



Provision of Services Related to Enabling Readiness for Up Scaling Investments in Building Energy Efficiency for Achieving NDC Goals in Thailand

Contract No.: UNEP/2020/252 (4700019197)

INCEPTION REPORT

Prepared for

UNITED NATIONS SUPPORT OFFICE – NAIROBI (UNSO)

By

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September 2020



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Acronyms

BEC	-	Building Energy Code
CTCN	-	Climate Technology Centre and Network
DEDE	-	Department of Alternative Energy Development and Efficiency
EIA	-	Environment Impact Assessment
IIEC	-	International Institute for Energy Conservation
MRV	-	Measurement, Report and Verification
NXPO	-	Office of National Higher Education Science Research and Innovation Policy Council
ONEP	-	Office of Natural Resources and Environmental Policy and Planning
PEECB	-	Promoting Energy Efficiency in Commercial Buildings
UNFCC	-	UN Framework Convention on Climate Change
UNEP	-	United Nations Environment Programme
TGO	-	Thailand Greenhouse Gas Management Organization



1 INTRODUCTION

The Division of Science of the United Nations Environment Programme (UNEP) based in Nairobi, Kenya, in association with Climate Technology Centre and Network (CTCN) issued an Request for Proposals (RFP) to develop options for the future form and function of its flagship report, the Global Environment Outlook. CTCN is the operational arm of the UN Framework Convention on Climate Change (UNFCCC) Technology Mechanism. Only Members of the CTCN Network were eligible participate in this solicitation. The International Institute for Energy Conservation (IIEC) being a member of the CTCN Network responded to the RFP and was selected as the Consultant Firm for the implementation of the project.

The Contract No: UNEP/2020/252 (4700019197) was executed on 3 August 2020 and an Inception kick-off meeting between all stakeholders was held video-conference on 28th August 2020. The project duration is 12 months and scheduled to be completed in August2021.

This Inception Report outlines a summary of stakeholder meetings, project approach, work plan and schedule for meeting the objectives of the Project.



2 PROJECT OVERVIEW

2.1 PROJECT OBJECTIVES

The overall objective of this GCF readiness proposal is to support Thailand in achieving national targets for energy efficiency in the building sector as defined in Energy Efficiency Plan of 2015, in NAMAs, and in Thailand's NDC. The NDC Road Map aims to reduce 113 million tonnes GHG emissions through energy efficiency (EE) and renewable energy (RE) with around 26.1 million tonnes in the building sector through compliance with the Building Energy Code (BEC), sustainable building materials and effective construction practices.

The scope focuses on five building types, namely, offices, hotels, department stores, medical centers and condominiums of floor area equivalent to or exceeding 2,000 square meters, and consistent with the performance indicators outlined in the BEC - building envelope, lightning system, air conditioning system, hot water generation system, renewable energy utilization and whole building performance.

2.2 SUMMARY OF APPROACH

The Terms of Reference (TOR) and GCF readiness proposal on Enabling readiness for up scaling investments in Building Energy Efficiency for achieving NDC goals in Thailand¹ already provide key project activities and indicative timeline for project implementation. In view of this, the proposed approach and methodology will generally conform to the TOR and GCF readiness proposal. However, the IIEC project team will capitalize experience from past and ongoing activities undertaken by the Government of Thailand (GoT), primarily the Department of Alternative Energy Development and Efficiency (DEDE), under the Ministry of Energy (MoEN), in implementing BEC, and ensure that the project activities will compliment current and future BEC related activities undertaken by different stakeholders.

Under the Energy Conservation and Promotion Act (ENCON Act), 1992 (amended in 2007), DEDE is the main agency responsible for development and promotion of the BEC. However, the ENCON Act does not mandate DEDE to enforce the BEC; and the BEC enforcement has been carried out through an inter-ministerial collaboration between DEDE and the Department of Public Works and Town and Country Planning (DPT) under the Ministry of Interior (MoI) and Local Administration Organizations (LAOs). The inter-ministerial enforcement has not been effective since the promulgation of the BEC in 2009 due to many reasons, including the capacity of DPT and LAOs, informational, and awareness barriers to be addressed by this project.

Over the past decade, DEDE has endeavored to overcome barriers pertaining to the BEC adoption and compliance, and multiple initiatives to promote and strengthen the BEC compliance have been implemented, including:

- Coordinating Center for Energy Conservation Building Design² - The Center was established in 2010 to support building designs and compliance in accordance with the BEC 2009.
- Promoting Energy Efficiency in Commercial Buildings (PEECB) in Thailand – This UNDP/GEF funded project was designed to support greater adoption of the BEC 2009. The project however did not cover high-rise residential buildings.

Although the BEC adoption, enforcement and compliance have not progressed in an accelerated manner, several key achievements related to BEC adoption and compliance over the past ten years are highlighted below:

- All government buildings must comply with the BEC (effective in 2013);

¹ https://www.greenclimate.fund/sites/default/files/document/readinessproposals-thailand-unep-ctcn-strategic-frameworks_0.pdf

² <http://new.2e-building.com/>

- Environment Impact Assessment (EIA) of buildings also considers compliance with the BEC;
- Buildings in compliance with the BEC are entitled to the specific privileges in building to land use area ratios.

The BEC was designed to cover both new and retrofitted buildings with floor areas equivalent to or exceeding 2,000 square meters; however, the national Energy Efficiency Plan for 2015-2036 (EEP2015) aims to enforce the BEC compliance through DPT on new buildings only, and a phase-step compliance strategy over a three-year period is illustrated in the below diagram:

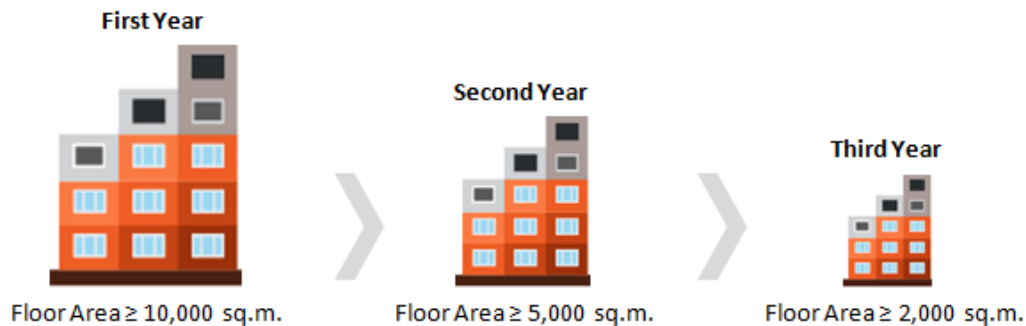


Figure 2.1: BEC Phase-Step Enforcement Strategy under EEP2015

DEDE planned to initiate the phase-step enforcement strategy in 2009, and the proposed draft of the new BEC ministerial regulation was approved by the Cabinet on July 8, 2020; and it is proceeding with the promulgation in the Government Gazette. The first effective year of compliance is planned in 2021; however, it is still to be confirmed. Considering this, the IIEC project team believe that the project activities on new and existing buildings specified in the TOR suit well with the GoT's strategies on BEC compliance and enforcement, and our approach and methodology in implementing the proposed activities to deliver expected outputs and outcomes are described below.

