**United Nations Development Programme**

**Royal Government of Thailand**

# Terminal Evaluation of UNDP/GEF Project: Promoting Energy Efficiency in Commercial Buildings in Thailand (PEECB)

(GEF Project ID: 4165; UNDP PIMS ID: 3937)

## Terminal Evaluation Report


***Mission Members:***

Mr. Roland Wong, International Consultant

Ms. Walaitat Worakul, National Consultant


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# SYNOPSIS

**Title of UNDP supported GEF financed project:** Promoting Energy Efficiency in Commercial Buildings in Thailand (PEECB)

**UNDP Project ID:** PIMS 3937

**GEF Project ID:** 4165

**Evaluation time frame:** November 2012 to March 2018

**CEO endorsement date**: 14 November 2012

**Project implementation start date**: 14 November 2012

**Project end date**: 30 April 2018

**Date of evaluation report:** 18 April 2018

**Region and Countries included in the project:** Thailand

**GEF Focal Area Objective:** SP-1 (for GEF-4): Promoting energy efficient technologies and practices in the appliance and building sectors

**Implementing partner and other strategic partners:** Implementing partner: Department of Alternative Energy Development and Efficiency (DEDE) under the Ministry of Energy

**Evaluation team members:** Mr Roland Wong, International Consultant
Ms. Walaitat Worukul, National Consultant

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# EXECUTIVE SUMMARY

This report summarizes the findings of the Terminal Evaluation Mission conducted during the 13-26 March 2018 period for the GEF project: "*Promoting Energy Efficiency in Commercial Buildings in Thailand*" (hereby referred to as PEECB or the Project), where UNDP received a US$3,637,273 grant from the Global Environmental Facility (GEF) in July 30, 2012.

## Project Summary Table

| Project Title: | *Promoting Energy Efficiency in Commercial Buildings in Thailand* (PEECB) | | | |
|---|---|---|---|---|
| GEF Project ID: | 4165 | | *at endorsement (Million US$)* | *at completion (Million US$)* |
| UNDP Project ID: | 3937 | GEF financing: | 3.637 | 3.637 |
| Country: | Thailand | IA/EA own: | 0.000 | 2.159 |
| Region: | Europe and CIS | Government: | 6.500 | 11.208 |
| Focal Area: | Climate Change | Other: | 5.767 | 0. |
| FA Objectives, (OP/SP): | CC-SP1 for GEF 4: Promoting energy efficient technologies and practices in the appliance and building sectors | Total co-financing: | 12.267 | 13.367 |
| Executing Agency: | Department on Energy Efficiency (DEE) under the State Committee on Standardization of Thailand | Total Project Cost: | 15.904 | 17.004 |
| Other Partners involved: | | ProDoc Signature (date project began): | | 14 November 2012 |
| | | (Operational) Closing Date: | Proposed: 31 December 2015 | Actual: 30 April 2018 |

## Project Description

The Project "Promoting Energy Efficiency in Commercial Buildings in Thailand" (PEECB) has the goal of "reducing intensity of GHG emissions from the commercial building sector", and an objective of "promoting and facilitating widespread application of building energy efficiency technologies and practices in commercial buildings in Thailand". The Project was designed to achieve this objective through activities designed to remove awareness, capacity and regulatory framework barriers, and support implementation of demonstration energy efficient measures in selected buildings. Though PEECB was originally designed as a 3.25-year project ending in December 2015, it officially commenced implementation on 14 November 2012, and was extended in July 2016, as a no-cost extension to April 30, 2018.

Prior to the preparation of the PEECB Project, Thailand's energy consumption during the 1998 to 2008 period according to DEDE was increasing at an average of 4% each year annually. In 2009, the commercial sector (which generally includes commercial buildings, public sector, not-for-profit organisations and public lighting) consumed about 35% of the total electricity consumption in Thailand, second to only the

industrial sector. During the period of 2010 to 2015, Thailand's annual electricity consumption grew at an average rate of 3.2% annually.

As of 2010 prior to the commencement of the PEECB Project, data on commercial building stocks, their electricity utilization and GHG emissions remain scattered amongst a number of different agencies and academic organizations involved with the commercial building sector. DEDE is currently involved in efforts towards the consolidation of building energy information through the development of a building database as a means of managing and regulating new commercial buildings that are compliant with the 2009 Building Energy Code (BEC) for new building construction.

Adoption of new buildings to the new BEC, however, was limited in 2010 due to building owners and most building practitioners in Thailand and their lack of familiarity of the new BEC requirements. Despite workshops and promotional measures being implemented to overcome this lack of familiarity prior to the PEECB Project, adoption of the BEC in new building designs remained slow. The PEECB Project sought to address this issue and the lack of development of BEC compliant buildings.

## Project Results

Actual outcomes of the PEECB Project are summarized on Table A in comparison with intended outcomes.

**Table A: Comparison of Intended Project Outcomes from the Inception Report to Actual Outcomes**

| Intended Outcomes in revised Project Planning Matrix of September 2017 | Actual Outcomes as of March 2018 |
|---|---|
| **Goal:** Reduced intensity of GHG emissions from the commercial building sector | **Actual achievement toward objective**: Against a target of 239 ktons $CO_{2eq}$ of emission reductions, the Project achieved 332 ktons $CO_{2eq}$ of cumulative reductions as of March 2018 based on PEECB-supported training to building stakeholders that has increased BEC compliance of 717 buildings (based on report from BEC Center) that results in energy savings and GHG emission reductions. This includes a small contribution by the 12 demo buildings that have demonstrated energy savings and GHG emission reductions. See Para 64 for further details. |
| **Objective:** Promotion and facilitation of the widespread application of building energy efficiency technologies and practices in commercial buildings in Thailand. | **Actual achievement toward objective**: Against a target of 411 GWh of energy savings, the Project achieved 572 GWh as of March 2018 based on PEECB-supported training to building stakeholders that has increased BEC compliance of 717 buildings (based on report from BEC Center) that results in energy savings and GHG emission reductions. This includes a small contribution by the 12 demo buildings that have demonstrated energy savings. In addition, 66% of new buildings are now compliant to the new BEC (from 20%) and 61% of these buildings classified as energy efficient buildings (being 10% better than SECs specified in the 2009 BEC). See Para 64 for further details. |
| **Outcome 1:** Enhanced awareness of the government, building sector and banks on EE technologies and practices. | **Actual Outcome 1**: There is enhanced awareness amongst government, building owners and operators, and the financial sector in Thailand of energy efficient technologies and practices that can be applied to commercial buildings, resulting in 20 EE investment projects facilitated through business links (See Paras 67 and 78). |
| **Outcome 2:** Effective implementation of favourable policies that encourage | **Actual Outcome 2**: Policies that encourage and support energy efficiency in commercial buildings have resulted in an increase in BEC |

| Intended Outcomes in revised Project Planning Matrix of September 2017 | Actual Outcomes as of March 2018 |
|---|---|
| EE technologies and practices for commercial building in Thailand. | compliance amongst building owners from 20% to 66% (see Paras 64, 73 and 74) |
| **Outcome 3.1:** Improved confidence in applying EE technologies and practices in commercial buildings in Thailand. | **Actual Outcome 3.1**: Increased confidence of commercial building owners and operators in the application of EE technologies and practices to their building assets based on the completion of energy efficiency investments made in 8 demonstration commercial buildings, and the collection of data from 9 demonstration buildings on energy savings from these investments (see Paras 95 to 97). |
| **Outcome 3.2:** Improved local technical and managerial capacity to design, manage and maintain EE technologies and practices | **Actual Outcome 3.2:** The capacities of local technical and managerial staff in commercial buildings to design, manage and maintain EE technologies and practices has improved for the more than 300 persons who participated in PEECB seminars and workshops on EECBs (see Paras 96 and 97). |
| **Outcome 3.3:** Replication of demonstration projects within the commercial building sector | **Actual Outcome 3.3:** Replication of PEECB demonstration projects within the commercial building sector has been achieved to the extent that the Project target of 20 EE buildings have been designed or influenced by PEECB demonstrations. |

## Summary of Conclusions, Recommendations and Lessons

Resources from the PEECB Project have been effectively utilized to build the capacity of DEDE for effective public outreach to promote energy efficiency in commercial buildings. The Project has delivered numerous outputs and useful outcomes designed to encourage investment commercial building owners into energy efficiency measures and technologies.

In consideration of achieving all the intended outcomes and the aforementioned outputs using a US$3.637 million GEF allocation and within a period of 5.45 years, the evaluation views the overall rating of the PEECB Project as **satisfactory**. Notwithstanding, the Project has had an impact on 2,900 high energy consuming "designated buildings", out of a total of more than 2.7 million commercial buildings in Thailand, roughly 0.1% of all commercial buildings in Thailand as mentioned in Para 112. The challenge for the Government of Thailand after the conclusion of PEECB is to scale-up current activities initiated by PEECB to encourage energy efficiency for the remainder of Thailand's building stock including commercial, residential, public and industrial buildings. While the policies and standards for energy efficient buildings apply to all buildings, the approaches to encouraging EE in other building sectors will be different, notably for the residential sector which may be the most challenging building sector in consideration of the patterns of energy use for various residential facilities, and the design of incentives that would be effective in catalysing investments.

The other challenge facing DEDE is the measurement of actual GHG emission reductions from existing buildings. While the PEECB Project produced M&V guidelines for existing building operators to measure and verify energy consumption of their buildings using best practices, there remain numerous building operators, engineers and consultants whose capacities will need to be strengthened to prepare mandatory energy consumption reports for thousands of other buildings in Thailand. Conversely, DEDE will require more personnel and collaborators at the municipal level to prepare these reports that are based on energy consumption reports of the 717+ new buildings to BEC that used new tools (BESM), financial incentives (revolving fund, BEC subsidy) to submit and implement a BEC-compliant design, and

those that are being monitored for energy consumption to determine Energy Performance Indicators or EnPIs (EnPIs are being developed for building owners as well as building design practitioners and DEDE personnel as an indicator reference to identify improvements to the energy performance of their own buildings. See Para 86 for details).

Corrective actions for the design, implementation, monitoring and evaluation of the project:

*Action 1 (to UNDP and GEF): Strengthen the preparation of a Project Planning Matrix (PPM) utilizing a Theory of Change (ToC) analysis and a Review of Outcomes to Impacts (ROtI) to increase the likelihood that project outcomes will result in the desired impacts.* This recommendation is addressed to future designers of GEF projects on the importance of a well-prepared PPM that is clear to the implementers of the Project of the pathways to development progress, has minimized the number of indicators for monitoring, and provides the highest likelihood that the project's causal pathways lead to intended project impacts. See Para 116 for details.

Actions to follow up or reinforce initial benefits from the project*:*

*Action 2 (to UNDP and DEDE): Continue strengthening collaborations with targeted partners, notably at the municipal level, to increase the profile of PEECB outputs.* Strengthened collaboration with including the Bangkok Metropolitan Authority (BMA), and the Engineers and Architects of Thailand (EAT), and other municipal-level partners can be leveraged to increase the familiarity, utility and eventual enforcement (through issuance of building permits) of these outputs amongst a wider spectrum of beneficiary stakeholders. See Para 117 for further details.

*Action 3 (to UNDP and DEDE): Raise the prominence of the commercial building energy consumption disclosure (CBECD) programme to building owners (both owners who are participating and those who are not) and building tenants.* See Para 118.

*Action 4 (to DEDE): Continue the best practice (as elaborated in Best Practice 2 in Para 126) of implementing continual improvements in the energy performance of commercial buildings through ongoing policy improvements (that were developed with PEECB assistance)* including the ongoing STEP-BEC programme, analysing reports from over 3,000 designated buildings for baseline energy use, all of which are designed to determine EnPIs for various building categories, and to upgrade SEC values, and continued consultations with the Comptroller's Office (Ministry of Finance) to develop a concrete proposal for e-Procurement for the public sector. See Para 119 for further details.

Proposals for future directions underlining main objectives of the PEECB project:

*Action 5 (to DEDE): Raise profile of energy efficiency in commercial buildings by developing a pilot "smart city zoning scheme" under a GEF-7 Sustainable Cities project*. As detailed in Para 121, this can be done in close collaboration with the Bangkok Metropolitan Authority (BMA) to be located within a high density area (such as in the CBD or the Rama IV area) and could include:

- promoting the development and implementing energy efficiency and renewable energy measures and other low carbon measures for various building types (i.e. shopping centers, public buildings) within the designated zone;
- integration of building databases of DEDE and BMA that would streamline approvals for BEC-compliant buildings as well as enforcement of energy conservation standards in designated buildings;

- streamlining reporting from building managers on compliance to energy conservation standards through the development of an on-line system for reporting. Such a system would reduce errors and encourage building owners to submit these reports which would add to the existing building databases;
- M&V for buildings in a smart zone and using this information to determine their EnPIs and improving their SEC values;
- programme to strengthen and expand building inspectors pool in BMA that will improve their ability to inspect EE performance in buildings to comply with BEC and existing energy conservation standards, and their knowledge on tools (such as BESM and M&V guidelines) to execute their enforcement duties; and
- formulation of laws and regulations relevant to smart or green city development in the pilot area followed by the joint issuance of these laws and regulations by DEDE and BMA.

*Action 6 (to DEDE): Strengthen linkages between TGO and demo buildings with an aim to scaling-up energy efficiency investments in buildings and incentivizing building owners to invest in energy efficiency through the generation and sale of Voluntary Emission Reductions (VERs).* As detailed in Para 122, this would require:

- raising awareness of EECB owners through conducting seminars and workshops to present proposals and mechanisms from which VERs can be generated from energy efficiency investments in buildings (that can be commercial, residential, public or industrial) and sold to various clients in Thailand or abroad;
- development of MRV protocols specific to energy efficiency in buildings and linked to the Step-BEC programme to provide consistent and confident estimates of GHG emission reductions from EE measures in these buildings;
- formalizing reporting protocols between demo buildings, ONEP, DEDE and TGO. This may involve the integration of building databases of DEDE and BMA as mentioned in *Action 5*; and
- ensuring there is sufficient technical consulting capacity to support the needs of building owners to prepare GHG emission reduction reports consistent with approved MRV protocols.

*Action 7 (to DEDE): Expand an energy efficiency programme for all buildings leveraging the leadership provided by owners of the demonstration commercial buildings.* As detailed in para 123, this would include:

- efforts by DEDE to encourage owners of demo buildings in Bangkok who have commercial building assets in other cities to undertake a leadership role for EECBs in other cities. This may involve a closer working relationship with these building owners (possibly through the Building Energy Consumption Disclosure Programme) and encouraging them to share their experiences on implementing EE measures on their other buildings with other building owners in Thailand;
- DEDE promotion of EE in buildings in other secondary cities in Thailand by sector including the hotel sector which could sell “green rooms” through a hotel association;
- DEDE promotion of EE in public and residential buildings, with an initial focus within the boundaries of a pilot smart city (see Action 5). Promotion of EE investments in residential buildings is expected to be more difficult due to the difficulties of demonstrating clear savings on energy costs that can help residents decide on such an investment;
- Encouragement of retrofits with incentives of VERs or CERs (see Action 6).

*Action 8 (to UNDP): Provide more exposure of the PEECB Project to other UNDP-GEF projects in energy efficiency in buildings.* See para 124.

Best and worst practices in addressing issues relating to relevance, performance and success:

*Best practice 1: Effectiveness of a project design can be maximized with the full participation of the beneficiary agency during the design phase*. See Para 125.

*Best practice 2: The policy tools setup and used during PEECB are an excellent example of how a public agency can boost public confidence in setting up an enabling regulatory environment that assists building owners in improving their compliance with the BEC and provides for continual improvement in the determination of SEC values for commercial buildings in Thailand.* See Paras 113 and 126.

*Best practice 3: The success of any energy efficiency project will be highly dependent on the agency recruiting a well-qualified project manager with good management skills (good understanding of the activities of the project, good inter-personal skills, responsive to all needs of the project), and good knowledge and technical skill in the subject matter*. The benefits to such recruitment allowed this GEF-supported UNDP project to progress on a sound strategic and technical basis towards meeting goals of the Project as well as the mandate of DEDE. While several projects employ a project manager that is very good in project management and supported by a CTA to oversee technical aspects of the project implementation, a project manager with strong technical skills would be a more desirable arrangement if such a person is available. See Para 127.

## Evaluation Ratings[1]

| 1. Monitoring and Evaluation | *Rating* | 2. IA & EA Execution | *Rating* |
|---|---|---|---|
| M&E design at entry | 5 | Quality of Implementation Agency - UNDP | 5 |
| M&E Plan Implementation | 6 | Quality of Execution - Executing Entity (DEDE) | 5 |
| Overall quality of M&E | 6 | Overall quality of Implementation / Execution | 5 |
| **3. Assessment of Outcomes** | **Rating** | **4. Sustainability[2]** | **Rating** |
| Relevance[3] | 2 | Financial resources | 3 |
| Effectiveness | 6 | Socio-political | 4 |
| Efficiency | 5 | Institutional framework and governance | 3 |
| Overall Project Outcome Rating | 5 | Environmental | 3 |
| | | Overall likelihood of sustainability | 3 |

[1] Evaluation rating indices (except sustainability – see Footnote 2, and relevance – see Footnote 3): 6=*Highly Satisfactory (HS)*: The project has no shortcomings in the achievement of its objectives; 5=*Satisfactory (S)*: The project has minor shortcomings in the achievement of its objectives; 4=*Moderately Satisfactory (MS)*: The project has moderate shortcomings in the achievement of its objectives; 3=*Moderately Unsatisfactory (MU):* The project has significant shortcomings in the achievement of its objectives; 2=*Unsatisfactory (U)* The project has major shortcomings in the achievement of its objectives; 1=*Highly Unsatisfactory (HU):* The project has severe shortcomings in the achievement of its objectives.

[2] Sustainability Dimension Indices: *4 = Likely (L):* negligible risks to sustainability; *3 = Moderately Likely (ML):* moderate risks to sustainability; *2 = Moderately Unlikely (MU):* significant risks to sustainability; and *1 = Unlikely (U):* severe risks to sustainability. *Overall rating is equivalent to the lowest sustainability ranking score of the 4 dimensions.*

[3] Relevance is evaluated as follows: 2 = Relevant (R); 1 = Not relevant (NR)

# ABBREVIATIONS

| Acronym | Meaning |
|---|---|
| APR | Annual Progress Report |
| BEC | Building Energy Code |
| BESM | Building Energy Simulation Model |
| BMA | Bangkok Metropolitan Authority |
| BMC | Bright Management Consultants |
| BRESL | UNDP-GEF Project on "Barrier Removal to the Cost-Effective Development and Implementation of Energy Efficiency Standards and Labeling Project" |
| CBD | Sensual Business District |
| CBECD | Commercial building energy consumption disclosure |
| CBEEC | Commercial Building EE Information Center |
| CER | Certified emission reduction |
| CGD | Comptroller General's Department (under the Ministry of Finance) |
| CO | Country Office |
| CPAP | Country Programme Action Plan |
| CTA | Chief Technical Advisor |
| DEDE | Department of Alternative Energy Development and Efficiency under the Ministry of Energy |
| EAT | Engineers and Architects of Thailand |
| EE | Energy efficiency |
| EECB | Energy efficient commercial buildings |
| EEDP | Energy Efficiency Development Plan |
| EERS | Energy Efficiency Resources Standard |
| EGAT | Electricity Generating Authority of Thailand |
| EMIS | Energy management information system |
| EnPI | Energy Performance Indicator |
| ENSOP | Engineering Solution Provider Co., Ltd. |
| EOP | End of Project |
| EPC | Energy Performance Contracting |
| EPPO | Energy Policy and Planning Office |
| ESCO | Energy service company |
| EU | European Union |
| FSP | Full Sized Project |
| GDP | Gross domestic product |
| GEF | Global Environment Facility |
| GEFSEC | Global Environment Facility Secretariat |
| GHG | greenhouse gas |
| GWh | Gigawatt hours |
| HEPS | High Energy Performance Standard Building |
| kWh | Kilowatt-hour |
| LAO | Departments of Public Works and Local Administrative Organization |
| LCCA | Lifecycle cost analyses |
| LED | Light emitting diode |
| MBEPS | Minimum building energy performance standards |
| MEA | Metropolitan Electricity Authority |
| MEPS | Minimum Energy Performance Standard |
| MIV | Monitoring, Inspection and Verification |
| MoE | Ministry of Energy |

| Acronym | Meaning |
|---|---|
| MoF | Ministry of Finance |
| MoNRE | Ministry of Natural Resources and Environment |
| MTR | Midterm Review |
| M&E | Monitoring and evaluation |
| M&V | Monitoring and verification |
| MRV | Monitoring, reporting and verification |
| MWh | Megawatt hour |
| NEX | National execution modality |
| NPD | National Project Director |
| nZEB | Nearly-zero energy buildings |
| ODA | Overseas development assistance |
| ONEP | Office of Natural Resources and Environmental Policy and Planning (under the Ministry of Natural Resources and Environment) |
| PB | Project Board |
| PEA | Provincial Electricity Authority |
| PEECB | UNDP-GEF Project on "Promoting Energy Efficiency in Commercial Buildings in Thailand" |
| PIF | Project Identification Form |
| PIR | GEF Project Implementation Report |
| PMU | Project Management Unit |
| PPG | Project Preparation Grant |
| PPM | Project Planning Matrix |
| ProDoc | UNDP Project Document |
| PSC | Project Steering Committee |
| PV | Photovoltaic |
| QPR | Quarterly Progress Report |
| ROtI | Review of Outcomes to Impacts |
| SEC | Specific energy consumption |
| SET | Stock Exchange of Thailand |
| SMART | Specific, Measurable, Attainable, Relevant and Time-bound |
| STAP | GEF Scientific Technical Advisory Panel |
| TA | Technical assistance |
| TE | Terminal Evaluation |
| TGBI | Thai Green Building Institute |
| TGO | Thailand Greenhouse Gas Organization |
| ToC | Theory of Change |
| ToR | Terms of Reference |
| TWh | Terawatt-hours |
| UNDCS | United Nations Development Cooperation Strategy |
| UNDP | United Nations Development Programme |
| UNDP-GEF | UNDP Global Environmental Finance |
| UNFCCC | United Nations Framework Convention on Climate Change |
| UNPAF | United Nations Partnership Framework |
| VER | Voluntary emission reduction |

# 1. INTRODUCTION

1. This report summarizes the findings, analyses and recommendations of the Terminal Evaluation Mission conducted during the 13-26 March 2018 period for the GEF-financed Project entitled: "**Promoting Energy Efficiency in Commercial Buildings in Thailand**" (herein referred to as the "PEECB Project" or the "Project") for which UNDP received a US$ 3,637,237 grant from the Global Environmental Facility (GEF) for implementation.

2. The PEECB Project has the goal of "reducing intensity of GHG emissions from the commercial building sector", and an objective of "promoting and facilitating widespread application of building energy efficiency technologies and practices in commercial buildings in Thailand". The Project was designed to achieve this objective through activities designed to remove awareness, capacity and regulatory framework barriers, and support implementation of demonstration energy efficient measures in selected buildings. This terminal evaluation covers these activities being implemented by UNDP Thailand with its implementing partner, the Department of Alternative Energy Development and Efficiency (DEDE) under the Ministry of Energy of Thailand.

## 1.1 Purpose of the Evaluation

3. This Terminal Evaluation (TE) for the PEECB Project is to *evaluate the progress towards the attainment of global environmental objectives, project objectives and outcomes, capture lessons learned and suggest recommendations on major improvements.* The TE is to serve as an agent of change and play a critical role in supporting accountability. As such, the TE will serve to:

   - promote accountability and transparency, and to assess and disclose levels of project accomplishments;
   - synthesize lessons that may help improve the selection, design and implementation of future GEF activities on climate change mitigation;
   - provide feedback on issues that are recurrent across the portfolio and need attention, and on improvements regarding previously identified issues; and
   - contribute to the GEF Evaluation Office databases for aggregation, analysis and reporting on effectiveness of GEF operations in achieving global environmental benefits and on the quality of monitoring and evaluation across the GEF system.

4. Outputs from this TE will provide an outlook and guidance in charting future directions on sustaining current efforts by UNDP, the Government of Thailand, their donor partners, and the private sector, to sustain the capacities of relevant Thai government institutions to promote and regulate improved energy efficiency in the commercial building sector throughout Thailand.

## 1.2 Scope and Methodology

5. The scope of the TE for the PEECB Project was to include all activities funded by GEF and activities from parallel-financing. The Terms of Reference (ToRs) for the TE are contained in Appendix A. Key issues addressed on this TE include:

   - The effectiveness of the Project's activities in raising awareness of the benefits of energy efficient commercial buildings (EECBs) in Thailand. This would entail a review of Project achievements to

gauge the extent stakeholders are incentivized to undertake EE measures for commercial buildings, measure their energy efficiencies and actual cost savings to owners and operators, and measure the effectiveness of efforts undertaken by the Project to disseminate this information and institutionalize these positive results, all essential actions in promoting investments into EECBs;

- The ability of the Project to achieve its GHG emission reduction targets and the means of the Project and its implementing partner, DEDE, to provide reasonable estimates of energy savings and GHG emission reductions from building stock in Thailand;
- Design of the Project and the targets set for a 39-month project, and an assessment of the achievability of these targets by the end-of-Project (EOP). This would include any changes or recommendations made by the Mid-Term Review (MTR) of the Project;
- Project sustainability that will include an assessment of DEDE's abilities to continue with further promotion of EECBs in Bangkok and other cities in Thailand (after the EOP) that have not yet had demonstration EECBs on which to base investment decisions. This will include an assessment of the institutional capacity of DEDE and partner agencies in their abilities to monitor and enforce their Building Energy Code concurrently with their promotion of EECBs;
- Lessons learned from this Project that could be used to scale-up the development of energy efficiency of commercial buildings in Thailand.

6. Outputs from this TE will provide an outlook and guidance in charting future directions on sustaining current efforts by UNDP and the Government of Thailand on strengthening the legal and regulatory framework for energy efficiency of building stock in Thailand, improving the knowledge base of energy efficiency issues in buildings amongst public, private and academia stakeholders involved with building energy efficiency in Thailand, and on implementing demonstration projects and mechanisms for information dissemination.

7. The methodology adopted for this evaluation includes:

    - Review of project documentation (i.e. APR/PIRs, meeting minutes of Project Board or multipartite meetings, MTR) and pertinent background information;
    - Interviews with key project personnel including the current and former Project Managers, technical advisors (domestic and international), and Project developers;
    - Interviews with relevant stakeholders including participating government agencies, engineering and architectural professionals and academic institutions; and
    - Field visits to selected Project sites and interviews with beneficiaries.

    A detailed itinerary of the Mission is shown in Appendix B. A full list of people interviewed and documents reviewed are given in Appendix C and Appendix D respectively. The Evaluation Mission for the UNDP-GEF project was comprised of one lead international expert and one national expert.

8. The Project was evaluated for overall results in the context of:

    - *Relevance* – the extent to which the outcome is suited to local and national development priorities and organizational policies, including changes over time;
    - *Effectiveness* – the extent to which an objective was achieved or how likely it is to be achieved;
    - *Efficiency* – the extent to which results were delivered with the least costly resources possible; and

- *Sustainability* - The likely ability of an intervention to continue to deliver benefits for an extended period after completion.

