REPUBLIC OF TURKEY

MINISTRY OF ENVIRONMENT, URBANIZATION AND CLIMATE CHANGE (MoEUCC)

GENERAL DIRECTORATE OF CONSTRUCTION AFFAIRS (GDCA)

"Seismic Resilience and Energy Efficiency in Public Buildings Project"

Loan No: 9261-TR | Project ID: P175894

CONSULTANCY SERVICES FOR

STRUCTURAL – ENERGY EFFICIENCY RETROFIT DESIGNS AND CONSTRUCTION SUPERVISION

Reference No:

WB/CS-DESSUP-01

TERMS OF REFERENCE

"For Structural Feasibility, Energy Audit, Structural - Energy Efficiency Retrofit Design"

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I. Introduction and Background

Exposure and vulnerability to natural hazards, including earthquakes, landslides, and floods also threaten sustainable development in Turkey. Among these disasters, earthquakes have claimed the highest number of lives and caused the greatest economic loss, with 76 earthquakes since 1900 resulting in approximately 90,000 fatalities, a total affected population of 7 million, and direct losses exceeding US$25 billion[1] . About half the casualties were due to two earthquakes on the North Anatolian Fault in 1939 and 1999. In the 1999 Marmara earthquakes, which affected 10 cities[2] in the Marmara Region of Turkey where almost 35 percent of the Turkey's GNP was produced, the death toll was over 18,000 with a direct economic impact estimated at US$5 billion (2.5 percent of GNP). Although less catastrophic, floods and landslides are frequent events in Turkey and result in localized losses. Observed and anticipated climate change impacts, such as more intense precipitation, extreme heat and rising sea level, are expected to lead to increasing risks to natural disasters, including more frequent and intense flooding in low-lying areas of river deltas and coastal cities and other extreme weather events, such as storms, hail, and tornados.[3].

Moreover, energy efficiency is critical for Turkey to sustain its economic growth while meeting its commitments for climate change and environmental sustainability. Turkey's energy intensity (that is its energy use per unit of GDP, or 158.4 kgoe/€1,000 of GDP in 2018) was about 35 percent higher than that of the EU-28 countries (117.9) but compares favorably with many of its neighboring countries in Eastern Europe and the Balkans (~300-500). However, as energy use per capita in Turkey rises (from 1.31 toe per capita compared with 2.2 in the EU and 4.2 in OECD countries), its energy intensity is expected to grow[4] . This high intensity negatively impacts energy security—Turkey's energy imports have increased in recent years, from US$37.2 billion in 2017 to about US$43.0 billion in 2018, and it accounts for almost 19 percent of the country's total imports. It also has a negative impact on the environment, with the energy sector accounting for 72.2 percent of the country's greenhouse gas (GHG) emissions in 2017

Therefore, it is essential to promote a strategic national approach to increasing energy efficiency and seismic performance in public buildings through an integrated approach creates a demonstration effect and builds the foundations critical to reach scale and improve the vast building stock in Turkey. To this respect, Government of Turkey signed a loan agreement in the amount of USD 265 million for the Seismic Resilience and Energy Efficiency in Public Buildings Project (SREEPBP) that will be implemented by the Ministry of Environment, Urbanization and Climate Change (MoEUCC).

The General Directorate of Construction Affairs (GDCA) under the MoEUCC has been delegated to assume overall responsibility for the project. This will include completion of the necessary activities to support project preparation as well as implementation for the six-year project period. In parallel, grant funding has been mobilized from the The Global Facility for Disaster Reduction and Recovery (GFDRR) to explore innovative approaches for structural strengthening and EE activities.

The GDCA has established a project implementation unit (PIU) to administer all aspects of the project, including raising awareness about the Project, identification of the vulnerable buildings within the agreed eligibility and prioritization, procurement of the various contractors and Project monitoring and reporting.

II. Project Objectives

The project investments will focus primarily to improve the disaster resilience and energy savings in selected central government buildings, and to strengthen the policy framework and institutional capacity to develop, finance and implement resilient and sustainable public buildings in Turkey. The proposed project would be implemented through three components: (i) investments in Central Government Buildings for seismic strengthening and energy efficiency (EE) improvement; (ii) advanced technical assistance (TA) and capacity building; and (iii) project implementation support.

Through the Project, approximately 143 large public buildings such as education buildings (pre-primary and

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[1] Erdik, M. (2013), Earthquake Risk in Turkey, Science Mag, Vol. 341, Issue 6147, pp. 724-725, DOI: 10.1126/science.1238945

[2] Kocaeli, Sakarya, Yalova, Istanbul, Bursa, Bolu, Eskisehir, Duzce, Karabuk, and Zonguldak

[3] Republic of Turkey Ministry of Environment and Urbanization (2018), Seventh National Communicaton of Turkey under the UNFCCC.

[4] Eurostat. https://ec.europa.eu/eurostat/web/main/home

tertiary)[5], dormitories, hospitals, and public administrative buildings[6] will be structurally strengthened and renovated, or demolished and reconstructed. The Project will seek to ensure minimum energy performance of the renovated buildings (i.e., Turkish Class C energy performance certificates or higher) and a minimum energy savings which will be specified and agreed in the Project Operations Manual. Architectural, mechanical, electrical renovations and some renewable energy (RE) systems (e.g., rooftop solar photovoltaic (PV), ground source heat pumps, solar water heaters, trigenerators) will also be included, subject to their economic viability. For buildings where demolition and reconstruction are necessary, all the new building financed by the Project will be disaster and climate resilient and classified Class B or higher, and potentially near-zero energy buildings (nZEB).

III. Scope of Services

Within the framework of the Project, a consulting firm will be employed to conduct structural feasibility, energy audit and structural - energy retrofitting design consultancy services.

The Consultant will be required to conduct structural feasibility, investment grade energy audit and preliminary renovation designs and detailed (final) renovation designs (includes interventions both structural and energy efficiency). Once the renovation designs completed, the Consultant shall prepare works tender documents which includes bill of quantities, full set of renovation projects, detailed technical specifications, cost estimates, etc. and Environmental and Social Management Plans (ESMPs).

The aforementioned consultancy services cover **eleven (11)** public building campuses, which are given in Annex-1.

IV. Description of the Consultants's Tasks

Task 1: Conduct Structural Feasibility

The latest version of Turkish Earthquake Code (abbreviated as TEC in the following sections) shall be followed for seismic assessment and strengthening. Assessment of each building's vulnerability to seismic activity will at least include:

Assess building structure by the means of surveying and material testing:

- Survey structural, foundation, architectural, mechanical and electrical characteristics of the buildings using available data, measurements, and other best practice techniques such as destructive, non-destructive testing (i.e. Ground Penetrating Radar (GPR), Light-Detection and Ranging (LiDAR), etc.) as well as detailed additional surveys.
- Plan drawings of the building shall be prepared with fieldwork. Dimensions and locations of structural members as well as locations, openings, thicknesses and materials of infill walls on each story shall be identified on the plan drawing.
- All types of equipment and devices related to architectural, mechanical and electrical disciplines are needed to be determined and their characteristics clarified such as radiator panels, plugs, boiler, etc in a table format. Also, roofs should be identified using air photos and detailed survey projects should be prepared for them considering their existing situation.
- Propose the laboratories for Material Testing, which shall be approved and registered by Ministry of Environment, Urbanization and Climate Change.
- Conduct destructive and non-destructive tests required for material characterization of the building. Data collection requirements defined in Section 15.2.5 of TEC2018 for comprehensive knowledge level (i.e. knowledge factor=1) shall be followed. A detailed methodology developed by the Consultant for sampling, surveying and testing procedures shall include the required number, type and labelling of material samples to be extracted, steel reinforcement inspections to be conducted as well as repairing methods after sampling and inspection works. During the execution of the works in connection with inspection of the buildings, all costs incurred for the reinstatement of the areas

[5]Through a parallel Project – Disaster Risk Management in Schools (P157683), the Bank is supporting disaster resilience and energy efficiency interventions in primary and secondary schools under the Ministry of National Education.

[6]This Project will not include any government buildings associated with law enforcement, justice, or the military (i.e. police buildings, courthouses etc.) and dormitories for police, gendarme, or military personnel)

affected by the sample extraction and reinforcing steel inspection by means of removal of cover concrete conducted by Consultants shall be executed without any cost to the Client. Core holes shall be filled with high strength repair mortar having non-shrinkage properties. All damaged concrete cover shall be replaced after inspection. Removed steel reinforcement shall be replaced by spliced reinforcement of same size to maintain continuity of the reinforcing steel. Reinstatement of the disturbed places should be completed to the satisfaction of the Client.

- The foundation type shall be determined by means of inspection pits both inside and outside of the buildings as per TEC.
- Material characterization for masonry structures shall be conducted as per section 15.2.11.3 of TEC2018. Material testing for masonry structures will be performed according to TS EN 1052-1 and TS EN 1052-3.

Assess site-specific geo-technical conditions:

- Conduct geotechnical investigation through on-site and laboratory tests in order to prepare geotechnical report for the building site. Local soil class, bearing capacity of the soil and liquefaction potential of the site shall be identified within the geotechnical report.
- The general procedure, location and required number of boreholes to be opened for soil characterization shall follow section 16A of TEC2018. Standard Penetration Test (SPT) shall be conducted at every 1.5m depth of the borehole and the total depth of the borehole should be 30m unless two consecutive SPT readings exceed N=50 at an earlier depth.
- The Consultant shall ensure that all activities related to the above site surveys and investigations are carried out according to best environmental, social and OHS practices to avoid any associated impacts. Additionally, the Consultant shall plan and implement all mitigation/prevention measures to address Covid-19 or any other communicable disease/pandemic risk through all work activities.

Submit Material and Geotechnical Test Reports:

An adequate material and geotechnical test report and documentation for approval shall include the following:

- Laboratory and on-site test results (destructive, non-destructive, geo-technical, etc.) for each individual building covering;
    - The name and address of the testing facility or laboratory.
    - The necessary registration documents of the selected laboratories.
    - A brief description of the materials inspected or tested.
    - Location of the inspected or tested materials specified on the plan drawings.
    - The time, date, and place of each approval inspection and test.
    - On-site photograph of each material sample where the extracted sample, the area affected by the sample extraction and the label of the sample are clearly visible.
    - The name and title of each person performing, supervising, and witnessing the inspections and tests.
    - The performance data for each test, including a description of failure, observed mechanical properties and findings.
    - A description of the procedures and apparatus used in the inspections or tests, or a reference to another document that contains an appropriate description or photographs.
    - A laboratory testing photograph of each material sample where the tested sample, the testing apparatus and the label of the sample are clearly visible.
- Surveys, all the architectural, structural, mechanical and electrical findings and information gathered through foundation pit openings.
- A complete test report prepared by the testing laboratory covering all of the testing results conduct for characterization of the materials (concrete cores, steel reinforcement samples), identification of reinforcement details (steel exposure, ferroscan readings) and soil investigation boreholes.
- Architectural plan drawings shall be shared with the Client in dwg and pdf format.

Assess seismic performance of the building structure by the means of calculations, analysis and observations;

- Design supervision, control and approval of Design Supervisor(s) shall be mandatory on the below mentioned calculations and respective designs.
- Compile the sets of information gathered from geometric survey, material characterization and geotechnical investigation to build the structural model for performance assessment of the building structure according to TEC.
- Review all available construction documents for the building, including original structural and architectural drawings and specifications, any significant modifications or upgrades,
- Identify structural defects, apparent detailing problems and structural configurations that cause unacceptable performance,
- Prepare 3-D (three dimensional) computer model of the building structure and analyse the building using an appropriate analysis method (i.e. linear or non-linear) considering the limitations defined for each analysis method in TEC.
- Refer to the 2018 Seismic Hazard Map prepared by Disaster and Emergency Management Presidency (AFAD) for estimation of intensity of ground motion as a function of return period.
- Performance target of the building and the associated seismic demand for the building structure shall be defined according to TEC.
- Assess the structural performance of the existing building as per section 15.8 of TEC2018.
- Develop an inventory of critical non-structural components, including building utility equipment (power supply, HVAC systems), operating equipment, ceilings, building fascia panels, elevators, and fire protection systems.
- Assess mechanical and electrical systems and give information on operational deficiencies and specific findings for the buildings (i.e: such as electrical system failure, nonoperational elevator).

Submit the Structural Feasibility Report:

- The Consultants shall carry out all the services for the Structural Feasibility Stage and submit a Structural Feasibility Report indicating their findings and assessment with respect to the services outlined above, to the satisfaction of the Client.
- The Consultants shall provide and submit with the Structural Feasibility Report with all the available executable structural analysis software files (i.e. Etaps, Sap2000, Protastructures, Sta4cad, etc.), section analysis software files, worksheets (i.e Excel, Matlab, Matcad, etc.) utilized for calculations and postprocessing. The consultant shall provide the Client with one (1) license of each structural software program(s) used for the above-mentioned analyses. The licenses should be valid during the contract (Lump-Sum Phase and Time-Based Phase).
- A surveillance report "Gözetim Raporu" reflecting the calculations and respective designs with the approval of the Design Supervisor(s) shall be mandatory with the report.
- The Consultants shall provide and submit with the Structural Feasibility Report all the cadastral information [deed, layouts, cadastral extract, building permits, occupation permits, plans, survey, etc – (tapu, çap, kroki, istikamet rölevesi, vaziyetplanı, vs)] for all the buildings within the assessment phase.
- The consultant shall identify the possible functionality renovations, improvements and required repairs such as leakage of water at basements, defects in plasters and roofs, deterioration in wet areas, etc. after consultation with the beneficiaries and report these to the Client for all the buildings.
- The Consultants shall submit fact-finding report (tespit tutanağı) signed between the principal and/or directorates of the relevant public buildings and the Consultant's representative for:
    - Structural and architectural survey
    - Material tests for concrete core and reinforcement samples and reinstatement of the areas affected

- Electrical and mechanical survey
- Site soil investigations and boreholes.

Task 2: Preparation of Preliminary Renovation Designs and Cost-Comparision

Developing Conceptual-Level Preliminary Designs and Cost Comparision:

- Develop conceptual-level upgrade designs for the required performance criteria by taking the TEC into consideration and identify the design criteria.
- Discuss restrictions on placement of retrofit elements, relative to building appearance and functionality concerns.
- Discuss the proposed concept preliminary design with the Client and Design Supervisor.
- Discuss and propose detailed temporary measures to be taken during the construction and phasing plans in order to minimize disruption of the public services in the buildings.
- Analyze and assess the performance of retrofitted building to ensure that the required performance is satisfied.
- Prepare a preliminary cost comparison analysis by using the calculation of the reconstruction cost for each existing building, and cost of retrofitting according to the performance criterion defined in TEC. When calculating the reconstruction cost of a building, same size and functionality shall be assumed.

Submit Preliminary Renovation Report:

- The Consultants shall carry out all the services to submit a preliminary renovation design report for each building indicating their findings and designs with respect to the services outlined above

Table.3: Preliminary Renovation Design Report

Report Section	**Required Content**
Executive Summary	• Restates the purpose of the report, highlight the major points of the report, and describe any results, conclusions, or recommendations from the report
Introduction	• A concise outline in simple language, describing the project in general • Typically includes the location, general type of building, and reason for the assessment • Does not include any results, conclusions, or recommendations ▪ May include brief summary of serious concerns if applicable
Scope of Work	• A point-by-point description of what has been completed in the assessment
Building Description	• Should generally include the following: ▪ Description of the structural systems and the building ▪ Dates of construction, additions, major repairs ▪ Current and/or proposed use, changes in use
Methodology	• Usually technical in nature • Describes the type of analyses, assumptions, performance levels, and similar methods upon which the assessment is based • Provides details on which codes, standards, and guidelines are used or relied upon in the assessment
Document Review	• Outlines all the existing building documents used in the assessment
Field Evaluation	• Describes the observations and data collected
Analysis	• Presents the results of the preliminary renovation design task including estimated cost comparison
Discussion	• Provides more detailed explanation and interpretation of, or comments on, the assessment findings
Conclusions and Recommendations	• Includes a summary of the significant facts or findings of the assessment • Includes recommendations to address the structural and/or energy efficiency concerns identified in the assessment, and alternative levels of upgrade. • Clearly states any Immediate Actions and other requirements
Appendices	• Can include relevant background documents, such as; ▪ field sketches, photographs, data and evaluation results

	▪ Architectural plan drawings in dwg and pdf format ▪ Executive structural analysis software files, section analysis software files and worksheets

Task 3: Conduct Investment Grade Energy Audit Report

For each building, the consultant shall conduct investment grade energy audits to identify and recommend energy efficiency measures (EEMs) for implementation of energy efficiency (EE) investments according to the audit template provided in the Annex-2. The activities required to conduct investment grade energy audits include, but may not be limited to, the tasks described in the following sections. The work conducted should comply with the principles and processes described in ISO 50002.

*Conduct preliminary reviews***:**

- Perform an initial energy use evaluation by reviewing all utility data and building or system diagrams, which can include architectural plans, electrical plans and cuts, electrical board schemes, thermal systems (production and distribution) plans, equipment lists and catalogues, operation and maintenance logs, and other available facility information.
- The initial activities under this task include determining the required scope of work, identifying key personnel (including personnel responsible for Operation and Maintenance (O&M) and energy-related issues); and requesting specific information and data. The data to be requested and collected from the building managers should include, but may not be limited to:
    - Meteorological data of the site: Monthly ambient temperature and humidity, heating degree days (HDD) and cooling degree days (CDD) for a 3 consecutive year period
    - Energy bills for the past three calendar years; all forms of energy should be included in this analysis
    - Online billing data
    - Building Management System (BMS) history and data
    - Building layout drawings and site plans
    - Equipment lists for main energy-using equipment
    - Process flow diagrams
    - Process and instrumentation drawings (P&IDs) for large energy users
    - Operational, weather and other data relevant for energy use (occupancy, weather, production data)
    - Copies of any previous energy audits, studies or details of known opportunities for energy efficiency
    - Details of upcoming organizational changes or other investment plans that are expected to affect energy efficiency or energy use
- Review all available facility documentation with site representatives where possible. Review at least three years of energy data and discuss year-to-year variations and seasonal variations in energy use patterns. Calculate the baseline consumption, i.e., the expected energy consumption under current operating conditions, based on the monthly ambient temperature and the historical consumption data for a selected reference period. If national norms for lighting/heating/cooling are not met in the existing status of the building and current baseline does not represent a fair benchmark for energy use of previous years, an adjusted baseline shall be generated so that energy consumption of the building before and after energy efficiency measures are implemented can be accounted in a fair and correct way. The baseline consumption shall be normalized as defined in ISO 50006 and later be revised using data from site assessments. In the case that energy data is not avaliable, energy modelling shall be performed to calculate the baseline consumption.