2.3 SUMMARY OF PROJECT COMPONENTS

2.3.1 Task 1: Conduct Energy and GHG baselines and consumption benchmarks for New Buildings for each building type covered in BEC

This task includes the following:

- Assessment of available existing energy consumption data and methodology for final energy baselines and benchmarks for five building types (offices, hotels, department stores, hospitals and condominiums) as defined in the BEC; including the development of methodology for energy and GHG emission benchmarks and application of the tool to streamline the energy consumption data from the existing database.
- Carry out a simulation and parametric run to design energy and GHG emissions benchmarks that would be achievable by the BEC for each of the five building types, using technology and cost related information from tasks 2 and 3
- Validation of the established energy and GHG baselines and energy benchmarks for the five building types and analysis of, and recommendations, on, municipal bylaws on baselines and benchmarks.
- Organize a stakeholder consultation workshop to share the results and validate the established energy and GHG baselines and energy benchmarks for the five building types.



2.3.2 Task 2: Technology Assessment of Five Building Types within the BEC Framework

This task includes the following:

- Assessment of relevant technologies with BEC compliance. Carry out an assessment of available technologies relevant for new buildings in Thailand, which include the assessment of parameters for six different building energy components under BEC - building envelope, lightning system, air conditioning, system, hot water generation system, renewable energy utilization and whole building performance.
- Preparation of a list of relevant technologies with BEC compliance and in consultation with relevant stakeholders prepare a prioritized listing of technologies applicable to the six building energy components for the five building types.
- Conduct a workshop to disseminate technology assessment results.

2.3.3 Task 3: Financial Assessment for New Buildings within the BEC Framework

This task includes the following:

- Conduct energy performance simulation for the five building types under different scenarios for the five technology groups; and carrying out a financial assessment of the proposed technologies under the five technology groups and recommend possible technology options that can be promoted to achieve BEC targets.
- Develop a methodology for net cash flow to economically assess the viability of the technologies under all technology groups.
- Conduct a workshop to present recommended technology options.

2.3.4 Task 4: Conduct Energy Audits on the Five Building Types

This task includes the following:

- Conduct detailed energy audits of five building types with data parameters not currently covered in the government's existing energy database to propose technology recommendations and policy revisions for retrofitting. This activity would include collection of data for designing the MRV framework (Task 5).
- Develop and run a simulation model to calculate the actual GHG emission and energy saving potential in the existing buildings through identified technology options.

2.3.5 Task 5: Develop MRV Framework for Existing and New Buildings within BEC Framework

This task includes the following:

- Development of a Measurement, Report and Verification (MRV) framework for GHG emission reductions and energy consumption and savings for existing and new buildings; including monitoring and communication materials.
- Identify the scope and key indicators for the MRV framework covering both GHG emissions, energy use and energy savings Indicators and ensuring the overall MRV framework to be gender sensitive
- Facilitate a stakeholder consultation workshop to discuss and finalize the MRV framework for real time measurement, automatic report generation and systematic verification strategies for GHG emission reductions, energy consumption and energy saving.



2.3.6 Task 6: Development of Monitoring and Communication Materials

This task includes the following:

- Development of 3 handbooks for local authorities, practitioners (engineers, architects, developers) and investors and banks to increase awareness of the BEC standards and provide guidelines on ensuring compliance. The handbooks will be translated into Thai language. and distributed by the national authorities.
- Development of a technical assistance impact description document including intended outcomes and impacts from this technical assistance, drafted at initiation of implementation and revised at closure, using the relevant CTCN template.
- Development of a monitoring and evaluation plan identifying all relevant indicators as specified in the TA Closure and Data Collection Report as well as other specific, measurable, achievable, relevant, and time-bound
- Development of a CTCN technical assistance closure report. using the relevant CTCN template



3 INCEPTION MISSION – SUMMARY OF MEETINGS

3.1 OVERVIEW

The initial kick-off meeting was coordinated by CTCN on 28 August 2020 via video-conference (GotoMeeting). This was followed by a meeting between the Consultants (IIEC) and CTCN’s National Designated Entity – NDE (The Office of National Higher Education Science Research and Innovation Policy Council (NXPO). The summary of the discussions is given below

3.2 SUMMARY OF MEETINGS

3.2.1 Inception Meeting with CTCN and Stakeholders

Date	28 August 2020	Time	11.00 am (CEST)	Location	Video Conference
Attendanc e	Name	Title		Organization	
	Mr. Rajiv Garg	Regional Manager-Africa		CTCN/UNEP	
	Mr. Sambit Nayak	Mitigation Specialist- Asia Pacific		CTCN/UNEP	
	Ms. Natthanich Asvapoositkul	Director of Climate Change Management and Coordination Division		ONEP	
	Ms. Kittisak Prukkanone	Director of Measure and Mechanism Development Section		ONEP	
	Dr. Jarunee Nugranad	Environmentalist (Senior Professional level), Climate Change Management and Coordination Division		ONEP	
	Ms. Oranuch Ratana	Policy specialist		NXPO	
	Ms. Sirinporn Daengphuang	Policy analyst		NXPO	
	Ms. Sopin Wachirapuwadon	Senior Project Manager		IIEC	
	Mr. Sanjay Dube	President & CEO		IIEC	
	Mr. Felix Gooneratne	Director		IIEC	

Summary of Discussions:

- CTCN confirmed the appointment of International Institute for Energy Conservation (IIEC) as the Contractor for the implementation of the Project, in conjunction with CTCN’s National Designated Entity (NDE) - The Office of National Higher Education Science Research and Innovation Policy Council (NXPO) and GCF’s National Designated Agency (NDA) - Office of Natural Resources and Environmental Policy and Planning (ONEP).
- The following were nominated as the Focal Points for the Project:
 - a. Mr. Sambit Nayak (CTCN)
 - b. Ms. Oranuch Ratana (NXPO)
 - c. Ms. Sopin Wachirapuwadon (IIEC)



- CTCN advised that the commencement of this Project was delayed due to various issues and emphasized the need to adhere to the accepted timeline (12 months) thereby avoiding any no-cost extensions.
- It was accepted that there are several challenges due to the uncertainties relating to Covid-19 and IIEC and the NDE will make every effort to overcome these. NDE confirmed that currently there are no restrictions on gatherings that would have an impact on the workshops planned in the Project.
- CTCN outlined the role of the NDA and its reporting requirements to the GCF. In this regard, it was noted that the next report to the GCF is due in December 2020 and requested IIEC to make an extra effort to complete the scheduled activities so that it could be documented in the report.
- All relevant issues concerning the NDA will be communicated through CTCN and NDE.
- IIEC agreed to have informal monthly meetings with the NDE to brief on the progress.
- Draft copies of all project reports will be forwarded to CTCN and NDE for review prior to finalization incorporating any comments. IIEC will endeavor to submit draft reports at least a week before schedule thus allowing time for review.
- CTCN confirmed, for contractual purposes, the Project commencement date as 28 August 2020.
- CTCN agreed to provide the templates for the communication documents for output 6.2 to 6.4.

3.2.2 Meeting with National Designated Entity (NDE)

Date	8 September 2020	Time	11.00 am	Location	Video Conference
Attendance	Name	Title		Organization	
	Ms. Oranuch Ratana	Policy specialist		NXPO	
	Ms. Sirinporn Daengphuang	Policy analyst		NXPO	
	Dr. Apichit Therdyothin	Director, Energy Conservation Laboratory		KMUTT	
	Mr. Warut Chiwamawin	Deputy Managing Director, Energy Conservation Laboratory		KMUTT	
	Mr. Damrong Bouyom	Senior Project Manager		KMUTT	
	Mr. Sommai Phon-Amnuaisuk	Director, Asia-Pacific,		IIEC	
	Ms. Sopin Wachirapuwadon	Senior project manager		IIEC	
	Mr. Sran Sribhibhadh	Senior consultant, M&E Expert		IIEC	
	Mr. Preecha Preedavichit	Senior consultant, Building EE Expert,		IIEC	

Following the inception meeting with CTCN, NDE and NDA, IIEC coordinated with NDE and the KMUTT team (the project technical advisor) to organize a separate meeting to discuss additional project background information, and conclude the proposed methodology, detailed work plan, and deliverable timelines, prior to submission of the inception report to CTCN. The meeting was held on 8 September 2020 via video-conference (Zoom).

Summary of Discussions:

- NDE informed the meeting that the project was initially developed as TA, and submitted to CTCN by KMUTT.



- The roles of NDE is to support and collaborate with relevant key stakeholders, e.g., DEDE, TGO, EPPO, EGAT, involved in the project activities. The details of project activities will be guided and recommended by KMUTT, acting as the project technical advisor, to ensure that the project implementation and outputs are aligned with the initial TA requirement.
- IIEC presented the proposed project activities, detail work plan and deliverable timeline, and it was agreed and accepted by NDE and KMUTT.
- KMUTT viewed that commercial building owners and developers are reluctant to comply with the BEC regulation due to various reasons, such as limited supply and data on performance of commercially available technologies, lack of understanding in suitable cost effective technologies, etc.
- It was agreed that the technology assessment will include local and international commercially available technologies that are cost effective and suitable with the Thai context (i.e., climatic conditions, local supply chain, labor skills, etc.).
- It was agreed that the project do not aim at requesting DEDE to adopt the project outputs and integrate them as part of the BEC regulation. The project outputs will rather serve as the optional tool for DEDE to promote greater compliance with the BEC regulation.
- For CTCN reporting, IIEC is required to identify relevant quantitative and qualitative indicators as specified in the CTCN closure report. However, the project core indicators have not yet been identified, and it was agreed that IIEC will come up the indicators for review and comment by KMUTT and NDE.
- To facilitate communication between IIEC and key project stakeholders, NDE will provide introductory letters to all key stakeholders. Specifically, for DEDE, IIEC will prepare a brief project background document (in Thai), and KMUTT will help communicating with DEDE to secure DEDE's support and collaboration in implementation of the project activities.

3.2.3 Data Requirements and Resources

3.2.3.1 Data Requirements

- BEC compliance building database commissioned by DEDE;
- Energy consumption data, SEC and benchmarks studies for the five target buildings; offices, hotels, department stores, medical center, and condominiums;
- Annual energy consumption and conservation measures reporting of the compliance Designated buildings for five target buildings, commissioned by DEDE;
- Annual GHG emission reduction reporting of building sector submitted to ONEP/NDA;
- GHG emission reduction database of NAMA program and T-VER for private building sector, commissioned by TGO;
- BEC simulation software and modeling promoted by the Coordinating Center for Energy Conservation Building Design, commissioned under DEDE;
- EE building technologies under the BEC certified buildings, and High Efficiency building construction material database, commissioned under DEDE;
- Energy efficiency NO.5 appliance database, maintained by EGAT;
- EE project financed by the Energy Revolving Fund (EERF) and ESCO Revolving Fund
- ESCO case studies on the building EE measures, implemented by FTI-ESCO association;
- M&V guidelines for EE building technologies, implemented by ESCO association.
- MRV frameworks for four type of designated building developed by TGO



3.2.3.2 Data Resources

The IIEC project team will utilize our existing relationships and contacts with the relevant stakeholders shown in the table below to accomplish data collection and compilation activities.