9. All possible efforts have been made to minimize the limitations of this independent evaluation. During the 15 days spent in Bangkok by the evaluation team, meetings were setup to collect and triangulate as much information as possible, and visits were made to 3 out of 12 energy efficiency demonstration building projects. Notwithstanding, follow-up interviews, Skype conversations and e-mails were utilized by the evaluation team after the terminal evaluation mission to fill in information gaps.

## 1.3 Structure of the Evaluation

10. This evaluation report is presented as follows:

- An overview of Project activities from commencement of operations in November 2012 to the present activities of the PEECB Project;
- An assessment of results based on Project objectives and outcomes through relevance, effectiveness and efficiency criteria;
- Assessment of sustainability of Project outcomes;
- Assessment of monitoring and evaluation systems;
- Assessment of progress that affected Project outcomes and sustainability; and
- Conclusions, recommendations and best and worst practices.

11. This evaluation report is designed to meet GEF's "Guidelines for GEF Agencies in Conducting Terminal Evaluations, Evaluation Document No. 3" of 2008:

http://www.thegef.org/gef/sites/thegef.org/files/documents/Policies-TEguidelines7-31.pdf

12. The Evaluation also meets conditions set by:

- the UNDP Document of 2012 entitled "UNDP GEF – Terminal Evaluation Guideline": http://web.undp.org/evaluation/documents/guidance/GEF/UNDP-GEF-TE-Guide.pdf;
- the UNDP Document entitled "Handbook on Planning, Monitoring and Evaluating for Development Results", 2009: http://www.undp.org/evaluation/handbook/documents/english/pme-handbook.pdf; and
- the "Addendum June 2011 Evaluation": http://www.undp.org/evaluation/documents/HandBook/addendum/Evaluation-Addendum-June-2011.pdf

# 2. PROJECT DESCRIPTION AND DEVELOPMENT CONTEXT

## 2.1 Project Start and Duration

13. The "Promoting Energy Efficiency in Commercial Buildings" Project officially commenced implementation on 14 November 2012, the date when the Thai government signature for the Project document (ProDoc) was obtained. The Project duration originally was planned for 3.25 years ending in December 2015. However, the Project had realized the insufficient time remaining to achieve Project objective and outcomes and exhaust Project funds; in July 2016, a request for a no-cost extension of the Project to 30 April 2018 was approved.

## 2.2 Problems that PEECB Project Sought to Address

14. Prior to the preparation of the PEECB Project, Thailand's energy consumption during the 1998 to 2008 period, according to DEDE, was increasing at an average of 4% each year annually. In 2009, the commercial sector (which generally includes commercial buildings, public sector, not-for-profit organisations and public lighting) consumed about 35% of the total electricity consumption in Thailand, second to only the industrial sector. During the period of 2010 to 2015, Thailand's annual electricity consumption grew at an average rate of 3.2% annually (as shown on Table 1). Electricity consumption of the commercial and public services sector comprises 30 to 34% of the total electricity consumption of Thailand, second only to the industrial sector. At the time PEECB was being prepared and currently, specific energy consumption and GHG emission figures were not available for the commercial sector alone. However, based on development projects within Thailand during the period of 2010 to 2015 and to the present, there is a common perception that the commercial sector is the fastest growing end-use sector for electricity based on many commercial buildings being constructed in Bangkok as well as many of its secondary cities.

**Table 1: Growth in Electricity Consumption in Thailand ('000 GWh)[4]**

| | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | Average 2010-2015 growth |
|---|---|---|---|---|---|---|---|
| Final Consumption | 149.3 | 148.7 | 161.7 | 164.3 | 168.8 | 174.9 | |
| Commercial and public services | 51.2 | 51.0 | 56.3 | 56.4 | 50.3 | 52.1 | |
| % growth in final consumption | | -0.4% | 8.0% | 1.6% | 2.7% | 3.5% | 3.2% |
| % electricity consumed in commercial/public services sector | 34.3% | 34.3% | 34.8% | 34.3% | 29.8% | 29.8% | 1.7% |

15. As of 2010, data on commercial building stocks, their electricity utilization and GHG emissions remain scattered amongst several different agencies and academic organizations involved with the commercial building sector. According to Thailand's "National Assessment on Building and Energy Sector Policies for Climate Mitigation"[5], the current number of small commercial buildings in Thailand is in the range of 2.7 million. Prior to PEECB, DEDE wanted a focus on the highest energy consuming buildings; as such, these buildings were re-categorized as "designated buildings" with the

[4] From http://www.iea.org/statistics/statisticssearch/report/?country=Thailand&product=electricityandheat&year=2010

[5] See pg. 7 on http://ccap.org/assets/Apichit-Therdyothin-Buildings-EE-State-of-the-Sector.pdf

following characteristics: i) total installed capacity of transformers >1,175 kVA; and ii) energy consumption >20 million MJ/year. According to DEDE, the current number of designated buildings in Thailand is 2,900. DEDE is currently involved in using data from these buildings in developing a building database as a means of managing and regulating compliance with the 2009 Building Energy Code (BEC). This database has also been used for several studies commissioned by DEDE on Specific Energy Consumption (SEC) for various "designated building" categories that includes office buildings, department stores, hospitals, hotels and educational buildings.

16. Notwithstanding the promulgation of the Energy Conservation and Promotion Act of 1992, the awareness of commercial building stakeholders on energy conservation in 2012 at the commencement of the PEECB Project was limited to simple low cost and housekeeping measures that were easy to put into practice or to implement (such as switching off lights or other appliances when not in use). With the new BEC promulgated in 2009 that is applied to new building construction[6], its adoption was limited due to the lack of familiarity of its requirements to building owners as well as most building practitioners in Thailand. Despite workshops and promotional measures being implemented to overcome this lack of familiarity with the new BEC prior to the PEECB Project, adoption of the BEC in new building designs remained slow. The PEECB Project sought to address this issue and the lack of development of BEC compliant buildings.

17. Prior to PEECB, the overall business and regulatory environment in Thailand was not conducive to stakeholders making energy efficiency investments in commercial buildings nor was the implementation of energy efficient measures in commercial buildings sufficient in volume to meet the targets set in the Energy Efficiency Development Plan of 2015-2036 (EEDP). As of 2015, EEDP targets included a reduction of energy intensity (EI) by 30% in 2036 in comparison with 2010, and a GHG emission reduction target of 7% compared with emissions from 2005[7]. However, to meet these targets, PEECB Project proponents identified the following barriers to be lowered including:

- lack of easy access on information on energy efficiency for commercial buildings;
- lack of awareness amongst building owners and operators of energy efficiency opportunities;
- limited adoption of energy efficiency concepts during the design phase of a building;
- the absence of policy implementation guidelines, notable for municipal level governments who were key stakeholders in the approval of new building construction;
- weak coordination amongst relevant government agencies (including municipalities) to implement mandatory policy measures of the BEC as well as *Energy Conservation and Promotion Act*;
- lack of an appropriately sized pool of technical expertise on energy efficient buildings;
- lack of centralized and standardize information on energy efficient building products and equipment;
- lack of demonstrations on cost-effective energy efficiency measures in commercial buildings; and
- an absence of effective financing models for investments in commercial building energy efficiency.

[6] The BEC seeks to achieve 17% to 33% of efficiency improvement in new and retrofitted commercial buildings through the use of present technologies and present practices in building design and equipment specifications in Thailand
[7] Pp. 3-2 to 3-5 in the Thailand Power Development Plan 2015-2036 (PDP2015) accessible on: http://www.eppo.go.th/images/POLICY/ENG/PDP2015_Eng.pdf

## 2.3 Goal and Objective of PEECB Project

18. The goal of the PEECB Project was to "reduce intensity of GHG emissions from the commercial building sector" while its objective was to "promote and facilitate the widespread application of building energy efficiency technologies and practices in commercial buildings in Thailand". The project planning matrix (PPM) for the PEECB Project was amended in September 2017 to provide targets for PEECB for its extension to 30 April 2018, and is contained in Appendix F.

## 2.4 Baseline Indicators Established

19. Baseline indicators for the amended 2017 PPM for PEECB can be found on Appendix F, with the design of the PEECB Project and its PPM indicators further discussed in Section 3.1.1. The main goal and objective baseline indicators of the PPM of PEECB includes:

- Cumulative $CO_2$ emission reduction from the commercial building sector by EOP in kton $CO_{2eq}$;
- % reduction in GHG emissions from the commercial buildings sector by EOP;
- Cumulative energy savings from the commercial building sector by EOP in GWh;
- % of new buildings that are fully compliant with the new Building Energy Code by EOP; and
- % of new buildings in Thailand that are classified as energy efficient buildings by EOP.

The baseline value for all these indicators of the PEECB Project can be found in the November 2012 PPM in Appendix F.

## 2.5 Main Stakeholders

20. Main stakeholder categories that are of interest to the Evaluation includes:

- Stakeholders within the Government of Thailand including those involved with the Project in DEDE, notably those involved with the updating and improvement of policy measures to catalyze interest and facilitate investments in energy efficient buildings and meeting the targets of the EEDP mentioned in Para 17;
- Building and energy efficiency practitioners within private industry, academia, and municipal and central government agencies. This would include energy auditors in Thailand;
- Building owners and managers who are decision-makers in energy efficiency investments.

21. A complete listing of stakeholders who have participated on the PEECB Project is provided in Section 3.2.2 (Paras 43-47).

## 2.6 Expected Results

22. To achieve the specific PEECB objective of "promoting and facilitating the widespread application of building energy efficiency technologies and practices in commercial buildings in Thailand", the PEECB Project was designed with the following expected **Project outcomes** (from the 2017 amended PPM):

- Outcome 1: Enhanced awareness of the government, building sector and banks on EE technologies and practices;

- Outcome 2: Effective implementation of favorable policies that encourage EE technologies and practices for commercial building in Thailand;
- Outcome 3.1: Improved confidence in applying EE technologies and practices in commercial buildings in Thailand;
- Outcome 3.2: Improved local technical and managerial capacity to design, manage and maintain EE technologies and practices;
- Outcome 3.3: Replication of demonstration projects within the commercial building sector.

# 3. FINDINGS

## 3.1 Project Design and Formulation

23. Design of the PEECB Project was conducted between September 2010 and September 2011. The PEECB ProDoc packaged these designs into a GEF climate change mitigation project that would support the country's efforts to lower existing barriers to awareness, appropriate regulatory policies and technical barriers to energy efficiency in commercial buildings. The strategy of the PEECB Project to lower these barriers included implementing Project activities divided into 3 components, namely:

- Component 1: Awareness Enhancement on Building EE Technologies and Practices;
- Component 2: EE Building Policy Frameworks; and
- Component 3: EE Building Technologies and Applications Demonstrations.

### 3.1.1 Analysis of Project Planning Matrix

24. The original Project Planning Matrix (PPM) for the PEECB Project from 2012 consisted of 6 goal and objective level indicators, 10 indicators for 5 outcomes, and 29 indicators for 13 outputs. A revised PPM was formulated in September 2017 to revise 4 goal/objective-level targets and 3 output-level targets as well as the addition of 2 indicators and targets to a new Output 3.2.3 level. This was done to guide the Project extension to April 2018 with these new targets reflected in the revised PPM as shown in Appendix F.

25. In general, the PPM has clarity with all indicators meeting *SMART criteria*[8]. In the context of best practices for PPM preparation, some general comments on the composition of the PPM for the PEECB Project are made as follows:

- The maximum number of outcomes in a project is recommended to be 4 to ease the monitoring efforts of the PMU. The Evaluation Team believes Outcome 3.3 (Replication of Demo EECBs) could have been combined with Outcome 3.1 since Outcome 3.1 pertains to "improved confidence in application of EE technologies and practices in commercial buildings in Thailand" which could include an additional indicator on the replication of EECBs;
- The monitoring of 29 output indicators is too onerous on monitoring efforts of the PMU. Despite this comment, the PEECB PMU has provided monitoring reports for all 29 indicators;
- There is a lack of clarity on the $CO_2$ emission reductions target of 230 ktons as further elaborated in Para 26;
- Designers of PPMs need to be cognizant of the efforts and costs required to monitor indicators in a PPM. Reporting on the progress of many of the indicators would have required surveys or questionnaires soliciting opinions from beneficiaries; such surveys would need to appropriately costed as a part of the M&E plan acknowledging the confidence levels such surveys would provide in its findings;
- Improvements in the design of PPMs need to incorporate "Theory of Change" approaches, accompanied with a "Review of Outcomes to Impacts" (ROtI)[9]. This approach would strengthen formulation of intended direct outcomes of PEECB through reviewing the pathways from which these direct outcomes will reach the intended impact (or goal of this Project which is "the

[8] Specific, Measurable, Attainable, Relevant and Time-bound

[9] These approaches were not requirements during the design period of PEECB in 2011 and 2012.

reduced intensity of GHG emissions from the commercial building sector") through various intermediate states.

26. With regards to the "End of Project target for energy savings and GHG reductions", the MTR reported that the "difference in the target and the actual annual energy saving is too vast"[10]. The Terminal Evaluation team delved into the *ProDoc calculation* of the goal-level GHG emission reduction target of PEECB of 230,000 tonnes $CO_{2eq}$ cumulative by the EOP, and found several issues and a lack of clarity with this target:

- *Para 41 (and Table 6) in the ProDoc provides an annual $CO_2$ emission reduction of 252 ktons/year or a cumulative $CO_2$ emission reduction of 493 ktons by the EOP of 2015*. These estimates were linked to Project activities described in Para 41 of the ProDoc through the "promotion of energy efficient design in buildings and by improving the utilization efficiency in the operation of existing buildings";
- *Part III in the ProDoc (Page 95) mentions the "potential" cumulative $CO_2$ emission reduction target for PEECB of 230 ktons by the EOP of 2015*. Unfortunately, this is the same number used in PEECB's goal-level target in the PPM on Page 72 of the ProDoc. While the PPM clearly states that this target is cumulative, it is not clear on Page 99 of the ProDoc. Furthermore, Page 99 mentions that the cumulative $CO_2$ emission reductions is 493 ktons by the EOP, contradicting the PPM target of 230 ktons, but linking PEECB's barrier removal work to generate the 493 ktons $CO_2$ of emissions reductions;
- Table 16 in the ProDoc adds to this confusion by stating all $CO_2$ emission reductions in ktons attributable to PEECB including direct emission reductions (over their lifetimes of 26.4 ktons) and indirect emission reductions from bottom-up and top-down. This table does not mention a rationale for the emission reduction estimates of 230 or 493 ktons;
- *In summary, the PPM in Part II, Table 12 of the ProDoc uses cumulative emission reduction of 230 ktons $CO_2$ as its target to achieve the goal-level objective for PEECB.* This target is highly problematic given that there is no rationale in the ProDoc for this estimate, and no reliable means of monitoring progress of this indicator. There is also the issue that this target is overly ambitious given that there were only 4 years to change the mindsets of commercial building owners in Thailand to become more energy efficient. With the direct GHG emission reduction estimate of 26.4 ktons from 7 demonstration EE buildings, the Project would need to achieve energy efficiency for more than 60 buildings to achieve the 230 kton target over a 4-year period.
- The "Alternative Scenario" in Para 34 of the ProDoc, however, describes the involvement of a wide range of building practitioner associations and local administration organizations, and in Paras 35 and 36 describes how implementation of the new 2009 Building Energy Code (BEC) would be strengthened that would result in 60% of all new commercial buildings being compliant and 30% of all commercial building stock retrofitted with EE technologies. Para 38 then estimates the annual energy consumption of commercial buildings sector to be 16,232 GWh by 2015 based on trend analysis of historical energy consumption data and estimated to be 1.2% below the BAU scenario where there is no project. There does not appear to any relationship between this estimate and the emission reductions in Para 41.

27. Guidance from GEF in 2015 indicates that GHG emission reductions can be claimed from policy products generated by GEF-supported project; for the PEECB Project and its target of 239 ktons $CO_2$ reductions (from the September 2017 PPM), buildings designed and implemented from

[10] PEECB MTR report, Section 3.1.1 on pg. 10

improvements to enhanced implementation of policies that encourage EE technologies and measures in commercial buildings from activities supported in Component 2 (EE Building Policy Frameworks) should claim direct GHG emission reductions as a means of meeting the goal-level target of 239 ktons $CO_2$ reductions. The credibility of these emission reductions, however, will be dependent on the capacity of DEDE to monitor the development of EECBs compliant with a new BEC, and the system of oversight monitoring of these EECBs to generate sustained energy savings and GHG emission reductions over their service life.

28. In conclusion, the lack of clarity in the calculation of the GHG emission reduction target is a concern. As GHG emission reductions estimates stand as one of the most important metrics in CCM projects, more care and clarity is required in determining GHG emission reduction targets for CCM projects, targets that should reflect the successful implementation of the Project strategy.

### 3.1.2 Risks and Assumptions

29. Project risks and assumptions are covered in Part IV of the ProDoc. Six risks were identified[11] that were within, to a certain extent, under control of PEECB activities. A more substantial risk identified that was not amongst the 6 risks, was the lack of stable economic growth in Thailand, a risk that is heavily influenced by global and regional developments that is beyond the control of the Project. In summary, risks and assumptions identified in the ProDoc were reasonably complete with mitigation measures identified, assisting the PMU in initiating analysis of Project risks throughout the operations of PEECB.

### 3.1.3 Lessons from Other Relevant Projects Incorporated into PEECB Project Design

30. The ProDoc of the PEECB Project does not list any other relevant projects into its design.

### 3.1.4 Planned Stakeholder Participation

31. One of the primary purposes of PEECB Project was to increase the knowledge and build the capacity of stakeholders involved with the design, implementation, construction, management and operation of commercial buildings to the extent that will result in additional investments into energy efficiency in commercial buildings, and a higher compliance rate of new building applications to the 2009 BEC.

32. The stakeholder involvement approach in the PEECB ProDoc involved consultations with several categories of stakeholders including:

- Central government agencies including the Prime Minister's office and the Ministry of Finance;
- Line ministries and their policymaking agencies. These include the:
  - Ministry of Energy which has several policymaking agencies reporting to them including EPPO, DEDE (the implementing partner), EGAT, MEA and PEA;
  - Ministry of Natural Resources and Environment (MoNRE) which oversees the operations of ONEP;
  - Ministry of Interior that oversees the operations of the various Departments of Public Works and Local Administrative Organizations (LAOs) such as the Bangkok Metropolitan Administration (BMA) who are key in approving new building construction;

[11] Table 17, pg. 101 of the ProDoc

- Professional institutions and entities including the Engineers and Architects of Thailand (EAT);
- Private sector entities such as the Thai Hotel Association; and
- Institutions such as the Private Hospital Association as well as other individual hospital groups that serve as demonstration hosts.

In summary, this level of stakeholder involvement is satisfactory in consideration of the need for building strength and capacity of government regulators, building practitioners and raising awareness of building owners and operators (notably commercial building owners whose buildings emit a significant proportion of GHG emissions from this sector) to the requirements of the BEC.

### 3.1.5 Replication Approach

33. The Project design envisaged a replication approach through Outcome 3.3 which basically assumed that the demonstrations would provide sufficient influence on new building applications to the extent that EE technologies and measures used in demonstration buildings would be used in these replicated buildings. The target number of EE buildings by the EOP was 20.

### 3.1.6 UNDP Comparative Advantage

34. UNDPs comparative advantage to other donor agencies is its local presence and focus on policy-based and cross-sectoral approaches positioning them to build local capacities through effective collaboration with a wide range of local stakeholders, ranging from the public and private sectors to technical experts, civil society and grassroots level organizations. These approaches have been strongly demonstrated on the PEECB Project. Given UNDP's long track record on a wide variety of projects within the energy sector, UNDP was suited as an implementing agency for this Project.

### 3.1.7 Linkages between PEECB Project and Other Interventions within the Sector

35. The PEECB Project was intended to be linked with another ongoing UNDP-GEF Project on "Barrier Removal to the Cost-Effective Development and Implementation of Energy Efficiency Standards and Labeling Project" (BRESL), which aimed at promoting energy efficiency standards and labeling in each participating country harmonizing these standards regionally. Implemented between 2009 and 2014, BRESL targeted products that are also targeted under PEECB including air-conditioners, motors, and fans. The project was executed by the Thailand Greenhouse Gas Management Organisation (TGO) who also sit on the PEECB Board. Conversely, DEDE is a member of the BRESL's project board and the working committee. Potential coordination between BRESL included (1) the synergy between ES&L policy framework and the PEECB's recommendations on the EE policy in EE building policy framework; (2) lessons learned from BRESL's pilot cases which was to focus on promoting the use of the energy efficiency appliances in selected municipalities as part of the TGO's policy in promoting low carbon development plan at the city-level; (3) the recommendations on the carbon footprint analysis of 2 BRESL products (lighting and air-conditioners) could be taken into account in the PEECB's energy efficiency promotion action plan. According to Project personnel, this coordination was realized, notably the identification of labelled energy efficient equipment in buildings such as air conditioners and lighting products.

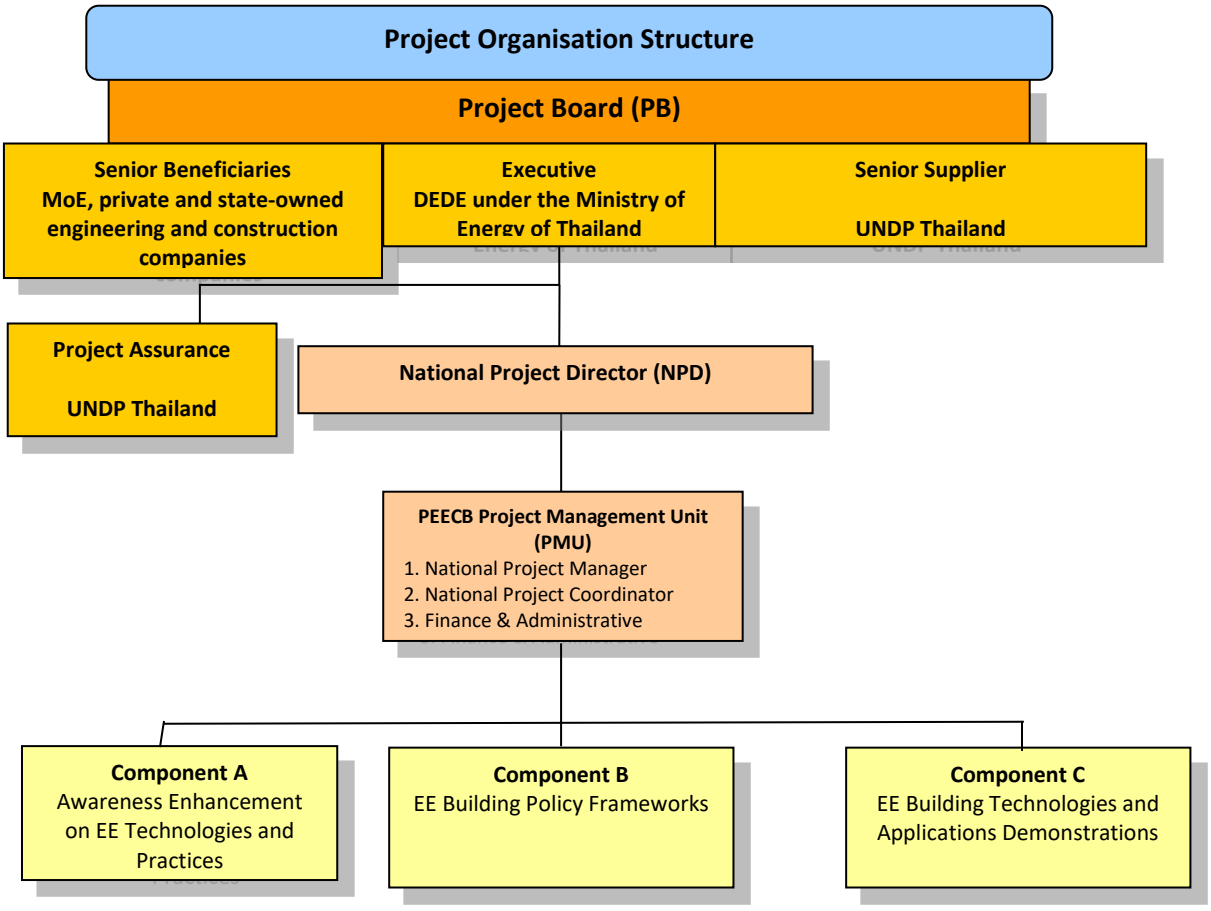
### 3.1.8 Management Arrangements

36. The implementing partner of the PEECB Project was the Department of Alternative Energy Development and Efficiency (DEDE) under the Ministry of Energy of Thailand. The PEECB Project was to be implemented in accordance with UNDPs National Implementation Modality. NIM modality tasked DEDE with responsibility for certifying work plans and approved budgets, reporting on procurement, coordinating and tracking co-financing, terms of reference for contractors and tender documentation, and chairing the Project Board (PB). The Chair of the PB was to be the National Project Director (NPD) from DEDE.

37. In the ProDoc, UNDP was to provide the PEECB Project with project assurance which is an oversight role to ensure that project management milestones are managed and completed. Other roles of UNDP included ensuring mainstreaming of PEECB interventions are in line with country level interventions, establishing effective networking between project stakeholders, specialised international organizations and the donor community, and facilitating networking amongst country-wide stakeholders. While UNDP Thailand fulfilled this role in a satisfactory manner, one area of improvement that is recommended is the exposure of this Project to other donors and similar UNDP-GEF projects in the energy efficiency in buildings (such as in Malaysia and India).

38. An organogram of the PEECB Project implementation arrangements is provided on Figure 1.

**Figure 1: Management Arrangements for the UNDP-GEF Project "Improving Energy Efficiency in Residential Buildings" (PEECB)**



## 3.2 Project Implementation

39. The following is a compilation of critical path events and issues of PEECB Project implementation in chronological order:

- The ProDoc was signed on 14 November 2012 marking the official start of the Project;
- BRIGHT Management Consulting Co. Ltd. (BMC), was contracted in April 2013 for project management, and activities of Components 1 and 3;
- BMC established the PEECB Project Management Unit (PMU) in May 2013, nearly 11 months after the official start of the Project;
- First Project Board meeting which also served as the Project Inception Workshop organized in May 2013;
- BMC contracted Engineering Solution Provider Co., Ltd. (ENSOP) in August 2013 as the main consultant for Components 2 and 3;
- Preparation of detailed Project activities during May-December 2013 period including identification of demonstration buildings (Component 3);
- In October 2013, CBEEC website was setup as well as delivery of first public PEECB seminars (non-technical) from Component 1;
- In November 2013, selected PEECB stakeholders visited Japan on a study tour to interact with the Nikken Sekkei Research Institute on low energy buildings, smart buildings and smart cities;
- Commencement of other Component 1 activities in early 2014 such as newsletters, developing the BESM model, and developing training curricula;
- The PEECB Mid Term Review (MTR) conducted during the period of July to September 2015. At this time, it was a foregone conclusion that the Project would be extended for a sufficient period to exhaust all Project funds. This was done in July 2016 with the Project extended to September 2017;
- EE measures in 12 demo buildings undertaken during 2015 and 2016 followed by monitoring of energy saved in 2017 (Component 3);
- The Project implementation period was extended from September 2017 to 30 April 2018 with additional activities for:
    - Non-technical training and upgrade of Building Energy Simulation Modelling (BESM) under Component 1; and
    - Energy Performance Indices (EnPIs) and Energy Disclosure Programme (EDP) under Component 3.