Conduct site assessments:

- Further investigate the major energy-consuming processes in the facility. At the end of this task, the buildings and systems descriptions and collection of consumption and other relevant data to propose

and describe EEMs should be completed. All relevant findings related to the visual inspections, field measurements, and interviews must be included in the energy audit report. The site assessment shall focus on all passive and active systems available on site and will include, but may not be limited to, the following subtasks:

- Conduct visual inspections
- Develop time plan for field visits and measurements
- Conduct field measurements, i.e., electricity measurements of the main consumption points per floor or per main use (e.g., X-rays in hospitals), internal and ambient temperature and humidity per hour during the period of audits
- Conduct field interviews

- *Conduct visual inspections:* Conduct visual inspections in a walk through to verify the completeness and accuracy of available documentation. This will include, but may not be limited to:
    - Construction details of the building envelope (e.g., walls, roof, windows, doors) and related insulation values
    - Heating and cooling production systems (e.g., chillers, boilers) and their capacities, rated efficiency, and maintenance status
    - Heating, Ventilation and Air Conditioning (HVAC) distribution system capacities, rated efficiency, and maintenance status
    - Electrical motors, their end-use, efficiency data, and maintenance status
    - Type of control methods and operation schedules
    - Interior and exterior lighting systems and related controls
    - Service hot water systems, their storage capacity, efficiency, and maintenance status
    - Renewable Energy (RE) generation and integration with building systems
    - Other relevant energy consumption drivers
- The report should include images to present the current state of the facility, possible shortcomings in the construction or in systems maintenance.
- *Develop a time plan for field visits and measurements***:** Define and agree on a time plan for field visits and measurements with the building supervisor, the O&M team and inform PIUat least 10 business days before. The time plan may be revised based on the operational conditions and availability of the building depending on the Covid-19 restrictions.
- *Conduct field measurements:* Perform all necessary on-site measurements to detail the energy baseline and collect data required for identifying EEMs. Install and operate the necessary energy monitoring equipment on-site suitable for the relevant data collection (e.g., data loggers, flue gas meters, temperature and hygrometer sensors, electric/gas meters, air and water flow meters, thermal cameras). If is not possible to measure the actual performance of systems and equipment (e.g., due to temporary malfunction, or out of season audit), performance of the systems and equipment shall be simulated based on theoretical and inspection data.
    - Field measurements should include, but may not be limited to:
        a) Building envelope: Windows, doors and insulation
            - Outside and inside surface temperatures
            - Thermal image for energy loss/gain and surface temperature
            - Insulation layer thickness
            - Glazing details/thickness
        b) Heating/cooling production and distribution system
            - Input values like electrical instantaneous and continuous power consumption for electrical based systems (e.g., chillers, fan, pumps)

- Enthalpy measurements for chillers and boilers
- Output values like airflow, water flow, air and water temperatures

c) Efficiency of boilers and other heat-generating equipment

- Flue gas temperature and chemical composition (O2, CO2)
- Fuel/gas instantaneous consumption

d) Electrical consumption of lighting systems

- Electrical instantaneous and continuous power consumption for sample circuits
- Lighting level (lux) in sample representative locations

e) Motors (including fans, pumps) and other plugged systems

- Electrical instantaneous and continuous power consumption for sample circuits.

f) Other energy consumption systems and equipment.

During the field measurement phase, building supervisor should provide the corresponding relevant variables, e.g., operating parameters, production data, occupation data. Additional measuring points, appropriate measuring equipment, associated processes and feasibility of installation may be identified during field measurements.

- *Conduct field interviews:* Interview key stakeholders (e.g., building manager, O&M staff, and users) to assess O&M routines, potential changes in user patterns (e.g., number of users or changes in user behavior), and comfort levels (e.g. indoor temperature, air quality, lighting levels) and to collect/confirm other relevant information. Interviews shall consider data collected during the previous tasks and aim at obtaining relevant information to explain seasonal and year-to-year changes in historical energy consumption, identifying current energy management practices and improvement potential, and identifying the feasibility of potential EEMs.

Data analysis:

- Revise the baseline energy consumption using data collected in previous tasks. If national norms for lighting/heating/cooling are not met in the existing status of the building and current baseline does not represent a fair benchmark for energy use of previous years, an adjusted baseline shall be generated so that energy consumption of the building before and after energy efficiency measures are implemented can be accounted in a fair and correct way. Identify EEMs and their investment costs, energy savings, and cost benefit. Develop scenarios for different combinations of EEMs with consideration of cross-effects between different EEMs. The audit report should document methodology, assumptions, and supporting calculations. This task will include, but may not be limited to, the following subtasks:

1) Describe audit scope
2) Review energy baseline and conduct EEM calculations
3) Determine investment costs
4) Establish different investment scenarios
5) Conduct financial analysis
6) Determine energy performance class

- *Describe audit scope:* Describe buildings and systems analyzed in the energy audit (e.g., areas/buildings covered, building envelope, heating/cooling, lighting and RE, alternatives to fossil fuel-based heating).
- *Review energy baseline and conduct EEM colculations:* Review the preliminary assessment of the energy consumption baseline using data collected in the previous tasks, including:

a. Use measurement data to explain the consumption behavior of the main users and refine the energy consumption baseline.

b. Compare energy consumption with specific energy use values of similar buildings if available (local and international experience)

c. Identify Best Available Techniques (BAT) at international level

d. Study the historical pattern of energy performance and establish relationships between energy performance and the relevant variables (e.g., heating/cooling degree days, occupation)

e. Assess existing energy performance indicators, e.g., kWh/m2, kWh/occupant, kWh/bed, and additional energy performance indicators, e.g., kWh/HDD or CDD

If there is insufficient quality data for setting up the baseline, dependencies and correlations between historical data, field data and other variables (e.g. weather-related variables, occupancy, events, documented equipment malfunctions, etc) should be used to establish a suitable baseline. If national norms for lighting/heating/cooling are not met in the existing status of the building and current baseline does not represent a fair benchmark for energy use of previous years, an adjusted baseline shall be generated so that energy consumption of the building before and after energy efficiency measures are implemented can be accounted in a fair and correct way. This process has to be documented in the report.

The field measurements and the catalogue/historical data must be used for the calculation to simulate the future energy performance with the proposed EEMs. If deemed necessary by the Consultant, several software tools may be used for baseline and EEM simulation calculation (not exhaustive): *Trace* for life cycle analysis; *Energy Plus*, *IESV* or *Carrier HAP* for energy modelling. Software tools to be used to simulate the level of service and envelope requirements may include: *Dialux* for lighting levels; *TS 825 Heat Insulation Standard* for insulation requirements.

- EEMs shall be developed based on the specific building analysis, but typical measures that should be considered include:
    - New or improved building envelope insulation
    - Renewal of window and doors
    - Heating boiler renewal
    - Boiler burner adjustment
    - Boiler waste heat recovery integration
    - Renovation of cooling/chiller systems
    - Variable speed circulation pumps and fans
    - Piping and duct insulation
    - Thermostatic valve usage in heating/cooling circuit
    - Lighting ballast type renewal
    - LED lighting systems
    - Movement sensor integration to lighting systems
    - Building automation systems
    - Energy monitoring system
    - Upgrade of electric motors with high-efficiency models
    - Cogeneration/Trigeneration
    - Photovoltaic (PV) systems
    - Solar water heating (SWH)
    - Biomass or other alternatives to fossil fuel-based energy
    - Heat pumps
- In all cases, the main energy-consuming vectors have to be addressed in the EEM proposal. The RE generation should be carefully detailed, with simulation production, grid connection point and relevant construction requirements, if any. No-cost measures, e.g., energy management and O&M, shall be stated but not included in the financial analysis.
- The indirect effects of the EEM implementation have to be considered:
    - Repairs or operational changes required for the EEM to be effective
    - Impact on O&M procedures and cost
    - Impacts on occupant health, comfort or safety, as well as non-energy benefits, especially improvements to health, safety and environment, changes in equipment run time, and maintenance labor hours
    - Commissioning requirement

- *Determine investment costs:* Accurate investment cost need to be determined for the financial analysis by gathering equipment, installation and construction costs from a sample of vendors and contractors. Costs should include any specific considerations for the particular facility and all indirect costs needed for implementation (e.g., dismantling, transport, scrapping, recycling, scaffolding, pipe accessories, civil construction works, electrical connections, changes in electrical boards). O&M costs, commissioning, and reinvestment cost have to be included in the financial analysis.
- *Establish different investment scenarios:* At least two different scenarios of combination of EEMs shall be presented in the audit report. The suitable combination of EE measures will be determined by energy audits and will result in a payback period of less than 15 years and a minimum energy performance of the renovated buildings (i.e., Turkish Class C energy performance certificates or higher).
    - All EEMs that were considered but not included in any of the scenarios should also be presented in the report.
    - The scenario construction will depend on the specific circumstances. The scenarios should include retrofitting the insulation and fenestration according to the TS 825 Heat Insulation Standard, basic building-level energy metering, and other EEMs with shorter payback periods.
    - The EE/RE measures will be ranked based on their financial viability and grouped in scenarios to be developed per building; measures need to be coherent (e.g. wall insulation requires installation of automatic temperature control). The final energy audit reports should present at least two scenarios to meet at least the minimum 20% savings and payback period of less than 15 years for the combination of EE/RE measures in order to identify the most optimal package of measures. For each scenario, disaggregated and aggregated results with regards to energy savings, fuel savings, CO2 reductions, simple payback, NPV, IRR and energy cost savings will be assessed and a clear conclusion on the recommended scenario needs to be provided.
    - A basic energy monitoring system should be included in all scenarios, i.e., building-level energy meters, or submeters that can be aggregated to provide building-level energy use data (electricity, natural gas, fuel oil, propane, etc.). Utility-owned meters capable of aggregating base building-level resource use are acceptable. The basic system can be standalone, i.e., without automated report capabilities or software aggregation.
- *Conduct financial analysis:* Each measure and scenario must include a Cost-Benefit Analysis with the calculation of energy cost savings, simple payback period, NPV and IRR over a 15-year period. The financial analysis must be presented in TRY. (The foreign exchange rate will be fixed for each audit for converting the cost of imported equipment/goods into TRY currency.) If the net life of the measure is lower than the NPV timeframe, re-investment costs need to be included in the analysis. O&M costs and other indirect related costs should be included in the analysis. Investments are made in year 0 (or when re-investments take place) and the savings will start in year 1. Details of the financial analysis are laid out in the audit report template in Annex-2.
- *Determine the energy performance class:* Determine the energy performance class of the building in the current state by issuing an Energy Performance Certificate (EPC-EKB) so that it can be compared to the performance class after renovation (issuance of an actual energy performance certificate is not required for the building in the current state if the building already has an EPC (EKB) issued by the most recent version of national EPC software, BEP-TR2). The performance class to be achieved has to be calculated using the recommended measures list. Preliminary Calculation Result Report (Ön Hesap Sonuç Raporu) has to be obtained for the building to be achieved with proposed energy efficiency measures by using most recent version of national EPC software, BEP-TR2. In any case, the proposed scenario must achieve at least an Energy Performance Class (EKB) B. After energy efficiency measures are implemented on site and construction works are finalized, a new EPC (EKB) shall be issued for the upgraded form of the building.

Develop innovative and green solutions:

- Applications based on green and innovative technologies to enable the behavioral change that support the implementation of energy efficiency measures. Meeting the energy efficiency goals will require significant efforts to change consumer and user behaviors. Strategies and targets need to be in line with the motivations of individual building users and owners, and actions need to be easily integrated into daily behaviors to be effective. Changing these daily behaviors is a major challenge, requiring

training and awareness activities, as well as feedback measures and incentives to trigger long-term change.

- The Consultant shall develop innovative and green solutions derived from the energy efficiency measures applied in the buildings such as; PV powered mobile device and electric vehicle charging station, occupant information screens that shows the current energy consumption data of the building, etc. that can help awareness raising towards energy consumption and have high impact on user behaviors. The proposed innovative visibility technologies shall be building specific and have an impact assessment for each proposal. Additionally, the estimated cost for the proposed innovative technologic solutions shall be calculated and provided in a separate table other than the table prepared for energy efficiency measures.

Final audit reports:

- The report should follow the audit report template given in Annex-2. Changes to the report structure have to be authorized by the Client. The audit report should be prepared both in English and Turkish concise and clearly written; capture all calculations, analyses and assumptions; and discuss difficulties encountered in data collection and field work.

  Revisions shall be made by the Consultant, in calculations or other documents in case of any discrepancy or mistake recognized during the Construction Phase. Any problems related to the eligibility of audit reports are binding for the Consultant regardless of when the problem occurs.

Task 4: Preparation of Detailed (Final) Renovation Designs

Following the approval of the Preliminary Renovation Design Report, the agreement between the Client and and the beneficiaries on the structural retrofitting, energy efficiency other collateral measures to be included, the Consultant shall prepare the detailed (final) renovation designs and all tender documents for works.

Design supervision, control and approval of Design Supervisor(s) shall be mandatory on the below mentioned calculations and respective designs.

Preparation of Detailed (Final) Designs and Tender Documents including, but not limited to:

- The detailed (final) renovation designs and all tender documents for the works tender shall be prepared according to "World Bank Procurement Regulations for IPF Borrowers" (dated November 2020) and based on the approved preliminary renovation design recomendations, energy audit reports and a cost-benefit analysis, using clear energy savings indicators, which then should be monitored and verified upon project completion.
- Detailed renovations should include architectural (including comparative drawings clearly showing the revisions/differences/interventions before and after renovation) and engineering services (all mechanical and electrical services, including but not limited to: heating, cooling, ventilation, hot and cold water supply systems, fire protection, electrical supply system, lighting system, gas distribution, power and service sockets, telephone/television/radio, lifts, building management/automation system (if any) etc.) related with renovation and collateral works.
- Renovation designs and general and specific technical specifications for all the renovation works shall be prepared in accordance with MoEUCC's "Construction Works, Civil, Mechanical Works and Electrical Works General Specifications". However, if no proposed interventions are being considered for a particular area (e.g., no lighting or other electrical measures), detailed (e.g., electrical) drawings may not be required.
- Identify possible functionality renovations, improvements and required repairs such as leakage of water at basements, defects in plasters and roofs, deterioration in wet areas, etc. after consultation with the administrations and report these to the Client. Relevant BoQ's and Technical specifications shall be prepared by the Consultant in detail and shall be submitted to the Client for approval, following the decision of the Client on which parts of these works shall be integrated to the relevant parts of the tender documents.
- In case a solar PV installation measure exists in the finally approved EEM list, Consultant shall organize and coordinate the whole Call Letter process (GES Çağrı Mektubu) with the beneficiary and/or building owner institution, electricity distribution grid operator company and/or Turkish

Electricity Distribution Grid Operator (TEDAŞ). Consultant shall receive Call Letter at the end of the formal application process

- In case a cogeneration /trigeneration measure exists in the finally approved EEM list, Consultant shall carry out the mechanical/electrical design process by keeping in mind that these systems will need an approval from relevant central and regional energy authorities (Ministry of Energy and Natural Resources, Turkish Electricity Distribution Grid Operator (TEDAŞ) or Turkish Electromechanic Industries Co. (TEMSAN) and regional environment authorities (Environmental Impact Assessment Exemption, etc.). Hence, all provisional design and calculations shall be made based on not only the building's electrical/thermal loads but also the capacity and availability of the connected transformer of local electrical grid, the regional grid operator's feedbacks/opinions.
- Other eligible measures included in the retrofit and renovation of buildings will support universal access improvements (e.g., addition of wheelchair ramps), water efficiency improvements (e.g., rainwater harvesting during times of water scarcity) and measures to improve fire safety – particularly as they relate to the upgrading of heating systems, electricity supply (rooftop solar PV, capacitors, transformers, rewiring) – and for fire detection and warning. An additional allowance of up to 10% of the total building renovation cost (civil works) can be used to meet other requirements requested by the building owner to improve the building, such as functionality improvements, increased internal ventilation and air filtration to reduce airborne diseases, painting, basic repairs, etc.