Project Requirements	Recommended Resources
Energy consumption data and benchmarks, Building database	<ul style="list-style-type: none"> • Specific Energy Consumption and Benchmarking Studies for offices, hotels, department stores, and hospitals commissioned by DEDE; • Compliance database of more than 800 government and private sector buildings maintained by the Coordinating Center for Energy Conservation Building Design under DEDE (www.2e-building.com); • Compliance database of the annual report of energy consumption and conservation measures of Designed buildings under DEDE; • Building database maintained by the Real Estate Information Center under supervision of the Government Housing Bank (www.reic.or.th);
Simulation software and modeling	<ul style="list-style-type: none"> • BEC compliance program promoted by the Coordinating Center for Energy Conservation Building Design; • Building Energy Codes Program (Visual Doe) promoted by U.S. Department of Energy (www.energycodes.gov/software-and-web-tools). • EDGE App promoted by the World Bank/IFC (www.edgebuildings.com).
EE building technology assessment	<ul style="list-style-type: none"> • Case studies on successful building EE measures with robust measurement and verification (M&V) results implemented by local Energy Service Companies (ESCOs); • EE projects financed by the Energy Efficiency Revolving Fund (EERF) and ESCO Revolving Fund. • Building EE technologies used in the BEC certified buildings in the Coordinating Center for Energy Conservation Building Design under DEDE • High efficiency building construction materials database maintained by DEDE (http://labelling.dede.go.th/survey/product/list-product-info) • Energy efficient No. 5 appliance database maintained by the Electricity Generating Authority of Thailand – EGAT (http://labelno5.egat.co.th)
MRV frameworks for five building types	<ul style="list-style-type: none"> • M&V guidelines for EE building technologies prepared by the ESCO Information Center (www.thaiesco.org); • MRV frameworks for four types of designated buildings (office, hotel, department store and hospital) developed by the Thailand Greenhouse Gas Management Organization (TGO);



3.2.1 Stakeholder Engagement

The IIEC project team will work closely with the Office of Natural Resources and Environmental Policy and Planning (ONEP), GCF's National Designated Authority, and the The Office of National Higher Education Science Research and Innovation Policy Council (NXPO), CTCN's National Designated Entity (NDE) to ensure that the project implementation are aligned with national climate priorities. The IIEC project team will also engage other key stakeholders, as listed below, through stakeholder consultation meetings, direct communication, and direct communication carried out during the project implementation.

Stakeholder name	Potential Areas for Engagement and Collaboration
Energy Policy and Planning Office (EPPO) – Ministry of Energy	EPPO is the key stakeholder in implementation of project activities on development and recommendation on fiscal incentives and/or a financial mechanism to support EE buildings, and incentivize private sector to participate in the EE building scheme.
Department of Alternative Energy Development and Efficiency (DEDE) – Ministry of Energy	DEDE is the regulator responsible for enforcement of the BEC in collaboration with DPT. DEDE has carried out numerous studies related to building specific energy consumption (SEC), benchmarking, MRV, and also implemented various financial mechanisms to support investment of EE measures in buildings. DEDE also houses the Coordinating Center for Energy Conservation Building Design which promotes BEC compliance services.
Pollution Control Department (PCD) - Ministry of Natural Resources and Environment (MONRE)	PCD has implemented the public Green Procurement Program (GPP) which support development and certification of EE green technologies for adoption by government and private sector buildings.
Department of Public Work and Town & Country Planning (DPT) – Ministry of Interior	DPT is the main agency responsible for enforcement of the BEC in collaboration with DEDE. DPT also supports LAOs in issuing construction permits.
Thailand Greenhouse Gas Management Organization (TGO)	TGO developed MRV frameworks for four types of designated buildings (office, hotel, department store and hospital) for the Energy Performance Certificate (EPC) scheme, and TGO will be engaged to support development of the MRV framework for the five building types.
Real Estate Information Center (REIC)	The REIC will provide relevant data of building stock and annual construction.
King Mongkut University of Technology Thonburi (KMUTT), Thailand	KMUTT has actively been promoting EE building in Thailand for decades, and will provide building energy audit and consumption data, as well as development of communication materials.
Thai Green Building Institute (TGBI)	TGBI is the main actor in development and implementation of green design standards for buildings in Thailand, and will be the key stakeholder in provision of building performance data, finalization of the MRV framework, and dissemination of communication materials.



Stakeholder name	Potential Areas for Engagement and Collaboration
Thai ESCO Association	The Thai ESCO Association has compiled case studies on successful building EE measures with robust measurement and verification (M&V) results implemented by local Energy Service Companies (ESCOs), and also produce M&V guidelines for EE building technologies.



4 PROJECT WORK PLAN

4.1 INTRODUCTION

Considering the project duration of 12 months, a detailed workplan is provided for the first six months (September 2020 to February 2021). An overview of the proposed activities for the second half of the Project (March 2021 to August 2021) is also provided and a detailed plan will be prepared in March 2021.

4.2 WORK PLAN FOR SEPTEMBER 2020 TO FEBRUARY 2021

4.2.1 Task 1: Conduct Energy and GHG baselines and consumption benchmarks for New Buildings for each building type covered in BEC

The following activities will be undertaken during this period.

4.2.1.1 Activity 1.1: Collection and Evaluation of Energy Consumption Data

The IIEC Project Team will coordinate with NDE in the collection of data as outlined in Section 3.2.3. It is expected that the NDE will provide introductions to the identified agencies and IIEC will coordinate directly in sourcing the required information. Following initial meeting with the agencies and review of the available information, data gaps will be identified and a data collection plan will be prepared and undertaken. The project team will conduct a detailed review and assessment of available energy consumption data for the five selected building types, i.e. offices, hotels, department stores, hospitals and condominiums

Under the scope of the ENCON Act and decree on designated facilities, large buildings in Thailand are classified as designated energy consumers, and subject reporting their annual energy consumption data to DEDE. In addition, the estimated energy consumptions of buildings under the scope of the BEC are reported based on the building design. Hence, this is likely to be a key source of information.

In addition, the project team will review data compiled by the previous projects including, but not limited to, the Thai-German Climate Programme (TGCP) implemented by GIZ, and Thailand Voluntary Emission Reduction Program implemented by TGO. The project team will determine the comprehensiveness, type, and quality of the available data, data sources and data collection approaches (including frequency of data collection), and then develop a methodology to finalize the energy baselines and benchmarks for the five selected building types.

4.2.1.2 Activity 1.2: Streamlining of Energy and GHG Emissions Baselines and Benchmarks for the Five Building Types

Following the evaluation of the energy consumption data, the project team will streamline energy consumption and benchmark data using the agreed methodology. There are several benchmarking indicators that have been referenced in Thailand, including annual specific energy consumption (SEC) or energy use index (EUI) in kWh/m², lighting power density in W/m².

