement history, presence or absence of defects, and other conditions of existing equipment shall be investigated, and actual operating conditions such as operating hours and temperature settings shall be identified. Interviews with facility managers and users shall also be conducted to identify current issues.

Organization of energy consumption: Based on energy consumption performance data provided by the client, such as monthly consumption of electricity, gas, fuel, and other energy sources, annual consumption shall be organized by energy type. CO2 emission factors shall be set for each energy type, and current annual CO2 emissions shall be calculated.

Understanding current building and equipment conditions: Through the on-site survey, the condition of the building envelope, including insulation performance and opening performance, and the condition of major equipment shall be confirmed. The current condition of the building and equipment, including deterioration and aging, shall be evaluated.

Calculation of energy performance indicators: Using the Building Energy Consumption Performance Calculation Program (Standard Input Method) of the Building Research Institute, the standard primary energy consumption and the current designed primary energy consumption of the target facility shall be calculated. Indicators such as BEI (ratio of designed primary energy consumption to standard primary energy consumption) and BPI shall be calculated to evaluate the building's energy performance. In addition, the annual energy consumption breakdown by use, such as air conditioning, ventilation, lighting, hot water supply, and power, shall be estimated using the same program to understand the current characteristics of energy consumption.

ZEB Feasibility Study

Based on the results of the basic energy survey above, the feasibility of energy-saving renovations through the introduction of ZEB technologies at the target facility shall be examined as described below. Renovation options that can be compared with the current case shall be established, namely a ZEB-achieving renovation option ("ZEB Renovation") and a standard renovation option equivalent to the current level ("Standard Renovation"), and a comparative study shall be conducted.

Study on Improvement of Envelope Performance and Equipment Renovation

Measures to improve the passive performance of the building and renovation plans for aging equipment shall be examined. Specifically, measures to improve the building envelope performance through insulation

renovation of exterior walls, roofs, and openings, the introduction of high-performance glazing and solar shading, and other measures shall be examined, together with energy-saving measures through the replacement and renovation of existing equipment.

Study on Higher Efficiency of Air-Conditioning and Other Equipment

The replacement and introduction of high-efficiency equipment for air conditioning, ventilation, lighting, hot water supply, and other systems shall be examined. The introduction of an energy management system (BEMS) shall also be considered as necessary. In these studies, detailed air-conditioning load calculations shall be performed to determine the required capacity and to support the proposed equipment capacities and performance. In addition, illuminance distribution calculations shall be performed for representative rooms to confirm the appropriateness of the lighting plan.

Study on Introduction of Renewable Energy Equipment, etc. (Including Use of Storage Batteries)

The feasibility of introducing renewable energy equipment such as photovoltaic power generation systems and storage battery systems shall be examined. The installable area for photovoltaic panels on the building roof and within the site, as well as orientation and tilt conditions, shall be investigated, and the expected power generation shall be estimated. The effects of introducing storage batteries shall also be examined.

Energy Evaluation of ZEB Renovation

For each renovation option examined in Sections 4.3.1 to 4.3.3 above, primary energy consumption, BEI/BPI, and other indicators shall be calculated using the Standard Input Method program of the Building Research Institute, and the energy-saving performance shall be evaluated. The energy reduction rate and ZEB achievement level that can be realized by each renovation option (ZEB, Nearly ZEB, ZEB Ready, or ZEB Oriented) shall be clarified.

Calculation of Approximate Renovation Costs

Approximate renovation costs shall be calculated for each of the examined ZEB Renovation and Standard Renovation options. The calculation shall include all expenses related to the renovation, such as design costs, construction costs, equipment replacement costs, BELS acquisition costs, and subsidy application costs. From a long-term perspective, costs required for future second-stage renovations shall also be estimated.

Comparative Study of Energy-Saving Effects and Economic Efficiency

For the ZEB Renovation and Standard Renovation options, energy consumption, CO2 emissions, utility costs, maintenance costs, renovation costs, and other items shall be compared, and differences in energy savings, CO2 reductions, and economic efficiency resulting from the ZEB Renovation shall be evaluated. Utility cost reductions and maintenance cost reductions resulting from energy conservation, investment payback periods, and other indicators shall be calculated to analyze long-term cost-effectiveness.

Study on Utilization of National Subsidy Programs, etc.

In promoting the ZEB Renovation, available subsidy programs and subsidy systems of the national government and local governments shall be investigated. Information on applicable conditions, application periods, and other matters for related subsidy systems administered by the Ministry of the Environment, Ministry of Economy, Trade and Industry, Ministry of Land, Infrastructure, Transport and Tourism, and other agencies shall be collected, and the possibility of utilizing suitable subsidy programs for this project shall be examined.