Table.2: Indicative list of eligible measures other than EE and RE measures

Building component	**Eligible Measures**
Water efficiency	▪ Harvesting rain water ▪ Cool/green roofs ▪ Gray water
Accessibility	▪ addition of wheelchair ramps and lifts ▪ accessible WC ▪ information desks and signage ▪ accessible parking space
Fire safety	▪ fire detection and warning ▪ fire staircases and other escape routes ▪ rewiring
Functionality improvements	▪ increased internal ventilation and air filtration to reduce airborne diseases ▪ Painting ▪ Basic repairs, e.g., gutters and down spouts

- Design drawings should be presented in such a way that:
    - The drawings can easily be understood
    - They visually communicate the concept to the beneficiary and the construction contractor
    - They clearly show the renovation interventions before and after renovation so the beneficiary and construction contractor can easily understand what sections/areas/systems/components are to be renovated
    - Clear and understandable "General Notes" and "Project Specific/Key Notes" should be embedded in the design plans/drawings so that the beneficiary and construction contractor can easily understand what to be done at which areas/sections/systems/components
    - Scope of demolition work and new work shall be clearly identified on the drawings
    - They are legible
    - All information from previous revisions and updates are included.
    - No details will be provided in the areas not subject to any intervention.
- The design drawings should include the following aspects:

- Site layout for each building (within the campus, considering the scope of buildings and any other works (if applicable) required outside the buildings.
- Plan views (focusing on the areas related with the renovation works) and system cross-sections and details as necessary from the points of renovation
- Elevations showing scope of demolition and new works. Demolition drawings, plans, section and details as necessary
- There will be three sets of technical drawings and details in 1/50 scale, and details including system details (for interventions 1/20, 1/5 scales, 1/1 scale if needed), which have to be compliant with the applicable in force regulations:
    i. Architectural drawings: Site layout, floor plans/construction plans with all partition types and details provided for the areas subject to intervention, lighting plan for ceilings, System cross-sections from the points of renovation.
    ii. Mechanical drawings (in conformity with the heating zone where the building is located): The mechanical installation drawings should include the components recommended to be replaced by the energy audit. Heating, cooling, ventilation and sanitary plumbing projects and system drawings specific to each project should be prepared according to the obtained energy audit reports in conformity with electrical and architectural designs. Heat insulation calculations and reports should be prepared according to TS 825 Standard.
    iii. Electrical drawings: The electrical installation drawings should include the components recommended to be replaced by the energy audit. MV distribution, transformer, generator, UPS, lighting, socket (mains and UPS), mechanical and force distribution, cable transportation, earthing and lightning protection, elevator, table loading tables, strong current column diagram and calculations (lighting, heating, short circuit, voltage drop). Energy efficiency comparisons (comparison of current and new status) should be shown in the corresponding plans. Necessary infrastructure plans should be prepared for the remote monitoring of energy consumption.
    iv. Structural drawings: Structural plans, sections and details along with structural calculations based on relevant in force codes/regulations as well as for the works to be done independent of the existing structure (i.e. open parking lot canopies, canopy rooftop PV systems, etc.). Superposition plan of new components and existing structures (i.e. frame systems supporting rooftop PV system, solar hot water collectors, etc.). Structural design and calculation reports of newly added systems/components in compliance with in force codes/regulations (i.e. structural calculations and reports). Seismic calculation and design of the restraints of cogeneration/trigeneration systems and suspended piping network if applicable.
- The compliance of renovation designs with standards and regulations in force in Turkey shall be certified by the Consultant. The specifications shall be prepared in accordance with the Building Code, current By-law Concerning Construction in Planned Areas, By-Law on Building Energy Performance and related Turkish legislation and standards.
- Company should also propose measures to be taken in order to meet the national norms, standards and legislations about additional aspects (e.g., indoor air quality, humidity, comfort levels, fire protection measures).
- Regarding hospitals, if the Ministry of Health or hospital administrations request COVID-19 measures for any of its buildings in list, mechanical drawings should include measures to be taken such us modifications in filters or mechanical installations for COVID-19 patient rooms.

- The draft renovation design must be submitted to the beneficiary for formal consent, and to any required third parties for review and certification. Any comments provided by the beneficiary, third party auditor or the Client must be taken into account before the designs are finalized.
- Within the scope of preparation of technical specifications, Consultant shall;
    - Submit final Bill of Quantities (BoQ), all related design calculations, and relevant final cost comparison analysis. Prepare BoQ's in compliance with unit price guidelines of MoEUCC or other relevant state authorities or market prices. BoQ's prepared by the Consultant should be in compliance with pricing preambles, technical specifications and other relevant parts of the documents to be prepared for tender process. The BoQs and related cost estimation tables shall be prepared by using an accurate and easy-to-use cost estimating software that is approved by the Client.
    - The structural retrofitting work, required energy efficiency and collateral upgrades shall be seen separately on the Bill of Quantities (BOQ).
    - As specified above, for the preliminary renovation design and detailed (final) renovation design task specified above, the Technical Specifications, Bills of Quantities, final designs, system/detailed drawings shall be prepared and submitted to the Client for approval, following the decision of the Client on which parts of these works shall be integrated to the relevant parts of the tender documents.
    - The Consultants shall prepare all the deliverables in close cooperation with the Client and with due care and diligence. Any of the items in these documents shall not contradict with each other and all material specifications shall be in accordance with the specifications of the first quality materials satisfying the Turkish Standards, or otherwise international standards.
- The Consultant, before finalizing and submitting the technical designs and tender documents to the Client, shall present the detailed (final) renovation designs of the buildings to the beneficiary (and their user/occupant committees) for their approval considering their needs and the function of the building. The Consultants shall submit a letter countersigned by the principal and/or directorates of the relevant public buildings and the Consultant's representative indicating that the principal and/or directorate is informed about and agreed on the Final Architectural, Structural, Mechanical and Electrical works subject to tendering following the decision of the Client on the works approved to be integrated to the relevant parts of the tender documents.
- Revisions shall be made by the Consultant, in drawings or other documents in case of any discrepancy or mistake recognized during the Construction Phase.
- The Consultants shall carry out all the services for the Detailed (Final) Designs and Tender Documents and submit the services outlined above, to the satisfaction of the Client. The Detailed (Final) Designs shall include a surveillance report "Gözetim Raporu" prepared and approved by the Design Supervisor(s) shall be mandatory.
- Visual presentation file of renovation designs and works, including:
    - Posters, leaflets with 3D images that is prepared to give information and to raise awareness about the energy efficiency measures implemented in the building, and the benefits of these applications.
    - Graphic representation of the design steps that shifts the energy performance of a standard building to an efficient energy use class.
    - The graphic designs of the presentation visuals will be subject to PIU approval before printing. All visual materials shall include the logo and the names of the Client and the project, the template of which will be provided by the Client. The posters will be presented especially in the areas/sections where innovative and green applications are implemented. The number of the leaflets to be printed and distributed will be up to 500-1000 for each building complex according to the number of the building users and visitors to be distributed.
- The Consultant shall prepare Measurement and Verification (M&V) Plan that explain how to verify savings for each Energy Efficiency Measure, how to adjust the Reference Energy Consumption (or baseline) by using the data of the building, with methods and calculation details. The plan will include

the verification method of savings, important measures to be taken, the timing of these activities, the duties and responsibilities of the parties and how to ensure quality assurance for this process.

Task 5: Identification of Environmental - Social Risks and Preparation of Environmental and Social Management Plans (ESMPs)

Identify environmental and social risks and impacts associated with the building renovations:

- Identify environmental and social risks and impacts associated with the building renovation, including identifying presence and quantity of any hazardous materials (specifically asbestos and mercury containing light-bulbs) that would have to be removed as part of the renovation works.

Prepare site specific Environmental and Social Management Plans (ESMPs):

- Prepare site-specific Environmental and Social Management Plans (ESMPs) in line with the Environmental and Social Standards (ESSs) of the World Bank's Environmental and Social Framework (ESF), the World Bank Group (WBG) General Environment, Health and Safety (EHS) Guidelines (including Covid-19 measures) and the Environmental and Social Management Framework (ESMF) developed for the Project and Good International Industrial Practices (GIIPs).
- The ESMPs shall outline the mitigation, monitoring and mitigation measures to be taken during project implementation to avoid or eliminate negative environmental and social impacts.
- The Consultant shall submit the ESMPs to the PIU to be finalized and integrated into construction contractor bidding documents. The ESMF of the project entails an ESMP format, which shall be deployed in development of ESMPs for renovation activities. In addition, the consultant shall update the ESMPs during the project implementation/construction in consultation with the construction contractors, if required.
- The ESMPs shall provide the baseline data, environmental and social risks and impacts assessment, relevant mitigation measures to be taken, monitoring and reporting arrangements, and a Land Acquisition Checklist (provided as an annex to the ESMF) to screen out any activities requiring extra land for demolishing and reconstructing.
- The ESMPs shall include specifications an, bill of quantities for removal, packaging, transport and disposal/interim storage of hazardous materials, personal protective equipment, monitoring requirements (the Environmental Mitigation and Monitoring Measures based on the Environmental and Social Management Framework) and estimate of costs for the measures. This will also include the location where the asbestos can be disposed and the interim storage location for the mercury containing lightbulbs as per ESMF and Turkey legislation.
- The Consultant shall prepare the ESMPs in both English and Turkish languages for World Bank review, until otherwise advised by the World Bank at later stage of the project implementation.
- The Consultants shall liaise with the MoEUCC in order to finalize the ESMPs with the World Bank's approval and help MoEUCC to organize disclosure and consultation for the ESMPs with the public (especially including the stakeholders who might be affected from the renovations).
- Each of the ESMPs will be made publicly available on the websites of the MoEUCC and respective buildings to be renovated. The physical copies will be accessible to the public at the offices in the construction yard during the construction activities. In this manner, all stakeholders will have full access to the ESMPs which provides information regarding the potential environmental and social impacts and risks, and the details of the mitigation measures to be taken. The Consultant will make sure that site specific ESMPs are publicly available both at the construction sites and at easily accessible places within the local area.

V. Timeline

This assignment is expected to initiate in the second quarter of 2022 and finalized in a period of 12 months. The Consultant shall submit all the documents in a timely manner to complete the services on time without any delay. Consultant shall deliver its first Detailed (Final) Renovation Designs at the end of the fifth (5^{th}) month and make the related buildings ready to tender until the end of sixth (6^{th}) month. To achieve this, the Consultant shall carry out the necessary arrangements in field/home teams. The Client shall give a decision

within 28 days of receipt of a review or approval request. A tentative time schedule for the completion of the consultants' services (including Client's review and approval durations) for the various parts of the Project is given below;

Table.4: Tentative Timeline

N°	Deliverables/Tasks	Months											
		1	2	3	4	5	6	7	8	9	10	11	12
1	Structural Feasibility Reports												
2	Preliminary Renovation Design Reports												
3	Investment Grade Audit Reports												
4	1st Group of Buildings (3 Campuses)												
5	2nd Group of Buildings (3 Campuses)												
6	3rd Group of Buildings (1 Campus)												
7	4th Group of Buildings (2 Campuses)												

	Structural Feasibility		**Preliminary Renovation Design**		**Investment Grade Audit**		**Detailed (Final) Renovation Designs & Preparation of ESMPs**		**Tender Documentation**

VI. Time Schedule for Deliverables

The deliverables for each task will be submitted to and approved by the Client. The Consultant must obtain approval for each deliverable before moving to subsequent tasks. The table below summarizes the deliverables for each building and includes an indicative timeline and payment schedule. The deadlines stated in the table means calender days after effectiveness of the contract.

Table.5: Table of Deliverables for each Building

Task	Deliverable	Deadline	Submission Requirement
1	Material and Geotechnical Test Reports, Plan Drawings	90 days	• Material and geotechnical Test Reports and Visual Presentation File shall be prepared in only Turkish • Other Deliverables shall be initialed (executive summary sections shall be signed, if exists) and prepared in 2 hard copies for both English and Turkish • Electronic copies of all Deliverables shall be submitted with an External SSD • All Deliverables shall be uploaded into the online platform which the Client addresses
	Structural Feasibility Report	120 days	
2	Preliminary Renovation Design Report	150 days	
3	Investment Grade Audit Report	210 days	
4	Detailed (Final) Renovation Designs and Tender Documents	365 days	
	Visual Presentation File	365 days	
	Measurement and Verification (M&V) Plan	365 days	
5	Environmental and Social Management Plans (ESMPs)	365 days	

The consultant can submit all deliveries in a single SSD (Solid State Drive) with sufficient capacity. The metric system of weights and measures shall be used. The drawings shall be submitted in A1 paper size (unless otherwise required or agreed) and includes drawings in PDF and AutoCAD format, labeling, grouping and details as required by the Client. The plot size, parcel, map sheet for all buildings shall be listed and integrated into the drawings and other required documents.

As indicated in the General Conditions of Contract all the drawings, reports, plans, specifications, and any other documents produced under this Contract are the property of the Client and therefore the Consultants shall also submit all the originals of the drawings and the other documents in required format.

VII. Facilities provided by the consultant

The Consultant must ensure that its professional staff has adequate support and equipment. All costs for equipment and administrative and logistic support must be covered by the Consultant and included in the bid price, including:

- All costs arising from the activities of its staff during the contract period, including accommodation, allowances, transportation, insurance, etc.
- Automotive, equipment, equipment for field and lab tests, office supplies, hardware and software (software for modeling and static/dynamic analysis of critical structures) etc.
- All communication costs, including fax, email, telephone, etc.
- All the equipment, instruments, services and logistical support required for the implementation of the contract, and any costs incurred during its preparation of documents and drafts, copying, printing, qualified translation, interpretation etc.
- Technical equipment at the monitoring site.
- One (1) license of each structural software program(s) used for the analyses to be provided for the Client. The licenses should be valid during the contract (Lump-Sum Phase and Time-Based Phase).

VI. Support to be provided by the client to the consultants

- The Client provides the existing inputs, project data, reports etc. about the buildings with the RFP. The consultants shall verify the provided inputs during the field studies and in all cases; the assignment shall be undertaken according to the consultant's own inputs.
- If any delay or no response received from the beneficiary or other third parties during the execution of aforementioned tasks, the Consultant shall inform the Client in a timely manner with indicating the possible grounds. The Client will accelerate the process or give consent to proceed the task.

VII. Team Composition & Qualification Requirements for The Key Staff

The Consultant shall provide experienced staff with proven technical and managerial competence and experience in the structural and energy efficiency assessments, related with latest Turkish Earthquake Code and Energy Performance Regulation in Buildings. The Consultant shall separately indicate the task assignments for each staff.

i) Consultant Profile:

The Consultants should be in consulting business, have similar previous experience in the scope of services, demonstrate sound administrative and financial capacity and availability of the key experts for the performance of the services described in this TOR.

The attention of interested Consultants is drawn to Section III, paragraphs, 3.14, 3.16, and 3.17 of the World Bank's "Procurement Regulations for IPF Borrowers" November 2020 and The Bank's 'Guidelines on Preventing and Combating Fraud and Corruption in Projects Financed by IBRD Loans and IDA Credits and Grants,' (revised as of July 01, 2016) ('Anticorruption Guidelines').

Consultants may associate with other firms to enhance their qualifications, but should indicate clearly whether the association is in the form of a joint venture and/or a sub-consultancy. In the case of a joint venture, all the partners in the joint venture shall be jointly and severally liable for the entire contract, if selected.

ii) Team Composition:

The working language of the project is English. All the team members assigned by the Consultant must possess proficiency in English language. Day-to-day communication language will be Turkish or English at the field level to ensure smooth communication among all participants, direct and indirect, of the Project.

All key staff and support staff shall be mobilized immediately after the contract signature. In addition, support staff for the administrative services shall be proposed additionally as required (surveyors, clerks, drivers, secretary etc.).

The Consultants shall be obliged to get service from the Design Supervisor while undertaking the all assignments in this TOR starting form the assessment to final design submissions according to clause 1.3 of TEC2018. The Design Supervisor shall have temporary or permanent "Special Buildings Design Supervision Certificate" given by the Ministry of Environment, Urbanization and Climate Change in the required profession fields[7]. The Consultants shall include financial implications and costs of obtaining such approval to their assessment reports, design criteria, calculations and designs in their proposals. All the respective processes shall be in line with the Comminique named "Türkiye Bina Deprem Yönetmeliği Kapsamında Yapılacak Tasarım Gözetimi ve Kontrolü Hizmetlerine Dair Tebliğ" dated 11.01.2019 with the Official Gazette referenced 30652.

All expatriate staff who will work in Turkey should obtain a work permit and all who are resident for more than 90 days should obtain a non-resident visa. The consultant will obtain all required permits, visas for all expatriate staff at his own cost. Furthermore, the Consultant will be responsible to ensure that all proposed personnel are eligible to obtain such permits and visas. The information related to visas can be obtained from the embassies and consulates of Turkey. The Client will assist the consultant for the issue of work permits. The Consultant is required to obtain all the necessary permits, approvals, payment of all fees and contributions, as well as all the other elements necessary for the work of his professional staff who is engaged at his own expense for the performance of this Contract.

Key and support staff qualifications shall include but not limited to the following table.

Table 6: Staff Qualification Requirements

Tasks	Position (Min. *Number of Staff Required*)	Required Experience
All Tasks	Project Manager (1):	Civil Engineer with minimum fifteen (15) years of professional experience includes at least ten (10) years' experience in structural feasibility and structural retrofitting design of similar buildings and five (5) years working experience in manager position.
	Deputy Project Manager (1)	Architect, Civil, Electrical or Mechanical Engineer with minimum fifteen (15) years of professional experience, includes at least ten (10) years' experience in design of energy efficiency related works in similar buildings and five (5) years working experience in manager position.
Task.1, 2,4	Structural Engineer (1):	Civil Engineer (Structural Engineer, MSc. or above) with minimum ten (10) years of professional experience, includes at least five (5) years' experience in structural design of retrofitting works and knowledge of alternative retrofitting materials. Temporary or permanent "Special Buildings Design Supervision Certificate" in TGUA-3 profession field would be an asset.
	Seismic Engineer (1)	Civil Engineer (Seismology related, MSc. or above) with minimum ten (10) years of professional experience, includes at least five (5) years' experience in developing of soil behaviour analyses of structural retrofitting related works. Temporary or permanent "Special Buildings Design Supervision Certificate" in TGUA-1 profession field would be an asset.

[7] *The profession fields are abbreviated as TGUA and can be summarized as TGUA-1: Profession in earthquake ground motion, TGUA-2: Profession in ground behavior analysis, TGUA-3: Profession in non-linear analysis, TGUA-4: Profession in highrise building analysis, TGUA-5: Profession in earthquake isolation design and analysis.*

Tasks	Position (Min. *Number of Staff Required*)	Required Experience
	Geotechnical Engineer (1)	Civil Engineer (Geotechnical Engineer, MSc. or above) with minimum ten (10) years of professional experience, includes at least five (5) years' experience in design of geotechnical projects of superstructures. Temporary or permanent "Special Buildings Design Supervision Certificate" in TGUA-2 profession field would be an asset.
Task 2	Mechanical Engineer (1):	Mechanical Engineer having ten (10) years of professional experience including five (5) years' energy audit experience in similar buildings. Energy manager or audit-project certification given by Ministry of Energy and Natural Resources is mandatory.
	Electrical Engineer (1):	Electrical Engineer having ten (10) years of professional experience including five (5) years' energy audit experience in similar buildings. Energy manager or audit-project certification given by Ministry of Energy and Natural Resources is mandatory.
Task 2,3,4	Cost and Planning Engineer (1):	Civil Engineer with minimum five (5) years of professional experience, includes at least least two (2) years' experience in tender documentation. These experiences should be mainly on development of project specifications, time schedules and budgets of prepared designs of similar buildings.
Task.4,5	Environmental and Social Specialist (1):	University degree in engineering with minimum five (5) years of professional experience including at least three (3) years' experience in the national environmental and social legal framework, environmental and social impact/risk assessment, preparation of environmental and social assessment tools (ESMP, Environmental and Social Impact Assessment (ESIA), etc.) and knowledge in environmental and social safeguard policies and ESSs of the World Bank's Environmental and Social Framework (ESF) or other international development institutions, GIIPs.
	Occupational Health and Safety (OHSE) Expert (1)	Occupational Health and Safety Specialist with minimum five (5) years of professional experience, including at least three (3) years' experience in OHS assessment and management in construction projects financed by international finance institutions or other international donors, preferably the World Bank and with a knowledge in environmental and social safeguard policies and ESSs of the World Bank's ESF or other international development institutions, having A or B Class Occupational Safety Expert certificate received from the Directorate General of Occupational Health and Safety or equivalent international certificate.
Support Staff	Technical Support Staff Requirement	To assure the required services at least ten (10) Technician/Junior Engineer/Architect (Architect (2), Civil (4), Mechanical (2) and Electrical (2) Technician/Engineer) shall be assigned in addition to input from the Key Experts. Technician/Junior Engineer will not be evaluated as key staff.
	Administrative Support Staff Requirement	Support staff for the administrative services shall be proposed additionally as required (surveyors, clerks, drivers, secretary etc.)