### 3.2.1 Adaptive Management

40. Adaptive management is discussed in GEF terminal evaluations to gauge Project performance in its ability to adapt to changing regulatory and environmental conditions, common occurrences that afflict many GEF projects. Without adaptive management, GEF investments would not be effective in achieving their intended outcomes, outputs and targets. For the PEECB Project, there are several examples of adaptive management that were required and carried out to ensure efficient implementation of PEECB during its 5.5-year duration to date and through numerous changing circumstances during the Project:

- To ensure efficient implementation of PEECB under a NEX modality, DEDE recruited their management consultant, BMC, to manage all PEECB activities, leaving DEDE personnel in an

oversight position to ensure PEECB was managed in a manner to benefit DEDE personnel in their work tasks on energy efficiency mandates mentioned in Paras 20 and 27;

- The activities in the PEECB ProDoc needed additional details to assist DEDE in addressing its priorities in the promotion of energy efficiency in commercial buildings. BMC in close collaboration with DEDE prepared a 4-year master plan for PEECB during the Inception Phase from May to September 2013 to provide these details;
- Due to senior management personnel changes within DEDE during the early stages of PEECB in 2013 and 2014, risks to implementation delays were substantial, notably in the approval of quarterly budgets which needed the approval of DEDE prior to submission to UNDP for fund advances. PEECB management minimized this risk through advanced preparation of these quarterly budgets that were submitted to UNDP for initial approval prior to DEDE approvals;
- During the 2014 period of unrest in Thailand, the DEDE offices were occupied by protesters forcing PEECB to find an alternate venue for Project Board meetings. This resulted in minimal delays to the implementation of PEECB;
- During the process of selecting demonstration sites, PEECB encountered difficulties in securing the participation of some building owners for the planned demonstrations. With selection criteria prepared by the PEECB for demonstration buildings, PEECB personnel reached out to additional building owners to secure commitments for their participation;
- To minimize delays caused by the indecision of building owners to invest in EE technologies, PEECB personnel worked closely with these owners to provide the necessary business cases for these investments, and to ensure their awareness of the energy savings, GHG emission reductions, and shorter payback periods of these investments;
- PEECB PMU preparing and implementing the extension plan of PEECB from September 2017 to April 2018 to strengthen the achievements of Project goals and objectives utilizing a Project surplus of US$500,000. DEDE provided the rationale for proposed action plans to continue its activities in raising awareness on energy efficiency in commercial buildings, for further training courses utilizing the latest updates on the BESM software, for extending the work of demonstrating EE technologies for commercial buildings, and improving information dissemination on the results of these demonstrations in public and commercial buildings. Much of this work was designed to provide continual improvements in the specific energy consumption data for commercial buildings in Thailand to improve BEC compliance. Further details of the extension phase are provided in Paras 86 and 99.

41. The Mid Term Review (MTR) for PEECB that was conducted in July 2015 was an opportunity for further adaptive management changes. In line with the MTR recommendations, DEDE undertook a review of the PPM in 2016 as well as a review of its stakeholder outreach to raise awareness of energy efficiency in commercial buildings. Notwithstanding that some MTR recommendations were not implemented (such as an external consultant review of the PPM which was deemed not necessary by DEDE), the MTR did catalyze an active review by DEDE and BMC of their 4-year master plan to ensure that the remaining outstanding activities would be contributors to the Project goals and objectives, and the sustainability of the Project.

42. In conclusion, PEECB'S efforts to adaptively manage this Project were sincere and ***satisfactory*** in consideration of PEECB meeting its targets and achieving successful outcomes.

### 3.2.2 Partnership Arrangements

43. The PEECB Project was designed to promote and facilitate the widespread application of energy efficiency technologies and practices in commercial buildings in Thailand. To achieve this objective, PEECB resources were used to form key partnerships between DEDE and relevant government agencies and stakeholders involved with the development and operation of "designated buildings" (see Para 15) for the lowering of barriers to the widespread application of EE technologies and practices in these buildings in Thailand. Prior to the commencement of PEECB, DEDE was experiencing difficulties in engaging these agencies and stakeholders to promote and facilitate investments in energy efficiency in commercial buildings. Many of these difficulties were manifested by the lack of clarity regarding the requirements of commercial building designs for compliance to Specific Energy Consumption (SEC) guidelines as well as the Building Energy Code (BEC). DEDE estimated that prior to PEECB that only 40% of "designated buildings" were compliant to the BEC.

44. The key vehicle for PEECB to engage relevant government stakeholders was through the Project Board (PB) which was set up during the early stages of the Project in April 2013. The PB consisted of 14 members ranging from various agencies within the Ministry of Energy (MoE), the Ministry of Natural Resources and Environment (MoNRE), Ministry of Finance (MoF), autonomous organizations such as the Thailand Greenhouse Gas Management Organization (TGO) and the Thai Green Building Institute (TGBI), municipal level organizations (such as the Department of City Planning of the Bangkok Metropolitan Authority), and UNDP. The selection of these partners was strategic representing stakeholders involved in the construction approvals of new buildings as well as approvals for building retrofits to comply with SEC guidelines. Up to the end of 2017, eight PB meetings were held, mainly to report on work progress, approval of yearly plans and budgets, and occasionally for approval of special events. A review of the PB Meeting Minutes reveals contributions, recommendations and valuable inputs by all Project Board members that have served to strengthen PEECB effectiveness.

45. PEECB engagement of commercial building owners was undertaken in a very strategic manner. Through the guidance of DEDE and its rationale that the largest commercial buildings in Thailand consume more than 70% of the energy in this subsector (also known as "designated buildings" as described in Para 15), PEECB sought to engage this subsector of building owners for demonstration activities under Component 3. With the active and collaborative work carried out by BMC and ENSOP, initial contacts were made with 12 designated building owners and their staff for various facilities, mostly located around Bangkok. These contacts included discussions and energy audits of the proposed demonstration buildings consisting of commercial and public buildings such as hospitals, schools and autonomous agency government buildings. However, more importantly, many of the designated building owners selected for demonstration had the potential to "self-replicate" energy efficient practices and measures with their own asset portfolios comprising of several other buildings located in Bangkok and other secondary cities of Thailand. This included companies such as CP Land and Kasikorn Bank. This would have the impact of accelerating the number of buildings compliant to BEC.

46. Further engagement of the stakeholders (both government agencies and commercial building stakeholders) was undertaken through the invitation of the technical staff of these buildings to attend various non-technical as well as technical training sessions for energy efficiency in buildings, commencing in 2014 and supported under Component 1. Topics covered under these training courses included energy efficiency and eco-friendly building design, EE and eco-building

development, life cycle cost analysis, EE and eco-friendly building design (hospital and office building), measurement and verification (M&V), and the building energy simulation model (BESM). Several these training courses included site visits to EE building sites while other site venues were located in EECBs. In addition, many of the stakeholders were extended invitations to attend annual PEECB seminars to provide progress updates on the Project.

47. In summary, PEECB's efforts on partnership arrangements were **highly satisfactory** in consideration of the strategic selection of partners to work with, and the services offered by the Project to assist appropriate stakeholders in meeting their objectives of promoting EECB's and reducing building energy consumption.

### 3.2.3 Feedback from M&E Activities Used for Adaptive Management

48. Feedback from M&E activities was provided primarily from BMC and ENSOP through their activities on their respective components with BMC providing the overall management oversight. Based on the content in the *PIRs from 2014 to 2017,* DEDE shared sufficient information with the PMU to provide an understanding of progress, risks, and details of activities for adaptively managing the Project. Eight meetings of the Project Board as well as 73 PMU meetings were used to review feedback on Project progress and to undertake adaptive management decisions. These meetings were used as the mechanism to review and approve annual work plans developed to reflect necessary adjustments from the pre-designed 4-year workplan based on quarterly and annual progress report. PMU meetings were held every two weeks between the NPD, key DEDE staff, the NPM and the managing consulting firms, BMC and ENSOP. These PMU meetings proved to be an effective mechanism for regular feedback on Project implementation leading to joint decisions on necessary adaptive management and timely corrective actions.

49. The only issue with regards to feedback for M&E activities was with the GHG emission reduction and energy saving targets which lacked clarity in the ProDoc as discussed in Paras 26 and 27. Through guidance from UNDP RBEC on the calculation of cumulative GHG emission reductions of PEECB, the PMU and DEDE were to include the direct GHG emission reductions from the demonstration buildings under Outcome 3.1 and energy savings of BEC-compliant buildings in comparison with the Energy Use Index (EUI) which was used by DEDE prior to PEECB for studies on specific energy consumption (SEC) of various building types. Paras 64-66 provides further details of this calculation.

50. The feedback provided by these PIRs to monitor progress of meeting set targets of the Project is **satisfactory**. Much of this can be attributed to the quality of the PPM (notwithstanding the high number of indicators for monitoring), and the relative simplicity of the wording of various indicators and targets (outside of the confusion of the goal-level target of cumulative GHG emission reductions), as explained in detail in Para 25. A second reason is the strong ownership of the Project by DEDE where the design of PEECB strongly reflects the work priorities of DEDE to promote and facilitate investments in EECBs. As such, feedback from DEDE was much more effective to adaptively manage PEECB progress to have a greater impact on routine tasks undertaken by DEDE personnel.

### 3.2.4 Project Finance

51. The PEECB Project had a GEF budget of USD 3,673,273 that was disbursed over a 5.5-year duration, managed by the PMU under the direction of DEDE. Table 2 reveals:

**Table 2: GEF Project Budget and Expenditures for Thailand PEECB Project (in USD as of 31 March 2018)**

| PEECB Outcomes | Budget (from Inception Report) | 2012[24] | 2013 | 2014 | 2015 | 2016 | 2017 | 2018[25] | Total Disbursed | Total to be expended in 2018[26] |
|---|---|---|---|---|---|---|---|---|---|---|
| OUTCOME 1: Enhanced awareness of the government, building sector and banks on EE technologies and practices | 1,196,400 | | 173,265 | 342,319 | 161,728 | 127,580 | 217,771 | 25,833 | 1,048,494 | 147,906 |
| OUTCOME 2: Effective implementation of favourable policies that encourage EE technologies and practices for commercial building in Thailand | 634,673 | | 90,315 | 177,382 | 121,323 | 81,363 | 45,805 | 9,226 | 525,413 | 109,260 |
| OUTCOME 3.1: Improved confidence in applying EE technologies and practices in commercial buildings in Thailand | 976,700 | | 83,745 | 227,894 | 375,397 | 263,362 | 211,328 | 60,127 | 1,221,853 | 249,747 |
| OUTCOME 3.2: Improved local technical and managerial capacity to design, manage and maintain EE technologies and practices | 421,200 | | | | | | | | 0 | |
| OUTCOME 3.3: Replication of demonstration projects within the commercial building sector | 73,700 | | | | | | | | 0 | |
| Monitoring and Evaluation | 93,500 | | 430 | 2,995 | 37,407 | 4,964 | 149 | 5,644 | 51,589 | 41,911 |
| Project Management | 241,100 | | 62,015 | 78,227 | 44,908 | 32,615 | 8,154 | 12,404 | 238,323 | 2,777 |
| Exchange rate losses | | | 23,727 | -3,014 | 17,781 | 2,567 | -12,170 | -3,218 | 25,672 | -25,672 |
| Total (Actual) | **3,637,273** | **0** | **433,498** | **825,802** | **758,543** | **512,450** | **471,036** | **110,016** | **3,111,344** | **525,928** |
| Total (Cumulative Actual) | *3,637,273* | *0* | *1,348,700* | *806,900* | *784,200* | *697,473* | - | - | | |
| **% Expended of Planned Disbursement** | | *0%* | *32%* | *102%* | *97%* | *73%* | - | - | | |
| Annual Planned Disbursement (from ProDoc)[27] | | **0** | **433,498** | **1,259,299** | **2,017,842** | **2,530,293** | **3,001,328** | **3,111,344** | | |

[24] Commencing 14 November 2012 - the Project Document signed by the Government of Thailand on 14 November 2012
[25] Up to 31 March 2018
[26] Up to terminal date of project of 30 April 2018
[27] From planned ProDoc disbursements

- no significant deviations in total component expenditures from original ProDoc outcome expenditures. This could be explained through the actual management arrangements of PEECB which was for DEDE outsourcing of the management of PEECB to a private consulting firm, BMC, who were paid based on milestones achieved during implementation. This would also explain the US$525,928 of PEECB funds remaining to be expended by the EOP date of 30 April 2018. This amount is equivalent to the last milestone payment on the BMC contract with DEDE;
- a slow start to the PEECB Project in 2013 where 2013 expenditures were only 30% of the expected expenditure in the ProDoc of US$1,348,700;
- the expenditures for Component 3 were spread out over a period of 1 January 2016 through to 30 April 2018 (from the original plan of only 2016). This was partially caused by less expenditures on Component 3 demonstration projects up to 2016, leaving surplus funds available to the Project by 30 September 2017, the date when PEECB extension activities were formalized;
- expenditures for Outcome 3 were all lumped together without dividing them amongst the 3 sub-outcomes. As mentioned in Para 25, Outcomes 3.1 and 3.3 should have been consolidated to reduce this accounting effort;
- The ProDoc allocation in Outcome 3.1 originally had an equipment line item (ATLAS code 72200 of US$210,000) originally intended for providing Project resources to demonstration building stakeholders to catalyse or facilitate EE equipment investments. These funds were re-allocated to various technical assistance activities throughout the Project.

52. Approximately 97% of the PEECB budget was to fund payments under “contractual services-companies” (ATLAS Account #72100) which comprised the BMC contract to manage all PEECB supported activities. These contracts were set up to comply with UNDP disbursement protocols where payments were made based on milestones defined in the contract. A review of the ToRs for the BMC contract reveals that BMC were responsible for management, monitoring, and reporting as well as recruitment of appropriate specialists and companies and the setting up of seminars and workshops. To advance and strengthen the outcomes of Component 2 and Component 3, BMC sub-contracted ENSOP for strengthening policy framework and its application to increasing the adoption of energy efficient technologies and practices in commercial buildings in Thailand. Although there is no breakdown of expenditure types within these contracts (i.e. consulting personnel, travel, workshops, miscellaneous expenses, etc.), most of these funds were likely expended on consulting time of both BMC and ENSOP personnel. The remaining 3% of the PEECB budget was spent on international consultants (Nikken Sekkei Research Institute), travel costs for a study tour to Japan in 2013, professional costs to strengthen Project M&E, as well as on UNDP personnel and Project audits.

53. Project co-financing was US$ 13.367 million which is 9% more than the than the ProDoc estimate of US$12.268 million. The level of co-financing on the PEECB Project is reflective of:

- DEDE financial commitments for financial assistance to all demonstration building stakeholders;
- in-kind commitments of DEDE; and
- investments made by demonstration building owners on various EE efficient technologies and measures.

Table 3 details of PEECB co-financing while Table 4 provides a summary of PEECB co-financing.

**Table 3: PEECB Co-financing Details**

| Partner Agency | Co-Financing up to March 2018 (US$) | Activities to date | Annual energy savings (MWh) | Annual GHG emission reductions (tons $CO_2$) |
|---|---|---|---|---|
| Department of Alternative Energy Development and Efficiency, DEDE | 11,207,750 | • Co-finance by DEDE contributing to support projects implementation to improve energy efficiency in building sector during PEECB Project Period = US$ 10,084,767<br>• Co-finance by DEDE to support personnel involved in the project activities and Office Space provided by DEDE is at US$ 187,500<br>• Co-finance by DEDE contributing to conduct the follow-on projects on Energy Performance Indicator (EnPI) at US$ 774,194 and Energy Consumption Disclosure Programme at US$ 161,290 | n/a | n/a |
| Aikchol I Hospital | 245,654 | Investment made in procurement of EE chiller and LED light bulbs | 733 MWh | 426 tons $CO_2$ |
| Aikchol II Hospital | 314,516 | Investment made in procurement of EE chiller | 578 MWh | 336 tons $CO_2$ |
| Centara Grand at Central World | 116,234 | Investment made in procurement of LED Light Bulbs | 985 MWh | 572 tons $CO_2$ |
| Chaweng Garden Beach Resort | 64,466 | Investment made in procurement of High Energy Efficient Light Bulb and replacing of electric heater with Solar Water Heater | 24 MWh | 14 tons $CO_2$ |
| C.P. Tower 2 & Fortune town | 29,800 | Modification made in chillers to improve performance, LED Light Bulbs | 142 MWh | 82 tons $CO_2$ |
| Grand Mercure, Bangkok | 376,869 | Investment made in procurement of heat pump and EE Chiller | 678 MWh | 394 tons $CO_2$ |
| Kasikorn Bank | 572,258 | Investment made in procurement of EE chiller | 580 MWh | 337 tons $CO_2$ |
| Saint Gabriel's College | 380,087 | Investment made in procurement of LED Light Bulbs, High EE Air Conditioners and EE Chiller | 388 MWh | 225 tons $CO_2$ |
| Samrong General Hospital | 50,516 | Investment made in procurement of High EE Air Conditioners and LED Light Bulbs | 281 MWh | 163 tons $CO_2$ |
| **Total:** | **13,367,150** | | **4,388 MWh** | **2,550 tons $CO_2$** |

**Table 4: Summary of Co-Financing for Thailand PEECB Project (as of 31 March 2018)**

| Co-financing (type/source) | UNDP own financing (million USD) | | Government (million USD) | | Partner Agency (million USD) | | Private Sector (million USD) | | Total (million USD) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Planned | Actual | Planned | Actual | Planned | Actual | Planned | Actual | Planned | Actual |
| Grants [28] | | | | 10.085[29] | | | 5.768 | 2.159[30] | 5.768 | 12.244 |
| Loans/Concessions | | | | | | | | | 0.000 | 0.000 |
| • In-kind support | | | 6.500 | 1.123 | | | | | 6.500 | 1.123 |
| • Other | | | | | | | | | 0.000 | 0.000 |
| **Totals** | **0.000** | **0.000** | **6.500** | **11.208** | **0.000** | **0.000** | **5.768** | **2.159** | **12.268** | **13.367** |

[28] Includes all cash contributions
[29] See Table 3 for breakdown
[30] See Table 3 for breakdown

54. In conclusion, the cost effectiveness of the PEECB Project has been **satisfactory** in consideration of PEECB meeting all of its intended targets, and raising the awareness of building energy efficiency in Thailand. With an estimated 332,000 tons of $CO_2$ emissions directly reduced by PEECB (see Para 64 for details), the unit cost of GHG emission reductions by GEF funds was US$13.55 per ton $CO_2$ reduced. While the PEECB has been cost-effectiveness on raising interest on energy efficiency issues with over 25% of "designated buildings" (as further detailed in Section 3.3.10), PEECB has only addressed less than 0.1% of all 2.7 million commercial buildings throughout Thailand. The challenge for DEDE after the conclusion of PEECB will be to scale-up energy efficiency in in the remaining building stock in Thailand.

### 3.2.5 M&E Design at Entry and Implementation

55. The M&E design as covered in Part IV (Paras 136-155) in the PEECB Project ProDoc is robust and thorough. The design covers all M&E activities including:

- the Project inception phase;
- monitoring responsibilities and advance;
- monitoring reporting requirements including annual Project reviews and Project implementation reports (APRs/PIRs);
- independent evaluations that includes the Midterm Evaluation as well as the Final Evaluation;
- project audits; and
- dissemination of Project results to encourage learning and knowledge sharing.

The M&E design, however, did not include M&E of the demonstration projects. As such, *the M&E design is rated as **satisfactory***.

56. Monitoring and evaluation activities were implemented by the PMU who met every 2 weeks for this purpose (see Para 48). The UNDP programme officer regularly met the PMU on a quarterly basis to discuss the progress and problems, and to focus the reporting on the indicators in the PPM. In addition, there were periodic visits and regular phone communication with demonstration project proponents. In response to the Midterm Review's recommendation on improving monitoring and documentation of results, the Project team revisited the logical framework to ensure that all the targets are clearly understood and good documentation was in place to report the results against the targets. With regular project monitoring meetings being conducted, systematic documentation of results improved after early-2016 with UNDP providing additional assistance to DEDE in preparing monitoring results of the PEECB Project. Towards the end of the Project in 2017 and 2018, this systematic reporting was used more effectively as a means of measuring training results and the use of the BESM.

57. Implementation of the M&E plan was *rated as **highly satisfactory***. Ratings according to the GEF Monitoring and Evaluation system[31] are as follows:

[31] 6 = HS or Highly Satisfactory: There were no shortcomings;
5 = S or Satisfactory: There were minor shortcomings,
4 = MS or Moderately Satisfactory: There were moderate shortcomings;
3 = MU or Moderately Unsatisfactory: There were significant shortcomings;
2 = U or Unsatisfactory: There were major shortcomings;
1 = HU or Highly Unsatisfactory

- *M&E design at entry - 5;*
- *M&E plan implementation - 6;*
- *Overall quality of M&E - 6.*

### 3.2.6 Performance of Implementing and Executing Entities

58. The performance of the implementing partner, the Department of Alternative Energy Development and Efficiency (DEDE) can be characterized as follows:
    - DEDE had a significant role in the design of PEECB during the 2011-12 period, shaping the design to enhance the capacity of their staff to promote and enforce the BEC and energy conservation standards in existing buildings. DEDE viewed the PEECB Project to be beneficial by securing a donor's long-term technical assistance funding commitment to improve their capacities to accelerate adoption of energy efficiency standards for all buildings in Thailand;
    - They made the decision to outsource the functions of the PMU to BMC using PEECB funds. The performance of BMC has allowed DEDE personnel from its several bureaus (including Bureau of Energy Regulation and Conservation, Bureau of Human Resource Development and Bureau of Energy Efficiency Promotion) to offload Project monitoring and reporting obligations for GEF-support projects and allowed for DEDE personnel to focus on integrating PEECB knowledge outputs into their work that included information from monitored demonstration projects in Outcome 3.1;
    - The recruitment of BMC also increased access for DEDE to the qualified expertise of "Engineering Solution Providers Company Limited (ENSOP)" who carried out targeted activities for Components 2 and 3;
    - Their PMU called and participated in regular weekly meetings to solicit and provide valuable inputs to PEECB. Project weekly meeting has also been set up to continuously follow up on the progress of the project;
    - DEDE provided strategic leadership for PEECB to ensure the Project responded to the needs of DEDE personnel and their work priorities in boosting public confidence in the BEC approvals process for new buildings and in promoting energy conservation measures for existing buildings. This also included their inputs on Project activities for the PEECB extension phase that commenced in September 2017;
    - DEDE facilitated the numerous adaptive management decisions that minimized delays to allow the Project to achieve its targets for all outcomes;
    - In summary, DEDE oversight ensured the PEECB Project provided the aforementioned technical assistance benefits to their personnel as well as their target stakeholders, commercial building owners and operators. As such, the overall performance of DEDE is rated as **satisfactory**.

59. The performance of UNDP (the Implementing Agency) can be characterized as follows:

    - UNDP considerably reduced its work load related to the monitoring and evaluation activities of PEECB by agreeing with DEDE to outsource the management and reporting functions of PEECB to a competent management consultant who was also familiar with DEDE. UNDP's work load was also reduced by this contract since the BMC contract was paid on a milestone basis thereby reducing the number of Project fund transfers to be prepared during implementation;

U/A = Unable to assess
N/A = Not applicable.

- UNDP provided an appropriate level of support to DEDE and BMC to manage the Project within the guidelines for NEX-modality projects. This included UNDP support to guide BMC on M&E activities and the quality of progress reporting in PIRs and QPRs in 2015;
- With no significant implementation issues on PEECB, the overall performance of UNDP on the PEECB Project is rated as **satisfactory**.

60. A summary of ratings of the implementing and executing entities of the PEECB Project are as follows:

- *Implementing Partner (DEDE)* – 5;
- *Implementing Entity (UNDP)* – 5;
- *Overall quality of implementation/execution (UNDP/DEE)* – 5.

## 3.3 Project Results

61. This section provides an overview of the overall results of the PEECB Project and assessment of the relevance, effectiveness and efficiency, country ownership, mainstreaming, sustainability, and impact of the PEECB Project. In addition, evaluation ratings for overall results, effectiveness, efficiency and sustainability are also provided against the revised November 2012 PPM (as provided in Appendix F)[32]. For Tables 5 to 8, the "status of target achieved" is color-coded as per the following colour coding scheme:

| | | |
|---|---|---|
| Green: Completed, indicator shows successful achievements | Yellow: Indicator shows expected completion by the EOP | Red: Indicator shows poor achievement – unlikely to be completed by project closure |

### 3.3.1 Overall Results

62. A summary of the achievements of PEECB Project at the Project Goal and Objective level with evaluation ratings are provided on Table 5.

63. Prior to the commencement of PEECB in 2012, there were no tangible GHG emission reductions and energy savings monitored from new buildings that complied with the 2009 Building Energy Code (BEC). Moreover, DEDE estimates that less than 20% of new buildings applying for approval for construction complied with the BEC. The PEECB Project was designed to address these issues by:

- improving awareness and technical capacity of building owners and design practitioners with greater access to knowledge of EE technologies, practices and opportunities;
- improving secondary legislation, policies, standards and financial incentives to encourage and accelerate investments into EE measures and technologies for new and existing buildings; and
- setting up demonstrations of EE technologies, practices and measures in new and existing buildings that will inform policies and standards by which building owners and design practitioners can be guided.

[32] Evaluation ratings are on a scale of 1 to 6 as defined in Footnote 31.