The project team will develop necessary Access/Excel tools to assist in the streamlining work, and to consolidate existing energy consumption data into a single database for subsequent simulation of energy consumption and GHG emission baselines and benchmarks of the BEC compliant office, hotel, department store, hospital and condominium.



4.2.1.3 Activity 1.3: Simulation of Energy and GHG Benchmarks

The project team will utilize existing modeling software including, but not limited to, the BEC software and Visual DOE to carry out a simulation and parametric run to design energy and GHG emissions benchmarks that would be achievable by the BEC for each of the five building types. Since the parametric run needs technology and cost related information, the benchmarking activity will be carried out in conjunction with findings from activities under Task 2 and 3.

4.2.1.4 Activity 1.4: Stakeholder Consultations and Validation

The project team will organize a stakeholder consultation workshop to share the results and validate the established energy and GHG baselines and energy benchmarks for the five building types. In addition, the project team will also conduct analysis of relevant municipal regulations and recommend possible options for integration of baselines and benchmarks into the local regulations. The recommendations will be presented to selected local authorities in a separate workshop.

For each workshop, the project team will prepare a program outline, and, in consultation with CTCN, NDE and other agencies finalize the program, and identify target stakeholders, including local authorities, deem appropriate as potential participants in each workshop. It should be noted that Thailand has more than 7,800 local government units across the country, therefore the priority will be given to those with strong interest and capacity to promote EE building at the city level.

Following the completion of the workshops, the reports summarizing the outcomes and workshop evaluation results will be prepared for submission to CTCN and NDE.

4.2.2 Task 2: Technology Assessment of Five Building Types within the BEC Framework

The following activities will be undertaken during this period.

4.2.2.1 Activity 2.1: Assessment of Relevant Technologies with BEC Compliance

In parallel with Task 1, the project team will carry out an assessment of available technologies relevant for new buildings in Thailand. The assessment will review commercially available technologies against assessment parameters for six different building energy components covered under BEC: building envelope, lighting system, air conditioning system, hot water generation system, renewable energy utilization and whole building performance. This activity will include the conduct of interviews with local suppliers/manufacturers, local ESCOs, as well as potential international suppliers/manufacturers to ensure that all potential technologies, which are relevant and could promote a greater compliance with the BEC, are included in the assessment.

4.2.2.2 Activity 2.2: Prioritizing of Relevant Technologies with BEC Compliance

Following the assessment, a long and comprehensive list of feasible technologies will be developed. Following consultation with relevant stakeholders' criteria for short-listing technology options will be developed; and a priority listing of feasible technologies applicable for the key energy components of the five selected building types will be developed.

The project team will prepare and finalize the short-listing criteria in consultation with relevant stakeholders, and then short list priority feasible technologies applicable for the key energy components of the five selected building types. Findings from this activity will also serve as the inputs for simulation work under Task 1.



4.2.2.3 Activity 2.3: Conduct Workshop for Dissemination of Results

A workshop will be organized to disseminate technology assessment results on priority technologies to relevant stakeholders. The project team will prepare a program outline, and, in consultation with CTCN, NDE and other agencies, identify target stakeholders deemed appropriate as potential participants in the workshop. In addition to policy makers and authorities, it is envisaged that building practitioners (e.g., engineers and architects), and EE technologies suppliers/manufacturers will be the main target audience for this dissemination workshop.

Following the workshop, will prepare a report summarizing discussions and conclusions from the workshop, including the workshop evaluation results and participant lists for submission to CTCN and NDE.

4.2.3 Task 3: Financial Assessment for New Buildings within the BEC Framework

The following activities will be undertaken during this period.

4.2.3.1 Activity 3.1: Conduct Energy Performance Simulation for Five Building Types

The priority technologies identified under Task 2 will be utilized as the key parameters to simulate the energy performance of the five selected building types under different adoption scenarios of the five technology groups for building energy component (i.e., building envelope, lighting system, air conditioning system, hot water generation system, renewable energy utilization). Investment costs for each adoption scenario will be estimated and included in the report.

4.2.3.2 Activity 3.2: Assessment of Financial Aspects of Technology

Based on the energy performance of different technologies and investment costs, the project team will conduct financial and economic assessments of the priority technologies and recommend possible technology options that can be promoted to achieve the targets set in BEC.

This activity will continue into to the next period (April – August 2021).

4.2.3.3 Activity 3.3: Workshop on Recommended Technology Options

This activity is scheduled for the next period

4.2.4 Task 4: Conduct Energy Audits on the Five Building Types

4.2.4.1 Activity 4.1: Conduct of Energy Audits and Simulation of Energy and GHG Reduction Potential

The project team will carry out detailed energy audits of five building types with data parameters not currently covered in the government's existing energy database to propose technology recommendations and policy revisions for retrofitting.

Based on the initial implementation plan outlined in the GCF readiness proposal, it is envisaged that around 10 representative audit sites will be selected in consultation with CTCN, NDE and other stakeholders for detailed audits. The energy audits will also collect data and findings for designing the MRV framework (Task 5).



The activities will include the following:

- **Site Selection:** The overall approach will be to initially select three to five sites for each building type. The project team will discuss with relevant stakeholders on the merits of selection of audit sites, and ensure that the selections will adequately address the gaps in the existing database.
- **Preliminary Surveys and Confirmation of sites for Detailed Audit:** The preliminary surveys of the potential sites will be conducted to ensure that the final sites selected will meet all the criteria of the objectives of the activity. The final site selection will be primarily based on the replicability potential of the EE technologies for new and retrofitted buildings.
- **Detailed Audits:** This phase would involve the conduct of detailed energy audits covering all the major end-uses including, but not limited to, lighting and HVAC systems, and would include load monitoring and assessment of current energy management practices. Following the audit, the project team will identify potential energy savings and GHG emission reductions based on applications of technology options identified under Task 3. The existing MRV frameworks for the project level (or Measurement & Verification – M&V frameworks), such as IPMVP, CDM and TGO’s T-VER, will be carefully evaluated and recommended with cost versus accuracy consideration. All equipment required for the Energy Audits will be provided by IIEC.