Annex 1: Building List

Annex 2: Audit Template

Annex-1

List of Buildings covered under the Assignment

CAMPUS Nº	OWNERSHIP	BUILDING NAME	REGION	PROVINCE	DISTRICT	TYPE of BUILDING	BUILDING	CONST. YEAR	AREA (m²)
1	Boğaziçi University	Deprem Mühendisliği Binası	Marmara	İstanbul (Asia)	Kandilli	Educational Settings	1	1991	1.458,00
	Boğaziçi University	Afete Hazırlık Eğitim Birimi (AHEB)	Marmara	İstanbul (Asia)	Kandilli	Educational Settings	1	1996	1.695,00
	Boğaziçi University	Yeni Jeofizik Binası	Marmara	İstanbul (Asia)	Kandilli	Educational Settings	1	1995	1.102,00
2	Boğaziçi University	Kapalı Spor Salonu	Marmara	İstanbul (Europe)	Sarıyer	Educational Settings	1	1999	2.862,00
	Boğaziçi University	Superdorm (Otopark)	Marmara	İstanbul (Europe)	Sarıyer	Educational Settings	1	1989	19.700,00
3	Boğaziçi University	1.Öğrenci Yurdu	Marmara	İstanbul (Europe)	Sarıyer	Educational Settings	8	2002	9.482,00
	Boğaziçi University	YADYOK Derslik B Blok	Marmara	İstanbul (Europe)	Sarıyer	Educational Settings	1	1991	3.655,00
	Boğaziçi University	Sosyal Tesis & Yurt	Marmara	İstanbul (Europe)	Sarıyer	Educational Settings	1	1994	2.080,00
	Boğaziçi University	YADYOK Derslik A Blok	Marmara	İstanbul (Europe)	Sarıyer	Educational Settings	1	1991	5.681,00
4	Ministry of Interior	Hükümet Konağı	Marmara	Sakarya	Adapazarı	Administrative Buildings	1	2001	42.656,00
5	Ministry of Youth & Sports	Gazanfer Bilge Öğrenci Yurdu	Marmara	Kocaeli	Karamürsel	Dormitory and Social Facilities	1	2005	13.520,00
6	Ministry of Youth & Sports	Kandıra Öğrenci Yurdu	Marmara	Kocaeli	Kandıra	Dormitory and Social Facilities	1	2007	11.340,00
7	Marmara University	Marmara Üniversitesi Yabancı Diller Yüksek Okulu	Marmara	İstanbul (Asia)	Kadıköy	Educational Settings	1	1996	2.250,00
	Marmara University	Marmara Üniversitesi Mühendislik Fakültesi	Marmara	İstanbul (Asia)	Kadıköy	Educational Settings	1	1992	2.400,00
	Marmara University	Marmara Üniversitesi Teknik Eğitim Fakültesi	Marmara	İstanbul (Asia)	Kadıköy	Educational Settings	1	1994	1.200,00
	Marmara University	Atatürk Eğitim Fakültesi	Marmara	İstanbul (Asia)	Kadıköy	Educational Settings	1	1982	16.200,00

CAMPUS Nº	OWNERSHIP	BUILDING NAME	REGION	PROVINCE	DISTRICT	TYPE of BUILDING	BUILDING	CONST. YEAR	AREA (m²)
8	İstanbul Technical University	Vadi Yemekhane	Marmara	İstanbul (Europe)	Ayazağa	Dormitory and Social Facilities	1	1994	1.350,00
	İstanbul Technical University	Vadi Spor Salonu	Marmara	İstanbul (Europe)	Ayazağa	Dormitory and Social Facilities	1	1994	1.298,00
	İstanbul Technical University	Vadi Yurdu B	Marmara	İstanbul (Europe)	Ayazağa	Dormitory and Social Facilities	1	1994	5.151,06
	İstanbul Technical University	Vadi Yurdu C	Marmara	İstanbul (Europe)	Ayazağa	Dormitory and Social Facilities	1	1994	5.179,42
	İstanbul Technical University	Vadi Yurdu D	Marmara	İstanbul (Europe)	Ayazağa	Dormitory and Social Facilities	1	1994	5.160,71
	İstanbul Technical University	Vadi Yurdu E	Marmara	İstanbul (Europe)	Ayazağa	Dormitory and Social Facilities	1	1994	5.177,40
9	İstanbul Technical University	Uçak Uzay Fakültesi	Marmara	İstanbul (Europe)	Ayazağa	Educational Settings	4	1992	8.414,29
	İstanbul Technical University	Ayazağa Kız Öğrenci Yurdu	Marmara	İstanbul (Europe)	Ayazağa	Dormitory and Social Facilities	1	1992	3.395,25
	İstanbul Technical University	Fen Bilimleri Enstitüsü.	Marmara	İstanbul (Europe)	Ayazağa	Educational Settings	1	1989	4.361,00
	İstanbul Technical University	Gemi İnşaat Fakültesi	Marmara	İstanbul (Europe)	Ayazağa	Educational Settings	6	1987	13.020,00
	İstanbul Technical University	Maden Fakültesi	Marmara	İstanbul (Europe)	Ayazağa	Educational Settings	13	1987	18.765,85
	İstanbul Technical University	Kapalı Spor Salonu	Marmara	İstanbul (Europe)	Ayazağa	Administrative Buildings	3	1986	2.500,00
10	İstanbul University Cerrahpaşa Faculty	Avcılar Öğrenci Kültür Merkezi	Marmara	İstanbul (Europe)	Avcılar	Educational Settings	1	1998	9.349,00
	İstanbul University Cerrahpaşa Faculty	Avcılar Merkez Laboratuar	Marmara	İstanbul (Europe)	Avcılar	Educational Settings	1	2001	1.240,00
	İstanbul University Cerrahpaşa Faculty	Rektörlük İdari Binası	Marmara	İstanbul (Europe)	Avcılar	Educational Settings	1	1990	2.840,00
11	İstanbul University Cerrahpaşa Faculty	Büyükçekmece C Blok Yurt Binası	Marmara	İstanbul (Europe)	Büyükçekmece	Dormitory and Social Facilities	1	1996	3.650,00
	İstanbul University Cerrahpaşa Faculty	Büyükçekmece V Blok Kız Yurdu	Marmara	İstanbul (Europe)	Büyükçekmece	Dormitory and Social Facilities	1	1996	8.000,00
						TOTAL:	**62**		**236.132,98**

Annex-2

Audit Template

Index

Audit Template

1. Cover Page

a) Main components:

b) Report title (with Building/Facility Name);

c) Entity for which Building/Facility has been audited;

d) Location of Building/Facility;

e) Building type (hospital, school etc.);

f) Building picture;

g) Date of report;

h) The firm responsible for the Audit;

i) Consultants certificate numbers.

2. Table of Contents, Tables and Figures

Table of Contents should include all significant headings, sub-section headings and appendix sections. Ensure that the table of contents is updated when the report is finalized. It is also desirable to add tables for relevant figures and tables. The abbreviations and acronyms used should also be indicated and explained in a friendly format, and the conversions and reference values should be presented, either at the beginning of the report or in the first Appendix.

3. Executive Summary

All information in the Executive Summary should be drawn from the detailed information of the full report. Must be concise and up to a point. The minimum contents should be as follow:

a) Short building description (owner, size, type of use, systems, insulation, etc.), using a table with this format:

Ref	Category	Description
1	Name of Building/Building Group	
2	Owner	
3	Year of Construction	
4	Purpose of Use	
5	Number of Buildings in Building Group	
6	Enclosed Volume	
7	Construction Area	
8	Building Floor Area	
9	Annual Heating Degree Days	
10	Annual Cooling Degree Days	
11	Heating/Cooling System	
12	Insulation Status	
12	Number of employees	
13	Number of other building users	
14	City	

Ref	Category	Description
15	Building Address	
16	Postal Code	
17	Phone number	
18	Fax Number	
19	email address	
20	Energy manager	
21	Certificate number of the energy manager	
22	Phone number	
23	Fax Number	
24	email address	
25	Energy Performance Certificate number (if any)	

b) Key yearly energy consumption:

Year	Total Annual Average Energy Consumption [TOE]
Year #1	
Year #2	
Year #3	
Year #(…)	
Baseline Energy use	

c) General Indicators:

#	Indicator	Units	Year #1	Year #2	Year #3	Year #(...)	Average
1	Energy Consumption per m^2	kWh/m^2 year					
2	Emissions per m^2	Ton CO_2 eq. /m^2 year					
3	Emissions per person	Ton CO_2 eq. /person year					
4	Fuel Consumption per HDD	kWh / HDD m^2 year					
5	Electricity consumption per CDD	kWh / CDD m^2 year					

d) Key systems and equipment analysed.

e) Resume of building energy consumption and consumption breakdown, through a table and a graph:

	Annual Energy Use [TOE]	Annual Energy Cost [TL]	Cost [TL/TOE]
TOTAL Baseline Energy Usage			
TOTAL Energy Savings			
TOTAL Proposed Energy Usage			

	Electrical				Fuel #(…)				Total		
year/month	Consumption	Consumption [TOE]	Share of Total Consumpt	Total Cost [TL]	Consumption	Consumption [TOE]	Share of Total Consumption [%]	Total Cost [TL]	Consumption	Consumption [TOE]	Total Cost [TL]
Year #1 total											
Year #2 total											
Year #3 total											
Total											

Insert a slice graph of the last table for easy reading of the total values.

f) Summary of recommended energy conservation measures (including cogeneration and renewables opportunities), annual energy savings and cost savings. There should always be four tables: i) base scenario, ii) deep renovation scenario, iii) recommended package and iv) measures that were studied but not taken into account. Refer to the Energy Efficiency Measures (EEM) chapter for scenario detail. The tables for all scenarios should follow this format:

No.	EEM	Estimated annual energy savings [TOE]	Estimated annual cost savings [TL]	Estimated implementation cost [TL]	Payback period [years]	IRR	NPV
1							
2							
(…)							
Total							

g) The EEMs that were studied but not proposed should be presented. The analysis for all the factors may not be detailed, but the reason for not being proposed has to be carefully explained. The table should follow this format:

No.	EEM	Estimated annual energy savings [TOE]	Estimated annual cost savings [TL]	Estimated implementation cost [TL]	Payback period [years]	Data based on the base or deep scenario	Comments
1							
2							
(…)							

h) Briefly present No Cost, Operations and Maintenance (O&M) or energy management opportunities, if any.

4. Energy Audit

In this chapter, there should be clearly stated all the information regarding the existing systems, from their basic characteristics to their energy consumption and their role in the energy profile of the installation.

4.1. Meteorological data

Present the monthly average ambient temperature and humidity, monthly HDDs and/or CDDs for 3 consecutive years for the area where the building is situated. The data should preferably be sourced from the National Meteorological Service.

4.2. Standards for indoor comfort and building operation

Present the national standards for indoor comfort and building operation, i.e., internal temperature and humidity, required fresh air requirements in different spaces (e.g., separately for ICUs, patient rooms), lighting, domestic hot water)

4.3. Building Info

The building description must contain sufficient baseline details about the building (e.g., year built, number of remodels, type of construction), including measured and/or verified area.

a) General

Building layout (show sections and years if remodeled), general construction, types of spaces/general layout, floor area. Explain, if needed, the different areas used (e.g. net, built, etc.).

b) Envelope

Describe the components/layers of the envelope (construction materials used for the exterior walls, roof and basement), including insulation material and its thickness, R-values/U-values of the envelope, condition, wall/roof/floor areas, and presence of asbestos or other materials. Indicate if the U-Values of the envelope components are relevant for the TS 825 Building Insulation Code for the region of the building. A table for comparison can be given. Use TS 825 Local Building Insulation Code, when possible.

c) Windows

Glazing type, frame type, location and dimension (area) of each unique type, shading, orientation, operability, weather-stripping, and condition. Include U or R-values, approximate Solar Heat Gain Coefficient (SHGC), and window tint description. Note if specific windows are left open for purposes of ventilation or comfort issues. Indicate also areas per different glazing/construction solution. Indicate if the U-Values of the windows are relevant for the TS 825 Building Insulation Code for the region of the building. A table for comparison can be given. Use TS 825 Local Building Insulation Code, when possible.

d) Observable deficiencies

Indicate the existence of wall cracks, observable structural elements, leakages, mould or other observable building pathologies.

e) Other

Insert floor plans that include all buildings.

Pictures of major building elevations and exterior. Include additional photos and descriptive captions of all building elements, systems, or conditions that are related to the proposed EEMs (included in EEM Section or Appendix).

4.4. Building occupancy

Provide a brief narrative describing typical daily, weekly, and annual occupancy patterns. Be sure to note unusual patterns, weekend or summer occupancy, especially if they affect total or seasonal energy usage. This information is also useful when comparing to Heating, Ventilation, and Air Conditioning (HVAC) schedules and understanding opportunities or limitations for certain EEM savings. Use a table format like this:

Indicate Building/Area	Hours/day	Days/week	Annual hours	# during normal occupancy	% of the building used

4.5. Equipment Info

a) Description of systems or equipment audited, their capacities and ratings, design and operating conditions, equipment schedules, etc., including information such as the type of systems, controls, type and number of auxiliary equipment, etc. Performance of systems or equipment audited (e.g. COP or SEER).

b) The system descriptions must contain sufficient detail to understand the building's major energy-using systems, including HVAC, Domestic Hot Water, Lighting, Plug Loads, and other.

The narrative should include explanations on the system type, age, nameplate capacity, condition, controls, the area served by each unit, operating schedules and sequence of operation/controls overview, current capabilities and limitations, and any significant known or suspected issues. This information should provide the necessary background to understand each EEM proposed.

Any equipment information (e.g., power, capacity, nameplate power, etc.) must be provided, as well as a citation of data sources (e.g., data logging, cut sheets, design drawings, engineering assessment, etc.) for each critical value and condition.

Summary findings from the equipment surveys should also be included in the narrative. The full equipment surveys must be included in the Appendix.

Include a description of any operation or conditions that are outside of recommended or standard ranges (e.g., excessive run times, over or under-lit areas, high or low setpoints, etc.).

1. HVAC

   Include a summary description of the HVAC system and HVAC zone(s) floor plan. Include a summary of the sequence of operations and fan schedules (detailed documents/tables to be included in the Appendix). Descriptions can be grouped into the following categories:

   a. Boiler and Chiller Plant

   Include a description of boiler and chiller plant(s), along with the distribution and condensate systems and cooling towers, where applicable. Describe the air handling or terminal units served by each plant and the zones they serve. Include equipment surveys in the Appendix.

   b. Airside and Other HVAC System Equipment

   Include a description of system equipment (e.g., furnaces, unit ventilators, radiators, heat recovery, etc.) and the zones they serve. Include equipment surveys in the Appendix.

   c. Packaged Units

   Include a description of packaged unit equipment (e.g., DX, Heat pumps, RTUs, etc.) and the zones they serve. Include equipment surveys in the Appendix.

   d. Building-Level HVAC Controls

   Individual equipment controls should be included with notations of the related equipment that they control. Building level/global controllers should be explained in the narrative. Include existing control configuration(s) and operating sequence(s).

2. Domestic Hot Water (DHW)

   Include a summary description of equipment, fuel type, capacity, the area served, and settings. This should include a description of tank and distribution, end-uses (e.g., showers for PE class and sports, kitchen, laundry, etc.). Note the major end-use fixture types (e.g., faucets, showers, dishwashers, etc.) and if any end-use equipment has unexpectedly high hot water usage or leaks. Include equipment survey in the Appendix.

3. Lighting (Interior and Exterior)

   Include a summary description of equipment, areas served, and controls. Include lighting survey

in the Appendix.

4. Pumps and fans (electrical motors)

   Include a summary description of equipment if not addressed in the HVAC chapter. Include equipment surveys in the Appendix.

5. Plug loads and Other Equipment

   Only include data if it is relevant for the audit work. If so, include a summary description of the location, type, and quantity. In case of hospitals, the data should be separated into medical and non-medical equipment. Include equipment survey in the Appendix.

6. Mechanical systems Insulation

   Refer and describe all insulation used in mechanical systems.

7. Electrical Installation, Power Generation, UPS

   A full description of the electrical installation of the hospital (transformers, network, etc), of the possible power generation (i.e. generators) and of the installed UPS

j) Equipment info should include an explanation for the assumption of working hours. It should also note any deficiencies with the current operations – under/overheating/cooling, unused equipment, broken/missing lights, and equipment capacity too big/small.

4.6. Energy consumption data

4.6.1. Rates and providers

In this section should be stated the actual tariffs and utility providers for the facility. The cost should be separated between the fixed tariff (e.g. power) and the net energy (e.g. kWh) tariff.

		Year #1	Year #n
Electric Utility Provider	Type of tariff		
	TL/kWh		
	Yearly average spending		
Natural gas Provider	Type of tariff		
	TL/kWh		
	Yearly average spending		
Other energy Provider	Type of tariff		
	TL/kWh		
	Yearly average spending		

k)

a) In the “Other Energy Provider”, all different types and amount of fuels have to be clearly specified.

b) If there are large differences between years (e.g. changes not explained by simple economic cycles), the Consultant must explain the possible reasons carefully. Ensure that units are correct.