**Table 5: Project-level achievements against PEECB Project targets**

| Project Strategy | Performance Indicator | Baseline | Target[33] | Status of Target Achieved | Evaluation Comments | Rating [34] |
|---|---|---|---|---|---|---|
| **Project goal:** *Reduced intensity of GHG emissions from the commercial building sector.* | Cumulative $CO_2$ emission reduction from the commercial building sector by End-Of-Project (EOP, Year 2015), kton $CO_{2eq}$ | 0 | ~~230~~ 239 | 332 ktons as of March 2018 based on report from BEC Center on 717 "designated buildings" that comply with BEC and the resulting energy savings and GHG emission reductions. This includes a small contribution by the 12 demo buildings that have demonstrated energy savings and GHG emission reductions. | See Paras 15 and 64 | 6 |
| | % reduction in GHG emissions from the commercial buildings sector by EOP | 0 | 1.2% | *1.73%. This is the actual % GHG emission reduction from whole level building sector as prepared by DEDE.* | See Para 64 | 6 |
| **Project objective:** *Promotion and facilitation of the widespread application of building energy efficiency technologies and practices in commercial buildings in Thailand* | Cumulative energy savings from the commercial building sector by Year 2015, GWh | 0 | ~~396~~ 411 | 572 GWh. *Status described in detail above under GHG emission reduction target.* | See Para 64 | 6 |
| | % Energy savings by EOP | 0 | 1.2% | 1.73%. *This is the actual % energy savings from whole level building sector as prepared by DEDE.* | See Para 64 | 6 |
| | % of new buildings that are fully compliant with the new Building Energy Code by EOP | 20% | ~~60%~~ 62% | *66%.* | See Para 64 | 6 |
| | % of new buildings in Thailand that are classified as energy efficient buildings by EOP | 10% | ~~40%~~ 42% | 61%. | See Para 65 | 6 |
| **Overall Rating – Project-Level Targets** | | | | | | **6** |

[33] Crossed out targets in red font were revised in September 2017 when PEECB was officially extended to 30 April 2018
[34] Ibid 31

## Figure 2: Screenshot of BEC Center Buildings Database

| No. | Building Name | Organization | Building Type | GFA (sqm) | Air Conditioned Area (sqm) | Other areas | Location | No. Floor | Exterior Wall Type | Exterior Glass Type | WWR /AC ZONE | Roof Material | Lighting System | Air Conditioner | OTTV | RTTV | LPD | OTTV after | RTTV after | LPD after | A/C Result | Water Heater | Energy Consumption (kWh/y) | | | Energy Saving |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | | | | | | | As Design | Reference | After improvement | |
| 1 | | | สำนักงาน | 71,440 | 55,455.00 | 43,209 | กรุงเทพฯ | 34 | ผนังคอนกรีตฉาบปูนเรียบ | ใส 2 ชั้น หนา 18 มิล | 0.31 | หลังคาเมทเลิเมตร มีช่องว่างอากาศ 50 | L- 36 วัตต์ และหลอดต | Split | 42.88 | 6.74 | 6.91 | - | - | - | Pass | - | 3,401,300 | 5,312,446.95 | 3,401,300 | 1,911,147 |
| 2 | | | สถานศึกษา | 9,695 | 4,095.82 | 5783.46 | นครสวรรค์ | 5 | ผนังอิฐมวลเบาฉาบปูนเรียบ | ชนิดเขียวตัดแสง และกระจกลามิเนต | 0.48 | ฝ้าเพดานยิปซัมบอร์ด หนา 45 มิลลิเมตร | หลอดฟลูออเรสเซนต์ และโคมดาวไลท์ | Split | 69.34 | 9.41 | 4.77 | 48.68 | - | - | Pass | - | 265,617 | 473,062.48 | 226,378.10 | 207,446 |
| 3 | | | สถานศึกษา | 10,525 | 5,177.00 | 5,384.00 | กรุงเทพฯ | 8 | ผนังภายนอกอาคารคอนกรีตเสริมเหล็ก | กระจกสะท้อนแสง | 0.25 | หลังคา METAL SHEET | หลอดฟลูออเรสเซนต์ และบัลลาสต์อิเล็กทรอนิกส์ | Split | 79.63 | 37.68 | 5.81 | 49.41 | - | - | Pass | - | 357,309 | 527,316.98 | 303,886.49 | 170,008 |
| 4 | | | สถานศึกษา | 11,971 | 5,857.00 | 4934 | กรุงเทพฯ | 6 | ผนังภายนอกอาคารคอนกรีตเสริมเหล็ก | ชนิดเขียวตัดแสงหนา 6 มิลลิ | 0.26 | หลังคาคอนกรีต | หลอดฟลูออเรสเซนต์ และบัลลาสต์อิเล็กทรอนิกส์ หลอ | Split | 64.52 | 20 | 3.57 | 49.89 | 6.28 | - | Pass | - | 273,454 | 545,802 | 251,156.18 | 272,348 |
| 5 | | | สถานศึกษา | 2,078 | 634.00 | 1,444.00 | ลำปาง | 2 | ผนังอิฐมวลเบาฉาบปูนเรียบ | กระจกใส | 0.08 | METAL SHEET ติดฉนวนกันความร้อน | หลอดฟลูออเรสเซนต์ และหลอดเมทัลฮาไลด์ | Split | 62.72 | 13.39 | 10.47 | 34.94 | - | - | Pass | - | 95,763.70 | 108,061.11 | 83,647.59 | 12,297 |
| 6 | | | สถานศึกษา | 16,820 | 4,694.00 | 15,552.00 | ลำปาง | 3 | ผนังอิฐมวลเบาฉาบปูนเรียบ | ชนิดเขียวตัดแสงหนา 6 มิลลิ | 0.22 | หลังคาเหล็กเคลือบสี | หลอดฟลูออเรสเซนต์ ชนิดผอมพิเศษ LED ขนาด 6 | Split | 55.3 | 11.5 | 2.66 | 43.3 | - | - | Pass | - | 293,351.50 | 862,630.00 | 274,933.68 | 569,279 |
| 7 | | | สถานศึกษา | 5,340 | 79.00 | 5,448.18 | ลำปาง | 4 | ผนังอิฐมวลเบาฉาบปูนเรียบ | ชนิดเขียวตัดแสงหนา 6-8 มิล | 0.22 | หลังคาเหล็กเคลือบสี | ดาวน์ไลท์ ขนาด 13-100 วัตต์ | Split | 41.7 | 0 | 2.26 | 26.30 | - | - | Pass | - | 122,606.63 | 576,296.97 | 118,134.88 | 453,690 |
| 8 | | | สถานศึกษา | 6,933 | 3,722.12 | 3,210.53 | กรุงเทพฯ | 4 | ผนังคอนกรีตมวลเบา | Low-E ความหนา 10.38 | 0.47 | หลังคาเมทลเชิงและหลังคา Metal sheet พร้อม | หลอดตะเกียบ T5 และหลอดดาวน์ไลท์ | Split | 45.3 | 2.44 | 8.68 | - | - | - | Pass | - | 182,931.23 | 352,673.35 | 182,931.23 | 169,742 |
| 9 | | | อาคารชุด | 32,261 | 17,084.00 | 15,177.00 | กรุงเทพฯ | 22 | ผนังภายนอกอาคารคอนกรีตเสริมเหล็ก | ชนิดเขียวตัดแสง หนา | 0.37 | หลังคาคอนกรีต | หลอดฟลูออเรสเซนต์ และหลอดดาวไลท์ ขนาด | Split | 38.5 | 18 | 5 | 27.02 | 5.25 | - | Pass | - | 2,256,895.79 | 5,338,328.97 | 2,128,790.63 | 3,081,433 |
| 10 | | | อาคารชุด | 40,375 | 17,027.00 | 23,348.00 | กรุงเทพฯ | 22 | ผนังภายนอกอาคารคอนกรีตเสริมเหล็ก | กระจกลามิเนตสีเขียวตัดแสง หนา 6 | 0.37 | หลังคาคอนกรีต | หลอดฟลูออเรสเซนต์ และหลอดดาวไลท์ ขนาด | Split | 42.5 | 12.5 | 2.6 | 26.4 | 3.06 | - | Pass | - | 3,367,380.29 | 6,674,948.08 | 2,833,503.61 | 3,307,568 |
| 11 | | | อาคารชุด | 31,852 | 18,737.00 | 13,115.00 | กรุงเทพฯ | 22 | ผนังภายนอกอาคารคอนกรีตเสริมเหล็ก | ชนิดเขียวตัดแสง หนา | 0.33 | หลังคาคอนกรีต | หลอดฟลูออเรสเซนต์ และหลอดดาวไลท์ ขนาด | Split | 40.8 | 13.2 | 4.04 | 21.9 | 6.08 | - | Pass | - | 4,663,787.00 | 8,256,845.00 | 3,976,144.00 | 3,593,058 |
| 12 | | | สำนักงาน | 11,807 | 6,965.95 | 4,841.05 | กรุงเทพฯ | 6 | ผนังภายนอกอาคารคอนกรีตมวลเบา | กระจกใส และกระจกลามิเนตสี | 0.85 | หลังคาคอนกรีต ฉนวนกันความร้อน และหลังคาเหล็ก Metal | หลอดฟลูออเรสเซนต์ และหลอด LED ขนาด | VRF | 93.1 | 43.2 | 5.6 | 49.2 | 8.91 | - | Pass | - | 403,501.94 | 598,644.56 | 325,695.17 | 195,143 |
| 13 | | | สถานศึกษา | 16,180 | 2,688.50 | 13,491.37 | ร้อยเอ็ด | 10 | ผนังอาคารเรียนภายนอก/ไม่ | ชนิดเขียวตัดแสงหนา 6 มิลลิ | 0.19 | หลังคาเหล็กเคลือบสี พร้อมฉนวนกันความร้อน | หลอดฟลูออเรสเซนต์ ขนาด | Split | 54.9 | 0 | 5.94 | 42.4 | - | - | Pass | - | 462,919.60 | 766,757.37 | 447,840.10 | 303,838 |
| 14 | | | สถานศึกษา | 22,979.00 | 8,425.00 | 14,551.00 | กรุงเทพฯ | 13 | ผนังอิฐมอญ 2 ชั้น | กระจกลามิเนตสีเขียวตัดแ | 0.2 | หลังคาคอนกรีต และหลังคาเหล็กเคลือบสี | หลอดฟลูออเรสเซนต์ | แบบรวมศูนย์ | 43.3 | 8.89 | 5 | - | - | - | Pass | - | 525,186.75 | 1,143,414.39 | 525,186.75 | 618,228 |
| 15 | | | สถานพยาบาล | 17,597.00 | 8,353.00 | 9,244.00 | เชียงราย | 9 | ผนังอิฐมอญ ฉาบปูนเรียบ | กระจกลามิเนตสีเขียวตัดแ | 0.42 | หลังคาคอนกรีตพร้อมฉนวนกันความร้อน และแผ่นยิปซัม | หลอด LED ขนาด 7 | แบบรวมศูนย์ | 38.4 | 9.03 | 4.95 | 29.9 | - | - | Pass | - | 2,501,558.38 | 3,769,184.65 | 2,332,843.77 | 1,267,626 |
| 16 | | ศูนย์การค้า/ห้างสรรพสินค้า | | 112,983.00 | 85,366.00 | 27,617.00 | สมุทรสาคร | 3 | ผนังคอนกรีตมวลเบา | กระจกใส หนา 12 มิลลิ | 0.1 | หลังคาคอนกรีตพร้อมฉนวนใยแก้ว | หลอด LED ขนาด 2 | Split | 33.61 | 8.99 | 1.71 | - | - | - | Pass | - | 4,741,649.96 | 18,011,389.64 | 4,741,649.96 | 13,269,740 |
| 17 | | ศูนย์การค้า/ห้างสรรพสินค้า | | 173,833.49 | 171,985.49 | 1,848.00 | นครราชสีมา | 5 | ผนังอิฐมอญ ฉาบปูนเรียบ | กระจกลามิเนตใส หนา | 0.058 | หลังคาคอนกรีตพร้อมฉนวนใยแก้ว | หลอด LED ขนาด 6 | Split | 37.2 | 5.12 | 1.81 | - | - | - | Pass | - | 6,910,949.30 | 22,584,431.59 | 6,910,949.30 | 15,673,482 |
| 18 | | | สถานศึกษา | 11,971 | 5,857.00 | 4934 | กรุงเทพฯ | 6 | ผนังภายนอกอาคารคอนกรีตเสริมเหล็ก | ชนิดเขียวตัดแสงหนา 6 มิลลิ | 0.26 | หลังคาคอนกรีต | หลอดฟลูออเรสเซนต์ และบัลลาสต์อิเล็กทรอนิกส์ หลอ | Split | 64.52 | 20 | 3.57 | 49.89 | 6.28 | - | Pass | - | 273,454 | 545,802 | 251,156.18 | 272,348 |
| 19 | | | สถานศึกษา | 2,078 | 634.00 | 1,444.00 | ลำปาง | 2 | ผนังอิฐมวลเบาฉาบปูนเรียบ | กระจกใส | 0.08 | METAL SHEET ติดฉนวนกันความร้อน | หลอดฟลูออเรสเซนต์ และหลอดเมทัลฮาไลด์ | Split | 62.72 | 13.39 | 10.47 | 34.94 | - | - | Pass | - | 95,763.70 | 108,061.11 | 83,647.59 | 12,297 |
| 20 | | | สถานศึกษา | | | | | | | | | | | | | | | | | | Pass | | | | | |
| 21 | | | สถานศึกษา | 21,228.75 | 11,396.00 | 9,832.75 | นครปฐม | 5 | ผนังอิฐมอญฉาบปูนเรียบ | กระจกเขียวตัดแสง หนา | 0.12 | หลังคาคอนกรีต เว้นช่องว่างอากาศ | หลอดฟลูออเรสเซนต์ | Split | 52.86 | 22.76 | 12.1 | 45 | 9.56 | 12.14 | Pass | - | 1,046,898.78 | 1,193,590.63 | 997,184.78 | 146,692 |
| 22 | | | อาคารชุด | 10,444.00 | 5,162 | 5,282.00 | กรุงเทพฯ | 26 | หลังคาคอนกรีตติดฉนวน | กระจกลามิเนตสีเขียวตัดแ | 0.21 | หลังคาคอนกรีตติดฉนวนใยแก้ว | หลอด LED ขนาด 7 | Split | 23.86 | 5.03 | 3.51 | - | - | - | Pass | - | 933,223.53 | 1,998,135.34 | 933,223.53 | 1,064,912 |
| 23 | | | อาคารชุด | 10,796.00 | 5,176.00 | 5,620.00 | กรุงเทพฯ | 23 | ผนังภายนอกอาคารคอนกรีต | กระจกลามิเนตสีเขียวตัดแ | 0.25 | หลังคาคอนกรีตติดฉนวนใยแก้ว | หลอด LED ขนาด 7 | Split | 25.06 | 5.03 | 3.39 | - | - | - | Pass | - | 899,346.64 | 2,030,437.81 | 899,346.64 | 1,131,091 |
| 24 | | | อาคารชุด | 10,458.00 | 4,535.00 | 5,923.00 | กรุงเทพฯ | 27 | ผนังภายนอกอาคารคอนกรีต | กระจกลามิเนตสีเขียวตัดแ | 0.23 | หลังคาคอนกรีตติดฉนวนใยแก้ว | หลอด LED ขนาด 7 | Split | 25.02 | 7.29 | 2.98 | - | - | - | Pass | - | 948,315.80 | 2,030,550.47 | 948,315.80 | 1,082,235 |
| 25 | | | อาคารชุด | 10,796.00 | 5,176.00 | 5,620.00 | กรุงเทพฯ | 23 | ผนังภายนอกอาคารคอนกรีต | กระจกลามิเนตสีเขียวตัดแ | 0.25 | หลังคาคอนกรีตติดฉนวนใยแก้ว | หลอด LED ขนาด 7 | Split | 25.06 | 5.03 | 3.39 | - | - | - | Pass | - | 899,346.64 | 2,030,437.81 | 899,346.64 | 1,131,091 |
| 26 | | | อาคารชุด | 10,796.00 | 5,176.00 | 5,620.00 | กรุงเทพฯ | 23 | ผนังภายนอกอาคารคอนกรีต | กระจกลามิเนตสีเขียวตัดแ | 0.25 | หลังคาคอนกรีตติดฉนวนใยแก้ว | หลอด LED ขนาด 7 | Split | 25.06 | 5.03 | 3.39 | - | - | - | Pass | - | 899,346.64 | 2,030,437.81 | 899,346.64 | 1,131,091 |
| 27 | | | อาคารชุด | 10,796.00 | 5,176.00 | 5,620.00 | กรุงเทพฯ | 23 | ผนังภายนอกอาคารคอนกรีต | กระจกลามิเนตสีเขียวตัดแ | 0.25 | หลังคาคอนกรีตติดฉนวนใยแก้ว | หลอด LED ขนาด 7 | Split | 25.06 | 5.03 | 3.39 | - | - | - | Pass | - | 899,346.64 | 2,030,437.81 | 899,346.64 | 1,131,091 |
| 28 | | | อาคารชุด | 10,611.00 | 5,243.00 | 5,368.00 | กรุงเทพฯ | 27 | ผนังภายนอกอาคารคอนกรีต | กระจกลามิเนตสีเขียวตัดแ | 0.43 | หลังคาคอนกรีตติดฉนวนใยแก้ว | หลอด LED ขนาด 7 | Split | 28.8 | 5.03 | 1.97 | - | - | - | Pass | - | 844,049.78 | 1,967,753.78 | 844,049.78 | 1,123,704 |
| | | | | 1,861,407.21 | | | | | | | | | | | | | | | | | | | | | รวม | 142,375,911.62 |
| | | | | | | | | | | | | | | | | | | | | | | | | | | 498,315,690.67 |
| | | | | | | | | | | | | | | | | | | | | | | | | | | 12.169 |
| | | | | | | | | | | | | | | | | | | | | | | | | | | 82,578,028.74 |

64. With regards to the achievement of the Project goal of "reduced intensity of GHG emissions from the commercial building sector", Para 26 and 27 mentions the lack of clarity on the original target of 230 ktons $CO_{2eq}$ of cumulative emission reductions and 396 GWh of cumulative energy savings by the EOP. This target was revised upwards in September 2017 to 239 ktons $CO_{2eq}$ and 411 GWh of energy savings to March 2018 as shown in Appendix G. Achievement of these revised targets can be described as follows:

- The direct energy savings from 717 buildings that are BEC-compliant[35] is 538 GWh that is equivalent to 332 ktons of $CO_2$ emission reductions (derived from the BEC Center buildings database, a sample of which is provided on Figure 2). The achievement of these targets are directly linked to PEECB training that assisted building owners, managers and building practitioners to comply with BEC for energy efficiency in buildings. Details of this calculation can be found in Appendix E;
- Energy efficiency buildings or High Energy Performance Standard Building (HEPS), according to the building category in EEDP that comprises more than 42% of these 717 buildings, which had achieved with more than 10% of energy saving compare to BEC;
- The 717 buildings includes the direct energy savings of 17,596 MWh from demonstration buildings implemented in Component 3, the energy savings of which was monitored and documented by DEDE for dissemination to commercial building stakeholders. The energy savings for 9 monitored demonstration buildings using the GEF EE Tool can be found in Appendix E;
- The PMU informed the Evaluation Team that DEDE is preparing a figure on energy savings and GHG emission reduction from the entire building sector. The Evaluation accepts from DEDE the disclosure of 1.73% energy savings and GHG emission reductions from the entire building sector. The Evaluation Team, however, has no means of verifying the accuracy of this calculation, and to some extent, disputes the value of this indicator to the intended objective of this Project which has been difficult for the PMU to obtain from DEDE;
- DEDE reported only 20% compliance to BEC prior to the PEECB Project. During this Evaluation, DEDE reports that this compliance figure has risen to 66% based on the aforementioned 717 buildings. DEDE, however, also has data from another 2,000+ "designated buildings" in their database that is currently being analyzed[36].

65. A building achieving more than 10% energy savings from those mandated in the 2009 BEC are classified as an energy efficiency building or High Energy Performance Standard Building (HEPS) according to the building category in Energy Efficiency Development Plan (EEDP) as of March 2016. Based on the number of buildings that submitted data to DEDE through BEC Center with plans to achieve more than 10% of energy saving, DEDE reports that more than 61% of new buildings are classified as an HEPS buildings. PEECB training and capacity building can be attributed to this increase in HEPS buildings. Existence of this classification provides some basis for the calculation of the

[35] The Building Energy Code Center of DEDE has each BEC application that has sufficient information to calculate cumulative energy savings to the EOP including building design and floor area, date of approval, estimated completion date, and planned energy consumption.

[36] The GEF EE Tool as provided in Appendix E, did not use the 20% baseline and 66% Project compliance figures for determining direct GHG emission reductions from "building codes". Since DEDE had the actual direct emission reductions and 17,596 MWh of energy savings from the aforementioned 717 buildings, baseline compliance in the GEF Tool was artificially set at 40% with Project compliance artificially set at 60%. This approach is also more conservative to the 20% baseline and 66% Project compliance rates.

cumulative energy savings and emission reduction achievements to date, and a basis for DEDE to draft a new BEC to improve EE of new buildings by 20% in comparison to the 2009 BEC.

66. For these reasons, the evaluation has determined that the overall rating for goal and objective level targets is **satisfactory**. The Project has met its energy and GHG emission reduction targets, all of which were based on improved capacities of building owners, managers and practitioners to design and implement EE measures in their commercial and public buildings, and increased compliance of building applications to BEC. GHG emission reductions and energy savings estimates from this Project are also summarized on the GEF Tracking Tool as provided in Appendix F.

### 3.3.2 Component 1: Awareness Enhancement on Building EE Technologies and Practices

67. To achieve Outcome 1 (enhanced awareness of the government, building sector and banks on EE technologies and practices), Project resources were to be used to:

- establish a Commercial Building EE Information Center (CBEEC) (Output 1.1);
- complete development of a system of information exchange and dissemination on EE technologies and practices for commercial building stakeholders (Output 1.2);
- develop Energy Use Simulation Models for commercial building design (Output 1.3);
- deliver training courses on EE technologies and practices, and financial arrangement for commercial buildings (Output 1.4);
- deliver training courses on financial assessment of EE application projects in commercial buildings (Output 1.5); and
- establish business linkages between suppliers of EE technologies, building owners, banks and building practitioners (Output 1.6).

A summary of actual achievements of the Outcome 1 with evaluation ratings is provided on Table 6.

68. Prior to the commencement of this Project component, the general knowledge amongst personnel of the commercial building sector to energy related issues was poor. This is evidenced through the general weak implementation of the 2009 Building Energy Code where DEDE reported only 20% compliance of new buildings to this new code. From the perspective of knowledge dissemination, the baseline for awareness of EE in the commercial building sector can be characterized by:

- Absence of effective energy efficiency promotions at commercial buildings;
- Information on new and innovative building EE technologies and their suppliers was scattered and difficult to access;
- Lack of awareness and technical knowledge of energy efficiency opportunities amongst building practitioners; and
- New building owners and designers were not considering energy efficiency of the building.

69. Output 1.1: Establishment of the Commercial Building EE Information Center (CBEEC) was initially achieved as a website (http://dede-peecb.bright-ce.com) as of July 2014 with other ongoing activities after this date. This website includes quarterly newsletters to inform stakeholders of the status of PEECB activities, upcoming events and activities related to PEECB promotion, and other technical

**Table 6: Component 1 achievements against targets**

| Project Strategy | Performance Indicator | Baseline | Target | Status of Target Achieved | Evaluation Comments | Rating[37] |
|---|---|---|---|---|---|---|
| **Outcome 1: Enhanced awareness of the government, building sector and banks on EE technologies and practices** | % of overall commercial building stakeholders that agree to greater availability of pertinent information on EE technologies and practices through the PEECB project activities by Year 2015 | 0 | 80% | *80%* | This is a superfluous indicator to Output 1.2. See Para 70-71 | 5 |
| | % of overall commercial building stakeholders that are satisfied with availability and quality of information available from the PEECB project by Year 2015 | 0 | 70% | *70%* | This is a superfluous indicator to Output 1.1. See Para 69. | 5 |
| **Output 1.1:** Establishment of the Commercial Building EE Information Center (CBEEC) | % of overall commercial building stakeholders that are satisfied with availability and quality of CBEEC information services by Year 2015 | 0 | 70% | *78%* | See Para 69 | 5 |
| **Output 1.2:** A system of information exchange and dissemination on EE technologies and practices for commercial building stakeholders | % of overall commercial building stakeholders that agree to greater availability of pertinent information on EE technologies and practices through CBEEC as well as promotional and outreach activities by Year 2015 | 0 | 80% | *80%* | See Paras 70-71 | 5 |
| | No. of users of the information exchange system by EOP | 0 | ~~1,500~~ 2,010[38] | *7,581[39]* | -- | 6 |
| | No. of satisfied users of the information exchange system each year Starting Year 2012 | 0 | 70% | *80%* | See Paras 70-71 | 5 |
| **Output 1.3:** Developed and Promoted Energy Use Simulation Models | No. of modified BESMs with additional features (e.g. dual language user interface) by Year 2013 | 0 | 1 | *1* | See Paras 72-74 | 5 |

[37] Ibid 31
[38] Revised in September 2017. Target includes number of participants in Project-supported training sessions and seminars as well as users of the webpage
[39] Consists of 5,345 using the web, and 2,236 receiving information by Project-supported training and seminars

| Project Strategy | Performance Indicator | Baseline | Target | Status of Target Achieved | Evaluation Comments | Rating[37] |
|---|---|---|---|---|---|---|
| for Commercial Building Design | % of overall no. of trainees that are gainfully employing learned skills on EE building design by Year 2015 | 0 | 70% | *85%* | See Paras 72-74 | 6 |
| | No. of new buildings that were designed using the modified BESMs by EOP | 0 | 60 | *62* | See Paras 72-74 | 5 |
| **Output 1.4:** Completed training courses on EE technologies and practices, and financial arrangement for commercial buildings | No. of completed training courses on EE technologies and practices, and financial arrangement for commercial buildings by EOP | 0 | ~~7~~ 16 [40] | *17* | See Para 75 | 5 |
| | % of overall no. of trainees that are gainfully employing learned skills on EE building design, operation and maintenance by Year 2015 | 0 | 70% | *78%* | -- | 6 |
| | % of trainees that are engaged in EE building project design, implementation and financing by EOP | 0 | 50% | *70%* | -- | 6 |
| **Output 1.5:** Completed training courses on financial assessment of EE application projects in commercial buildings | No. of completed training courses on financial assessment of EE application projects in commercial buildings by EOP | 0 | ~~7~~ 9 [41] | *9* | See Para 76 | 5 |
| **Output 1.6:** Established business linkages between suppliers of EE technologies, building owners, banks and building practitioners | No. of EE investment projects facilitated through business links by EOP | 0 | 20 | *20* | See Para 77 | 5 |
| | No. of banks/FIs that have financed EE investment projects through the business links by EOP | 0 | 5 | *5* | See Para 77 | 5 |
| **Overall Rating – Component 1** | | | | | | **5** |

[40] Revised in September 2017
[41] Revised in September 2017 to include financial training courses

issues related to energy efficiency in commercial buildings with the Project obtaining agreements with other relevant agencies to link their websites with the DEDE-PEECB website. A total of 7,581 visitors had been to the DEDE-PEECB website as well as PEECB-supported training sessions and seminars. By 2016, pertinent information on EE technologies and practices were much more available to commercial building stakeholders. The CBEEC website also provided advice on available EE technologies and financial schemes (such as the 20% direct subsidy from DEDE) which was utilized to implement EE improvements to the 12 demo buildings. A Project-supported survey found 78% of persons interviewed were satisfied with this website.

70. Output 1.2: A system of information exchange and dissemination of EE technologies and practices for commercial building stakeholders has been used by stakeholders as per the targets set in the PPM. The Project, again, had undertaken surveys of the degree of usefulness and user satisfaction of the information exchange system. The 2015 survey results found an 80% satisfaction rate that the system provided pertinent information on EE technologies and applications to building stakeholders. Training sessions included sessions on EE concepts and new technologies related to green buildings, and a study tour to Australia. Seminars were also held twice annually with high profile guest speakers to promote EECBs to wider interest groups.

71. To strengthen information exchange of EECBs through outreach, the Project issued quarterly newsletters, and the "elec-ta-lon" (roving electrons) TV programme (that featured Project involvement with demo buildings), and commenced annual project symposiums in March 2015 to update commercial building stakeholders of the progress of the Project and recognition of energy savings of various demo buildings. These symposiums were well-attended by the commercial building sector as well as international development agencies

72. Output 1.3: Developed and promoted energy use simulation models for commercial building design that was delivered in 2015. Delivery of this output included the selection and modification of a building energy simulation model (BESM) software (originally a public domain software developed by the US Department of Energy). Focus group meetings were arranged in 2014 consisting of several academic institutes, government agencies and consulting professionals to support this activity. This software was modified to adapt to Thai conditions to simulate building energy consumption through modeling of the building envelope (using various construction materials), HVAC systems and electrical circuits[42].