This activity will commence in February 2021 and completed in June 2021

4.2.4.2 Activity 4.2: Develop Simulation Model for Energy and GHG Saving Potential in Existing Buildings

This activity is scheduled for the next period

4.2.5 Task 5: Develop MRV Framework for Existing and New Buildings within BEC Framework

4.2.5.1 Activity 5.1: Streamlining of Data for development of MRV Framework

Based on the energy consumption and benchmark data compiled under Task 1 and results from the energy audits, the project team will conduct a comprehensive review and streamline data necessary for development of an MRV framework. The project team will then conduct a review of methodological and operational MRV framework to assess GHG emission reductions, energy use and energy savings. These include review of the MRV frameworks for buildings prepared by other agencies, such as TGO.

This activity will be undertaken initially during December 2020-January 2021 and finalized in June 2021 after the completion of Task 4

4.2.5.2 Activity 5.2: Identification of Key Indicators

The project team will identify the scope and key indicators of the MRV framework covering GHG emissions, energy use and energy savings. Indicators and the overall MRV framework will include consideration on the gender aspect.

This activity will commence in January 2021 and completed in June 2021



4.2.5.3 Activity 5.3: Development of Draft MRV Framework

This activity is scheduled for the next period

4.2.5.4 Activity 5.4: Stakeholder Consultation of MRV Framework

This activity is scheduled for the next period

4.2.6 Task 6: Development of Monitoring and Communication Materials

4.2.6.1 Activity 6.1: Development of Handbooks to Increase Awareness of BEC Standards

This activity is scheduled for the next period

4.2.6.2 Activity 6.2: Develop Technical Assistance Impact Description Document

The project team will develop a technical assistance impact description document which is a one-page description of intended outcomes and impacts from this technical assistance, drafted at initiation of implementation and revised at closure, using the CTCN template.

4.2.6.3 Activity 6.3: Develop Monitoring and Evaluation Plan

Based the CTCN template, the project team will prepare a monitoring and evaluation plan, identifying all relevant indicators as specified in the TA Closure and Data Collection Report as well as other specific, measurable, achievable, relevant, and time-bound indicators suitable to monitor Outputs and Activities.

4.2.6.4 Activity 6.4: Develop CTCN Technical Assistance Closure and Data Collection Report

This activity is scheduled for the next period



4.3 OVERVIEW OF ACTIVITIES FOR MARCH TO AUGUST 2021

4.3.1 Task 1: Conduct Energy and GHG baselines and consumption benchmarks for New Buildings for each building type covered in BEC

Task completed in the last period

4.3.2 Task 2: Technology Assessment of Five Building Types within the BEC Framework

Task completed in the last period

4.3.3 Task 3: Financial Assessment for New Buildings within the BEC Framework

The following activities will be undertaken during this period.

4.3.3.1 Activity 3.1: Conduct Energy Performance Simulation for Five Building Types

Activity completed in the last period

4.3.3.2 Activity 3.2: Assessment of Financial Aspects of Technology

Based on the energy performance of different technologies and investment costs, the project team will conduct financial and economic assessments of the priority technologies and recommend possible technology options that can be promoted to achieve the targets set in BEC.

This activity commenced in the last period and will be completed in this period.

4.3.3.3 Activity 3.3: Workshop on Recommended Technology Options

The project team will organize a dissemination workshop to present the recommended technology options that can be promoted to achieve the targets set in the BEC. Organization of the dissemination workshop on recommended technology options will follow the similar approach as discussed under Activity 2.2. After the workshop, the project team will prepare a workshop report summarizing discussions and conclusions from the workshop, including the workshop evaluation results and participant lists for submission to CTCN and NDE.

4.3.4 Task 4: Conduct Energy Audits on the Five Building Types

4.3.4.1 Activity 4.1: Conduct of Energy Audits and Simulation of Energy and GHG Reduction Potential

The project team will carry out detailed energy audits of five building types with data parameters not currently covered in the government's existing energy database to propose technology recommendations and policy revisions for retrofitting.



Based on the initial implementation plan outlined in the GCF readiness proposal, it is envisaged that around 10 representative audit sites will be selected in consultation with CTCN, NDE and other stakeholders for detailed audits. The energy audits will also collect data and findings for designing the MRV framework (Task 5).

The activities will include the following:

- **Site Selection:** The overall approach will be to initially select three to five sites for each building type. The project team will discuss with relevant stakeholders on the merits of selection of audit sites, and ensure that the selections will adequately address the gaps in the existing database.
- **Preliminary Surveys and Confirmation of sites for Detailed Audit:** The preliminary surveys of the potential sites will be conducted to ensure that the final sites selected will meet all the criteria of the objectives of the activity. The final site selection will be primarily based on the replicability potential of the EE technologies for new and retrofitted buildings.
- **Detailed Audits:** This phase would involve the conduct of detailed energy audits covering all the major end-uses including, but not limited to, lighting and HVAC systems, and would include load monitoring and assessment of current energy management practices. Following the audit, the project team will identify potential energy savings and GHG emission reductions based on applications of technology options identified under Task 3. The existing MRV frameworks for the project level (or Measurement & Verification – M&V frameworks), such as IPMVP, CDM and TGO's T-VER, will be carefully evaluated and recommended with cost versus accuracy consideration. All equipment required for the Energy Audits will be provided by IIEC.

This activity commenced in February 2021 and will be completed in June 2021

4.3.4.2 Activity 4.2: Develop Simulation Model for Energy and GHG Saving Potential in Existing Buildings

The project team will evaluate the existing simulation models under Task 1 and modify the suitable model as necessary to enable calculation the actual GHG emission and energy saving potential in the existing buildings. Findings from the energy audits and technology assessment will be used to run the simulation model to estimate potential energy savings and GHG emission reduction for different technology options.

4.3.5 Task 5: Develop MRV Framework for Existing and New Buildings within BEC Framework

4.3.5.1 Activity 5.1: Streamlining of Data for development of MRV Framework

Based on the energy consumption and benchmark data compiled under Task 1 and results from the energy audits, the project team will conduct a comprehensive review and streamline data necessary for development of an MRV framework. The project team will then conduct a review of methodological and operational MRV framework to assess GHG emission reductions, energy use and energy savings. These include review of the MRV frameworks for buildings prepared by other agencies, such as TGO.