4.6.2. Energy Consumption Profile

l) This table has to be made with the actual energy and utility provider data and should reflect an overview of the total consumption and cost of energy on a yearly basis.

	Electricity				Fuel #(…)			
Year/month	Maximum Demand [kW] (if available)	Consumption [kWh]	Consumption [TOE]	Total Cost [TL]	Maximum Demand [kW, m3, ton] (if available)	Consumption [kWh]	Consumptio] [TOE]	Total Cost [TL]
(January… December)								
Year #1 total								
(January… December)								
Year #2 total								
(January… December)								
Year #3 total								

Add a column for each different type of fuel.

The Time Period should include (if available) at least three years of consecutive monthly data and three-year average. Be sure to include all-electric/gas/fuel meters if there are more than one.

year/month	Consumption [TOE]	Ton CO_2	Total Cost [TL]	TOE/cost [TL]	CO_2/cost [TL]
Year #1 total					
Year #2 total					
Year #3 total					
Average					

The reports should offer some explanation for the presented data on energy use. For example: If gas use increases over 10%, or energy unit prices change significantly from year to year.

Year to year changes (from each of the previous energy consumption data) should be presented and add the narrative to explain fluctuations.

Primary Energy [ToE]	YY1-2	YY2-3	YYn-n+1
Variation change [%]			

4.6.3.Energy Consumption Graphs

Display three years of consumption data graph (time on the x-axis). If available, show monthly values for all three years. All electricity, natural gas, and other fuels used at the facility need to be graphed

(each on the separate chart). The graph could be line or bar graphs or any form that visually shows patterns. It has to be properly scaled for relevant information.

Include a brief narrative describing seasonal utility usage patterns and anything that stands out (e.g., note and explain any anomalies, etc.). Explain any trends. As relevant, correlate with features that may drive consumption profiles (e.g., occupancy, use patterns, degree days, etc.), and introduce them in a secondary axis to each graph.

4.6.4.Energy baseline and calculation of energy indicators

Based on the available data on electricity and heating fuel consumption, energy baselines should be constructed for (i) electricity and (ii) heating fuel by correlating the electricity or heating fuel consumption with the average monthly outdoor temperatures, preferably over a period of 2 calendar years.

For the baseline construction, a calendar year should be divided into three zones:

- Winter zone, with temperatures $T_{ex} \leq 15.0$ ºC,
- Intermediate zone, with temperatures $15.0 < T_{ex} \leq 22.0$ ºC and the
- Summer zone, with temperatures $T_{ex} > 22.0$ ºC.

An example of the construction of an electricity baseline is shown below, using the following definitions:

- Electricity consumption E = b1 * T + b0
- b1: Regression coefficient
- T: Monthly average ambient temperature
- b0: Regression coefficient
- a/a: Number of the month
- RMSE: Root mean square error – the standard deviation of the residuals (prediction errors), where residuals measure the distance between the data points and the regression line.
- Min. target EE = RMSE / (average of the expected electricity consumption [baseline] of the zone)^2

Month - Year	A/A	Temperature (°C)	Electricity cons (kWh)	
Jan 19	13	9,7	144.018	
Feb 19	14	10,1	129.874	
Mar 19	15	13,6	173.838	
Apr 19	16	15,4	158.064	
May 19	17	19,9	165.948	
Jun 19	18	26,8	173.279	
Jul 19	19	28,2	205.729	
Aug 19	20	29,3	202.823	
Sep 19	21	24,8	162.341	
Oct 19	22	21,3	154.332	
Nov 19	23	17,7	138.543	
Dec 19	24	12,2	154.641	

Observed data

SUMMER ZONE	A/A	Temp .(°C)	Electricity (kWh)	Baseline
Jun 19	18	26,8	173.279	181.131,7
Jul 19	19	28,2	205.729	195.607,1
Aug 19	20	29,3	202.823	206.980,6
Sep 19	21	24,8	162.341	160.452,6
b1	b0	Average	186.043	186.043,0
10.339,5	-95.968,1	RMSE	9.616,9	Min. target EE
3,62	-1,23	< -t Stud/R2->	0,867	10,34%

Calcuated data

WINTER ZONE	A/A	Temp .(°C)	Electricity (kWh)	Baseline
Jan 19	12	9,7	144.018	145.934,5
Feb 19	13	10,1	129.874	146.238,3
Mar 19	14	13,6	173.838	148.896,8
Nov 19	15	17,7	138.543	152.011,0
Dec 19	24	12,2	154.641	147.833,4
b1	b0	Average	148.183	148.182,8
759,6	138.566,7	RMSE	19.332,7	Min. target EE
0,25	3,57	< -t Stud/R2->	0,021	26,09%

INTEMEDIATE	A/A	Temp .(°C)	Electricity (kWh)	Baseline
Apr 19	17	15,4	158.064	159.618,4
May 19	22	19,9	165.948	159.397,2
Oct 19	23	21,3	154.332	159.328,4
b1	b0	Average	159.448	159.507,8
-49,2	160.375,5	RMSE	8.384,1	Min. target EE
-0,03	4,38	< -t Stud/R2->	0,001	10,51%

BASELINE CONSTRUCTION

ALL ZONES	A/A	Temp .(°C)	Electricity (kWh)	Baseline
Jan 19	13	9,7	144.018	145.934,5
Feb 19	14	10,1	129.874	146.238,3
Mar 19	15	13,6	173.838	148.896,8
Apr 19	16	15,4	158.064	150.264,0
May 19	17	19,9	165.948	153.682,0
Jun 19	18	26,8	173.279	158.923,0
Jul 19	19	28,2	205.729	159.986,4
Aug 19	20	29,3	202.823	160.821,9
Sep 19	21	24,8	162.341	157.403,9
Oct 19	22	21,3	154.332	154.745,4
Nov 19	23	17,7	138.543	152.011,0
Dec 19	24	12,2	154.641	147.833,4
TOTAL			**1.963.430**	**1.836.740,7**

Calcuated data

Diagram 1 shows the monthly electric consumption in relation to the average monthly outdoor temperature and the corresponding baselines for the different temperature zones.

Diagram 1. Correlation of monthly electricity consumption to the mean average outdoor air temperature for the period January to December

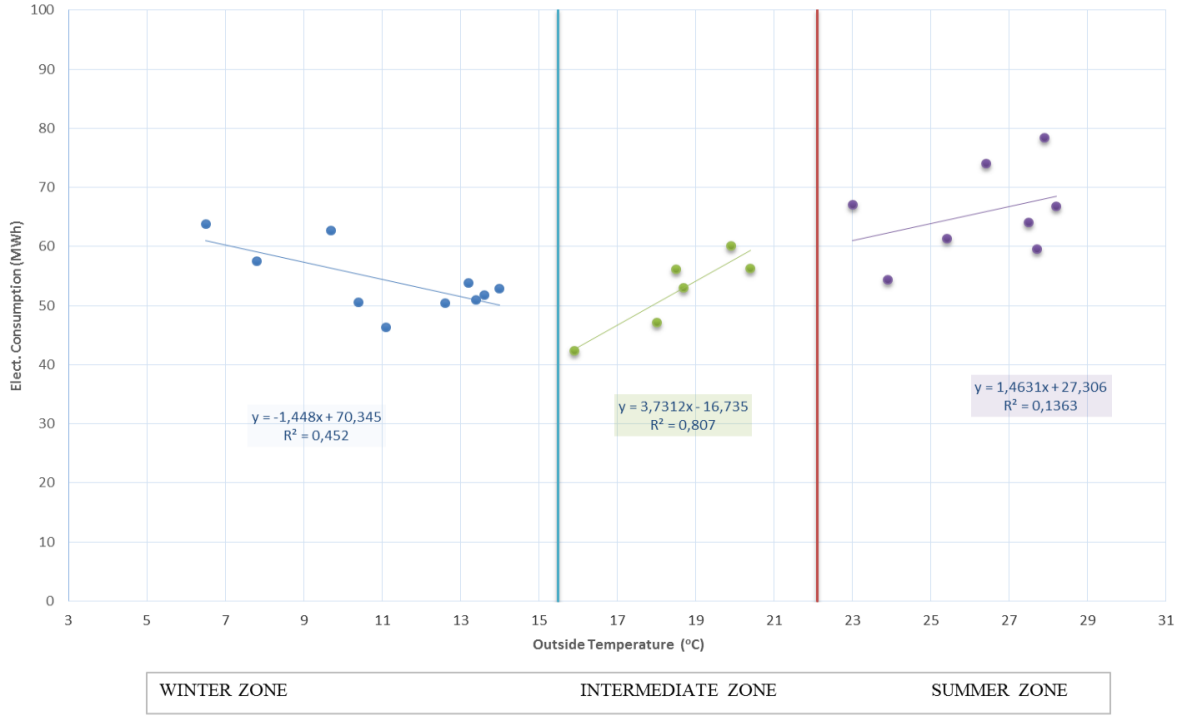

Table 1 provides details on the monthly actual consumption and expected corresponding values calculated from the baseline for the period from January December. Data are split into three zones based on the ambient temperature (as described above). The table also presents the estimated energy performance indicators, evaluation of the current situation, and the possibility of energy saving interventions.

- Divergence of balance = (monthly electric consumption recorded in bills) – (monthly expected electric consumption, baseline)
- CUSUM: Cumulative SUM of deviation between monthly electricity consumption and expected consumption. If m samples are collected, each of size n, compute the mean of each sample. Then the cumulative sum (CUSUM) is formed by one of the following equations.

$$S_m = \sum_{i=1}^{m}(\bar{x}_i - \hat{\mu}_0) \quad \text{or} \quad S'_m = \frac{1}{\sigma_{\bar{x}}}\sum_{i=1}^{m}(\bar{x}_i - \hat{\mu}_0)$$

  - where μ^0 is the estimate of the in-control mean
  - σx¯ is the known (or estimated) standard deviation of the sample means

  The choice of which of these two quantities is plotted is usually determined by the statistical software package (see regression in EXCEL). In either case, as long as the process remains in control centred at μ^0, the CUSUM plot will show variation in a random pattern centred about zero.
- Energy Performance Indicator, EPI = (consumed energy) / (monthly average ambient temperature)
- Energy Target Coefficient, ETC = (consumed energy) / (expected energy consumption)

Table 1. Estimation of energy indicators for January to December

	Month / Year	Divergence of Balance (MWh) Divergence per zone			Month / Year	CUSUM (MWh) 1	2	3	Energy Performance Indicator, EPI (MWh/Month)	Energy Target Coedfficient, ETC
WINTER ZONE	Jan 18	0,00			Jan 18	0,00			0,000	0,000
	Feb 18	0,00			Feb 18	0,00			0,000	0,000
	Mar 18	0,00			Mar 18	0,00			0,000	0,000
	Nov 18	0,00			Nov 18	0,00			0,000	0,000
	Dec 18	0,00			Dec 18	0,00			0,000	0,000
	Jan 19	-1,92			Jan 19	-1,92			1,485	0,987
	Feb 19	-16,36			Feb 19	-18,28			1,286	0,888
	Mar 19	24,94			Mar 19	6,66			1,278	1,168
	Nov 19	-13,47			Nov 19	-6,81			0,783	0,911
	Dec 19	6,81			Dec 19	0,00			1,268	1,046
INTERMEDIATE ZONE	Apr 18		0,00		Apr 18		0,00		0,000	0,000
	May 18		0,00		May 18		0,00		0,000	0,000
	Oct 18		0,00		Oct 18		1,55		0,000	0,000
	Apr 19		-1,55		Apr 19		-5,00		1,026	0,990
	May 19		6,55		May 19		0,00		0,834	1,041
	Oct 19		-5,00		Oct 19		0,00		0,725	0,969
SUMMER ZONE	Jun 18			0,00	Jun 18			0,00	0,000	0,000
	Jul 18			0,00	Jul 18			18,46	0,000	0,000
	Aug 19			0,00	Aug 19			15,06	0,000	0,000
	Sep 18			0,00	Sep 18			21,16	0,000	0,000
	Jun 19			-7,85	Jun 19			18,00	0,647	0,957
	Jul 19			10,12	Jul 19			16,23	0,730	1,052
	Aug 19			-4,16	Aug 19			7,94	0,692	0,980
	Sep 19			1,89	Sep 19			0,00	0,655	1,012

Diagram 2 shows the correlation of the monthly electric consumption and electric baseline for the period January to December.

Diagram 2. Correlation of monthly electricity consumption and electricity energy baseline for the period of January to December

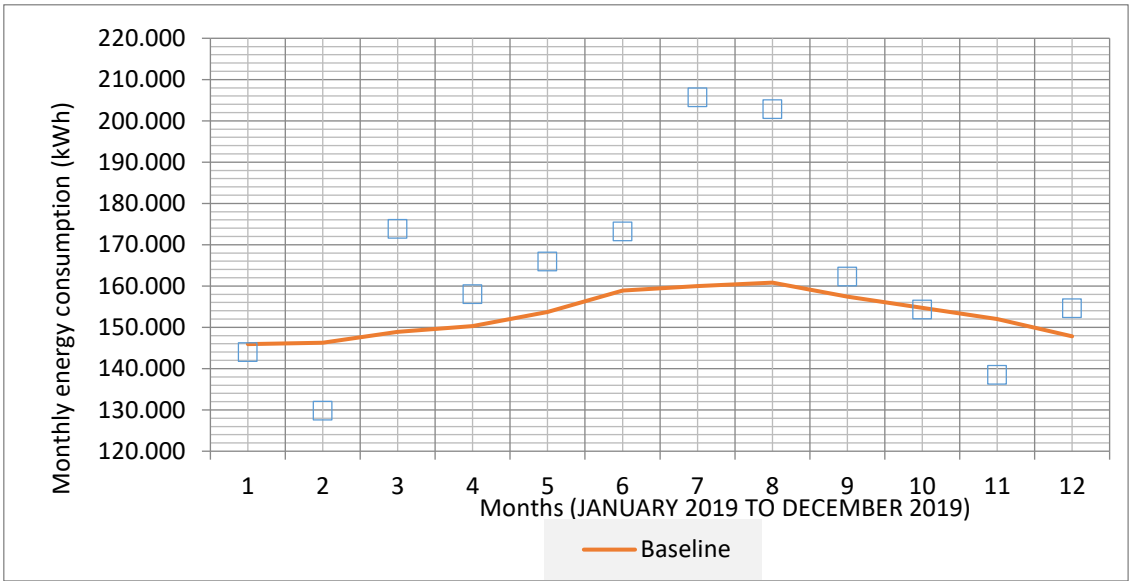

Table 3 presents a summary showing the minimum values of EPI and ETC for each of the three zones.

Table 3. Energy indicators

Winter		**Temp (ºC)**	**Electr (MWh)**	**Month**	**EPI**	**ETC**
EPI_{min}	0,783	17,7	138,5	Nov 19	-	0,91
ETC_{min}	0,888	10,1	129,9	Feb 19	1,29	-
$RMSE_{max}$=	19332,69					

Intermediate		**Temp (ºC)**	**Electr (MWh)**	**Month**	**EPI**	**ETC**
EPI_{min}	0,725	21,3	154,3	Oct 19	-	0,97
ETC_{min}	0,969	21,3	154,3	Oct 19	0,72	-
$RMSE_{max}$=	8384,09					

Summer		**Temp (ºC)**	**Electr (MWh)**	**Month**	**EPI**	**ETC**
EPI_{min}	0,647	26,8	173,3	Jun 19	-	0,96
ETC_{min}	0,957	26,8	173,3	Jun 19	0,65	-
$RMSE_{max}$=	9616,91					

5. Energy Efficiency Measures Detail

The EEMs list will be presented in scenarios tables. The tables should follow this format:

No.	EEM	Type of energy [eletrical, gas etc.]	Estimated annual energy savings [kWh]	Estimated annual energy savings [TOE]	% of total consumption [TOE] savings	Estimated annual cost savings [TL]	Emissions reducing [tCo2]	Estimated implementation cost [TL]	Payback period [years]	IRR	NPV
1											
2											
(…)											
Total											
Total Energy Savings [%]											

As indicated in the executive summary, three scenarios (along with three tables) will be presented:

a) Base scenario with measures that save a minimum of 20%* and the average payback period as a bundle will not exceed 12 years.
b) Deep renovation scenario with measures that will have a minimum of 30%* and the average payback period as a bundle will not exceed 20 years.
c) Recommended bundle of measures (this could be a selection of measures from the base scenario, a selection of measures from the deep renovation scenario, or a mix of measures from the base and deep renovation scenario).

* Primary energy efficiency improvement percentage may be used for calculating overall energy efficiency calculation of the deep renovation scenario in case on-site electricity production measures are proposed such as cogeneration/trigeneration, etc.

Provide an extra line for each type of energy vector that is saved in each measure.

After the table section, provide a complete description of each EEM proposed. Describe how the

system/operation would be made more efficient or how the new equipment would reduce energy use. The description must be sufficient to ensure facility staff understand how proposed EEM can be implemented or how this information will be used by an engineer/contractor for design and specification work.

If there are differences from the base scenario and the deep scenario for the same EEM, please describe the rationale (e.g. different savings values for the same piping insulation measure).

The EEM presentation and analysis are detailed in the Appendix sections (under "General notes regarding EEMs").

6. Energy Management and no/low-cost opportunities

a) Energy Management or O&M Measures

Include any relevant operational or maintenance measures. Follow the same instructions and template used for EEMs. This section would also include any negative energy savings measure that may be necessary for the implementation of an EEM or needed to help meet a specific operation or maintenance requirement (e.g., increased ventilation or lighting levels).

b) Low and No-Cost EEMs

Include a list of any important Low or No-cost EEMs applicable to the facility.

Please include a brief note for any measures analysed, but not included in EEM section of the report. Also, explain if any measure was not analysed, but sections of the audit report may suggest a measure might be needed (e.g., uninsulated shell but payback would have been over 50 years).

7. Building Management Systems (BMS) and metering systems

Add BMS if needed in the EEM list. As a general rule present a monitoring system with central control in the deep renovation scenario if the facility can manage it and only recommend it if payback for this measure is less than 20 years.