Preparation of Renovation Schedule

For the proposed renovation option, an overall schedule plan from the start of the study to completion of construction shall be prepared. The matters to be implemented and the required periods shall be indicated for each stage, including detailed design, budget securing, subsidy application, BELS evaluation,

bidding/contracting, construction, and completion, and a roadmap for systematic project implementation shall be developed.

Comprehensive Evaluation of ZEB Feasibility

Multiple renovation options examined shall be compared, and the optimal renovation policy for the target facility shall be organized. If ZEB conversion is feasible, the achievable ZEB rank (ZEB, Nearly ZEB, ZEB Ready, or ZEB Oriented) shall be clearly stated. Even if ZEB conversion is difficult, a renovation option that maximizes energy-saving effects shall be presented. In addition, comprehensive evaluation results regarding energy-saving effects, economic efficiency, improvement of comfort, and other aspects of each renovation option shall be compiled to clarify the feasibility of ZEB conversion at the target facility.

Notes on the ZEB Feasibility Study

Differences Between Drawings and On-Site Conditions

Because it is highly likely that the provided drawings do not reflect updates, differences shall be identified through the on-site survey, and the current conditions shall take precedence.

Detailed Air-Conditioning Load Calculation

Air-conditioning load calculation is important for downsizing equipment. The method of air-conditioning load calculation is not specified; however, detailed air-conditioning load calculations shall be performed. Simplified air-conditioning load calculation methods are not permitted.

Specific Equipment Installation Plan

Based on the renovation option, the installation locations of equipment and routes for piping and ducts shall be specifically planned and clearly indicated on the renovation plan drawings. A feasible plan shall be proposed. For example, it is not realistic to make a Φ250 core opening that cuts reinforcing bars in a concrete wall. When equipment is installed on the roof, the structural calculation documents of the existing building and other materials shall be referenced to confirm that the additional load is structurally allowable. When BEMS is introduced, a specific monitoring plan shall be proposed for the measurement points of energy consumption.

Method for Calculating Energy-Saving Performance

The envelope performance (PAL* value) and primary energy consumption (standard value and design value) of the proposed renovation option shall be calculated using the calculation support program of the Building Research Institute (Standard Input Method). The Model Building Method (simplified calculation method) shall not be used; accurate evaluation shall be performed using the Standard Input Method.

Preparation of Approximate Cost Estimates

For each renovation option, an approximate cost estimate shall be prepared in accordance with the specific renovation content. Estimate items shall be classified by work type and building part, and the breakdown shall indicate quantities and unit prices to the extent possible. The basis of calculation shall be indicated when preparing the approximate estimate. Approximate estimates shall be prepared for both the first-stage renovation and future second-stage renovation.

Quantitative Evaluation of Energy-Saving Effects and Economic Efficiency

Energy consumption, CO2 emissions, renovation costs, maintenance costs (maintenance expenses, utility costs, etc.) of the ZEB Renovation and Standard Renovation options shall be compared, and the energy savings, CO2 reductions, and economic benefits of the ZEB Renovation shall be quantitatively evaluated. Life cycle cost (LCC) analysis shall be conducted as necessary to evaluate economic efficiency from a long-term perspective.

Preparation of Renovation Schedule

ZEB renovation of an existing building is likely to be carried out while the facility remains in operation. The current usage status of the building shall be understood, an outline construction schedule shall be prepared, and the feasibility of renovation while the facility remains in operation and the required construction period shall be indicated.

Deliverables

ZEB Feasibility Study Report (One Paper Copy)

A report summarizing the survey results shall be submitted. The report shall include the following items.

Primary energy consumption calculation results before and after renovation: The annual primary energy consumption in the current condition (before renovation) and after the proposed renovation shall be calculated, and the comparative results shall be shown.

ZEB renovation policy: The energy-saving policy for the proposed ZEB renovation option. The purpose and outline of each renovation item shall be organized separately for architectural (passive) aspects and equipment (active) aspects.

Policy for use of renewable energy: The policy for introducing renewable energy equipment such as photovoltaic power generation shall be shown.

Renovation costs: A breakdown of the approximate renovation costs required to implement the proposed ZEB renovation option. In addition to design and construction costs, the expected subsidy amount shall also be shown if subsidies are used.

Renovation work schedule: A schedule table showing the implementation process of the renovation plan. The sequence from the start of survey and study through design, construction, and completion shall be described chronologically.

ZEB measure summary table (Appendix Table 1): A list summarizing proposed energy-saving renovation measures. A table shall be prepared summarizing the renovation content for building and equipment items and the effects of reducing primary energy consumption.

Renovation plan drawings: Drawings showing the proposed renovation content. These shall include renovation area drawings and renovation sections for the architectural field, major equipment layout drawings for the equipment field (heat source equipment, air conditioners, indoor units, lighting fixture layouts, etc.), and renewable energy equipment layout drawings (installation locations of photovoltaic panels, storage batteries, etc.).