4.3.5.2 Activity 5.2: Identification of Key Indicators

The project team will identify the scope and key indicators of the MRV framework covering GHG emissions, energy use and energy savings. Indicators and the overall MRV framework will include consideration on the gender aspect.



4.3.5.3 Activity 5.3: Development of Draft MRV Framework

With the existing data sets and identified key indicators, the project team will design the methodological and operational MRV framework for the five selected building types within the BEC framework.

4.3.5.4 Activity 5.4: Stakeholder Consultation of MRV Framework

The project team will facilitate a stakeholder consultation meeting to discuss and finalize the MRV framework for measurement, automatic report generation and systematic verification strategies for GHG emission reductions, energy consumption and energy saving. Findings under Task 4 will also be presented in the consultation meeting.

4.3.6 Task 6: Development of Monitoring and Communication Materials

4.3.6.1 Activity 6.1: Development of Handbooks to Increase Awareness of BEC Standards

The project team will develop three handbooks that will summarize and visualize the key findings of this technical assistance for the three main target groups 1) local authorities 2) practitioners (engineers, architects, developers) and 3) investors and banks. The contents will be presented based on the needs of each target group and clearly outline the key findings of the technical assistance. The handbook for local authorities will focus on enhancing enforcement in all buildings with floor areas equivalent to or greater than 2,000 m² and strengthen municipal regulations in consistent with the BEC. The handbook for practitioners will focus on technology options to adhere to the BEC requirements. While the handbook for investors and bankers will focus on costing compliance options and increasing awareness of the financial risks of noncompliance. The handbooks will be translated into Thai language and distributed by the national authorities.

4.3.6.2 Activity 6.2: Develop Technical Assistance Impact Description Document

Activity completed in the last period

4.3.6.3 Activity 6.3: Develop Monitoring and Evaluation Plan

Activity completed in the last period

4.3.6.4 Activity 6.4: Develop CTCN Technical Assistance Closure and Data Collection Report

The project team will also prepare a technical assistance “Closure and Data Collection Report” using the CTCN template for submission to CTCN.



4.4 PROJECT SCHEDULE – DELIVERABLES

The expected outputs and project reporting schedule are summarized in the Table below.

Task / Activity	Project Outputs and Reports	Submission Date
	Inception Report	30 Sep 2020
6.2	CTCN Technical assistance impact description document	
6.3	CTCN Monitoring and evaluation plan	
Task 1		
1.1	Report on existing energy data, baselines and benchmarks. Methodology for development of energy and GHG emission benchmarks for five selected building types	31 Dec 2020
1.2	Database on energy consumption data streamlined	28 Feb 2021
1.3	Recommendations on energy and GHG emissions baselines and benchmarks for the five building types finalized	
1.4	Stakeholder consultation report for the activity 1.4.1	
1.5	Workshop report for the activity 1.4.2	
Task 2		
2.1	Non-prioritized assessment report of technologies compliant and relevant for the BEC.	30 April 2021
2.2	Long list and short list of prioritized technologies for the BEC.	31 May 2021
2.3	Workshop report on technology results and identified prioritized technologies	
Task 3		
3.1	Energy performance reports of the building prototypes through model simulations	31 Jul 2021
3.2	Report of financial assessment including applied methodology, key data, findings and recommendations	
3.3	Report from dissemination workshop for activity 3.3.1	
Task 4		
4.1	Energy audit report on potential GHG and energy saving option for existing five building types, to generate data for the government database, policy recommendations, technology options, and recommendation for the MRV framework	31 Jul 2021
4.2	Report with simulation results on energy and GHG emission reduction potential by the identified technologies	
Task 5		
5.1	Review of existing data sets, methodological and operational MRV framework to assess GHG emission reductions, energy use and energy savings	31 Aug 2021
5.2	List of key indicators for the MRV framework	
5.3	Draft MRV framework for five building types	
5.4	Report from stakeholder consultation meeting and finalized MRV framework	
Task 6		
6.1	Three handbooks that will summarize and visualize the key findings of this technical assistance	31 Aug 2021
6.4	CTCN technical assistance closure and Data Collection report	

Note: Draft reports will be submitted to CTCN and NDE two weeks prior to the submission dates



5 PROJECT MANAGEMENT

5.1 CONTRACTUAL ISSUES

5.1.1 Impact of Covid 19 Restrictions

Project activities are influenced by Covid-19 restrictions primarily in Thailand and the host countries of IIEC's International Experts. In addition, participation of CTCN personnel especially in workshops and stakeholder meetings will also be impacted.

The project activities likely to be influenced by Covid 19 restrictions will be energy auditing and stakeholder consultation workshops. At present there are no restrictions in Thailand that would have a direct impact on project activities expect for international travel restrictions.

IIEC will liaise with NDE and CTCN in responding to any changes relating to this issue during project implementation.

5.1.2 Staffing Issues

Two of IIEC's nominated Experts are foreign nationals (Denmark and India) and currently they are subject to travel restrictions imposed in their respective countries and Thailand. In order to avoid delays in project implementation, IIEC has contingency plans of utilizing these Experts remotely and undertaking field work using IIEC's own resources in Thailand under the direction of the international Experts. All outputs will be reviewed by the Experts prior to submission.

5.2 PROJECT MANAGEMENT OFFICE

The Project Management Office will be located at IIEC's Asia Regional Office in Bangkok which is located at 15th Floor, Lumpini Tower, Rama IV Road, Thungmahamek, Sathorn, Bangkok 10120.

Project Coordinator – Ms. Sopin Wachirapuwadon (Tel: +66 2 285 6346 – 7)



6 ATTACHMENTS



6.1 PROJECT TIMELINE

Our project work plan will follow the approach and methodologies detailed in the above sections. We will adhere to the following plan and timelines for implementation of the main activities for delivering on the scope of work assigned to us.