Please note that basic building-level metering should be a mandatory measure in all scenarios if does not exists and if exists has to be described even if briefly in the systems description. The basic version should be aimed at primary level energy and to Install new or use existing base building-level energy meters, or submeters that can be aggregated to provide base building-level data representing total building energy consumption (electricity, natural gas, fuel oil, propane, etc.). Utility-owned meters capable of aggregating base building-level resource use are acceptable. The basic system can be standalone (e.g. without automated report capabilities or software aggregation).

8. On-site Generation and Renewable Energy Systems

Include data, on-site generation and RE systems. Some issues have to be addressed in the narrative, in text or table format: Total power, total production, installation summary description, connection point, if there is an off-site sale of energy (etc.).

Include some schematics (e.g. drawings for Photovoltaic (PV) panel installation site). Present in the Appendix calculation sheet for forecasted production.

9. Energy Performance Class (EKB)

The building energy class should be stated in a short table:

Current Energy Performance Class	Energy Performance class under Proposed Scenario

10. Energy Performance Contracting (EPC) methodology

For future reference, this chapter shows the approach to be used for EPC contracting. There should be a clear path and hard data for reference energy consumption data (baseline), reference conditions for measurement and verification (M&V) accordingly with International Performance Measurement and Verification Protocol (IPMVP) and a general description of what events will be accepted for baseline change.

The general information should be given in a table format:

Proposed EEM	M&V Option based on IPMVP	Correction Factor (%)	Sensitivity (%)

Proposed EEM	Total Usage Area that	Electricity Consumption	Natural Gas Consumption	Other Fuel (Please Specify) Consumption	Total Energy Consumption	Total Energy Consumption Cost	Reference O&M Cost	Total Emissions
	[m^2]	[TOE/Year]	[TOE/Year]	[TOE/Year]	[TOE/Year]	[TL/Year]	[TL/Year]	[Ton CO2 Eq.]

11. Audit Appendixes

The report appendixes must contain useful information to understand the narrative of the EEMs choice, but also to keep all this information form the main body of the report, for simplicity of analysis. The appendixes can be the following:

a) General Information Appendixes

- Audit Team;
- References, Reference Values and Abbreviations;
- Equipment and their certifications used in Audit.

m)

b) General Audit Appendixes

- Energy End-Use Calculations;
- Energy Modelling Documentation (if energy modelling approach is preffered for EEM calculations by the Consultant);
- Equipment Surveys;
- The sequence of Operation.

n)

c) EEM Related Appendixes

- Cogen details;
- EEM Specific Requirements;

- EEM Energy Calculation;
- EEM Cost Estimation;
- EEM Cut Sheets.

d) Site Measurement Appendixes

- Onsite Visits and Monitoring;
- Data logging and Monitoring Results.

e) Administrative Appendixes

- Audit Team;
- References, Reference Values and Abbreviations;
- Measurement Equipment and certifications used in Audit.

12. General Information Appendixes

12.1. General Notes

General requirements are items that the energy Consultant must use based on the information gained during the audit. Energy Audit Reports must follow this template report:
Energy Efficiency Measures (EEMs) and Simple Payback (SP) Requirements.

a) All potential EEMs with a *likely* SP less than 20 years (or insulation measures with any SP) must be analyzed.
b) All analyzed EEMs must be included in the Energy Audit Report.
c) Alternate formats may be used only after requesting and receiving prior written approval. If used alternate formats must still include all Sections Headings and required information, be presented in a concise manner, and include all supporting data and documentation.

Energy Audit Reports must be complete and well written. The report should demonstrate sufficient clarity to persons possessing moderate facility knowledge and an average understanding of energy engineering principles. They must be consistent and accurate. Values and measurements for a specific item or usage should be consistent across the entire Energy Audit Report and all supporting documents, including spreadsheets, modelling files, and other related documents.

o) Information on data collection for the principal energy systems and end uses, should be presented if needed with on-field interviews:

a) What is, if any, the current metering setup;
b) Data source: Statement about which data was used and which was measured, and which was estimated;
c) Provide a complete description of existing conditions. Provide a summary of all related measured site data, including monitoring results, measurements, light levels, and other relevant information. Include sketches, photographs and expanded narrative for clarity where applicable or required.

12.2. Calculations and Energy Modelling Requirements

Calculations used in analyses must be supported with sufficient detail and include justification of all assumptions. Calculations completed in spreadsheets must not hide any cells or contain any data, formulas, or referenced cells that are not relevant to the particular audit.

Consultants must use industry-accepted calculation methods to predict achievable energy savings (e.g. ASHRAE Guideline 14, TS 825, etc.). Calculation methods and assumptions must be clearly stated and supported. Accepted sources and citations may include metered data, peer-reviewed and industry-recognized white papers, energy clearinghouses, textbooks, and other similar sources. Use

of such sources must be cited and clearly presented.

In case energy modelling approach is followed by the Consultant, use building annual energy or use hourly simulations of energy use by energy source suitable for determining both load analysis and the proposed energy use for each proposed EEM.

The Energy Audit Report must clearly and separately list the baseline and proposed (post-EEM) parameters and inputs. All modelling inputs should reflect actual building characteristics and conditions as described in the Energy Audit Report.

12.3. Energy Modelling Documentation (If Energy Modelling Approach is preferred or used for EEM calculations by the Consultant)

If completing energy modelling using whole-building energy simulation computer programs, the Consultant must use annual energy use hourly simulations. Guidance and requirements for modelling done with annual energy use hourly simulations can be found in the ASHRAE 90.1-2016 Appendix G.

The firm must include all of the following documentation in this Appendix:

a) Which modelling software and version was used (e.g. TRNYS, EnergyPlan, etc.);
b) How the model was calibrated to utility data to be within ± 10 per cent;
c) Key model inputs and outputs for each modelling run.

All inputs and outputs should match narrative and data presented in the Energy Audit Report (e.g., equipment survey, data logging results, building characteristics narrative, etc.).
It is still necessary to provide a summary of how the EEMs save energy along with the details as to how estimated energy savings were calculated. Energy auditing firms should fully understand the methodology behind any energy-savings calculations provided by the model, detail this methodology in the Energy Audit Report, and be able to explain the accuracy and reasonableness of any savings estimates.

12.4. Equipment Surveys

A simple template for an equipment survey has to be used for the survey. One example is below (chillers). Complete the tables and provide any additional information to document all equipment at the facility fully. Any necessary information or system characteristics that cannot be fully incorporated into the tables should be included in alternative tables and narrative within the report.

General Information								
Ref.	Area Served	Year	Manufacturer	Model	Capacity [kW]	Refrigerant	Type	Air or water-cooled

Ref.	Efficiency			Controls		
	COP 100% load	COP 50% load	Eurovent	supply setpoint	Return Setpoint	Recovery setpoint

Ref.	Measurements				
	Water supply temp	Water return temp	Intake power [kW]	Water flow [l/h]	Outside temperature

12.5. HVAC Controls

If applicable, provide a detailed narrative for building-level/global controllers. The narrative for controls should include:

a) Age and condition;
b) Type (electronic, pneumatic, combination);
c) Manufacturer and model number;
d) Areas and equipment controlled;
e) Control configuration and operating sequence;
f) Control capabilities and limitations (e.g. optimized start, web interface);
g) Maintenance or operational issues.

12.6. Equipment Survey: Domestic Hot Water

Provide a detailed narrative for Hot Water production and distribution systems and controls. Include a brief explanation of the end uses locations and needs in terms of power and temperature. The actual system behaviors should also be analyzed from user feedback in terms of flow availability and temperature.

12.7. Equipment Survey: Lighting

Include all interior and exterior lighting showing specific locations by area, space, room number, or other individual space identification with the actual number and type of existing fixtures. Survey the building to determine connected interior and exterior lighting power and energy usage. Document existing lighting levels, lamp and ballast types, wattages, and controls. Use sampling if more efficient. Document the existence of any hazard's materials, including PCBs and mercury.
It is important to refer if the actual lighting levels are not satisfactory or if there are an important percentage of the lighting fixtures not working or disconnected from the occupants or facility manager feedback.

13. EEM Related Appendices

13.1. General notes regarding EEMs

a) EMMs scenarios

As already stated in the main template body, the EEMs list will be presented in scenarios tables.
The objective is to show the bundling effect of EEMs. The bundling scenario will be treated as one stand-alone EEM, with the totals being the cross-effect value from the whole bundling analyzed together.
As guidance, the recommended package should not include i) measures with payback periods longer than 20 years except for building envelope measure and ii) measures with paybacks longer than the lifetime of the equipment.
If no EEMs can match the conditions, the table will be empty.
If there are obvious problems for improved insulation application, the Consultant can skip the analysis stating the technical rationale in the narrative.
There should be different formatting (e.g., font color) to highlight what insulation is added in the basic and deep renovation scenario compared to the existing situation.

b) EEM Description

Provide a complete description of each EEM proposed. Describe how the system/operation would be made more efficient or how the new equipment would reduce energy use. The description must be sufficient to ensure facility staff understand how proposed EEM can be implemented or how this information will be used by an engineer/contractor for design and specification work.
Recommendations must meet current code requirements and standard design recommendations:

1. Describe any repairs or operational changes required for the EEM to be effective. Outline how the implementation of EEM may impact operations and maintenance (O&M) procedures and cost, any new operating skills required, recommended training & hiring, and any impact on existing equipment life;
2. Briefly describe any other impacts on occupant health, comfort or safety, as well as non-energy benefits, especially improvements to health, safety and environment, decreases in equipment run time, and maintenance labor hours. This should also include: Hazardous material disposal issues (e.g. PCB ballasts, asbestos) and ventilation and indoor air quality (IAQ) issues (e.g. new equipment may increase ventilation);
3. Commissioning Requirements. Include documents related to commissioning and scope of services in the Appendix;
4. The Systems/Equipment responsible for any meaningful consumption has to be addressed the EEM list to avoid having large consumption vectors without any intervention. If they are not addressed, the Consultant should briefly explain why.
5. A detailed explanation should also be given in the case that one particular equipment is not changed by not only more efficient but also for smaller capacity systems due to heat/cooling supply from tri-generation and reduced loads from insulation/window upgrade, for example

c) EEMs cross effect.

When considering multiple EEMs with interactive effects between measures, the order of analysis must start with load reduction measures and proceed with distribution systems and associated equipment efficiencies, and then plant and heat rejection systems.

For EEMs that involve system interactions within a single EEM (e.g. lighting retrofits that affect HVAC loads), those system interactions should be considered within that particular EEM analysis.

When analysing measures with interactive effects, including in the analysis:

1. Explanation of how EEMs interact with one another;
2. If and why savings from this EEM may be more or less effective depending on other EEMs;
3. Note if EEM is independent of all other EEMs in terms of savings or its practical application.
4. Interactions within lighting EEMs should be shown on the same row in the table (i.e., electrical savings entered as a positive value (net of cooling savings if any) and any non-electric heating should be entered as a negative value in appropriate heating fuel column. Assumptions on heating/lighting interactions (e.g. percentage of heat loss to conditioned space) should be explained in the EEM Section of the report.
5. If including mutually exclusive EEMs, list each as an individual row on the tables. Only one of the mutually exclusive EEMs should be included in the TOTAL EEM Energy Savings calculation (e.g. include only the recommended EEMs as to not “double count” measures in the total).

For each EEM, note if any significant variance in savings (+/- 20%) would occur if that measure is performed stand-alone, without the other proposed EEMs (for example, boiler replacement without other load reduction EEMs).

d) Cost-Benefit Analysis

Include a Cost-Benefit Analysis (e.g. payback, NPV and IRR) for each individual EEM and for the

bundle total.

1. Energy Savings: Calculate estimated energy savings and energy cost savings associated with each proposed EEM. When estimating energy cost savings, use and display current energy prices and rates, or refer to the report.
2. Cost Estimates: Provide summary cost estimates in the table, with detailed cost estimates located in the Appendix.
3. O&M savings are included in the EEM cost and should be described in the EEM section.
4. There must exist a clear indication (on the table, on footnote etc.) of the reference prices used for energy.

13.2. Cogeneration/Tri-generation details

If cogeneration (or tri-generation) is evaluated as energy efficiency improvement, then natural gas increase and electricity reduction should be given in details in a table format.

Fuel Consumption at Full Load [kw]	Max.Electricity Generation [kWe]	Max. Heat Generation [kWt]	Annual Expected Electricity Generation [kWh]	Annual Expected Heat Generation [kWh]	Annual Operation and Maintenance Cost [TL]	Annual Fuel Cost [TL]	Total Electricity and Heat Savings [TL]	Investment Cost [TL]	Pay Back [Year]

13.3. Financial analysis and legal requirements

The discount rate for NPV calculations (USD based) is 11%.

The USD/TL and ERU/TL exchange rates for the investment/maintenance cost conversion of imported goods/services will be determined by the Client at the beginning of the energy audit process.

Energy unit prices in TL will be assumed to be inflated by 9% per year regarding NPV calculations.

The NPV analysis is made over 20 years.

For NPV calculations investment expenses should occur in Year 0 and the first annual energy cost savings should then be accounted for in Year 1. The re-investments should be accrued in the year they are expected to occur. The O&M and other recurring yearly costs should be stated when they occur at today's prices.

The average life span of the EEMs, is the following:

EEMs	Working life [years]
Building insulation	35
Building windows	35
LED Lighting fixtures	12
Controls (BMS. Lights etc.)	10
Distribution systems (air&water)	20
Solar PV	25
Chillers and boilers	20
Other heat generation devices	20

LED working life is based on 50 000 hours. The 12 years of working life assume roughly 4150 hours per year. If the usage is significantly different, please adjust the working life, based on the actual working life of the proposed LED.

If other values are used, or if there are systems not referred to in the table, please describe the rationale, as a footnote of the EEM table.

If the NPV period analysis is larger than the EEMs useful life, some reinvesting funds have to be considered for the savings to be considered over the full NPV time analysis.

13.4. Lighting Measures (Interior and Exterior)

a) Provide a detailed lighting schedule showing specific locations (by area, space, room number, or other individual space identification) with the proposed number and type of new lamps, luminaires, ballasts and fixtures. Should be in table format.
b) When adding or upgrading lighting controls, detail the proposed operation scheme. Include the number, type, and location of new controls. Include explanation, assumptions, or data-logging to support any reductions in light levels or operating hours.
c) Recommend using sketches of new fixture layouts or controls to explain proposed measures.
d) Calculate the reductions in lighting energy and include any increases or decreases in other forms of energy use, such as increased heating, associated with installing the EEM.
e) For calculations, include all results, explain methodology and assumptions, and document all key input variables.
f) Use lighting simulation software (Dialux or equivalent) to verify the new fixture layout or fixture distribution. Verification must be used when minimum light levels and uniformity are a safety concern (e.g. parking lots, pedestrian areas, stairways, etc.).

13.5. EEM Investment Calculations

Include all supporting documentation for EEM Energy Calculations. Include key documents:

a) Materials & Equipment: Identify vendor and contact person who provided material and equipment estimates. Include dates and sources of information.
b) Labor: Must use prevailing wage rates. Include separate "Hours" and "$/Hour" rate. If vendor quotes are used, including dates and sources of information.
c) Itemize specific costs related to design and engineering, contractor overhead and profit, and contingency, if any. Document the source of estimates, amount, and a brief description that includes assumptions and data sources.
d) Disposal & Salvage: Indicate any required or expected disposal costs, including hazardous materials or abatement. Include any salvage value or possible reuse of materials. Document the source of estimates, amount, and a brief description that includes assumptions and data sources.
e) Commissioning: Include estimated commissioning cost for EEMs that require commissioning.
f) Add any additional explanation in the narrative below the table.

13.6. EEM Cut Sheets

Include all manufacturer or vendor cut sheets and performance data for recommended equipment and systems. Indicate or highlight key specifications (e.g., efficiency rating, wattage, size, etc.) used in developing the EEM and EEM savings.

14. Site Measurements Appendixes

14.1. Onsite Visits and Monitoring

a) For each visit, list:
    - Date,

- Purpose;
- Critical notes or findings.

b) For each dataset/parameter, list the following:
   - Dates (Installed and removed);
   - Logging period (if different):
   - For instantaneous/point measurements: List date, time, location;
   - Purpose and Measured Parameter(s);
   - Placement (equipment, location, etc.);
   - Quantity and type;
   - Logging Interval(s).

c) Any issues or abnormalities that may have affected monitoring data.

14.2. Data Logging and Monitoring Results

Include a summary description of data logging and monitoring methodology. Include monitoring type (e.g., instantaneous, load profile, periodic total) and general approach. Trend data should indicate duration and intervals, with key monitoring graphs and charts included.

Must include all key results that support the assumptions and recommendations made in the Energy Audit Report.

All charts and graphs should include a brief explanation of results and significance to the Energy Audit Report findings. Include annotations to graphs and charts as needed to illustrate key points or explain anomalies.

REPUBLIC OF TURKEY

MINISTRY OF ENVIRONMENT, URBANIZATION AND CLIMATE CHANGE (MoEUCC)

GENERAL DIRECTORATE OF CONSTRUCTION AFFAIRS (GDCA)

"Seismic Resilience and Energy Efficiency in Public Buildings Project"

Loan No: 9261-TR | Project ID: P175894

CONSULTANCY SERVICES FOR

STRUCTURAL – ENERGY EFFICIENCY RETROFIT DESIGNS AND CONSTRUCTION SUPERVISION

Reference No:

WB/CS-DESSUP-01

TERMS OF REFERENCE

"For Construction Supervision"

Issued on: *January 11, 2022*

I. Introduction and Background

Exposure and vulnerability to natural hazards, including earthquakes, landslides, and floods also threaten sustainable development in Turkey. Among these disasters, earthquakes have claimed the highest number of lives and caused the greatest economic loss, with 76 earthquakes since 1900 resulting in approximately 90,000 fatalities, a total affected population of 7 million, and direct losses exceeding US$25 billion[8] . About half the casualties were due to two earthquakes on the North Anatolian Fault in 1939 and 1999. In the 1999 Marmara earthquakes, which affected 10 cities[9] in the Marmara Region of Turkey where almost 35 percent of the Turkey's GNP was produced, the death toll was over 18,000 with a direct economic impact estimated at US$5 billion (2.5 percent of GNP). Although less catastrophic, floods and landslides are frequent events in Turkey and result in localized losses. Observed and anticipated climate change impacts, such as more intense precipitation, extreme heat and rising sea level, are expected to lead to increasing risks to natural disasters, including more frequent and intense flooding in low-lying areas of river deltas and coastal cities and other extreme weather events, such as storms, hail, and tornados.[10].