73. The BESM software being developed under PEECB to be user-friendly and viewed as a possible replacement to existing DEDE-approved software that is difficult to use and cited as a leading cause of poor compliance to BEC. By late 2015, building simulations and a curricular were developed and designed to tailor to the needs of the commercial building sector as well as DEDE to be used as a tool for assessing the energy consumption of a building with the design modules containing information about EE equipment. In July 2016, a DEDE energy efficiency database was reviewed and compiled for use as the data filing in the BESM and used as a source of SEC normalization to find the benchmark of energy consumption in building categories (with a focus on hotel, office, hospital and department store). The M&V Guidebooks (included in Output 2.2) were also incorporated into the training of the BESM. Users on the new software could model energy consumption within a specified part of a building such as a room or a section of a building, all of which can contribute to determination of

[42] Can include lighting, computer systems, pumps and elevators

building energy consumption under the "Building Energy Code" for new buildings. More importantly, however, the BESM was developed to model energy consumption in existing buildings using a menu of various EE technologies from a database of EE equipment developed by the Project under Component 2.

74. Feedback from users of the BESM software (both DEDE personnel, building owners, engineers, investors, and building practitioners). Feedback surveys from the participants as of early 2018 of the various BESM workshops and seminars (where the Project has recruited academic and consulting personnel to assist students in using the software) has been very encouraging including:

- 85% of BESM seminar participants currently employed and using their skills from these seminars;
- 62 new buildings currently or completed design using the modified BESM software.

75. *Output 1.4: Completed training courses on EE technologies and practices, and financial arrangements for commercial buildings* were delivered with 8 out of the 17 training courses delivered in 2017 and 2018. These courses included:

- 11 technical and 2 non-technical modules on energy efficiency in commercial buildings and an additional training programme for dissemination of BESM usage;
- attendance of more than 300 participants to these courses from both private and government sectors that covered EE and eco-friendly building design, EE and eco-building development, life cycle cost analysis, EE and eco-friendly building design (hospital and office buildings), measurement and verification (M&V), and usage of BESM;
- information to the Project website (www.dede-peecb.bright-ce.com) where course information is uploaded;
- building energy simulation models tailored for building owners, engineers, investors, and other related EE personnel in assessing the energy consumption of the building has been achieved with the design containing information about EE equipment, and for information support of DEDE's BEC.

76. *Output 1.5: Completed training courses on financial assessment of EE application projects in commercial buildings.* Nine of these courses from 2016 to 2018 were delivered with a key theme of informing participants of the need to analyze energy efficiency purchases through the lenses of life-cycle analysis that includes energy costs. This set of training courses has proven to be valuable to participants in the financial sector in assessing risks to energy efficiency loans.

77. *Output 1.6: Established business linkages between suppliers of EE technologies, building owners, banks and building practitioners* was delivered through the completion of PEECB workshops and seminars and monitoring the number of applicants to the Government's Revolving Fund for financial assistance to energy efficiency investments (see Para 84).

78. In conclusion, the results of Outcome 1 can be rated as **satisfactory** in consideration that all targets have been met with a high degree of satisfaction by the beneficiaries of the awareness raising and training from this Component, and that a number of EE investment projects have been facilitated through PEECB activities and outputs.

### 3.3.3 Component 2: EE Building Policy Frameworks

79. To achieve Outcome 2 (effective implementation of favorable policies that encourage EE technologies and practices for commercial building in Thailand), Project resources would be utilized to:

- update and improve effectiveness of policy measures on energy efficiency in commercial buildings (Output 2.1);
- revise and update data and information to facilitate policy implementation of commercial building EE (Output 2.2);
- approve and implement new and improved financing models for commercial buildings (Output 2.3); and
- develop and approve energy efficient promotion action plan (short and long term) to supplement DEDE activities (Output 2.4).

A summary of the actual achievements of Outcome 2 with evaluation ratings is provided on Table 7.

80. Prior to the commencement of Component 2, there was a lack of an effective and uniform implementation framework to encourage and facilitate EE investments in commercial buildings. This was evidenced by a 20% rate of compliance of newly constructed buildings to the 2009 Building Energy Code[43]. This lack of an implementation framework can be described as:

- Lack of clear guidance by DEDE to municipalities on how to administer and enforce implementation of EE building regulations that includes compliance checking of construction drawings and inspections during and after construction;
- Lack of coordination between DEDE and other government agencies on the implementation of mandatory measures stipulated under the BEC and MEPS of various building equipment types;
- Lack of information on EE building products and equipment that provide credible information to building developers and operators; and
- Poor utilization of various financing projects under DEDE's 2009 Energy Conservation Promotion Fund (ENCON) to encourage and support investments into EECBs.

81. Through the work of ENSOP, the Project assembled a focus group in 2013 to undertake an assessment of the energy policy framework, and to draft policies, secondary legislation and actions to improve support for the implementation of the BEC for EE in commercial buildings. This Project team in close collaboration with DEDE made 6 policy recommendations related to:

- Commercial building disclosure;
- Energy efficiency procurement for the public sector;
- Step-BEC;
- Building specific-type's financial support;
- Electricity generation for self-use; and
- Energy saving certificates.

[43] Based on results of assessment and evaluation of building designs conducted by King Mongkut University of Technology and Silpakorn University from 2008 to 2010

**Table 7: Component 2 achievements against targets**

| Project Strategy | Performance Indicator | Baseline | Target | Status of Target Achieved | Evaluation Comments | Rating[44] |
|---|---|---|---|---|---|---|
| **Outcome 2:** Effective implementation of favorable policies that encourage EE technologies and practices for commercial building in Thailand | No. of new policy measures for commercial building EE approved and implemented by Year 2015 | 0 | 2 | *2*<br>*This includes "Commercial Building Energy Consumption Disclosure" (CBECD) and EE Procurement for the public sector. Outcome indicator not necessary as it should be achieved by delivery of outputs.* | See Paras 82-83 | 5 |
| | No. of fiscal policies approved by DEDE for implementation by Year 2013 | 0 | 1 | *1*<br>*This includes TA from PEECB to design financial support from the Revolving Fund for buildings that are more than 10% better than BEC. This support is known as Step-BEC. Outcome indicator not necessary as it should be achieved by delivery of outputs.* | See Para 84 | 6 |
| | No. of short and long term action plans for commercial building EE integrated into DEDE's national Energy Conservation Program by EOP | 0 | 1 | *1*<br>*PEECB provided TA to assist DEDE to integrate its long action plans for EECBs into the 21-yr EEP (2016-2035) and short-term action plans into its 5-Year Action Plan (2017-21). Completion was in November 2016. Outcome indicator not necessary as it should be achieved by delivery of outputs.* | | 5 |
| **Output 2.1:** Revised and up-to-date data and information to facilitate policy | No. of new policy measures for commercial building EE approved and implemented by Year 2015 | 0 | 2 | *2*<br>*This includes PEECB TA for designing CBECD and EE Procurement for the public sector.* | See Paras 82-83 | 5 |

[44] Ibid 31

| Project Strategy | Performance Indicator | Baseline | Target | Status of Target Achieved | Evaluation Comments | Rating[44] |
|---|---|---|---|---|---|---|
| implementation of commercial building EE | No. of existing policy measures for commercial building EE modified and implemented by Year 2015 | 0 | 2 | *2*<br>*This includes PEECB TA for designing financial support from the Revolving Fund for Step-BEC, and modifications to specific building support for a public hospital* | See Para 84 | 5 |
| | No. of recommendations on improved and innovative implementation approaches for EE rating/labeling/ certification for commercial buildings in Thailand by Year 2013 | 0 | 2 | *2*<br>*This includes details for "Commercial Building Disclosure" and a rating for each building with an "Energy Saving Certificate".* | See Para 82 | 5 |
| **Output 2.2:** Revised and Up-to-date Data and Information to facilitate Policy Implementation of Commercial Building EE | % of overall commercial building stakeholders that are satisfied with availability and quality of the energy performance database by Year 2015 | 0 | 70% | *98%* | - | 6 |
| | No. of building energy use profiles established by Year ~~2014~~ 2016 | 0 | 4 | *4 SEC profiles for hospitals, offices, hotels and department stores* | See Paras 85-86, 88 | 5 |
| | No. of commercial building EE project referencing the improved M&V schemes by EOP | 0 | 20 | *20* | See Paras 87-88 | 5 |
| **Output 2.3:** Approved and implemented new and improved financing models for commercial buildings | No. of applicable fiscal policies on commercial building EE identified and formulated by Year ~~2012~~ 2014 | 0 | 3 | *3*<br>*This includes:*<br>• *financial support from the Revolving Fund for Step-BEC;*<br>• *modifications to specific building support for a public hospital; and*<br>• *direct subsidies for RE in buildings to achieve zero energy building* | See Para 84 | 6 |
| | No. of fiscal policies approved by DEDE for implementation by Year ~~2013~~ 2015 | 0 | 1 | *2*<br>*This includes financial policies for the Revolving Fund for Step-BEC, and modifications to* | | 5 |

| Project Strategy | Performance Indicator | Baseline | Target | Status of Target Achieved | Evaluation Comments | Rating[44] |
|---|---|---|---|---|---|---|
| | | | | *specific building support for a public hospital.* | | |
| | No. of the approved policies that are implemented by EOP | 0 | 1 | *2*<br>*This includes financial policies for the Revolving Fund for Step-BEC, and modifications to specific building support for a public hospital.* | | 6 |
| **Output 2.4:** Approved energy efficient promotion action plan (short and long term) to supplement DEDE activities | No. of short and long term action plans for commercial building EE integrated into DEDE's national EE policy by EOP | 0 | 1 | *1*<br>*DEDE has integrated its long action plans for EECBs into the 21-yr EEP (2016-2035) and short-term action plans into its 5-Year Action Plan (2017-21). Completion was in November 2016.* | See Para 89 | 5 |
| | No. of activities in the action plan that were considered for inclusion in the National Energy Conservation Program by EOP | 0 | 5 | *5*<br>*This includes the commercial building disclosure, Step-BEC, building specific-type financial support, updating of SECs for commercial buildings and M&V guideline preparations.* | See Para 89 | 5 |
| | No. of activities in the approved action plan incorporated in the National Energy Conservation Program that were implemented by EOP | 0 | 2 | *2* | See Para 89 | 5 |
| **Overall Rating – Component 2** | | | | | | **5** |

82. The commercial building energy consumption disclosure (CBECD) programme was initiated in 2015 and operating as a pilot project by 2016. CBECD was designed to benefit all commercial building stakeholders including DEDE and relevant government stakeholders, building owners, building managers, tenants, consultants and designers, and research and educational personnel. By the EOP, 7 buildings are expected to be under CBECD[45]. Activities under CBECD include a Project-supported data survey of energy consumption, inputs of data into software for Building Energy Simulation Model (or BESM tailored for use in Thailand), and data analysis of the thermal transfer values (reference and overall) in comparison with BEC values, and a determination of the energy performance of the building by comparing the building's operational performance index to its design performance index under BEC. With compliance below energy consumption values set by BEC, DEDE is proposing a system of awarding an Energy Saving Certificate to respective building owners.

83. In early 2016, the concept of EE Procurement for the public sector as proposed by PEECB's focus group was accepted by the Ministry of Finance's Comptroller General's Department (CGD). The concept to be developed was to ensure integration of EE procurement into E-market and E-Bidding, and by considering selection of EE equipment through life-cycle cost analysis of instead of lowest cost. This would complement the Government of Thailand's cabinet resolution to reduce energy usage by 10% annually. LED lighting and split-type air conditioners were proposed as pilot items for e-bidding in the public procurement process. DEDE with the assistance of PEECB had provided CGD support on developing specifications and standards of EE equipment that is in proportion with pricing set standard for the government e-procurement. The outcome of these actions should accelerate the deployment of EE appliances into public buildings throughout Thailand.

84. PEECB also assisted DEDE in designing and implementing fiscal policies using ENCON funds that would encourage investments into EE equipment. This includes:

- Revolving fund for financing new buildings under Step-BEC (for buildings that are more than 10% better than BEC) as a fiscal policy approved by DEDE that commenced in 2013. The scheme offered loans at 3.5% interest rate that originally had the participation of 5 banks capitalized by ENCON funds, an arrangement that did not work too well given these banks considered this work an extra burden on their routine work load. However, given the prominence of EE for commercial buildings as raised by the Project, 3 other banks are now offering their own revolving EE fund for commercial building owners;
- Provision of 30% of funds for upgrading energy efficiency of public hospitals as a pilot for EE financing of specific types of buildings. These funds would also include support for consultancy fees for energy audits and EE designs;
- Direct subsidies of 20% for the installation of renewable energy on commercial buildings that have ambitions of achieving status as a zero-energy building. This was commenced in early 2016.

85. Specific energy consumption (SEC) values for offices, hospitals, hotels and shopping centers were determined with the purpose of improving guidance to building owners and practitioners in Thailand on the extent of building energy efficiency requirements. Initial activities to determine SEC values for Thailand involved looking at SEC values for various buildings in other countries with similar climates (such as Malaysia). PEECB and DEDE personnel were then able to categorize buildings in

[45] This includes Kasikorn Bank, Siam Piwat Tower, CP Tower (Fortune Town), Architect Council of Thailand, EEC Academy, Stock Exchange of Thailand (SET) and SC Tower.

Thailand according to building types abroad used for determining their SEC values (which were offices, hospitals, hotels and shopping centers). Each of these building types were then modeled under the BESM to come up with an equation for SEC for the building type primarily based on building floor area and hours of usage. Studies on reviewing and possibly amending the existing BEC for office buildings are being conducted on "designated" office buildings using actual SEC profiles that have been generated using existing data and equations for SECs.

86. To continue the improvement and upkeep of BESM software, DEDE were undertaking efforts to strengthen SEC values for Thailand by comparing them with actual SEC profiles (as mentioned in Para 85) from existing "designated buildings" to determine an Energy Performance Indicator (EnPI) from the DEDE buildings database (see Para 15). Offices, hospitals, hotels and shopping centers were selected as designated building types as well as educational buildings. In early 2017, over 3,000 questionnaires were sent to select designated building owners and managers for specific energy information. More than 800 responses have been received to date. Out of these 800 questionnaires, funds from the September 2017 Project extension were being used to conduct analysis of 500 of these responses for determining actual SECs for each of these buildings and comparing it to the SEC determined by the equation described in Para 85. The EnPI can then be calculated as the SEC (kWh/year) provided by the designated building divided by the SEC of that building type determined by the equations mentioned in Para 85. As such, building owners as well as building design practitioners and DEDE personnel will have a reference against which to identify improvements to the energy performance of their own buildings. Designated building owners with an EnPI of more than 1.0 will have additional rationale to seek EE measures to reduce their EnPI value to less than 1.0.

87. Measurement and Verification (M&V) guidelines were prepared by the Project as a part of Output 2.2. M&V guidelines were prepared to provide guidance for building owners and operators to generate credible energy consumption data for the purposes of energy reporting as required by the BEC. M&V guidelines were prepared for lighting, air-conditioning, motors/pumps/fans, and hot water as a contribution to the energy efficiency promotion action plan. Over 20 buildings have referenced M&V guidelines in reporting their energy consumption and savings including the 12 demonstration buildings under Output 3.1.

88. Another product from Output 2.2 was the detailed database on locally available construction materials and energy efficiency equipment. The purpose and structure of the database was determined during 4 focus group meetings that solicited inputs from building operational staff, owners, building executives, and government officials. Categories within the energy efficient equipment database include construction material (833 items), lighting equipment (509 items), air conditioning (1,741 items), hot water equipment (157 items), solar PV (470 items), and solar thermal. The work on the database also included a guidebook for the administration of the EE Equipment Database.

89. Several of the delivered products from this component that were funded from PEECB resources were integrated into the 5-year (2017-21) and long term (2015-36) Energy Efficiency Plan of DEDE that includes developing energy efficiency in commercial buildings. These action plans include the continued development of the CBECD (see Para 82) and the updating of SEC values in commercial buildings (as mentioned in Paras 85-86).

90. In conclusion, the results of Outcome 2 can be rated **satisfactory** in consideration of the achievement of all outputs proposed, and the adoption of these policies towards the achievement of energy savings and GHG emission reduction targets of PEECB.

### 3.3.4 Component 3: EE Building Technologies and Applications Demonstrations

91. Component 3 was setup to implement visible demonstrations of the application of energy efficiency technologies and practices in commercial buildings. Within this component, 3 outcomes were expected:

- Outcome 3.1: Improved confidence in applying EE technologies and practices in commercial buildings in Thailand, which would be achieved utilizing Project resources to support implementation of operational demonstration projects in selected buildings (Output 3.1.1);
- Outcome 3.2: Improved local technical and managerial capacity to design, manage and maintain EE technologies and practices, which would be achieved utilizing Project resources to:
  - prepare documentation of demonstration projects and available EE technologies in the markets and dissemination of demo project results (Output 3.2.1); and
  - deliver training courses for personnel attached to the demo project (Output 3.2.2);
- Outcome 3.3: Replication of demonstration projects within the commercial building sector, which would be achieved utilizing Project resources to complete project documents and recommendations for EE project replication for the commercial building sector (Output 3.3.1).

A summary of the achievements of Component 3 with evaluation ratings is provided on Table 8.

92. Prior to the commencement of Component 3, Thailand lacked the presence of demonstration buildings that were fully invested into EE measures that could be used as a reference for other building owners and operators who are considering EE investments in commercial buildings. In addition, the absence of this type of demonstration building was a barrier to establishing benchmarks for commercial building energy efficiency that would inform and improve existing building energy performance standards as well as standards EE equipment being used to achieve energy efficiency.

93. Efforts of the Project to interest commercial buildings owners to work with PEECB in demonstrating energy efficiency measures in their buildings began in earnest in the early stages of the Project in 2014. This included:

- In 2014, the Project conducted a study on site selection for demonstration buildings initially identifying 7 commercial buildings in the categories of hotels, offices, hospitals, and hypermarkets[46]. Energy savings opportunities along with annual energy savings estimates were identified in these reports;
- By late 2015, 12 demonstration buildings were confirmed including hotels, retail stores, hospitals, schools, and office buildings. PEECB provided support for energy audits that include surveys of baseline energy consumption of these demonstration buildings, which revealed that 4 out of 11 buildings had already undertaken some of the energy efficiency measures planned. Several of these building owners have multiple properties and have shown interest in expanding

[46] This included Samrong General Hospital, Provincial Electricity Authority, Central World, Katinal Hotel in Phuket, TESCO Lotus, Ake Chon Hospital in Chonburi, and Chaweng Beach Resort & Spa on Samui Island.

**Table 8: Component 3 achievements against targets**

| Intended Outcome | Performance Indicator | Baseline | Target | Status of Target Achieved | Evaluation Comments | Rating[47] |
|---|---|---|---|---|---|---|
| **Outcome 3.1:** Improved confidence in applying EE technologies and practices in commercial buildings in Thailand | No. of commercial building owners/ managers expressing interests and commitments in implementing EE investments by EOP | 10 | 40 | *41* | -- | 5 |
| | No. of building EE projects that adopted EE measures and designs being demonstrated and promoted by EOP | 5 | 10 | *8* | See Para 94 | 5 |
| **Output 3.1.1:** Installed and operational demonstration projects in selected buildings | No. of demonstration project implemented and regularly monitored starting Year 2012 | 0 | 7 | *9* | See Para 95 | 6 |
| | No of completed M&V exercises in accordance with the M&V guideline updated by the PEECB Project | 0 | 7 | *9* | See Paras 95 and 97 | 6 |
| **Outcome 3.2:** Improved local technical and managerial capacity to design, manage and maintain EE technologies and practices | % of overall no. of demo building personnel that are gainfully employing learned skills on EE building design, operation and maintenance by Year 2015 | 0 | 70% | *92%* | See Para 97 | 6 |
| | No. of new buildings constructed that are partly or entirely based on the information regarding success of the demonstrations by EOP | 0 | 20 | *20* | See Paras 96, 97 | 5 |
| **Output 3.2.1:** Documentation of the demonstration projects and available EE technologies in the markets and dissemination of demo project results | % of overall no. of building practitioners that are aware of EE technologies/ techniques availableand applied in demo projects by Year 2015 | 0 | 70% | *100%* | See Para 96 | 6 |
| **Output 3.2.2:** Completed training courses for personnel attached to the demo project | % of overall no. of demo building personnel that are gainfully employing learned skills on EE building design, operation and maintenance by Year 2015 | 0 | 70% | 92% | See Para 97 | 6 |
| **Output 3.2.3:** Completed demonstration projects **on** building EE that adopted recommended EE policies for demonstration and promoted by EOP[48] | No. of building EE projects that adopted EE Policy on Energy Consumption Disclosure Program and promoted by EOP | | 5 | 2 | See Para 99 | 5 |
| | No. of EE building EE projects that adopted EE Policy on Specific Energy Consumption and promoted by EOP | | 50 | 22 | See Para 99 | 5 |
| **Outcome 3.3:** Replication of demonstration projects within the commercial | No. of new EE building projects designed based on,or influenced by, the results of the demonstration projects by EOP | 0 | 20 | *22* | See Para 98 | 6 |

[47] Ibid 31

[48] This output and its indicators were added to the PPM in September 2017 for the Project Extension.

| Intended Outcome | Performance Indicator | Baseline | Target | Status of Target Achieved | Evaluation Comments | Rating[47] |
|---|---|---|---|---|---|---|
| building sector | | | | | | |
| **Outcome 3.3.1:** Completed project documents and recommendations for EE project replication for the commercial building sector | No. of identified proven and feasible EE technologies and techniques that are applicable and applied in the Thai commercial building sector by EOP | 0 | 5 | *5* | See Para 98 | 5 |
| **Overall Rating – Component 3** | | | | | | **5** |

EE measures. Some of the demonstration building owners also have clear corporate policies on energy efficiency, establishing them as excellent partners to disseminate energy efficiency information to the sector and the country in general[49];

- The confirmation of the 12 demonstration buildings with baseline energy surveys served as a basis for commencing the preparation of M&V guidelines by PEECB (one of the products of Output 2.2).

94. Currently, 8 out of the 12 of the demonstration buildings had completed their EE investments, the details of which are found on Table 4. Most of these measures were completely installed by early 2017. The 4 demonstration buildings that had not yet made substantial EE investments were delayed for various reasons ranging from resource availability to ownership changes of the buildings. The understanding of the Evaluation Team is that the owners of these buildings are still planning to make these EE investments.

95. Nine of the demos have resulted in improved energy efficiency of 8 completed demo buildings and one demo building that still does not have all EE measures installed[50]. EE measures mainly focused on the replacement of high energy consuming equipment with EE equipment such as chillers, air-conditioning systems, LEDs, split type air-conditioners, and heat pumps. The estimated value of these investments was USD 2.159 million (see Table 3 for details). Selection of EE measures by these building owners required adoption of these measures that would be suitable to the building designs. All these building operators completed M&V exercises using M&V protocol guidebooks developed by the Project, to measure their energy savings.

96. As a part of Outcome 3.2, monitoring energy savings and GHG emission reductions from EE measures in the demonstration buildings was commenced in late 2016. This was undertaken with PEECB technical assistance and financial support of the ENCON Fund. With the information disseminated on the energy savings of these demonstrations, a 2017 PEECB survey indicated increasing interest amongst 100 commercial building managers and practitioners to committing to EE investments. More than 50% of those surveyed were decision-making managers.

97. The completion of demonstration EE measures by mid-2016 has resulted in a substantial increase in the number of building personnel gainfully employed with new skills on EE that were acquired through PEECB training programmes[51]. Many of these personnel were also involved with the collection of energy-related data from these buildings which was then analysed and reviewed by PEECB consultants and DEDE for improving the BESM, and providing inputs into the M&V guidelines for 4 systems of lighting, motor/pump/fan, air-conditioning, and hot water (Output 2.2).

98. By mid-2016, 22 new building projects and 2 retrofit building projects were referenced in the BEC Database as being influenced by the technologies in the demonstration buildings; 9 of these buildings

[49] This includes the owner of CP Tower and the Grand Mercure Hotel who considers EE as an important corporate management policy, and Kasikorn Bank who includes RE and EE as a part of its policies on social and environmental responsibilities. Saint Gabriel College also has influence financially and politically over other schools under supervision of Catholic Church in Thailand. The project can leverage the interest of the Church to attract more stakeholders to invest in building energy efficiency.

[50] The Chaweng Garden Beach Resort is monitoring its energy savings from EE measures installed; however, they still have not completed all their planned EE measures.

[51] As mentioned by DEDE and evidenced in meetings with demonstration building managers and operators as well as attendees at the BESM training course visited during the evaluation mission.

have improved their EE through implementing consultant recommendations on the installation of EE technologies (i.e. magnetic bearing chillers, solar PV air-conditioning system, LED, heat pump and solar hot water) with the other 3 buildings making EE modifications to their existing technologies. For the implementation of this activity, ENSOP has pushed the effort to promote the buildings. The EE successes of the 12 demonstration buildings have been disseminated through the PEECB website[52].

99. Using surplus funds made available in September 2017 (see Paras 40 and 51), the PEECB extension phase included an initiative to increase the profile of demonstration buildings that participated on DEDE's "Building Energy Consumption Disclosure Programme", which was designed to extensively survey energy consumption information from successfully demonstrated PEECB demo EE buildings; this includes 2 selected demo buildings, the EEC Academy Building and the Stock Exchange of Thailand. In addition, these surplus funds supported the survey of energy consumption for 50 BEC-compliant "designated" buildings (see Para 15 for designated buildings description) that includes 5 major building categories (office, hotel, hospital, education, department store) for reviewing EnPI values (as described in Para 86).

100. In conclusion, the results of Outcome 3 can be rated **satisfactory** with the Project achieving most of its intended targets.

### 3.3.5 Relevance

101. The PEECB Project is **relevant** to the development priorities of Thailand, namely its National Economic and Social Development Plans issued by the National Economic and Social Development Board under the Office of the Prime Minister:

- The 11th National Economic and Social Development Plans (2012-16)[53] under "Development Guidelines" states under Section 5.2.3 to "develop environmentally friendly cities with emphasis on integrated urban planning having cultural, social and ecological aspects" that includes compact urban designs where areas are used creatively with emphasis on the expansion of green spaces and increased energy efficiency;
- The 12th National Economic and Social Development Plans (2017-21)[54] under "development Guidelines" makes special mention of the BEC under Section 3.4.1 that applies to "increasing efforts increasing efforts in enforcing laws and regulations regarding energy conservation and energy efficiency, especially the enforcement of the Building Energy Code (BEC) for new buildings and the Energy Efficiency Resources Standard (EERS) for energy producers and distributors.