Task and Activity	Sep-2020	Oct-2020	Nov-2020	Dec-2020	Jan-2021	Feb-2021	Mar-2021	Apr-2021	May-2021	Jun-2021	Jul-2021	Aug-2021
Task 1: Conduct Energy and GHG baselines and consumption benchmarks for New Buildings												
Activity 1.0: Prepare Work Plan and Inception Report												
Activity 1.1: Evaluation of Existing Energy Consumption Data												
Activity 1.2: Streamlining Energy and GHG Emissions Baselines and Benchmarks for the Five Building Types												
Activity 1.3: Simulation of Energy and GHG Benchmarks												
Activity 1.4: Validation of Benchmarks and stakeholder consultations												
<i>Deliverable 1.0: Detailed work plan and inception report</i>	X											
<i>Deliverable 1.1: Report on existing energy data, baselines and benchmarks. Methodology for development of energy and GHG emission benchmarks for five selected building types.</i>						X						
<i>Deliverable 1.2: Database on energy consumption data streamlined.</i>						X						
<i>Deliverable 1.3: Recommendations on energy and GHG emissions baselines and benchmarks for the five building types finalized.</i>						X						
<i>Deliverable 1.4.1: Stakeholder consultation report.</i>						X						
<i>Deliverable 1.4.2: Workshop report.</i>						X						
Task 2: Technology Assessment of Five Building Types within the BEC Framework	Sep-2020	Oct-2020	Nov-2020	Dec-2020	Jan-2021	Feb-2021	Mar-2021	Apr-2021	May-2021	Jun-2021	Jul-2021	Aug-2021
Activity 2.1: Assessment of Relevant Technologies with BEC Compliance												
Activity 2.2: Prioritizing Relevant Technologies with BEC Compliance												
Activity 2.3: Workshop for Dissemination of Results												
<i>Deliverable 2.1: Non-prioritized assessment report of technologies compliant and relevant for the BEC.</i>								X				
<i>Deliverable 2.2: Long list and short list of prioritized technologies for the BEC.</i>									X			



Task and Activity	Sep-2020	Oct-2020	Nov-2020	Dec-2020	Jan-2021	Feb-2021	Mar-2021	Apr-2021	May-2021	Jun-2021	Jul-2021	Aug-2021
<i>Deliverable 2.3: Workshop report on technology results and identified prioritized technologies.</i>									X			
Task 3: Financial Assessment for New Buildings within the BEC Framework												
Activity 3.1: Energy Performance Simulation for Five Building Types												
Activity 3.2: Assessment of Financial Aspects of Technology												
Activity 3.3: Workshop on Recommended Technology Options												
<i>Deliverable 3.1: Energy performance reports of the building prototypes through model simulations.</i>										X		
<i>Deliverable 3.2: Report of financial assessment including applied methodology, key data, findings and recommendations.</i>											X	
<i>Deliverable 3.3: Report from dissemination workshop.</i>											X	
Task 4: Conduct Energy Audits on the Five Building Types												
Activity 4.1: Conduct of Energy Audits and Simulation of Energy and GHG Reduction Potential												
Activity 4.2: Develop Simulation Model for Energy and GHG Saving Potential in Existing Buildings												
<i>Deliverable 4.1: Energy audit report on potential GHG and energy saving options for existing five building types, to generate data for the government database, policy recommendations, technology options, and recommendations for the MRV framework.</i>										X		
<i>Deliverable 4.2: Report with simulation results on energy and GHG emission reduction potential by the identified technologies.</i>											X	
Task 5: Develop MRV Framework for Existing and New Buildings within BEC Framework												
Activity 5.1: Streamlining of Data for development of MRV Framework												
Activity 5.2: Identification of Key Indicators												
Activity 5.3: Development of Draft MRV Framework												
Activity 5.4: Stakeholder Consultation of MRV Framework												
<i>Deliverable 5.1: Review of existing data sets, methodological and operational MRV framework to assess GHG emission reductions, energy use and energy savings.</i>										X		
<i>Deliverable 5.2: List of key indicators for the MRV framework.</i>										X		
<i>Deliverable 5.3: Draft MRV framework for five building types.</i>											X	
<i>Deliverable 5.4: Report from stakeholder consultation meeting and finalized MRV framework.</i>												X



Task and Activity	Sep-2020	Oct-2020	Nov-2020	Dec-2020	Jan-2021	Feb-2021	Mar-2021	Apr-2021	May-2021	Jun-2021	Jul-2021	Aug-2021
Task 6: Development of Monitoring and Communication Materials												
Activity 6.1: Development of Handbooks to Increase Awareness of BEC Standards												
Activity 6.2: Develop Technical Assistance Impact Description Document												
Activity 6.3: Develop Monitoring and Evaluation Plan												
Activity 6.4: Develop CTCN Technical Assistance Closure and Data Collection Report												
<i>Deliverable 6.1: Three handbooks.</i>												X
<i>Deliverable 6.2: Technical assistance impact description document.</i>	X											
<i>Deliverable 6.3: Monitoring and evaluation plan.</i>	X											
<i>Deliverable 6.4: CTCN technical assistance closure and Data Collection report.</i>												X



6.2 CHECKLIST OF DATA REQUIREMENTS

Data Requirements	<input type="checkbox"/>	Sources of Info.
BEC compliance building database commissioned by DEDE	<input type="checkbox"/>	DEDE
Energy consumption data, SEC and benchmarks studies for the five target buildings; offices, hotels, department stores, medical center, and condominiums;	<input type="checkbox"/>	DEDE
Annual energy consumption and conservation measures reporting of the compliance Designated buildings for five target buildings, commissioned by DEDE;	<input type="checkbox"/>	DEDE
Annual GHG emission reduction reporting of building sector submitted to ONEP/NDA;	<input type="checkbox"/>	DEDE/ONEP/NDA
GHG emission reduction database of NAMA program and T-VER for private building sector, commissioned by TGO;	<input type="checkbox"/>	TGO
BEC simulation software and modeling promoted by the Coordinating Center for Energy Conservation Building Design, commissioned under DEDE;	<input type="checkbox"/>	DEDE
EE building technologies under the BEC certified buildings, and High Efficiency building construction material database, commissioned under DEDE;	<input type="checkbox"/>	DEDE
Energy efficiency NO.5 appliance database, maintained by EGAT;	<input type="checkbox"/>	EGAT
EE project financed by the Energy Revolving Fund (EERF) and ESCO Revolving Fund	<input type="checkbox"/>	EPPO
ESCO case studies on the building EE measures, implemented by FTI-ESCO association;	<input type="checkbox"/>	DEDE/FTI-ESCO Association
M&V guidelines for EE building technologies, implemented by ESCO association.	<input type="checkbox"/>	DEDE/FTI-ESCO association
MRV frameworks for four type of designated building developed by TGO	<input type="checkbox"/>	TGO