Moreover, energy efficiency is critical for Turkey to sustain its economic growth while meeting its commitments for climate change and environmental sustainability. Turkey's energy intensity (that is its energy use per unit of GDP, or 158.4 kgoe/€1,000 of GDP in 2018) was about 35 percent higher than that of the EU-28 countries (117.9) but compares favorably with many of its neighboring countries in Eastern Europe and the Balkans (~300-500). However, as energy use per capita in Turkey rises (from 1.31 toe per capita compared with 2.2 in the EU and 4.2 in OECD countries), its energy intensity is expected to grow[11] . This high intensity negatively impacts energy security—Turkey's energy imports have increased in recent years, from US$37.2 billion in 2017 to about US$43.0 billion in 2018, and it accounts for almost 19 percent of the country's total imports. It also has a negative impact on the environment, with the energy sector accounting for 72.2 percent of the country's greenhouse gas (GHG) emissions in 2017

Therefore, it is essential to promote a strategic national approach to increasing energy efficiency and seismic performance in public buildings through an integrated approach creates a demonstration effect and builds the foundations critical to reach scale and improve the vast building stock in Turkey. To this respect, Government of Turkey signed a loan agreement in the amount of USD 265 million for the Seismic Resilience and Energy Efficiency in Public Buildings Project (SREEPBP) that will be implemented by the Ministry of Environment, Urbanization and Climate Change.

The General Directorate of Construction Affairs (GDCA) under the MoEUCC has been delegated to assume overall responsibility for the project. This will include completion of the necessary activities to support project preparation as well as implementation for the six-year project period. In parallel, grant funding has been mobilized from the The Global Facility for Disaster Reduction and Recovery (GFDRR) to explore innovative approaches for structural strengthening and EE activities.

The GDCA has established a project implementation unit (PIU) to administer all aspects of the project, including raising awareness about the Project, identification of the vulnerable buildings within the agreed eligibility and prioritization, procurement of the various contractors and Project monitoring and reporting.

II. Project Objectives

The project investments will focus primarily to improve the disaster resilience and energy savings in selected central government buildings, and to strengthen the policy framework and institutional capacity to develop, finance and implement resilient and sustainable public buildings in Turkey. The proposed project would be implemented through three components: (i) investments in Central Government Buildings for seismic strengthening and energy efficiency (EE) improvement; (ii) advanced technical assistance (TA) and capacity building; and (iii) project implementation support.

Through the Project, approximately 143 large public buildings such as education buildings (pre-primary and

[8] Erdik, M. (2013), Earthquake Risk in Turkey, Science Mag, Vol. 341, Issue 6147, pp. 724-725, DOI: 10.1126/science.1238945

[9] Kocaeli, Sakarya, Yalova, Istanbul, Bursa, Bolu, Eskisehir, Duzce, Karabuk, and Zonguldak

[10] Republic of Turkey Ministry of Environment and Urbanization (2018), Seventh National Communicaton of Turkey under the UNFCCC.

[11] Eurostat. https://ec.europa.eu/eurostat/web/main/home

tertiary)[12], dormitories, hospitals, and public administrative buildings[13] will be structurally strengthened and renovated, or demolished and reconstructed. The Project will seek to ensure minimum energy performance of the renovated buildings (i.e., Turkish Class C energy performance certificates or higher) and a minimum energy savings which will be specified and agreed in the Project Operations Manual. Architectural, mechanical, electrical renovations and some renewable energy (RE) systems (e.g., rooftop solar photovoltaic (PV), ground source heat pumps, solar water heaters, trigenerators) will also be included, subject to their economic viability. For buildings where demolition and reconstruction are necessary, all the new building financed by the Project will be disaster and climate resilient and classified Class B or higher, and potentially near-zero energy buildings (nZEB).

III. Scope of Services

Within the framework of the Project, a consulting firm will be employed to conduct construction supervision consultancy services.

The Consultant will be required to conduct construction supervision (in compliance with the sub-project specific Environmental and Social Management Plan [ESMPs]) and building commissioning services, issuance of an energy performance certificate after the renovation, supervise remedial works to rectify defects that arise during the Defects Notification Period (DNP), and prepare Measurement and Verification (M&V) reports for the renovated buildings.

This Terms of Reference (ToR) covers above-mentioned consultancy services of the public buildings that were originally prepared during the first phase design services contract.

IV. Description of the Consultants's Tasks

The Consultant as "the Engineer" or "the Project Manager" shall be responsible to carry out all the duties envisaged in World Bank's Standard Procurment Documents (SPD). The Consultant shall also be responsible as the "Engineer" or "the Project Manager" to provide details and instruct the contractors whenever it necessitates, during the course of works and execute the services in accordance with recent laws and regulations (including the sub-project specific ESMPs). Significant issues shall be subject to approval of the Client as indicated in the General Conditions (GCC) or Special Conditions (SCC) of the Construction Contracts.

The Consultant's Structural, Mechanical, Electrical Engineers and Architects shall check and review the existing desings for their applicability to field. If any revision is needed in the existing designs, a report will be provided to the Client. If the revision needs to be approved by a "Design Supervisor", the approval will be obtained by the consultant. All costs of "Design Supervisor" approval belong to the consultant.

The Consultants shall provide sufficient, qualified and experienced staff to ensure proper construction supervision of the works and engineering services both during the Construction period and during the Defects Notification/Maintenance period.

Task 1: Carry out construction supervision and building commissioning services

Consultant's responsibilities (included but not limited to) for this task are summarized as follows:

Initiation of the Works:

- The Consultant shall follow up evacuation of buildings respect to Contractors' work programs closely on site and shall communicate with related authorized persons for public buildings (in compliance with the mitigation measures identified within the sub-project specific ESMPs). The Client shall be informed simultaneously of the actual evacuation progress. In case evacuation does not take place on time, necessary actions to ensure the completion of works without delay in close cooperation with the Client and the Contractors shall be taken by the Consultant.
- The Consultant shall prepare initial inspection reports of the blocks for each room and use digital camera for this purpose to prove that work is executed according to initial status or agreed modifications.

[12]Through a parallel Project – Disaster Risk Management in Schools (P157683), the Bank is supporting disaster resilience and energy efficiency interventions in primary and secondary schools under the Ministry of National Education.

[13]This Project will not include any government buildings associated with law enforcement, justice, or the military (i.e. police buildings, courthouses etc.) and dormitories for police, gendarme, or military personnel)

- The Consultant shall collect necessary documents required for obtaining the modification construction permit from the municipality and assist the contractors for obtaining the modification construction permit. The Consultant shall also sign the documents be submitted for construction permit.
- The Consultant shall review the designs, plans, technical specifications, BOQs, etc. that were originally prepared during the Lump-Sum (first phase design services) Contract and any alteration request of Contractor(s). In case of existence of any findings that may adversely affect the quality of the work, increase the Contract Price, or delay the execution of the Works, the Consultant may require the Contractor to provide an estimate of the expected effect of the future event or circumstance on the contract price and completion date of the Works. In case it is considered that any alterations in any of the Contract Documents necessary by the Consultant, the Consultant shall prepare and submit such alterations to the Client with the Initial Inspection Report, upon two (2) weeks from initiation of the works.The report should be supported by the necessary calculations, details and, time and cost implications. The Consultant shall state whether the alterations will cause any delay in the work program, and therefore the contractor(s) to be entitled any time extension or not, supported by necessary documentation. On receiving written approval from the Client, the Consultant shall promptly amend the existing designs or supply any additional designs, plans, drawings and specifications where required or found necessary for the satisfactory completion of the works. The Client shall not be responsible from the consequences of the fact of which the Client is not informed in advance.

<u>Retrofitting/Installation Supervision Stage</u>

- The Consultant shall be responsible for supervising the construction and installation of the works as well as the inspection and testing of all materials, plant and equipment both during the construction period and for any works that have to be completed during the Defects Notification Period (DNP). The Consultant shall approve materials and application methodologies submitted by Contractor according to national and international standards. The Consultant shall provide sufficient, qualified and experienced staff to ensure proper construction supervision of the works and engineering services during the construction period.
- The Consultant shall supervise and oversee all aspects of the construction and installation of the various components of the works and engineering services to ensure strict compliance with the drawings and contract documents.
- The Consultant, shall ensure the construction progress is in compliance with the workplan, building access plan, and restrictions (for access to users during the construction phase).
- The Consultant shall carry out the Services with all due diligence, care and in timely manner so as not to cause any delay. It is deemed that the Consultant familiarized himself with the nature of Project and is expected to take all sorts of precautions during the performance of Services so as to get the works completed by the Contractors on time.
- The Consultant shall not delay any action required to be taken by the Consultant during the construction.
- It is the duty of the Consultants to interpret the drawings and specifications and to consult with the Contractors as required to ensure compliance with the Contract Documents and the construction/installation programme.
- Ensure that all health & safety measures are respected by the construction company in compliance with the monitoring and reporting requirements of relevant official authorities and the World Bank
- Placement of concrete may be executed by the Contractor in night hours rather than daily hours because of traffic or other reasons not allowed by related authorities. In that case, Contractor will inform the Consultant in a timely manner before placement of concrete, Consultant will arrange his staff employment according to this condition without any cost to the Client and the Contractor.
- The Consultant shall arrange weekly and monthly meetings with contractors, inform the Client about progress of the work and activities, attend any meetings reasonably convened by the Client and provide any information or evidence reasonably required by the Client at any public meetings or inquiries which might be held in connection with the Project.
- Since the similar construction works may also be supervised by other Consultants in other sites, the Consultant shall co-operate with the other Consultants and join the meetings whenever required by the Client.
- The Consultant shall take necessary measures for environmental, social and occupational health and safety (OHS) aspects. In this context, alongside with the Environmental and Social Management Plans (ESMPs)

prepared based on the ESMF, the Environmental and Social Standards (ESSs) of the World Bank's Environmental and Social Framework and the World Bank Group (WBG) General Environment, Health and Safety (EHS) Guidelines, and Good International Industrial Practices (GIIPs), the most recent Turkish environmental, OHS and social regulations are required to be taken into consideration particularly during the supervision of the construction works.

- The Consultant shall supervise the Contractor on behalf of the Client for performing and implementation of all Occupational Health and Safety activities (including mitigation/prevention measures to address Covid-19 or any other communicable disease/pandemic risk) in accordance with the enforcement of the related Turkish Laws and legislations, and measures specified in the ESMP. The consultant duties and responsibilities shall include:
    - Conduct regular visits to all construction sites to check the contractor's OHS documents and compliance, provide on-the job trainings, ensure compliance of the works with OHS practices and regulations, and issue non-compliance notices to the contractor and report the same to the Client.
    - Ensure that the workers are provided OHS training and have complete health records and personal files in accordance with pertinent legal requirements, and avoid access of the workers to work site if there any non-compliance
    - Make available an OHS expert in high-risk worksites (e.g.: high elevations scaffolds, confined space, crane works, digging works, etc.).
    - Check conformity of equipment/ machines on worksites with national standard, and avoid their use in case of non-compliances
    - Promptly notify the Client within 48 hours of any incident or accident related to the Project which has, or is likely to have, a significant adverse effect on the environment, the affected communities, the public or workers including health and safety serious injuries and road accidents. Provide sufficient detail regarding the incident or accident, indicating immediate measures taken or that are planned to be taken to address it, and any information provided by any contractor
    - Participate in the contractor's regular OHS meetings and provide input for needed improvements.
    - Provide the contractor with a copy of key OHS documents (Law 6331 on OHS Code, 5510 Social Security and General Health Insurance Law, 4857 Labour Code and also IFC Environmental, Helath and Safety (EHS) Guidelines) and check the compliance.
- The Consultant shall ensure that the Contractor's activities are following the ESMP. The Consultant shall supervise the Contractor's implementation of environmental and social mitigation measures as identified in the ESMP. The Consultant should ensure Contractor that the Project's Grievance Mechanism set forth by Client is utilized and made available, accessible and visible in Project site.
- The Consultant shall ensure that the Contractor records any grievance received by local community or worker and report it in monthly ESMP monitoring reports to PIU.
- The Consultant shall provide feedback and give notice to the Client regarding environmental and social issues at sites.
- The Consultant shall be responsible for assisting the Client with supervision of the implementation of environmental and social aspects of the project as part of its overall supervision responsibilities, in accordance with ESMP.
- If the Contractor is found to be non-compliant with the ESMP requirements, the Consultant shall file a non-conformity report and any relevant payment orders should be put on hold, until non-compliance issues are remedied satisfactorily or issue a fine in consultation with Client.
- The Consultant shall attend workshops to be organized by the Client that may be related to the project implementation, environmental and social safeguards, occupational health and safety, communication and public information, and grievance redress mechanism.
- The Consultant shall ensure that brochures, posters, grievance forms and other visual communication products to be provided by the Client are available and properly displayed at construction sites from beginning to end of the construction work.
- The Consultant shall ensure that the Contractor deliver the hoarding panels and install them around the construction site appropriately before construction work starts.

- The Consultant shall be in contact with the Client in responding to inquiries and grievances received at construction sites in timely manner, provide including but not limited to logistical and data collection support to communication activities to be carried out at such as informative meetings and trainings in the project site before construction work starts and contribute to community awareness raising operations.
- The Consultant shall ensure that all activities related to the Consultant's tasks are carried out according to best environmental, social and OHS practices to avoid any associated impacts. Additionally, the Consultant shall plan and implement all mitigation/prevention measures to address Covid-19 or any other communicable disease/pandemic risk related to his task through all work activities.
- The Consultant shall monitor/assess Contractors' activities in compliance with the site-specific ESMPs (including environmental, social, occupational health and safety, community safety, received grievances, if any, etc.), include ESMP issues and grievances (if any), in the monthly progress reports, and provide feedback and give notice to the MoEUCC.
- The details of the Environmental and Social Management and the responsibilities of the "Engineer/Project Manager" shall also be detailed in the Contractor's contract. Consultant shall have the responsibility for relevant supervision and instruction of the applications to the Contractor.
- If any alterations in any of the contract drawings, documents occur during construction excavation for foundations of buildings, the Consultant shall immediately inform Client by providing all data for redesign.
- The consultant will assist PIU in the Stakeholder Consultation Meetings for SREEPB Project that will be led by PIU. The consultation meetings might be carried out virtually due to the restrictions related with Covid-19 pandemic. Both virtual and physical consultation meetings will be held with participation of PIU representative/s. Presentation material(s) including relevant content of per sub-project to be shared during the consultation meetings shall be prepared by the consultant and the presentation shall be delivered by the relevant personnel of the consultant. Content of each presentation for per sub-project is subject to review and approval of the PIU.

Progress Payments to Contractors, Variations

- The Consultant shall check the Contractor's valuations for payment on account and issue certificates according to the Conditions of Contract used and shall also be responsible for agreeing with the Client on each payment certificates in payable amount. The actual procedure and presentation of the certificates, supporting documents, etc. shall be discussed and agreed with the Client.
- The Consultant shall review and report on any financial claims submitted by the Contractors within 2 weeks of receipt of such claim submission. Report on any claim shall include (not limited to) determinations, the justification letter, cost-benefit analysis, all probable effects on approved work plan and the final decision on any variation.
- If payment certificate is not prepared by contractor, consultant will prepare payment certificate for contractor,

Tests

- The Consultant shall approve an appropriate Material Testing Laboratory for all tests required that will be mentioned in Contractors' Technical Specification and shall discuss the various testing requirements stipulated in its documents with personnel of the laboratory. The Consultant shall give at least 24 hours' prior notice to the laboratory for all tests which are required to be undertaken. All samples shall be properly labeled in accordance with the requirements of the laboratory and the Consultant shall be responsible for the delivery of all samples for testing and for the collection of all test reports.
- The involvement of the approved Materials Testing Laboratory is limited to the actual performance of the tests in accordance with the Consultant's laid down procedures and/or the specified standards stated in the Contract. The Consultant shall be responsible for interpreting the results received, instructing the repetition or the carrying out of additional tests and taking whatever action necessary to ensure compliance with the contract requirements. The Laboratory staff may from time to time offer advice to the Consultant on any matter within the scope of their competence but it is up to the Consultant whether to accept or reject such advice or suggestion. If any advice or suggestion is accepted by the Consultants, they shall become completely responsible for it as if the advice or suggestion has been of its own initiative.
- The Consultant shall stipulate the criteria, the planning and the procedure for all tests and inspections necessary for the materials (such as pull-out tests for anchorages (embedded new reinforcements)), equipment, plant and workmanship and the commissioning of the Works and shall provide supervision

and inspection for these tests. The Consultant shall compile a record of all such tests and compare the results with the specifications, standards or with the performance criteria that has been guaranteed by the suppliers or contractors.

Accounts, Claims

- In any case, all the correspondences received from the contractor shall be reviewed, evaluated and responded within one week. Any claim from the contractor(s) under the construction contracts shall be evaluated by the Consultant and necessary recommendation shall be made the latest within two weeks, as well.
- The Consultant shall review and report on any financial claims submitted by the Contractors within 2 weeks of receipt of such claims.

Disputes

- The Consultant shall assist in the setting of all disputes or differences, which may arise between the Client and the Contractors, in a timely manner. In the case of litigation and arbitration the Consultant shall assist the Client in the preparation of the documents needed by the Client.