### 3.3.6 Effectiveness and Efficiency

102. The effectiveness of the PEECB Project has been **highly satisfactory** in consideration of:

- The high rate of satisfaction amongst non-technical participants at PEECB seminars and workshops on the usefulness of these seminars towards understanding energy efficiency in buildings;

[52] http://dede-peecb.bright-ce.com/Demonstration%20Buildings/fortune.html
[53] http://www.nesdb.go.th/nesdb_en/ewt_dl_link.php?nid=3786
[54] http://www.nesdb.go.th/nesdb_en/ewt_w3c/ewt_dl_link.php?nid=4345

- High rate of satisfaction amongst technical participants at PEECB workshops on energy efficiency measures applied to commercial buildings and the use of the BESM tool for designing these measures and understanding life cycle analyses of EE investments;
- The high rate of utility of PEECB outputs that promote and support implementation of EE measures for commercial buildings in Thailand including financial support mechanisms (such as step BEC, revolving fund and financial support were specific building types), Commercial Building Energy Consumption Disclosure programme, updating of SEC values for commercial buildings, and M&V guidelines. Usage of these outputs by commercial building stakeholders appears to be very high, and has provided this subsector with accelerators towards energy consumption reductions targeted by the EEDP;
- Implemented energy efficiency measures and technologies with demonstrated energy savings and GHG emission reductions for over 9 prominent designated buildings in Bangkok, where the owners of these buildings have willingly shared information on the energy savings in the Commercial Building Energy Consumption Disclosure Programme with public and commercial building stakeholders.

103. The efficiency of the PEECB Project has been rated as **satisfactory** in consideration of:

- PEECB realizing more than 95% of its targets as set in its PPM by September 2017, prior to the Project extension and within a 4.83-year period of implementation, and within the original expenditures envisaged in the ProDoc[55];
- The use of surplus funds (~US$500,000) during the Project extension (to 30 April 2018) to meet revised and more ambitious targets in a new PPM (see Appendix G);
- The Project being implemented without noticeable delays despite external factors which substantially raised the risk of delays (further described in Para 40). The Project, unfortunately, was not able to be implemented within the 39-month period as per the ProDoc;
- The drivenness of DEDE to ensure the success of the PEECB Project towards increasing compliance of commercial buildings to new energy efficiency standards that would contribute towards energy intensity goals of the EEDP (see Para 126).

### 3.3.7 Country Ownership and Drivenness

104. The drivenness of the Government of Thailand to achieve energy efficiency in its building stock is reflected of its Energy Efficiency Development Plan (2015-2036) under the Energy Policy and Planning Office of the Ministry of Energy[56]. In Section 3.1 of this Plan, 6 guidelines were to be developed to encourage energy conservation including the Building Energy Code. Table 3.1 in the EEDP provides energy savings targets for various building categories under the various measures that involved PEECB assistance in their strengthening including SEC, BEC, and HEPS/MEPS. Table 3.2 in the EEDP provides energy savings targets for these measures at 5-year intervals from 2016 to 2036.

105. Strong country ownership of PEECB has been demonstrated by the executing agency, DEDE, and the actions of their personnel in managing PEECB activities. During extensive interviews with personnel from the Bureaus of Energy Regulation and Conservation, Energy Efficiency Promotion, and Human Resource Development, all personnel stated that the PEECB Project was viewed as a resource

[55] Although the project was designed to be implemented during a 4-year period, 6 months were lost to awaiting Cabinet approval of the PEECB Project document, and the recruitment of BMC through the Government of Thailand's public procurement process.
[56] https://www.egat.co.th/en/images/about-egat/PDP2015_Eng.pdf

designed to enhance the abilities of its personnel to increase compliance to its energy conservation standards for buildings, and to the BEC for new buildings. This viewpoint is refreshing given that the NEX modality of PEECB was not viewed as a burden to their personnel. This viewpoint was facilitated by DEDE's hiring of Bright Management Consultants to undertake many of the GEF reporting functions.

### 3.3.8 Mainstreaming

106. The PEECB Project has mainstreamed climate change goals of the 2012-16 UNPAF[57], specifically:

- Outcome 2: Energy, industry and transport sector progressively contribute to the development of a low carbon and green economy; and
- Outcome 3: Harmonized information and knowledge system built and partnerships established among line ministries, department and other stakeholders (including neighbouring countries) for informed decision making.

107. The PEECB Project is also mainstreamed with the updated UNPAF of 2017-21[58], specifically:

- Outcome Strategy 1: Collaborate at national and sub-national levels to strengthen systems, structures and processes for effective, inclusive, and sustainable policymaking and implementation. This includes harmonizing Thailand's solid base of national policies and regulatory frameworks with international standards for consistent and effective implementation, and convergence between international obligations and domestic actions, policy coherence, capacity-building, public participation and multi-stakeholder engagement;
- Outcome Strategy 3: Collaborate at national and sub-national levels to build systems, structures and processes that recognise and engage the private sector as a collaborator in national development. This includes the Project continuing to collaborate with the private sector to address a wide spectrum of issues, such as environmental pollution, climate change, and providing direct advice and support to private sector enterprises in adopting and implementing more responsible, inclusive and sustainable business and investment practices.; and
- Outcome Strategy 4: Collaborate at national and sub-national levels to build systems, structures and processes that expand the methodical exchange of expertise and technology available regionally/globally to support social, political and economic development. With the predominance of Thailand's Sufficiency Economy Philosophy practiced as a key approach to achieving the Sustainable Development Goals, the Project's activities only encourage this approach.

108. PEECB appears to have mainstreamed gender in its activities where the participation of both men and women appears balanced. During the mission, the TE team had interviewed several women who served in prominent positions. This includes women in lead roles in the development of training curricula for the BESM, External Experts Focus Group Meeting (comprising 32% women), and a few women in managerial positions (such as at CP Tower) for building operations.

[57] https://www.unicef.org/spanish/about/execboard/files/Thailand-THA_UNPAF_2012-2016_27_April_2011-Final.pdf

[58] https://www.google.ca/url?sa=t&rct=j&q=&esrc=s&source=web&cd=4&cad=rja&uact=8&ved=0ahUKEwiQl7KfmdHaAhUD34MKHZgqCP0QFgg5MAM&url=https%3A%2F%2Fims.undg.org%2FdownloadFile%2Fef7ff9f4af69bef50f4f91886258b1896fd0e553a3b3f084473da718d58a3002&usg=AOvVaw1gRYpubJToeZll3bh8mlec

### 3.3.9 Sustainability of Project Outcomes

109. In assessing sustainability of the PEECB Project, the evaluators asked "how likely will the Project outcomes be sustained beyond Project termination?" Sustainability of these objectives was evaluated in the dimensions of financial resources, socio-political risks, institutional framework and governance, and environmental factors, using a simple ranking scheme:

- *4 = Likely (L):* negligible risks to sustainability;
- *3 = Moderately Likely (ML):* moderate risks to sustainability;
- *2 = Moderately Unlikely (MU):* significant risks to sustainability; and
- *1 = Unlikely (U):* severe risks to sustainability; and
- *U/A = unable to assess*.

Overall rating is equivalent to the lowest sustainability ranking score of the 4 dimensions.

110. *The overall PEECB Project sustainability rating is (ML).* This is primarily due to:

- DEDE has stated that the seminars and courses would be conducted in future on a cost recovery basis, unlike previous seminars which were offered for free under PEECB. The impact of this decision if carried through is unknown, and may decrease attendance of building owners with less fiscal resources;
- Stakeholders who participated in PEECB seminars and those participating on the Commercial Building Energy Disclosure Programme are primarily aware of the fiscal benefits of energy efficiency for commercial buildings. However, there appears to be less awareness of environmental benefits of EECBs including GHG emission reductions which slightly increases sustainability risks;
- The risk of less fiscal resource availability to smaller commercial building owners to implement EE measures and technologies. By comparison, many of the large commercial building owners do have fiscal resources to invest in EE for their building assets.

Details of sustainability ratings for the PEECB Project are provided on Table 9.

### 3.3.10 Impacts

111. The Project has made significant impacts within the engineering and architectural professions as well as with building developers in Thailand. In a business-as-usual scenario, it is highly probable that fewer commercial building owners as well as their engineers and architects would consider energy efficiency investments into new building designs and existing buildings. Moreover, there would not be a high level of awareness of these stakeholders on the benefits of energy efficiency in commercial buildings, and a smaller volume of energy efficiency investments in commercial buildings. The main impact of the PEECB Project has been a higher compliance of large buildings (whose total installed capacity of transformers is >1,175 kVA, and annual energy consumption >20 million MJ) to the 2009 BEC, and the generation of tangible energy savings from 9 demonstration buildings implemented with the technical assistance of the PEECB Project. Achievement of these impacts was possible through the creation of an enabling regulatory environment and increased knowledge of building owners, managers and operators as well as DEDE and other government personnel on best international practices for designing and implementing energy efficiency measures and technologies for commercial buildings.

112. However, from a national and global perspective, the impact of the PEECB Project has been small in the context of actual GHG emission reductions from the entire commercial building sector in Thailand. Based on the information in Para 15 that there are more than 2.7 million small commercial buildings and the focus of PEECB on the 2,900 "designated buildings", around 0.1% of all buildings in Thailand will have been influenced by this Project. The challenge for the Government of Thailand after PEECB is to facilitate scale up EE investments not just in the other 2.0 million plus commercial buildings commercial buildings in Thailand, but also for residential and industrial buildings. This may include other financial incentives that are currently not prominent in Thailand such as VER schemes under the oversight management of the Thailand Greenhouse Gas Organization (TGO)[59].

[59] Interviews with TGO indicate they are currently under-resourced and unable to effectively raise awareness of VERs to promote the use of this mechanism as an incentive to encourage energy efficiency investments.

**Table 9: Assessment of Sustainability of Outcomes**

| Actual Outcomes (as of March 2018) | Assessment of Sustainability | Dimensions of Sustainability |
|---|---|---|
| **Actual Outcome 1**: There is enhanced awareness amongst government, building owners and operators, and the financial sector in Thailand of energy efficient technologies and practices that can be applied to commercial buildings, resulting in 20 EE investment projects facilitated through business links. | • *Financial Resources:* At the time of the TE, financial resources from the Government of Thailand were being availed for the purposes of continuing EECB seminars for nontechnical and technical stakeholders. DEDE has stated that the seminars and courses would be conducted in future on a cost recovery basis, unlike previous seminars which were offered for free under PEECB. The impact of payment for the seminars on building sector personnel is unknown, and may reduce attendance of building owners with less fiscal resources;<br>• *Socio-Political Risks:* The Government of Thailand is strongly committed to meeting its goals and targets of the EEDP (2015 to 2036), and is supportive of the EECB seminars. Commercial building stakeholders ranging from government agencies from central and municipal levels to building management and operational personnel to building engineering practitioners are all supportive and have expressed their need to attend these seminars;<br>• *Institutional Framework and Governance*: The policies of the Ministry of Energy, much of which is encapsulated within their EEDP, has been strengthened to the extent that stakeholders are aware of SEC standards for existing buildings as well as BEC requirements for new building. These policies as well as DEDE efforts to continually improve the SEC standards for several categories of buildings only serves to improve public confidence of government standards set for energy efficiency in buildings in Thailand;<br>• *Environmental Factors:* Stakeholders who participated in the EECB seminars are primarily aware of the fiscal benefits of energy efficiency for commercial buildings, and secondarily, environmental benefits involving GHG emission reductions. However, more effort is required to ensure that building owners who are participating on the Energy Disclosure Programme can better understand these environmental benefits.<br>***Overall Rating*** | 3<br>4<br>4<br>3<br>**3** |
| **Actual Outcome 2**: Policies that encourage and support energy efficiency in commercial buildings have resulted in an increase in BEC compliance amongst building owners from 20% to 66%. | • *Financial Resources:* The Ministry of Energy have sufficient budget allocated for the continued strengthening of building energy efficiency standards. This includes continued analysis of energy information from 3,000 designated buildings after the EOP which will be used to increase energy consumption datasets for specific building categories, and improve the SEC values of these buildings;<br>• *Socio-Political Risks:* With ongoing work with the Energy Disclosure Programme and the EnPI, the intention of the Ministry of Energy is to have mandatory policies and standards on specific energy consumption values of buildings within a few years | 4<br>4 |

**Table 9: Assessment of Sustainability of Outcomes**

| Actual Outcomes (as of March 2018) | Assessment of Sustainability | Dimensions of Sustainability |
|---|---|---|
| | following a period of voluntary compliance and research into improving the confidence level of SEC values for specific categories of buildings;<br>• *Institutional Framework and Governance:* The Ministry of Energy have ongoing programmes for the continued strengthening of building energy efficiency standards. This includes continued analysis of energy information from 3,000 designated buildings which will be used to increase energy consumption datasets for specific building categories, and improve the SEC values of these buildings. The enforcement of these policies and standards, however, may be challenging considering the small number of DEDE personnel currently dedicated to promoting and enforcing the BEC and SEC standards;<br>• *Environmental Factors:* Policies and standards that were strengthened under PEECB only serve to reduce energy consumption of buildings and related GHG emissions.<br>***Overall Rating*** | 3<br>4<br>**3** |
| **Actual Outcome 3.1**: Increased confidence of commercial building owners and operators in the application of EE technologies and practices to their building assets based on the completion of energy efficiency investments made in 8 demonstration commercial buildings, and the collection of data from 9 demonstration buildings on energy savings from these investments. | • *Financial Resources:* Many of the large commercial building owners have fiscal resources to invest in EE for their building assets. However, the extent of fiscal resource availability to smaller commercial building owners is not known, and will depend on the extent to which the revolving fund is utilized to finance their EE technologies and measures;<br>• *Socio-Political Risks:* Energy efficiency appears to be widely accepted amongst all building owners, managers, and operators;<br>• *Institutional Framework and Governance:* DEDE is providing the necessary policies and standards that informs building owners, managers and operators of the required works and investments to meet compliance;<br>• *Environmental Factors:* Building owners and operators understand that EE compliance will also convert to energy savings and reduced cost of operations which in turn results in positive environmental benefits.<br>***Overall Rating*** | 3<br>4<br>4<br>4<br>**3** |
| **Actual Outcome 3.2**: The capacities of local technical and managerial staff in commercial buildings to design, manage and maintain EE technologies and practices has improved for the more than 300 persons who participated in PEECB seminars and workshops on EECBs. | • *Financial Resources:* DEDE have mentioned that financial resources are budgeted for the continuation of training courses for energy efficiency for commercial buildings. They have also mentioned that building owners, operators and practitioners will also be asked to pay for their attendance at these courses in future. The impact on the level of attendance by commercial building stakeholders would not likely be impacted considering that building SECs and the BEC will be mandatory in a few years; | 4 |

**Table 9: Assessment of Sustainability of Outcomes**

| Actual Outcomes (as of March 2018) | Assessment of Sustainability | Dimensions of Sustainability |
|---|---|---|
| | • *Socio-Political Risks*: Building owners will need to comply with future SEC standards, forcing building owners to comply with these new standards. In addition, building owners in general appear to have strong agreement with these new standards and are in general not opposed to them;<br>• *Institutional Framework and Governance:* Buildings will need to comply with future mandatory SEC standards. DEDE, however, will need to have a replication or scale-up plan as well as improve its institutional capacity or the capacity of their partners to enforce and promote building energy efficiency to new building owners as well as owners of existing buildings;<br>• *Environmental Factors:* Knowledge of environmental issues of building owners and operators on environmental benefits to energy efficiency in buildings can be improved.<br>***Overall Rating*** | 4<br>3<br>3<br>**3** |
| **Actual Outcome 3.3**: Replication of EECB demonstration projects within the commercial building sector has been achieved to the extent that the Project target of 20 EE buildings have been designed or influenced by PEECB demonstrations. | • *Financial Resources:* Many of the large commercial building owners have fiscal resources to invest in EE for their building assets. However, the extent of fiscal resource availability to smaller commercial building owners is not known, and will depend on the extent to which the revolving fund is utilized to finance their EE technologies and measures;<br>• *Socio-Political Risks:* Energy efficiency appears to be widely accepted amongst all building owners, managers, and operators;<br>• *Institutional Framework and Governance:* DEDE is providing the necessary policies and standards that informs building owners, managers and operators of the required works and investments to meet compliance. DEDE, however, will need to have a replication or scale-up plan as well as improve its institutional capacity or the capacity of their partners to enforce and promote building energy efficiency to new building owners as well as owners of existing buildings;<br>• *Environmental Factors:* Building owners and operators understand that EE compliance will also convert to energy savings and reduced cost of operations which in turn results in positive environmental benefits.<br>***Overall Rating*** | 3<br>4<br>4<br>4<br>**3** |
| | ***Overall Rating of Project Sustainability:*** | **3** |

# 4. CONCLUSIONS, RECOMMENDATIONS AND LESSONS

113. Resources from the PEECB Project have contributed to the achievement of the GHG emission reduction goal and the PEECB Project objective. The Project has delivered numerous outputs and useful outcomes designed to encourage investment commercial building owners into energy efficiency measures and technologies. This includes:

- raised awareness of EE in commercial buildings by targeting "designated buildings" in Bangkok, which consumes the bulk of energy consumption in commercial buildings through activities implemented under Component 1;
- providing tools for building owners, operators and technical personnel to design EE measures for new and existing commercial buildings that comply with the BEC by developing user-friendly software, the BESM, from resources under Component 1;
- strengthening and implementing policy measures to encourage EE investments in commercial buildings including a draft policy for EE procurement for the public sector, financial assistance to building owners (such as STEP-BEC program, financial support for a specific building types, and the revolving fund) using resources from Component 2;
- continuous improvement of energy efficiency standards for commercial buildings. This includes improving SEC values for various building categories and building types through the Building Energy Consumption Disclosure Program, and ongoing data collection for building energy use profiles for determining EnPIs (from Specific Energy Consumption levels) of various buildings types. These EnPIs can be used as guidance (prior to mandatory reporting) for building owners on extent of EE compliance required;
- providing M&V protocols (based on best international practices) but adapted to Thailand as a standardized means of determining energy savings for equipment common in many commercial buildings;
- providing energy efficiency equipment databases for common commercial building equipment available in Thailand complete with specifications relevant to energy savings; and
- the completion of demonstration of the cost-effective application of energy efficiency measures and technologies in selected commercial buildings in Bangkok where documented energy savings has been disseminated amongst building owners, managers and operators as well as the engineering and architectural professions in Thailand.

114. In consideration of achieving all the intended outcomes and the aforementioned outputs using a US$3.637 million GEF allocation and within a period of 5.45 years, the evaluation views the overall rating of the PEECB Project as **satisfactory**. Notwithstanding, the Project has had an impact on 2,900 high energy consuming "designated buildings", out of a total of more than 2.7 million commercial buildings in Thailand, roughly 0.1% of all commercial buildings in Thailand as mentioned in Para 112. The challenge for the Government of Thailand after the conclusion of PEECB is to scale-up current activities initiated by PEECB to encourage energy efficiency for the remainder of Thailand's building stock including commercial, residential, public and industrial buildings. While the policies and standards for energy efficient buildings apply to all buildings, the approaches to encouraging EE in other sectors will be different, notably for the residential sector which may be the most challenging building sector in consideration of the patterns of energy use for various residential facilities, and the design of incentives that would be effective in catalyzing investments. The Evaluation Team is not aware of any such scale-up plan in Thailand.

115. The other challenge facing DEDE is the measurement of actual GHG emission reductions from existing buildings. While the PEECB Project produced M&V guidelines for existing building operators to measure and verify energy consumption of their buildings using best practices, there remain numerous building operators, engineers and consultants whose capacities will need to be strengthened to prepare mandatory energy consumption reports for thousands of other buildings in Thailand. Conversely, DEDE will require more personnel and collaborators at the municipal level to prepare these reports that are based energy consumption reports of the 717+ new buildings to BEC that used new tools (BESM), financial incentives (revolving fund, BEC subsidy) to submit and implement a BEC-compliant design, and those that are being monitored for energy consumption to determine EnPIs.

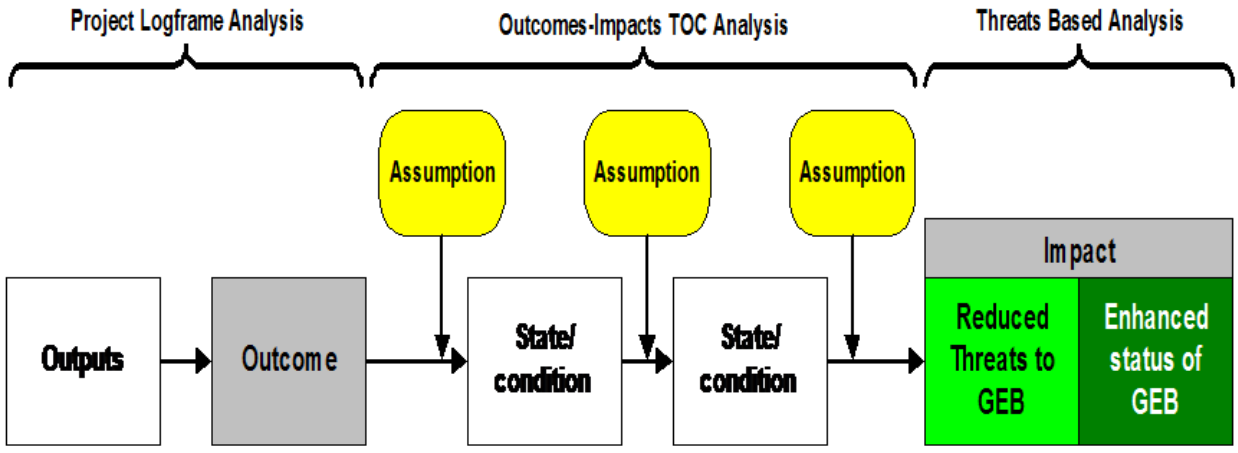
## 4.1 Corrective actions for the design, implementation, monitoring and evaluation of the project

116. *Action 1 (to UNDP and GEF): Strengthen the preparation of a Project Planning Matrix (PPM) utilizing a Theory of Change (ToC) analysis and a Review of Outcomes to Impacts (ROtI) to increase the likelihood that project outcomes will result in the desired impacts.* Notwithstanding that the PEECB Project was well executed resulting in the desired outcomes, this recommendation is provided on the basis of comments on the PPM made in Para 25. This recommendation is addressed to future designers of GEF projects on the importance of a well-prepared PPM that is clear to the implementers of the Project of the pathways to development progress, has minimized the number of indicators for monitoring, and provides the highest likelihood that the project's causal pathways lead to intended project impacts. This recommendation requests project designers during preparation stages of a project, to ensure the activities of the project have clear linkages to global benefits (in the case of PEECB, a linkage to GHG emission reductions) through a ToC analysis. A draft PPM should be prepared and reviewed through an iterative ROtI process which forces the designer to review how the project will reach the desired impacts from the designed project outcomes. Project designers should review the pathways to achieve a desired impact from a baseline scenario to a desired impact with causal pathways consisting of project outputs, project outcomes, and intermediate states leading to the desired impacts (this can and should be done with the input of project beneficiaries and other relevant stakeholders). A Theory of Change diagram should then be prepared illustrating the linkages or causal pathways leading from the baseline to outputs, outcomes intermediate state and the intended impacts. With an acceptable development (causal) pathway from outcomes to impacts, the designers should then review the PPM to ensure it reflects pathway to desired impacts. In the context of PEECB, a ToC approach may need to closely the following:

- the baseline scenario and identification of barriers to energy efficiency in commercial buildings;
- drivers of change that includes government policies and stakeholder needs (better knowledge of EE and lack of user-friendly compliance tools);
- assumptions for the design project intervention to succeed and for the project to achieve its long-term outcomes and sustainability (sustained economic health of the commercial sector, etc.);
- project stakeholders and their linkages to relevant project activities and outputs; and
- examination of activities of each project component to achieve their intended outcomes.

Figure 3 provides a generic ToC flowchart.

**Figure 3: Generic Theory of Change Diagram[48]**




## 4.2 Actions to follow up or reinforce initial benefits from the project

117. *Action 2 (to UNDP and DEDE): Continue strengthening collaborations with targeted partners, notably at the municipal level, to increase the profile of PEECB outputs.* Strengthened collaboration with including the Bangkok Metropolitan Authority (BMA), and the Engineers and Architects of Thailand (EAT). BMA, EAT and other municipal-level partners can be leveraged to increase the familiarity, utility and eventual enforcement (through issuance of building permits) of these outputs amongst a wider spectrum of beneficiary stakeholders:

- additional exposure of BEC and the efforts of DEDE on determination of EnPI values to these partners through workshops and seminars that will increase their confidence in SEC values for various building categories;
- M&V guidelines developed under PEECB could be expanded or updated for new equipment with contributions from other stakeholders for use by these partners. This could also include M&V guidelines linked and harmonized with MRV protocols being developed under ONEP.

118. *Action 3 (to UNDP and DEDE): Raise the prominence of the commercial building energy consumption disclosure (CBECD) programme to building owners (both owners who are participating and those who are not) and building tenants*. Para 110 mentions the need for sustained awareness raising amongst building owners of the environmental reasons for energy efficiency in buildings. The increased exposure of the CBECD (as mentioned in Para 82) through various media and environmental campaigns, will increase the awareness of participating building disclosure owners on the environmental reasons for disclosing their energy consumption that includes climate change mitigation, reduced imported fuels, and encouragement to other building owners to follow their specific example of implementing EE measures.

[48] Reproduced from April 2009 GEF Presentation by Todd and Risby, accessible on: https://www.google.ca/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=0ahUKEwiOz7Wfk-DYAhUF62MKHV6UCsQQFggnMAA&url=http%3A%2F%2Fwww.3ieimpact.org%2Fmedia%2Ffiler%2F2013%2F02%2F25%2F13_1_gef_eo_cairo_presentation_final.ppt&usg=AOvVaw3rP1GHRIb0YW2cABRZ8D0g

119. *Action 4 (to DEDE): Continue the best practice (as elaborated in Para 126) of implementing continual improvements in the energy performance of commercial buildings through ongoing policy improvements.* This would include continued support for:

- the ongoing STEP-BEC programme to incentivize building owners to maximize energy savings;
- analysing reports from over 3,000 designated buildings for baseline energy use, all of which are designed to determine EnPIs for various building categories, and to upgrade SEC values to be specified under a new Ministerial Regulation;
- continued consultations with the Comptroller's Office (Ministry of Finance) to develop a concrete proposal for e-Procurement for the public sector noting that the Comptroller's Office is familiar with life-cycle analysis of equipment. The next opportunity for these consultations is at the concluding PB meeting for PEECB sometime during the second quarter of 2018.

## 4.3 Proposals for future directions underlining main objectives

120. In proposing future directions of the Project, the following recommendations are suggestions taken from various stakeholders on increasing efforts to lower the carbon footprint of the commercial buildings sector in Thailand. The Evaluation Team understands that some of these recommendations may already be implemented by DEDE. The Team also understands that future course of actions by DEDE to promote energy efficiency in commercial buildings as well as other building categories will be strategic in the context of the most effective course of action to undertake and heavily reliant on the resources available to undertake certain recommendations.