Study materials based on renovation content: Various study materials supporting the validity of the proposal. These shall include detailed results of air-conditioning load calculations, illuminance calculation results, input conditions and detailed calculation results of energy simulations, equipment layout drawings, and other materials.

Evaluation of ZEB renovation effects: Evaluation results of the energy-saving effects, CO_2 reduction effects, and economic efficiency of the ZEB Renovation option compared with the Standard Renovation option. Primary energy consumption reduction rates, CO_2 emission reduction rates, utility and maintenance cost reductions, investment payback periods, and other indicators shall be summarized in comparison tables or similar formats.

Policy for utilization of subsidy programs, etc.: A list of applicable subsidies and support systems for the proposed renovation option and the policy for their use. The names and outlines of the subsidy systems to be used, subsidy rates, points to note in application procedures, and other matters shall be organized.

Overall schedule: An overall schedule from the start of survey and study to completion of construction. The main work items and planned timing at each stage (survey and study, budget request, subsidy application, design, bidding, construction, and completion) shall be covered.

Materials Used for the Survey

The following materials used for the survey shall be submitted. The report shall include the following items.

Input files used for primary energy consumption calculation (Excel): Excel sheets used for Standard Input Method inputs for the current condition (before renovation), standard renewal, and ZEB renewal.

Air-conditioning load calculation results: Air-conditioning load calculation results for standard renewal and ZEB renewal.

Renovation plan drawings (A3): Drawings showing the proposed renovation content, including renovation area drawings and renovation sections for the architectural field; major equipment layout drawings for the equipment field (heat source equipment, air conditioners, indoor units, lighting fixture layouts, etc.); and renewable energy equipment layout drawings (installation locations of photovoltaic panels, storage batteries, etc.).

Approximate cost estimate: A breakdown of the approximate renovation costs required to implement the proposed ZEB renovation option. In addition to design and construction costs, the expected subsidy amount shall also be shown if subsidies are used.

Report Data (Electronic Media) (CD-R, etc., One Copy)

Electronic data of the above report (PDF format and editable original data).

Other

If there are any materials separately instructed by the client, such materials shall also be submitted.

Provided Materials

In carrying out this work, the client shall provide the following materials. The contractor shall use them as necessary and supplement any missing information through interviews and other means.

Materials related to the target facility: Basic materials related to the target facility, such as architectural documents, structural documents, equipment documents, finish schedules, and equipment ledgers (PDF or CAD data, etc.).

Structural calculation documents: Structural calculation documents of the existing building.

Periodic inspection survey reports: Survey reports related to building aging and other conditions.

Equipment lists: Lists and specifications of major equipment such as lighting, air conditioning, ventilation, hot water supply, and elevators.

Energy consumption data: Actual utility cost data for the target facility, including monthly consumption and charge data by energy type.

Facility renovation and repair records: Records of facility renovations and repairs.

Equipment maintenance records: Records of equipment maintenance.

Other: Other related materials requested by the contractor and available for provision by the client.

Notes

Implementation of on-site survey: When conducting the on-site survey, the schedule and survey content shall be sufficiently coordinated in advance with the client's representative. During the survey, care shall be taken not to interfere with facility operations, and work shall proceed safely and smoothly.

Submission of work plan: Promptly after commencement, a work implementation plan describing the specific implementation methods, schedule, organization, and other matters for this work shall be prepared and submitted to the client (to be prepared through consultation with the client's representative).

Thorough safety management: During the on-site survey, relevant laws and regulations such as the Industrial Safety and Health Act shall be complied with, and necessary safety measures shall be taken.

Consumables for on-site survey: Equipment, consumables, and other items necessary for the on-site survey shall be prepared by the contractor.

Ownership of deliverables: Intellectual property rights, including the rights under Articles 27 and 28 of the Copyright Act, related to all deliverables prepared in this work, such as reports, drawings, and calculation data, shall belong to the client. Confidential information obtained in the course of this work shall not be disclosed to any third party.

Appendix Table 1

Category	Item	Current: main specification (after renovation)	Current: standard primary energy (MJ/m^2)	Current: design primary energy (MJ/m^2)	Current: BPI/BEI	ZEB Renovation: main specification (after renovation)	ZEB: standard primary energy (MJ/m^2)	ZEB: design primary energy (MJ/m^2)	ZEB: BPI/BEI
Envelope	Exterior walls								
Envelope	Roof								
Envelope	Windows								
Air conditioning	Heat source								
Air conditioning	System								
Ventilation	Equipment								
Ventilation	System								
Lighting	Fixtures								
Lighting	System								
Hot water supply	Equipment								
Elevators	Equipment								
Other technologies	Fixtures								
Other technologies	System								
BEMS									
Photovoltaic power generation									

Cogeneration									
Storage batteries									
	Total energy-saving technologies								
	Total energy-saving + renewable energy								