Completion of Works and Commissioning

- Confirm the projects' compliance with the investment plan. In case of deviation from those plans, justification of the differences and evaluation of consequences in terms of compliance of the project with the eligibility criteria of the facility.
- Before issuing the Certificate of Completion of the Works, the Consultant will enforce any obligation placed on the construction contractor to remove all obstructions, surplus materials, plant, wreckage, rubbish and temporary works.
- Upon completion of the works, the Consultant will require the construction contractor to remove all plant, equipment and materials except those required to complete any outstanding or remedial works and facilities required by the Consultant during the Defects Notification Period.
- The Consultant shall witness the performance tests carried out after completion and will analyze, evaluate and approve the final performance tests with the concurrence of the Client. The analyses, results and conclusions with recommendations shall be compiled in the Final Completion Report to be submitted to the Client.
- The Consultant shall oversee training of O&M staff on new equipment.
- The Certificate of Completion of the Works shall be prepared and issued by the Consultant in consultation with the Client. Defects are expected to be minimum for a competent Consultant Firm during issuance of Certificate of Completion of the Works.
- The issuance of the Certificate of Completion of the Works shall be subjected to:
    - The Contractor having provided the operating and maintenance manuals, training of O&M staff on new equipment, as well as all the drawings and documents handed over to the Client requested in the construction contract.
    - Non-existence of major defects
    - Preparation of Consultant's Final Inspection Report

Reporting Requirements for this Task:

- **Initial Inspection Report:** The report should indicate the early findings on tendered documents for the Works and if any alterations needed, include the necessary calculations, details, the opportunities that the effects may be avoided or reduced, and time and cost implications.
- **Weekly Site Pictures:** The Consultant have to record views from at least 5 points for each building, on weekly base, showing the progress on the site with dates and record them with acceptable format and submit to the Client.
- **Weekly Progress Report:** The Consultant shall also prepare a report in table form showing summary of cumulative progress in main work activities on weekly basis. The report shall be submitted to the Client in an acceptable format by the Friday of each week via electronic mail.

- **Monthly Progress Report:** The report shall be prepared on the fifth day of each month until issuing taking-over certificate. Report will describe the physical and financial progress of the works and will address contractual and technical matters. Upon two weeks after the issuance of taking-over certificate this report shall be submitted for a last time as Final Completion Report. Sample report outline is given with the table below:

Table.1: Monthly Progress Report

Report Section	Required Content
Introduction	• A concise outline in simple language, describing the project in general • Also include major milestones, obstacles, achievements, constraints on progress, problems encountered, appropriate identified solutions and remarks on procedural issues.
Description of Physical Progress	• Include progress charts and dated photographs in color giving all information regarding the progress of the Works • Give explanations for differences between actual and forecast progress
Description of Financial Progress	• a summary financial report containing cash-flow forecasts and budget expenditure • status of payments and requests for payment • explanations for differences between actual and forecast cash-flow on summary of claims and disputes
Projections	• variations and proposals for future variations to the timing and budgets of individual activities • a projection of activities for the forthcoming month • recommendation for further actions and improvements, both short- and long-term
Summary of Records	• Records of variation/change orders, design changes and shop drawings issued. • records of human resources, mechanical equipment and materials, testing and quality control, with copies of the test results and, statistical evaluation of the test results in table or graphical form. Action taken with regard to poor results shall be stated; • local issues/stakeholder issues (including any grievances received by nearby communities and/or workers); • a summary of site-specific environmental, social and OHS issues (i.e. update on the status of implementation of the sub-project specific ESMPs – including implementation actions taken/to be taken within the scope of the sub-project, OHS and E&S requirements, grievance mechanism, mitigation measures, etc.,
Appendices	• Include relevant background documents, such as correspondences, photographs, revised drawings, change orders, as-builts (with Final Completion Report), etc. • PowerPoint presentation (based on above information)

- **Final Inspection Report:** The report shall be prepared and shall address the status of the work items at the time of Taking-over by the Consultant. The minor outstanding works, defects, failures, shortcomings are to be listed and compiled. Possible remedial actions by the Contractor as needed, are to be listed and noted, including the given period of time the Contractor is to rectify. The material handed over by the Contractor to the Client will be checked and listed for status and completeness.

- **Other reports upon request:** The Client may request the Consultant to submit specific reports on the issues related to the execution of the works. The Consultant will make the requested report in such manner within a reasonable time. The Consultant is obliged to provide all assistance to the Client, upon request, in drawing up reports to the bodies that comprise the institutional framework for project implementation described in the introduction to this project task, relating to project implementation reports, financial reports and etc.

Task 2: Supervise remedial works to rectify defects that arise during the Defects Notification Period (DNP)

The DNP period covers 12 months, starting on the date of building commissioning.

- The Consultant shall continue to be responsible for the supervision and inspection of the construction and completion of the Works during the DNP as defined in the works contracts.

- The level of supervision shall be appropriate to the scale of the works being carried out. The Consultant will provide adequate number of field technical staff acceptable to the Client on each construction site during the DNP.

- These inspections and supervision are to ensure that works, agreed to be carried out during the DNP, are properly carried out and have been completed and that any failure of any part of the Works has been rectified. If any defect is discovered, during this period, the Consultant shall promptly investigate the

reason for it, report to the Client and take required actions to rectify the defect. These inspections shall be submitted to the Client under DNP Quarterly Report, which shall include all details of any defects, faults, accidents or breakdowns, which have occurred together with the estimated costs of repair and the time scales within which they will be completed. Once all the defects have been remedied, DNP Final Report shall be submitted.

- The Consultant should prepare a Final Completion Report in 2 months' time after the issuance of the Certificate of Completion of the Works. Final Completion Report is a formal document and the Consultant shall strictly follow-up the Contractor to obtain the required documents such as as-built and draft final account of the contractors. Otherwise, the Client may ask to the Consultant for preparation of these documents according to the construction contract therefore, the consultant is encouraged to estimate and include the required staff-months to complete the missing documents upon Client's request.

Reporting Requirements for this Task:
The Reports should cover, but not necessarily be limited to, the information as follows:

- **Final Completion Report**, to be delivered in 2 months' time after the issuance of each Certificate of Completion of the Works.

  The report shall contain at least:

  (i) Copies of Certificate of Completion of the Works including Contractor's request letters

  (ii) Approved As-Built Drawings showing all the modifications in relation to the main design elements or surveyor of performed works

  (iii) Any certification / permit / consent / declaration, lists of installed equipment, and photos

  (iv) Final account of "Work Contract Package"

  (v) Quality assessment of materials and workmanship;

  (vi) Data on the technical difficulties encountered and how they were solved;

  (vii) Comment on the As-Built Design,

  (viii) List of Instructions for Use and Maintenance,

  (ix) Energy Performance Certificate (EKB) should be prepared for each building after completion of the renovation works.

  (x) Final Report on Contractor's ESHS performance (Code of Conduct, compliance with ESMP, consent/permits and other relevant project requirements.

  The report shall be delivered to the Client upon completion of the works all job records, reproducible "as-built" drawings including (but not limited to) calculations, drawings, specifications, test reports and final accounts and the instruction necessary for the satisfactory operation and maintenance of the works. As-Built drawings shall be provided in AutoCAD 2006 (or newer) compatible files and PDF files that shall be signed by the project managers of both parties (Contractor and Consultant).

- **DNP quarterly Report:** A report of the DNP inspections shall be submitted to the Client, which shall include all details of any defects, faults, accidents or breakdowns, which have occurred together with the estimated costs of repair and the time scales within which they will be completed. The reports shall be prepared on a quarterly basis.

- **DNP Final Report:** The report shall be submitted by the time of the expiration of the DNP giving full details of all works carried out during the period. This report shall be submitted by the Consultant to the Client at least 30 days prior to issuing the Defects Notification Certificate for the completed Works.

Task 3: Preparation of Measurement and Verification (M&V) report

The M&V period covers 12 months, starting on the date of building commissioning.

- Conduct required measurements to prepare the M&V Report. Measurement and verification of savings will be made in accordance with TS ISO 50.006 and IPMVP Option C (full facility renovation) the consultant should compare the baseline and final energy bills and adjust for degree days (HDD and CDD), changes in operating use, changes in energy prices, occupancy rates, etc.

- Prepare M&V reports for all buildings by the end of DNP. The M&V reports need to be consistent with the format to be published by MENR. The PIU will review and approve the M&V report or request from the contractor to revise the report. The M&V report shall demonstrate the amount of savings realized by comparing the actual energy consumption with the reference energy consumption in which the necessary adjustments are made according to the TS ISO 50.006 standard and IPMVP will be calculated.

V. Timeline

This assignment is expected to initiate in the first quarter of 2023 and finalized in a period of in twenty-six (26) months period (14 months for construction and 12 months for Defects Notification Period), subject to completion of the construction contract. A tentative time schedule for the completion of the consultants' services for the various parts of the Project is given below;

Table.2: Tentative Timeline

N°	Deliverables/Tasks	Months											
		2	4	6	8	10	12	14	16	18	20	22	24	26
1	1st Group of Buildings (3 Campuses)													
2	2nd Group of Buildings (3 Campuses)													
3	3nd Group of Buildings (1 Campuses)													
4	4th Group of Buildings (2 Campuses)													

Construction Supervision **Defects Notification Period**

VI. Reporting Requirements

The reports will be submitted to the Client according to the below given table. The Consultant must obtain consent for each report before proceeding.

Table.3: Table of Reports

Task	Reports	Deadline	Submission Requirement
1	Initial Inspection Reports	Upon two (2) weeks from Initiation of the Works	• All Reports shall be initialed and prepared in 2 hard copies for both English and Turkish (except electronic mail submissions) • Interim Payments to Contractors shall be signed by Project Manager and responsible Key-Staff and submitted only Turkish • Electronic copies of all reports shall be submitted with an External SSD • All Reports shall be uploaded into the online platform which the Client addresses
	Weekly Site Pictures	Every Friday via electronic mail starts from Initiation of the Works	
	Weekly Progress Report		
	Monthly Progress Report	Fifth day (5th) of each month starts from Initiation of the Works till issuance of Taking-Over Certificate	
	Interim Payments to Contractors	Monthly starts from Initiation of the Works till issuance of Final Acceptance	
	Final Inspection Report	Upon with issuance of Taking-Over Certificate	
2	DNP Quarterly Report and DNP Final Report	Starts from first quarter following the issuance of Taking-Over Certificate and shall be submitted quarterly till issuance of Final	

		Acceptance	
	Final Completion Report	in 2 months' time after the issuance of each Certificate of Completion of the Works.	
3	Measurement and Verification (M&V) Report	At the time of submitting the DNP Report	

The consultant can submit all reports in a single SSD (Solid State Drive) with sufficient capacity. The metric system of weights and measures shall be used. The drawings shall be submitted in A1 paper size (unless otherwise required or agreed) and includes drawings in PDF and AutoCAD format, labeling, grouping and details as required by the Client. The plot size, parcel, map sheet for all buildings shall be listed and integrated into the drawings and other required documents.

As indicated in the General Conditions of Contract all the drawings, reports, plans, specifications, and any other documents produced under this Contract are the property of the Client and therefore the Consultants shall also submit all the originals of the drawings and the other documents in required format.

VII. Facilities provided by the consultant

Supervision of the works and engineering services both during the construction and defects notification period including M&V works and ensure that the works are executed in accordance with recent regulations and rules. All costs for equipment and administrative and logistic support must be covered by the Consultant and included in the bid price, including:

- All costs arising from the activities of its staff during the contract period, including accommodation, allowances, transportation, insurance, etc.
- Automotive, equipment, equipment for field and lab tests, office supplies, hardware and software (software for modeling and static/dynamic analysis of critical structures), etc.
- All communication costs, including fax, email, telephone, etc.
- All the equipment, instruments, services and logistical support required for the implementation of the contract, and any costs incurred during its preparation of documents and drafts, copying, printing, qualified translation, interpretation etc etc.
- Technical equipment at the monitoring site;

VIII. Support to be provided by the client to the consultants

- The client will sign letters with the beneficiary buildings that describe the responsibilities of the beneficiary, including appointing a contact/facility coordinator for all project phases, facilitating access to buildings or facilities, providing existing documentation, etc. Client shall, where possible, assist the Consultants in obtaining approvals, permissions from the Municipalities and other State Authorities in respect of the Services to be performed.
- The inputs (contract drawings, Bill of Quantities, tender documents, etc.) shall be provided free of charge by the Client to the Consultants. Consultant shall return all such drawings and documents received to the Client upon the completion of services.
- The Works Contractors' bidding documents are already arranged to incorporate clauses to provide temporary office facilities to the Consultants depending on the size and location of the construction sites, the size and number of rooms (generally the site office has approximately 80 m2 area and includes 1 meeting room, 3 room, 1 WC and 1 Kitchen) shall be jointly determined by the Client and the Consultant considering the needs of the Client as well. However, these will be constructed by the Contractors and will take some time.
- The Consultants will be fully responsible for providing their central site office until the contractors are in place to make site offices available. The central office shall be furnished and equipped by the Consultants, whereas the site offices shall be furnished by the Contractor. All sort of running expenses

for the site offices except water and electricity (to be provided by the Contractor) shall be under the Consultant's responsibility.

- The Consultant shall not be required to deliver any equipment and materials provided by the reimbursable expenses and which have been used for the Services to the Client.

IX. Team Composition & Qualification Requirements for The Key Staff

The Consultant shall provide an experienced construction supervision and contract administration team with proven technical and managerial competence and experience in the supervision of construction works under Fédération Internationale des Ingénieurs Conseils(FIDIC) Conditions of Contract or other internationally recognized contract conditions used by IFI's. The Consultant shall separately indicate the task assignments for each staff.

i) Consultant Profile:

The Consultants should be in consulting business, have similar previous experience in the scope of services, demonstrate sound administrative and financial capacity and availability of the key experts for the performance of the services described in this TOR.

The attention of interested Consultants is drawn to Section III, paragraphs, 3.14, 3.16, and 3.17 of the World Bank's "Procurement Regulations for IPF Borrowers" November 2020 and The Bank's 'Guidelines on Preventing and Combating Fraud and Corruption in Projects Financed by IBRD Loans and IDA Credits and Grants,' (revised as of July 01, 2016) ('Anticorruption Guidelines').

Consultants may associate with other firms to enhance their qualifications, but should indicate clearly whether the association is in the form of a joint venture and/or a sub-consultancy. In the case of a joint venture, all the partners in the joint venture shall be jointly and severally liable for the entire contract, if selected.

ii) Team Composition:

The working language of the project is English. All the team members assigned by the Consultant must possess proficiency in English language. Day-to-day communication language will be Turkish or English at the field level to ensure smooth communication among all participants, direct and indirect of the Project.

All key staff and support staff shall be mobilised immediately after the fist Construction Contract signature in way to evaluate the design and make the necessary adjustment before the works commence. At least one Technician/Junior Engineer shall be assigned to every campus. To ensure the occupational healt and safety measures of the construction sites at least one OHS Specialist (having at least Class C or equivalent internationally recognized OHS certificate) shall be assigned to each province. Technicians/Junior Engineers and OHS Specialists should have at least three (3) years' experience. In addition, support staff for the administrative services shall be proposed additionally as required (surveyors, clerks, drivers, secretary etc.)

The Project Manager together with the respective Cost & Planning, Civil, Electrical and Mechanical Engineers will be required for reporting and inspections during the twelve (12) months Defects Notification Period. The Supervision Team and the Project Manager will be entitled to follow, supervise and certify the implementation of the health and safety measures as per the Law 6331.

All expatriate staff who will work in Turkey should obtain a work permit and all who are resident for more than 90 days should obtain a non-resident visa. The consultant will obtain all required permits, visas for all expatriate staff at his own cost. Furthermore, the Consultant will be responsible to ensure that all proposed personnel are eligible to obtain such permits and visas. The information related to visas can be obtained from the embassies and consulates of Turkey. The Client will assist the consultant for the issue of work permits. The Consultant is required to obtain all the necessary permits, approvals, payment of all fees and contributions, as well as all the other elements necessary for the work of his professional staff who is engaged at his own expense for the performance of this Contract.

Key and support staff qualifications shall include but not limited to the following table.

Table 4: Staff Qualification Requirements

Tasks	Position (Min. *Number of Staff Required*)	Required Experience
All Tasks	Project Manager (1):	Civil Engineer with minimum fifteen (15) years of professional experience includes at least ten (10) years' experience in structural retrofitting supervision in construction projects of similar buildings and five (5) years working experience in manager position.
	Cost and Planning Engineer (1):	University degree in engineering with minimum five (5) years of professional experience, includes at least two (2) years' experience in preparation of progress payments, claim management, time schedules and reporting of construction projects that include similar buildings
	Mechanical Engineer (1):	Mechanical Engineer having ten (10) years of professional experience including five (5) years of energy efficiency related works experience in construction projects of similar buildings
	Electrical Engineer (1):	Electrical Engineer having ten (10) years of professional experience including five (5) years of energy efficiency related works experience in construction projects of similar buildings
Task.1	Structural Engineer (1):	Civil Engineer (Structural Engineer MSc. or above) with minimum ten (10) years of professional experience, includes at least five (5) years' experience in design of retrofitting works and knowledge of alternative retrofitting materials
	Architect (1):	Architect with minimum ten (10) years of professional experience including at least five (5) years' energy efficient building supervision experience in construction projects of similar buildings.
	QA/QC Engineer (1):	University degree in engineering with minimum five (5) years of professional experience including at least five (2) years' quality assurance and control experience in construction projects of similar buildings.
	Occupational Health and Safety (OHSE) Expert (1)	Occupational Health and Safety Expert with minimum five (10) years of professional experience, including at least three (5) years' experience in OHS assessment and management in construction projects financed by international finance institutions or other international donors, preferably the World Bank and with a knowledge in environmental and social safeguard policies and ESSs of the World Bank's Environmental and Social Framework (ESF) or other international development institutions, having A or B Class Occupational Safety Expert certificate received from the Directorate General of Occupational Health and Safety or equivalent international certificate.
	Environmental and Social Specialist (1):	University degree in engineering with minimum five (5) years of professional experience including at least three (3) years' experience in the national environmental and social legal framework, environmental and social impact/risk assessment, preparation of environmental and social assessment tools ESMP, Environmental and Social Impact Assessment (ESIA)), etc. and knowledge in environmental and social safeguard policies and ESSs of the World Bank's ESF or other international development institutions.
Support Staff	Technical Support Staff Requirement	To assure the required services at least twenty-seven (27) Technician/Junior Engineer/Architect (Architect (4), Civil (9), Mechanical (7) and Electrical (7) Technician/Engineer) and four (4) OHS Specialist shall be assigned in addition to input from the Key Experts. Technical Support Staff will not be evaluated as key staff

Tasks	Position (Min. *Number of Staff Required*)	Required Experience
	Administrative Support Staff Requirement	Support staff for the administrative services shall be proposed additionally as required (surveyors, clerks, drivers, secretary etc.)