121. *Action 5 (to DEDE): Raise profile of energy efficiency in commercial buildings by developing a pilot "smart city zoning scheme" under a GEF-7 Sustainable Cities project*. This can be done in close collaboration with the Bangkok Metropolitan Authority (BMA) to be located within a high density area (such as in the CBD or the Rama IV area). This recommendation is consistent with one vision and 2 objectives of the BMA's "Bangkok Comprehensive Plan 2013"[49] including Vision #5 of "a healthy metropolis that promote conservation of natural environment, Objective #10 on "conserving environment and natural resources by promoting conservation, maintenance and restoration", Objective #12 on "promoting solution against global warming by expanding green areas in order to reduce greenhouse gases", and Case #5 that "encourages a green building construction concept". Elements of this pilot scheme would include:

- promoting the development and implementing energy efficiency and renewable energy measures and other low carbon measures for various building types (i.e. shopping centers, public buildings) within the designated zone;
- integration of building databases of DEDE and BMA that would streamline approvals for BEC-compliant buildings as well as enforcement of energy conservation standards in designated buildings;
- streamlining reporting from building managers on compliance to energy conservation standards through the development of an on-line system for reporting. Such a system would reduce errors and encourage building owners to submit these reports which would add to the existing building databases;
- M&V for buildings in a smart zone and using this information to determine their EnPIs and improving their SEC values;

[49] http://cpd.bangkok.go.th:90/web2/NEWCPD2556/The%20Bangkok%20Comprehensive%20Plan%202013_a4_pdf.pdf

- programme to strengthen and expand building inspectors pool in BMA that will improve their ability to inspect EE performance in buildings to comply with BEC and existing energy conservation standards, and their knowledge on tools (such as BESM and M&V guidelines) to execute their enforcement duties; and
- formulation of laws and regulations relevant to smart or green city development in the pilot area followed by the joint issuance of these laws and regulations by DEDE and BMA.

122. *Action 6 (to DEDE): Strengthen linkages between TGO and demo buildings with an aim to scaling-up energy efficiency investments in buildings and incentivizing building owners to invest in energy efficiency through the generation and sale of Voluntary Emission Reductions (VERs)*. As a follow-up to Para 112, this would require:

- raising awareness of EECB owners through conducting seminars and workshops to present proposals and mechanisms from which VERs can be generated from energy efficiency investments in buildings (that can be commercial, residential, public or industrial) and sold to various clients in Thailand or abroad;
- the use of MRV protocols specific to energy efficiency in buildings and linked to the Step-BEC programme to provide consistent and confident estimates of GHG emission reductions from EE measures in these buildings;
- formalizing reporting protocols between demo buildings, ONEP, DEDE and TGO. This may involve the integration of building databases of DEDE and BMA as mentioned in *Action 5*;
- ensuring there is sufficient technical consulting capacity to support the needs of building owners to prepare GHG emission reduction reports consistent with approved MRV protocols.

123. *Action 7 (to DEDE): Expand an energy efficiency programme for all buildings leveraging the leadership provided by owners of the demonstration commercial buildings.* This would include:

- efforts by DEDE to encourage owners of demo buildings in Bangkok who have commercial building assets in other cities to undertake a leadership role for EECBs in other cities. This may involve a closer working relationship with these building owners (possibly through the Building Disclosure Programme) and encouraging them to share their experiences on implementing EE measures on their other buildings with other building owners in Thailand;
- DEDE promotion of EE in buildings in other secondary cities in Thailand by sector including the hotel sector which could sell “green rooms” through a hotel association;
- DEDE promotion of EE in public and residential buildings, with an initial focus within the boundaries of a pilot smart city (see Action 5). Promotion of EE investments in residential buildings is expected to be more difficult due to the difficulties of demonstrating clear savings on energy costs that can help residents decide on such an investment;
- Encouragement of retrofits with incentives of VERs or CERs (see Action 6).

124. *Action 8 (to UNDP): Provide more exposure of the PEECB Project to other UNDP-GEF projects in energy efficiency in buildings*. As mentioned in Para 37, there is a lack of exposure of the PEECB Project globally. The PEECB Project is providing numerous examples of progressive work in approaches to achieving energy efficiency to the buildings sector that should be shared with other similar projects such as in Malaysia, India, Turkey and Egypt with similar climatic conditions. Conversely, the knowledge sharing of other projects can be beneficial to DEDE on its subsequent projects in energy

efficiency, especially if these projects involve successful examples of energy efficiency in the industrial and residential building sub-sectors.

## 4.4 Best and worst practices in addressing issues relating to relevance, performance and success

125. *Best practice 1: Effectiveness of a project design can be maximized with the full participation of the beneficiary agency during the design phase*. During the design phase of PEECB, DEDE was fully involved with inputs into the PEECB design with the intent of improving the ability of DEDE to manage its work activities towards the promotion, support, and strengthening of efforts to improve the adoption of energy efficient practices (amongst other mandates) to reduce the importation of energy into Thailand. As a result of their strong participation in the design phase of PEECB, activities of PEECB have been fully embraced by DEDE personnel who view the activities of the Project as highly beneficial to DEDE in meeting its mandate of "creating sustainability of alternative energy and energy efficiency of the country, in order to boost efficiency energy production and consumption". The impacts of this strong ownership have been:

- the PEECB design providing support to missing links to effective policy implementation (such as the user-friendly BESM, more coordinated and focused approach to knowledge transfers, demo buildings);
- DEDE engagement in Project design, implementation and adaptive management that resulted in an appropriate mix of stakeholders for working groups and frequent meetings with project manager;
- adoption of PEECB outputs into DEDE's systems during and beyond the project, enhancing sustainability of the results of the Project beyond the EOP.

126. *Best practice 2: The policy tools setup and used during PEECB are an excellent example of how a public agency can boost public confidence in setting up an enabling regulatory environment that assists building owners in improving their compliance with the BEC and provides for continual improvement in the determination of SEC values for commercial buildings in Thailand* (as mentioned in Para 113). In light of the small sample size of SEC values for commercial buildings in Thailand, PEECB and DEDE have made efforts to improve BEC compliance and increase the sample size and data collection of commercial building energy consumption through:

- the Commercial Building Energy Consumption Disclosure (CBECD) program that includes assistance to building owners to analyse data on their energy consumption (using BESM) and comparing it to BEC values (see Para 82);
- collection of energy data from specific building types (such as office buildings or shopping centres) for buildings in other countries with similar climates such as Malaysia (as mentioned in Para 85), and formulating equations (again using BESM) for determining specific energy consumption (SEC) values based on floor area and hours of usage for specific building types;
- the issuance of over 3,000 questionnaires to designated building owners and managers for specific energy information with responses to the questionnaire to be used to compare the actual SEC value of those buildings with the SEC value determined in the equation (see Para 86);
- the use of an Energy Performance Index (EnPI) which is an actual SEC value from these questionnaires divided by the SEC value derived from equations. Building owners with an EnPI

greater than 1.0 can be provided guidance on the extent of EE measures required for the building owner to fall in line with other SEC values (as mentioned in Para 86);

- provision of incentives to building owners whose buildings are below SEC values (as set by BEC) with Energy Savings Certificates (see Para 82) and Step-BEC (see Para 84).

127. *Best practice 3: The success of any energy efficiency project will be highly dependent on the agency recruiting a well-qualified project manager with good management skills (good understanding of the activities of the project, good inter-personal skills, responsive to all needs of the project), and good knowledge and technical skill in the subject matter*. PEECB recruited a well-qualified project manager with these skills including an excellent knowledge and technical skill in energy efficiency and renewable energy. The benefits to such recruitment allowed this GEF-supported UNDP project to progress on a sound strategic and technical basis towards meeting goals of the Project as well as the mandate of DEDE. In addition and with the consent of DEDE, this well-qualified Project manager was sourced from a consulting firm that had a long working record with DEDE to manage the PEECB Project. By outsourcing these management functions to a well-qualified firm, UNDP saved much time and effort in managing the PEECB Project. While several projects employ a project manager that is very good in project management and supported by a CTA to oversee technical aspects of the project implementation, a well-qualified project manager would be a more desirable arrangement if such a person is available.

# APPENDIX A – MISSION TERMS OF REFERENCE FOR PEECB PROJECT TERMINAL EVALUATION

## TERMINAL EVALUATION TERMS OF REFERENCE

**Country:** Bangkok, Thailand

**Description of the assignment:** Terminal Evaluation Terms of Reference (International Consultant)

**Duty Station:** home-based with one mission to visit the project sites in Bangkok, Thailand

**Project name**: Promoting Energy Efficiency in Commercial Buildings (PEECB) in Thailand

**Period of assignment/services (if applicable):** 6 February 2018 – 15 May 2018 with total of 30 working days.

Proposal should be submitted no later than **31 December 2017**

Please click on the link below to apply: https://jobs.undp.org/cj_view_job.cfm?cur_job_id=73306

## INTRODUCTION

### 1. INTRODUCTION

In accordance with UNDP and GEF M&E policies and procedures, all full and medium-sized UNDP support, GEF-financed projects are required to undergo a terminal evaluation upon completion of implementation. These terms of reference (TOR) sets out the expectations for a Terminal Evaluation (TE) of the Promoting Energy Efficiency in Commercial Buildings (PEECB) in Thailand.

**PROJECT SUMMARY TABLE**

| Project Title: | PROMOTING ENERGY EFFICIENCY IN COMMERCIAL BUILDINGS (PEECB) IN THAILAND | | | |
|---|---|---|---|---|
| GEF Project ID: | GEF PIMS#4165 | | *at endorsement (Million US$)* | *at completion (Million US$)* |
| UNDP Project ID: | PIMS#3937<br>00078576 | GEF financing: | 3,637,273 | |
| Country: | Thailand | IA/EA own: | | |
| Region: | Asia-Pacific | Government: | 6,500,000 | |
| Focal Area: | Climate Change | Other Private Sector: | 5,767,500 | |
| FA Objectives, (OP/SP): | CC-SP1 Promoting EE technologies and practices in appliances and building | Total co-financing: | | |
| Executing Partner: | Department of Alternative Energy Development and Efficiency (DEDE) under the Ministry of Energy, Thailand | Total Project Cost: | 15,904,773 | |
| Other Partners involved: | | ProDoc Signature (date project began): | | 14 November 2012 |
| | | Operational Closing Date: | Proposed: 30 APRIL 2018 | Actual: |

### 2. OBJECTIVE AND SCOPE:

The PEECB project has for its goal the reduction in the annual growth rate of GHG emissions from the Thai commercial building sector. The project objective is the promotion and facilitation of the widespread application of building energy efficiency technologies and practices in commercial buildings in Thailand. The realization of this objective will be facilitated through the removal of barriers to the uptake of building energy efficiency technologies, systems, and practices. The project is in line with the GEF-4 Strategic Program No. 1, which is on Promoting energy-efficient buildings and appliances (CC-SP1). It is comprised of activities aimed at improving energy efficiency and promoting the widespread adoption of energy efficient building technologies and practices in the Thai commercial building sector.

The TE will be conducted according to the guidance, rules and procedures established by UNDP and GEF as reflected in the UNDP Evaluation Guidance for GEF Financed Projects.

The objectives of the evaluation are to assess the achievement of project results, and to draw lessons that can both improve sustainability of benefits from this project, and aid the overall enhancement of UNDP programming.

## 3. EVALUATION APPROACH AND METHOD

An overall approach and method[1] for conducting project terminal evaluations of UNDP supported GEF financed projects has developed over time. The evaluator is expected to frame the evaluation effort using the criteria of **relevance, effectiveness, efficiency, sustainability, and impact,** as defined and explained in the UNDP Guidance for Conducting Terminal Evaluations of UNDP-supported, GEF-financed Projects. A set of questions covering each of these criteria have been drafted and are included with this TOR (*Annex C*). The evaluator is expected to amend, complete and submit this matrix as part of an evaluation inception report, and shall include it as an annex to the final report.

The evaluation must provide evidence-based information that is credible, reliable and useful. The evaluator is expected to follow a participatory and consultative approach ensuring close engagement with government counterparts, particularly the GEF operational focal point, UNDP Country Office, project team, UNDP GEF Technical Adviser based in the region and key stakeholders. The evaluator is expected to conduct a field mission to Thailand, including the project sites in Bangkok and a nearby province.

Interviews will be held with the following personnel and organizations and individuals at a minimum:

- Project Director
- Representatives of responsible parties
- Building practitioner professional associations
- Project partners: Bangkok Metropolitan Administration and the Office of Natural Resources and Environmental Policy and Planning (ONEP)
- Stakeholders from both public and private sectors including building owners
- Members of Project Board
- UNDP-GER Regional Technical Advisor
- UNDP Country Office in Bangkok in-charge of this project

The evaluator will review all relevant sources of information, such as the project document, project reports – including Annual APR/PIR, project budget revisions, midterm review, progress reports, GEF focal area tracking tools, project files, national strategic and legal documents, and any other materials that the evaluator considers useful for this evidence-based assessment. A list of documents that the project team will provide to the evaluator for review is included in Annex B of this Terms of Reference. The full scope methods used in the evaluation are at the discretion of the evaluator(s), but a mixed method of document review, interviews, and direct observations should be employed, at a minimum. The TE inception report and TE report should explain all the evaluation methods used in detail.

## 4. EVALUATION CRITERIA & RATINGS

An assessment of project performance will be carried out, based against expectations set out in the Project Logical Framework/Results Framework which provides performance and impact indicators for project implementation along with their corresponding means of verification. The evaluation

will at a minimum cover the criteria of: **relevance, effectiveness, efficiency, sustainability and impact.** Ratings must be provided on the following performance criteria. The completed table must be included in the evaluation executive summary. The obligatory rating scales are included in Annex D.

| **Evaluation Ratings:** | | | |
|---|---|---|---|
| **1. Monitoring and Evaluation** | ***rating*** | **2. IA & EA Execution** | ***rating*** |
| M&E design at entry | | Quality of UNDP Implementation – Implementing Agency (IA) | |
| M&E Plan Implementation | | Quality of Execution - Executing Agency (EA) | |
| Overall quality of M&E | | Overall quality of Implementation / Execution | |
| **3. Assessment of Outcomes** | ***rating*** | **4. Sustainability** | ***rating*** |
| Relevance | | Financial resources | |
| Effectiveness | | Socio-political | |
| Efficiency | | Institutional framework and governance | |
| Overall Project Outcome Rating | | Environmental | |
| | | Overall likelihood of sustainability | |
| **5. Impact:** | ***rating*** | | rating |
| Environmental Status Improvement | | | |
| Environmental Status Reduction | | | |
| Progress towards status change | | | |
| | | | |
| **Overall Project Results** | | | |

## 5. PROJECT FINANCE / COFINANCE

The Evaluation will assess the key financial aspects of the project, including the extent of co-financing planned and realized. Project cost and funding data will be required, including annual expenditures. Variances between planned and actual expenditures will need to be assessed and explained. Results from recent financial audits, as available, should be taken into consideration. The evaluator(s) will receive assistance from the Country Office (CO) and Project Team to obtain financial data to complete the co-financing table below, which will be included in the terminal evaluation report.

| Co-financing (type/source) | UNDP own financing (mill. US$) | | Government (mill. US$) | | Partner Agency (mill. US$) | | Total (mill. US$) | |
|---|---|---|---|---|---|---|---|---|
| | Planned | Actual | Planned | Actual | Planned | Actual | Planned | Actual |
| Grants | | | | | | | | |
| Loans/Concessions ns | | | | | | | | |
| • In-kind support | | | | | | | | |
| • Other | | | | | | | | |
| Totals | | | | | | | | |

## 6. MAINSTREAMING

UNDP supported GEF financed projects are key components in UNDP country programming, as well as regional and global programmes. The evaluation will assess the extent to which the project was successfully mainstreamed with other UNDP priorities, including poverty alleviation, improved governance, the prevention and recovery from natural disasters, and gender.

## 7. IMPACT

The evaluators will assess the extent to which the project is achieving impacts or progressing towards the achievement of impacts. Key findings that should be brought out in the evaluations include whether the project has demonstrated: a) verifiable improvements in ecological status, b) verifiable reductions in stress on ecological systems, and/or c) demonstrated progress towards these impact achievements.

## 8. CONCLUSIONS, RECOMMENDATIONS & LESSONS

The evaluation report must include a chapter providing a set of **conclusions**, **recommendations** and **lessons**.

## 9. IMPLEMENTATION ARRANGEMENTS

The principal responsibility for managing this evaluation resides with the UNDP CO in Thailand. The UNDP CO will contract the evaluators and ensure the timely provision of per diems and travel arrangements within the country for the evaluation team. The Project Team will be responsible for liaising with the Evaluators team to set up stakeholder interviews, arrange field visits, coordinate with the Government etc.

## 10. EVALUATION TIMEFRAME

Duty Station: home-based with one mission to visit the project sites in Bangkok, Thailand.

The total duration of the evaluation will be 30 working days over a period from 6 February to 15 May 2018 according to the following plan:

| Activity | Timing | Tentative Period |
|---|---|---|
| **Preparation** | 5 working days | *6-12 February 2018* |
| **Evaluation Mission** | 13 working days (Monday-Friday); Per diem will be paid on working days and over the weekends. | *14-30 March 2018* |
| **Draft Evaluation Report** | 6 working days | *1-6 April 2018* |
| **Final Report** | 6 working days | *30 April – 6 May 2018* |

The tentative timeframe is as follows:

| TIMEFRAME | ACTIVITY |
|---|---|
| 7-31 December 2017 | Advertisement |
| 31 December 2017 | Application closes |
| 2– 26 January 2018 | Select TE Team/contract issuance process |
| 6-12 February 2018<br>(5 working days) | Handover of Project Documents<br>Document review, preparing TE Inception Report |
| 13-28 February 2018 | Finalization and Validation of TE Inception Report by CO and UNDP-GEF Technical Advisor |
| 14–29 March 2018<br>(12 working days) | TE mission: opening session, stakeholder meetings, interviews, field visits |
| 30 March 2018 (1 working day) | Mission wrap-up meeting & presentation of initial findings<br>- End of TE mission |
| 1-6 April 2018 (6 working days) | Preparing draft TE report<br>Submission of draft TE report to UNDP CO /UNDP-GEF RTA |
| 9-20 April 2018 | Circulation of draft report for comments |
| 30 April-4 May 2018<br>(5 working days) | Incorporating audit trail from feedback on draft report/finalization of TE report |
| 6 May 2018 (1 working day) | Preparation & Issue of Management Response |
| 7 May 2018 | Expected date of full TE completion |

## 11. EVALUATION DELIVERABLES

The evaluation team is expected to deliver the followings:

| Deliverable | Content | Timing | Responsibilities |
|---|---|---|---|
| **Inception Report** | Evaluator provides clarifications on timing and method | No later than 2 weeks before the evaluation mission: *13 February 2018* | Evaluator submits to UNDP CO |
| **Presentation** | Initial Findings | End of evaluation mission: *30 March 2018.* | To project management, UNDP CO |
| **Draft Final Report** | Full report, (per annexed template) with annexes | Within 1 week after the evaluation mission: *6 April 2018* | Sent to CO, reviewed by RTA, PCU, GEF OFPs |
| **Final Report**[50] | Revised report | Within 1 week of receiving UNDP comments on draft: *6 May 2018* | Sent to CO for uploading to UNDP ERC. |

## 12. TEAM COMPOSITION

The evaluation team will be composed of ***an international and a national evaluator***. The consultants shall have prior experience in evaluating similar projects. Experience with GEF financed projects is an

[50] When submitting the final evaluation report, the evaluator is required also to provide an 'audit trail', detailing how all received comments have (and have not) been addressed in the final evaluation report.

advantage. The international evaluator will be designated as the team leader and will be responsible for finalizing the report. The evaluators selected should not have participated in the project preparation and/or implementation and should not have conflict of interest with project related activities. The team members must present the following qualifications:

*A. INTERNATIONAL LEAD CONSULTANT PROFILE*

- Post-Graduate in environmental science, engineering, development studies, social sciences and/ or other related fields (20%)
- Minimum of 8 years accumulated and recognized experience in Climate Change Mitigation (20%)
- Minimum of 5 years of project evaluation and/or environmental project implementation experience in the result-based management framework, adaptive management and UNDP or GEF Monitoring and Evaluation Policy (20%)
- Familiarity in similar country or regional situations relevant to that of "Promoting Energy Efficiency in the Commercial Buildings" is an advantage (20%)
- Excellent written English (20%).

*RESPONSIBILITIES*

- Documentation review
- Leading the TE Team in planning, conducting and reporting on the evaluation
- Deciding on division of labor within the Team and ensuring timeliness of reports
- Use of best practice evaluation methodologies in conducting the evaluation
- Leading the drafting and finalization of the Inception Report for the Terminal Evaluation
- Leading presentation of the draft evaluation findings and recommendations in-country
- Conducting the de-briefing for the UNDP CO in Thailand and Core Project Management Team
- Leading the drafting and finalization of the Terminal Evaluation Report

*B. NATIONAL CONSULTANT PROFILE*

- Post-graduate in environmental science, environmental studies, development studies, social sciences and/ or other related fields (20%)
- Minimum of 5 years of supporting project evaluation and/or implementation experience in the result-based management framework, adaptive management and UNDP or GEF Monitoring and Evaluation Policy (20%)
- Knowledge of multilateral and bilateral cooperation project development and implementation (20%)
- Familiarity with Thailand development policy framework, environmental authorities, NGOs and other actors (20%)
- Excellent in written and spoken Thai and English (20%)
  - *RESPONSIBILITIES*
- Documentation review and data gathering
- Contributing to the development of the evaluation plan and methodology
- Conducting those elements of the evaluation determined jointly with the international consultant and UNDP
- Contributing to presentation of the review findings and recommendations at the wrap-up meeting
- Contributing to the drafting and finalization of the review report

## 13. EVALUATOR ETHICS

Evaluation consultants will be held to the highest ethical standards and are required to sign a Code of Conduct (Annex E) upon acceptance of the assignment. UNDP evaluations are conducted in accordance with the principles outlined in the UNEG 'Ethical Guidelines for Evaluations'.

# APPENDIX B – MISSION ITINERARY (FOR MARCH 2018)

| # | Activity | Stakeholder involved | Place |
|---|---|---|---|
| ***March 12, 2018** (Monday)* | | | |
| | Arrival of Roland Wong in Bangkok | | |
| ***March 13, 2018 (Tuesday)*** | | | |
| 1 | Briefing meeting with Ms. Milou Beerepoot, RTA-EITT, and Dr. Sutharin Koonphol, UNDP Thailand | UNDP | Bangkok |
| ***March 14, 2018 (Wednesday)*** | | | |
| | Evaluation team analysis of PEECB information | UNDP | Bangkok |
| ***March 15, 2018 (Thursday)*** | | | |
| 2 | Meeting with Mr. Pongphat Munkkunk, National Project Director (DEDE), and Mr. Kamol Tanpipat, PEECB National Project Manager (BMC) on Project oversight and background | DEDE | Bangkok |
| 3 | Meeting with Mr. Kamol Tanpipat, PEECB National Project Manager (BMC) on Component 1 | DEDE | Bangkok |
| ***March 16, 2018 (Friday)*** | | | |
| 4 | Meeting with Mr. Kamol, PEECB National Project Manager and Mr. Pyongan, Project Manager Engineering Solution Provider Co. Ltd. (ENSOP) on Components 2 and 3 | DEDE | Bangkok |
| 5 | Visit to observe BESM training course and meet with Assistant Professor Rd. Chankiang Pinprayoon, Faculty of Architecture | KidStart University | Bangkok |
| ***March 19, 2018 (Monday)*** | | | |
| 6 | Meeting with Mr. Kamol, PEECB National Project Manager on Extension phase and review of project log frame | DEDE | Bangkok |
| 7 | Field visit to CP Tower 2 Building in Bangkok and a meeting with Mr. Sal Malassada, Executive VP – Faculty Management | CP Land | Bangkok |
| ***March 20, 2018 (Tuesday)*** | | | |
| 8 | Field visit to SET Tower, a demonstration site on “Building Energy Consumption Disclosure Program” and a meeting with Mr. Theda Henchy, VP – Capital Market Center Project | Stock Exchange of Thailand | Bangkok |

| # | Activity | Stakeholder involved | Place |
|---|---|---|---|
| 9 | Meeting with Marproof Samsara and Rd. Pong pan Worsen, Bureau of Energy Regulation and Conservation (BERC), DEDE on Integration of PEECB results into BERC's action plan and activities | DEDE | Bangkok |
| ***March 21, 2018 (Wednesday)*** | | | |
| 10 | Meeting with Department of City Planning, Bangkok Metropolitan Administrator (BMA), Mr. Arsa Thongthammachart (Project Board) | Bangkok Metropolitan Authority | Bangkok |
| 11 | Meeting with Office of Natural Resources and Environmental Policy and Planning (ONEP), Ms. Nattanit Atsawapusitkul (Project Board) | ONEP | Bangkok |
| ***March 22, 2018 (Thursday)*** | | | |
| 12 | Meeting with Mr. Khun Tawatchai TGO (Project Board) | TGO | Bangkok |
| 13 | Field visit to Kasikorn Bank at observe EE measures and meet with building operators | Kasikorn Bank | Bangkok |
| 14 | Field visit to EGAT technology showcase building under PEECB training course | EGAT | Bangkok |
| ***March 23, 2018 (Friday)*** | | | |
| | Preparation of de-briefing presentation for PEECB | | Bangkok |
| ***March 26, 2018 (Monday)*** | | | |
| 15 | Debriefing meeting with DEDE | DEDE | Bangkok |
| 16 | Debriefing meeting with UNDP | UNDP | Bangkok |
| ***March 27, 2018 (Tuesday)*** | | | |
| | Departure of Roland Wong from Bangkok | | |
| ***May 31, 2018 (Thursday)*** | | | |
| 17 | Skype discussion with Mr. Sommai Phon-Amnuaisuk of IIEC, PEECB Project designer. | | |

Total number of meetings conducted: 17

# APPENDIX C – LIST OF PERSONS INTERVIEWED

This Draft is a listing of persons contacted in Bangkok (unless otherwise noted) during the Terminal Evaluation Period only. The Evaluator regrets any omissions to this list.

1. Ms. Milou Beerepoot, UNDP Regional Technical Advisor for CCM, Bangkok Regional Hub;
2. Dr. Sutharin Koonphol, Portfolio Manager, UNDP Thailand;
3. Ms. Nisakorn Puangkamalard, Project Assistant, UNDP Thailand;
4. Mr. Pongphat Munkkunk, NPD and Executive Director of Energy Human Resources Development Bureau, DEDE;
5. Dr. Prakoti Eamsaard, Director, New Building Standard Group, Bureau of Energy Regulation and Conservation, DEDE;
6. Dr. Pong pan Worsen, Bureau of Energy Regulation and Conservation (BERC), DEDE;
7. Ms. Nattanit Atsawapusitkul, Director, Office of Natural Resources and Environmental Policy and Planning (ONEP);
8. Ms. Chukwan Nilsiri, Director, City Planning Division, BMA;
9. Mr. Arsa Thongthammachart, Senior Urban Planner, Bangkok Metropolitan Administrator(BMA), Division of City Planning;
10. Ms. Thipawan Saenchan, City Planner, BMA;
11. Ms. Kwanchanok Sakdikosit, City Planner, BMA;
12. Mr. Tawatchai, Thailand Greenhouse Gas Organization (TGO);
13. Mr. Thada Phenchip, Vice President – Capital Market Center Porject, Stock Exchange of Thailand;
14. Mr. Sal Mulasatra, Executive Vice President Faculty Management, CP Land, Bangkok;
15. Mr. Kasem Chumchua, Building Manager, Kasikorn Bank, Bangkok;
16. Dr. Chanikarn Yimprayoon, Assistant Professor, Faculty of Architecture, KidStart University;
17. Mr. Kamol Tanpipat, Assistant Managing Director, BRIGHT Management Company Ltd. (BMC);
18. Mr. Jirayut Charoenchatchai, Manager, Energy Efficiency Division, BMC, Bangkok;
19. Mr. Phongkarn Piamsuttitam, Managing Director, Energy Solution Provider Co. Lts. (ENSOP), Bangkok.

20. Mr. Sommai Phon-Amnuaisuk, IIEC Project Manager, Bangkok;
21. Mr. Winai AnusornThanawat, Chairperson, Energy Conservation Working Group, CP Land;
22. Mr. Yuttana Khaomeesri, Vice Chairman, Energy Conservation Working Group, CP Land;
23. Mr. Pakorn Pleepool, Senior Energy Officer, CP Land;
24. Mr. Nalaswan Noocharoenkul, Secretary, Energy Conservation Group, Fortune Town;
25. Ms. Uraiwan Udomsinka, Energy Engineer, CP Land;
26. Mr. Suchart Sawpimai, Energy Engineer, CP Land;
27. Ms. Saraporn Assadakot, Energy Engineer, CP Land;
28. Mr. Yutthanan Phantha, Energy Engineer, CP Land.

# APPENDIX D – LIST OF DOCUMENTS REVIEWED

1. UNDP Project Document for the "Promoting Energy Efficiency in Commercial Buildings in Thailand" (PEECB Project);
2. GEF approved project document and Request for CEO Endorsement
3. Project Inception Report
4. Mid-term Evaluation Report
5. Annual work plans
6. Annual GEF Project Implementation Report (2013-2017)
7. CDRs
8. Financial audit reports
9. GEF Quarterly Reports
10. Project Steering Committee Minutes
11. Logs (Monitoring Logs, Offline Risk Logs, Lessons Learned Logs and Offline Issues Logs)
12. Project Technical Reports by project experts
13. Project's Events Proceedings (including agenda and presentations/publications of conferences, workshops, trainings, etc.)
14. Selected relevant regulations in housing and construction sectors prepared and/or indorsed by the Project
15. Relevant printed documentation (brochures, flyers, booklets, briefs, publications, press releases, etc.) or visual materials (photo, video) in support of the Project's achievements and results.

# APPENDIX E – CALCULATION OF EMISSION REDUCTIONS FROM EE TOOL

**Figure E-1: Screenshot of "Building Code" Worksheet in EE Tool for PEECB**

## Step 3: Model Activity Components

### Building Codes Module

**Project Information**

| | |
|---|---|
| Project Title | Promoting Energy Efficiency in Commercial Buildings (PEECB) in Thailand |
| Country | Thailand |
| Contact Name | |
| First Year of Project | 2013 |
| Last Year of Project | 2018 |

### Results: Building Code Activity Components

| | Cumulative | | | Annual | | | |
|---|---|---|---|---|---|---|---|
| | *Total* | *2013-2018* | *2019-2033* | *2013* | *2018* | *2025* | *2035* |
| Direct Electricity Savings (MWh) | 3,113,991 | 520,553 | 2,593,438 | 0 | 172,896 | 172,896 | 172,896 |
| N/A | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| N/A | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| N/A | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Direct Total Energy Savings (GJ) | 11,210,369 | 1,873,993 | 9,336,376 | 0 | 622,425 | 622,425 | 622,425 |
| Direct GHG Emission Savings (tCO2) | **1,920,253** | 321,001 | 1,599,252 | 0 | 106,617 | 106,617 | 106,617 |
| Direct Post-project GHG Emission Savings (tCO2) | **2,363,802** | | 2,363,802 | | | 141,771 | 313,599 |
| Indirect Bottom-up Emission Savings (tCO2) | | | | | | | |

### Component 1: none

| **Market Assumptions** | *Default* | *User-Specified* | *Notes* |
|---|---|---|---|
| Floor Area (m2) Subject to Code Built in Year 2013 | | 4,529,263 | |
| Annual Construction Growth Rate | | 3% | Form year 2009-2014 |

| **Project Assumptions** | *Default* | *User-Specified* | *Notes* |
|---|---|---|---|
| Annual Electricity Consumption (kWh/m2) | | 86.6 | |
| --- | | | |
| --- | | | |
| --- | | | |
| Year Building Code in Force | | 2014 | |
| Percent New Square Meters Built Compliant with Code | | 60% | Increases to 80% by 2025 |

| **Baseline Assumptions** | *Default* | *User-Specified* | *Notes* |
|---|---|---|---|
| Annual Electricity Consumption (kWh/m2) | | 125 | |
| --- | | | |
| --- | | | |
| --- | | | |
| Percent of Square Meters Built at Code Level Without Programme | | 40% | |
| Annual Reduction in Baseline Energy Consumption | 1% | 1% | |

## Figure E-2: Screenshot of "Building Code" Worksheet in EE Tool for PEECB

**Component 1: none**

| | | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MARKET | Building Area (m2) | 4,529,263 | 4,665,141 | 4,805,096 | 4,949,248 | 5,097,726 | 5,250,658 | 5,408,177 | 5,570,423 | 5,737,535 | 5,909,661 | 6,086,951 | 6,269,560 | 6,457,647 | 6,651,376 | 6,850,917 | 7,056,445 | 7,268,138 | 7,486,182 | 7,710,768 | 7,942,091 | 8,180,354 |
| PROGRAMME | Share of New Area in Compliance with Code | 40% | 60% | 60% | 60% | 60% | 60% | 60% | 60% | 60% | 60% | 60% | 60% | 60% | 60% | 60% | 60% | 60% | 60% | 60% | 60% | 60% |
| | Annual Non-Compliant Construction (m2) | 2,717,558 | 1,866,057 | 1,922,038 | 1,979,699 | 2,039,090 | 2,100,263 | 2,163,271 | 2,228,169 | 2,295,014 | 2,363,865 | 2,434,781 | 2,507,824 | 2,583,059 | 2,660,550 | 2,740,367 | 2,822,578 | 2,907,255 | 2,994,473 | 3,084,307 | 3,176,836 | 3,272,141 |
| | Annual Compliant Construction (m2) | 1,811,705 | 2,799,085 | 2,883,057 | 2,969,549 | 3,058,636 | 3,150,395 | 3,244,906 | 3,342,254 | 3,442,521 | 3,545,797 | 3,652,171 | 3,761,736 | 3,874,588 | 3,990,826 | 4,110,550 | 4,233,867 | 4,360,883 | 4,491,709 | 4,626,461 | 4,765,255 | 4,908,212 |
| | 1st year Consumption Electricity (MWh) | 497,130 | 473,615 | 485,441 | 497,574 | 510,023 | 522,797 | 535,905 | 549,355 | 563,157 | 577,320 | 591,854 | 606,769 | 622,076 | 637,785 | 653,907 | 670,454 | 687,436 | 704,866 | 722,756 | 741,119 | 759,967 |
| | --- | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | --- | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | --- | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Direct Annual Consumption Electricity (MWh) | 497,130 | 970,745 | 1,456,186 | 1,953,760 | 2,463,783 | 2,986,581 | 2,986,581 | 2,986,581 | 2,986,581 | 2,986,581 | 2,986,581 | 2,986,581 | 2,986,581 | 2,986,581 | 2,986,581 | 2,986,581 | 2,986,581 | 2,986,581 | 2,986,581 | 2,986,581 | 2,986,581 |
| | --- | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | --- | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | --- | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Direct Post-project Annual Consumption Electricity (MWh) | 0 | 0 | 0 | 0 | 0 | 0 | 535,905 | 1,085,260 | 1,648,417 | 2,225,737 | 2,817,591 | 3,424,361 | 4,046,437 | 4,684,222 | 5,338,130 | 6,008,583 | 6,696,019 | 7,400,885 | 8,123,641 | 8,864,760 | 9,624,727 |
| | --- | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | --- | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | --- | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Direct Annual GHG Emissions (tCO2) | 306,557 | 598,613 | 897,962 | 1,204,792 | 1,519,300 | 1,841,684 | 1,841,684 | 1,841,684 | 1,841,684 | 1,841,684 | 1,841,684 | 1,841,684 | 1,841,684 | 1,841,684 | 1,841,684 | 1,841,684 | 1,841,684 | 1,841,684 | 1,841,684 | 1,841,684 | 1,841,684 |
| | Direct Post-project Annual GHG Emissions (tCO2) | 0 | 0 | 0 | 0 | 0 | 0 | 330,468 | 669,229 | 1,016,502 | 1,372,508 | 1,737,477 | 2,111,643 | 2,495,248 | 2,888,541 | 3,291,775 | 3,705,212 | 4,129,122 | 4,563,780 | 5,009,469 | 5,466,483 | 5,935,119 |
| BASELINE | Share of New Area in Compliance with Code | 40% | 40% | 40% | 40% | 40% | 40% | 40% | 40% | 40% | 40% | 40% | 40% | 40% | 40% | 40% | 40% | 40% | 40% | 40% | 40% | 40% |
| | Annual Non-Compliant Construction (m2) | 2,717,558 | 2,799,085 | 2,883,057 | 2,969,549 | 3,058,636 | 3,150,395 | 3,244,906 | 3,342,254 | 3,442,521 | 3,545,797 | 3,652,171 | 3,761,736 | 3,874,588 | 3,990,826 | 4,110,550 | 4,233,867 | 4,360,883 | 4,491,709 | 4,626,461 | 4,765,255 | 4,908,212 |
| | Annual Compliant Construction (m2) | 1,811,705 | 1,866,057 | 1,922,038 | 1,979,699 | 2,039,090 | 2,100,263 | 2,163,271 | 2,228,169 | 2,295,014 | 2,363,865 | 2,434,781 | 2,507,824 | 2,583,059 | 2,660,550 | 2,740,367 | 2,822,578 | 2,907,255 | 2,994,473 | 3,084,307 | 3,176,836 | 3,272,141 |
| | 1st year Consumption Electricity (MWh) | 497,130 | 508,539 | 520,220 | 532,182 | 544,431 | 556,974 | 569,819 | 582,973 | 596,444 | 610,239 | 624,368 | 638,839 | 653,660 | 668,840 | 684,387 | 700,313 | 716,625 | 733,334 | 750,451 | 767,984 | 785,945 |
| | --- | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | --- | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | --- | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Direct Annual Consumption Electricity (MWh) | 497,130 | 1,005,669 | 1,525,889 | 2,058,071 | 2,602,502 | 3,159,476 | 3,159,476 | 3,159,476 | 3,159,476 | 3,159,476 | 3,159,476 | 3,159,476 | 3,159,476 | 3,159,476 | 3,159,476 | 3,159,476 | 3,159,476 | 3,159,476 | 3,159,476 | 3,159,476 | 3,159,476 |
| | --- | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | --- | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | --- | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Direct Post-project Annual Consumption Electricity (MWh) | 0 | 0 | 0 | 0 | 0 | 0 | 569,819 | 1,152,791 | 1,749,235 | 2,359,474 | 2,983,843 | 3,622,682 | 4,276,342 | 4,945,181 | 5,629,569 | 6,329,882 | 7,046,507 | 7,779,841 | 8,530,292 | 9,298,276 | 10,084,221 |
| | --- | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | --- | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | --- | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Direct Annual GHG Emissions (tCO2) | 306,557 | 620,149 | 940,944 | 1,269,116 | 1,604,841 | 1,948,301 | 1,948,301 | 1,948,301 | 1,948,301 | 1,948,301 | 1,948,301 | 1,948,301 | 1,948,301 | 1,948,301 | 1,948,301 | 1,948,301 | 1,948,301 | 1,948,301 | 1,948,301 | 1,948,301 | 1,948,301 |
| | Direct Post-project Annual GHG Emissions (tCO2) | 0 | 0 | 0 | 0 | 0 | 0 | 351,381 | 710,872 | 1,078,671 | 1,454,977 | 1,839,996 | 2,233,938 | 2,637,020 | 3,049,462 | 3,471,492 | 3,903,342 | 4,345,251 | 4,797,464 | 5,260,232 | 5,733,812 | 6,218,467 |
| SAVINGS | Direct Annual Consumption Electricity (MWh) | 0 | 34,924 | 69,703 | 104,312 | 138,719 | 172,896 | 172,896 | 172,896 | 172,896 | 172,896 | 172,896 | 172,896 | 172,896 | 172,896 | 172,896 | 172,896 | 172,896 | 172,896 | 172,896 | 172,896 | 172,896 |
| | --- | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | --- | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | --- | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Direct Post-project Annual Consumption Electricity (MWh) | 0 | 0 | 0 | 0 | 0 | 0 | 33,914 | 67,531 | 100,818 | 133,737 | 166,251 | 198,321 | 229,904 | 260,959 | 291,439 | 321,298 | 350,487 | 378,956 | 406,651 | 433,516 | 459,495 |
| | --- | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | --- | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | --- | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Direct Annual GHG Emissions (tCO2) | 0 | 21,536 | 42,983 | 64,324 | 85,542 | 106,617 | 106,617 | 106,617 | 106,617 | 106,617 | 106,617 | 106,617 | 106,617 | 106,617 | 106,617 | 106,617 | 106,617 | 106,617 | 106,617 | 106,617 | 106,617 |
| | Direct Post-project Annual GHG Emissions (tCO2) | 0 | 0 | 0 | 0 | 0 | 0 | 20,913 | 41,643 | 62,170 | 82,469 | 102,519 | 122,295 | 141,771 | 160,921 | 179,717 | 198,130 | 216,129 | 233,684 | 250,762 | 267,329 | 283,349 |

| | | | | |
|---|---|---|---|---|
| TOTALS | Direct Energy Avoided 2013-2018 (GJ) | 1,873,993 | Direct GHG Avoided 2013-2018 (tCO2) | 321,001 |
| | Direct Energy Avoided 2019-2033 (GJ) | 9,336,376 | Direct GHG Avoided 2019-2033 (tCO2) | 1,599,252 |
| | Direct Post-project Energy Avoided 2019-2033 (GJ) | 13,799,796 | Direct Post-project GHG Avoided 2019-2033 (tCO2) | 2,363,802 |

**Figure E-3: Screenshot of "Demo&Diffusion" Worksheet in EE Tool for PEECB**

## Step 3: Model Activity Components

### Demonstration/Diffusion Module

**Project Information**

| | |
|---|---|
| Project Title | Promoting Energy Efficiency in Commercial Buildings (PEECB) in Thailand |
| Country | Thailand |
| Contact Name | |
| First Year of Project | 2013 |
| Last Year of Project | 2018 |

### Results: Demonstration/Diffusion Activity Components

| | Cumulative | | | Annual | | | |
|---|---|---|---|---|---|---|---|
| | *Total* | *2013-2018* | *2019-2033* | *2013* | *2018* | *2025* | *2035* |
| Direct Electricity Savings (MWh) | 65,986 | 17,596 | 48,390 | 0 | 2,129 | 2,129 | 0 |
| N/A | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| N/A | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| N/A | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Direct Total Energy Savings (GJ) | 237,550 | 63,347 | 174,204 | 0 | 7,665 | 7,665 | 0 |
| Direct GHG Emission Savings (tCO2) | **40,691** | 10,851 | 29,840 | 0 | 1,313 | 1,313 | 0 |
| Direct Post-project GHG Emission Savings (tCO2) | | | | | | | |
| Indirect Bottom-up Emission Savings (tCO2) | **78,999** | | 78,999 | | | | |

## Figure E-4: Screenshot of "Demo&Diffusion" Worksheet for 3 individual demo buildings in EE Tool for PEECB[63]

**Component 1: Saint Gabriel's College -- General Inputs**

| Component Specifications | Default | User-Specified | Per Unit |
|---|---|---|---|
| Annual Electricity Savings (MWh) | | 388 | |
| --- | | | |
| --- | | | |
| --- | | | |
| Useful Lifetime of Investment | 15 | 15 | |

| Baseline Assumptions | Default | User-Specified |
|---|---|---|
| Percent of Activities Implemented in the Baseline | 10% | 10% |

| Indirect Bottom-up Estimate | Default | User-Specified |
|---|---|---|
| Number of s Implemented During Project Period | | 1 |
| Number of Replications Post-project as Spillover | | 4 |
| Total | | 4 |

**Component 1: Saint Gabriel's College -- Annual Inputs and Calculations**

| | | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2030 | 2031 | 2032 | 2033 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PROGRAMME | (s) in Year | 0 | 0 | 1 | 0 | 0 | | | | | | | | | | |
| BASELINE | (s) in Year | 0 | 0 | 0 | 0 | 0 | 0 | | | | | | | | | |
| NET | Cumulative (s) in Place | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| DIRECT SAVINGS | Annual Electricity Savings (MWh) | 0 | 0 | 388 | 388 | 388 | 388 | 388 | 388 | 388 | 388 | 388 | 0 | 0 | 0 | 0 |
| --- | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| --- | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| --- | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| TOTALS | | | | |
|---|---|---|---|---|
| | Direct Energy Avoided 2013-2018 (GJ) | 5,587 | Direct GHG Avoided 2013-2018 (tCO2) | 957 |
| | Direct Energy Avoided 2019-2033 (GJ) | 15,365 | Direct GHG Avoided 2019-2033 (tCO2) | 2,632 |
| | Direct Post-project Energy Avoided 2019-2033 (GJ) | | Direct Post-project GHG Avoided 2019-2033 (tCO2) | 0 |

| INDIRECT BOTTOM-UP SAVINGS | 2019-2033 | 14,356 tCO2 |
|---|---|---|

**Component 2: Provincial Electricity Authority -- General Inputs**

| Component Specifications | Default | User-Specified |
|---|---|---|
| Annual Electricity Savings (MWh) | | 11 |
| --- | | |
| --- | | |
| --- | | |
| Useful Lifetime of Investment | 15 | 15 |

KMT:
Target 368 MWh

| Baseline Assumptions | Default | User-Specified |
|---|---|---|
| Percent of Activities Implemented in the Baseline | 10% | 10% |

| Indirect Bottom-up Estimate | Default | User-Specified |
|---|---|---|
| Number of s Implemented During Project Period | | 1 |
| Number of Replications Post-project as Spillover | | 4 |
| Total | | 4 |

**Component 2: Provincial Electricity Authority -- Annual Inputs and Calculations**

| | | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2030 | 2031 | 2032 | 2033 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PROGRAMME | (s) in Year | 0 | 0 | 1 | 0 | 0 | | | | | | | | | | |
| BASELINE | (s) in Year | 0 | 0 | 0 | 0 | 0 | 0 | | | | | | | | | |
| NET | Cumulative (s) in Place | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| DIRECT SAVINGS | Annual Electricity Savings (MWh) | 0 | 0 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 0 | 0 | 0 | 0 |
| --- | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| --- | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| --- | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| TOTALS | | | | |
|---|---|---|---|---|
| | Direct Energy Avoided 2013-2018 (GJ) | 158 | Direct GHG Avoided 2013-2018 (tCO2) | 27 |
| | Direct Energy Avoided 2019-2033 (GJ) | 436 | Direct GHG Avoided 2019-2033 (tCO2) | 75 |
| | Direct Post-project Energy Avoided 2019-2033 (GJ) | 0 | Direct Post-project GHG Avoided 2019-2033 (tCO2) | 0 |

| INDIRECT BOTTOM-UP SAVINGS | 2019-2033 | 407 tCO2 |
|---|---|---|

**Component 3: C.P. Tower 2 & Fortune Town -- General Inputs**

| Component Specifications | Default | User-Specified | Per Unit |
|---|---|---|---|
| Annual Electricity Savings (MWh) | | 142 | |
| --- | | | |
| --- | | | |
| --- | | | |
| Useful Lifetime of Investment | 15 | 15 | |

| Baseline Assumptions | Default | User-Specified |
|---|---|---|
| Percent of Activities Implemented in the Baseline | 10% | 10% |

| Indirect Bottom-up Estimate | Default | User-Specified |
|---|---|---|
| Number of s Implemented During Project Period | | 1 |
| Number of Replications Post-project as Spillover | | 4 |
| Total | | 4 |

**Component 3: C.P. Tower 2 & Fortune Town -- Annual Inputs and Calculations**

| | | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2030 | 2031 | 2032 | 2033 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PROGRAMME | (s) in Year | 0 | 0 | 1 | 0 | 0 | | | | | | | | | | |
| BASELINE | (s) in Year | 0 | 0 | 0 | 0 | 0 | 0 | | | | | | | | | |
| NET | Cumulative (s) in Place | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| DIRECT SAVINGS | Annual Electricity Savings (MWh) | 0 | 0 | 142 | 142 | 142 | 142 | 142 | 142 | 142 | 142 | 142 | 0 | 0 | 0 | 0 |
| --- | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| --- | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| --- | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| TOTALS | | | | |
|---|---|---|---|---|
| | Direct Energy Avoided 2013-2018 (GJ) | 2,039 | Direct GHG Avoided 2013-2018 (tCO2) | 349 |
| | Direct Energy Avoided 2019-2033 (GJ) | 5,607 | Direct GHG Avoided 2019-2033 (tCO2) | 960 |
| | Direct Post-project Energy Avoided 2019-2033 (GJ) | 0 | Direct Post-project GHG Avoided 2019-2033 (tCO2) | 0 |

| INDIRECT BOTTOM-UP SAVINGS | 2019-2033 | 5,239 tCO2 |
|---|---|---|

[63] There are a total of 12 demo buildings, of which 8 are complete, and 9 of which are having their energy savings monitored.

**Figure E-5: Screenshot of "Results" Worksheet in EE Tool for PEECB**

## Step 4: Calculate Indirect Top-Down Impacts

| | *User-Specified* | *Notes* |
|---|---|---|
| Total Market Potential (tCO2) | 4,073,000 | |
| Causality factor | 42% | |
| Indirect Top-Down Emission Reductions (tCO2) | 1,710,660 | |

## Step 5: Review the Results

### Overall Results

**All Components**

| | Cumulative | | | Annual | | | |
|---|---|---|---|---|---|---|---|
| | *Total* | *2013-2018* | *2019-2033* | *2013* | *2018* | *2025* | *2035* |
| Direct Electricity Savings (MWh) | 3,179,977 | 538,150 | 2,641,828 | 0 | 175,025 | 175,025 | 172,896 |
| N/A | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| N/A | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| N/A | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Direct Total Energy Savings (GJ) | **11,447,919** | 1,937,339 | 9,510,580 | 0 | 630,090 | 630,090 | 622,425 |
| Direct GHG Emission Savings (tCO2) | **1,960,943** | 331,852 | 1,629,091 | 0 | 107,930 | 107,930 | 106,617 |
| Direct Post-project GHG Emission Savings (tCO2) | [illegible] | | [illegible] | | | [illegible] | [illegible] |
| Indirect Bottom-up Emission Savings (tCO2) | **78,999** | | 78,999 | | | | |
| Indirect Top-down Emission Savings (tCO2) | **1,710,660** | | 1,710,660 | | | | |

**Standards & Labeling Components**

| | Cumulative | | | Annual | | | |
|---|---|---|---|---|---|---|---|
| | *Total* | *2013-2018* | *2019-2033* | *2013* | *2018* | *2025* | *2035* |
| Direct Electricity Savings (MWh) | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| N/A | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| N/A | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| N/A | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Direct Total Energy Savings (GJ) | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Direct GHG Emission Savings (tCO2) | **0** | 0 | 0 | 0 | 0 | 0 | 0 |
| Direct Post-project GHG Emission Savings (tCO2) | **0** | | 0 | | | 0 | 0 |
| Indirect Bottom-up Emission Savings (tCO2) | | | | | | | |

**Building Codes Components**

| | Cumulative | | | Annual | | | |
|---|---|---|---|---|---|---|---|
| | *Total* | *2013-2018* | *2019-2033* | *2013* | *2018* | *2025* | *2035* |
| Direct Electricity Savings (MWh) | 3,113,991 | 520,553 | 2,593,438 | 0 | 172,896 | 172,896 | 172,896 |
| N/A | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| N/A | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| N/A | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Direct Total Energy Savings (GJ) | 11,210,369 | 1,873,993 | 9,336,376 | 0 | 622,425 | 622,425 | 622,425 |
| Direct GHG Emission Savings (tCO2) | **1,920,253** | 321,001 | 1,599,252 | 0 | 106,617 | 106,617 | 106,617 |
| Direct Post-project GHG Emission Savings (tCO2) | **2,363,802** | | 2,363,802 | | | 141,771 | 313,599 |
| Indirect Bottom-up Emission Savings (tCO2) | | | | | | | |

**Demonstration & Diffusion Components**

| | Cumulative | | | Annual | | | |
|---|---|---|---|---|---|---|---|
| | *Total* | *2013-2018* | *2019-2033* | *2013* | *2018* | *2025* | *2035* |
| Direct Electricity Savings (MWh) | 65,986 | 17,596 | 48,390 | 0 | 2,129 | 2,129 | 0 |
| N/A | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| N/A | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| N/A | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Direct Total Energy Savings (GJ) | 237,550 | 63,347 | 174,204 | 0 | 7,665 | 7,665 | 0 |
| Direct GHG Emission Savings (tCO2) | **40,691** | 10,851 | 29,840 | 0 | 1,313 | 1,313 | 0 |
| Direct Post-project GHG Emission Savings (tCO2) | | | | | | | |
| Indirect Bottom-up Emission Savings (tCO2) | **78,999** | | 78,999 | | | | |

# APPENDIX F – COMPLETED TRACKING TOOL

**Figure F-1: Screenshot of Page 1 of PEECB Tracking Tool**

## Tracking Tool for Climate Change Mitigation Projects (For Terminal Evaluation)

**Special Notes: reporting on lifetime emissions avoided**

**Lifetime direct GHG emissions avoided:** Lifetime direct GHG emissions avoided are the emissions reductions attributable to the investments made **during the project's supervised implementation period**, totaled over the respective lifetime of the investments.
**Lifetime direct post-project emissions avoided:** Lifetime direct post-project emissions avoided are the emissions reductions attributable to the investments made outside the project's supervised implementation period, but supported by financial facilities put in place by the GEF project, totaled over the respective lifetime of the investments. These financial facilities will still be operational after the project ends, such as partial credit guarantee facilities, risk mitigation facilities, or revolving funds.
**Lifetime indirect GHG emissions avoided (top-down and bottom-up):** indirect emissions reductions are those attributable to the long-term outcomes of the GEF activities that remove barriers, such as capacity building, innovation, catalytic action for replication.
Please refer to the Manual for Calculating GHG Benefits of GEF Projects.

Manual for Energy Efficiency and Renewable Energy Projects
Manual for Transportation Projects

For LULUCF projects, the definitions of "lifetime direct and indirect" apply. Lifetime length is defined to be 20 years, unless a different number of years is deemed appropriate. For emission or removal factors (tonnes of CO2eq per hectare per year), use IPCC defaults or country specific factors.

| General Data | Results at Terminal Evaluation | Notes |
|---|---|---|
| Project Title | Promoting Energy Efficiency in Commercial Buildings (PEECB) in Thailand | |
| GEF ID | 4165 | |
| Agency Project ID | 3937 | |
| Country | Thailand | |
| Region | EAP | |
| GEF Agency | UNDP | |
| Date of Council/CEO Approval | March 17, 2010 | Month DD, YYYY (e.g., May 12, 2010) |
| GEF Grant (US$) | 4,100,000 | |
| Date of submission of the tracking tool | February 5, 2018 | Month DD, YYYY (e.g., May 12, 2010) |
| | | |
| Is the project consistent with the priorities identified in National Communications, Technology Needs Assessment, or other Enabling Activities under the UNFCCC? | 1 | Yes = 1, No = 0 |
| Is the project linked to carbon finance? | 1 | Yes = 1, No = 0 |
| Cumulative cofinancing realized (US$) | 13,367,000 | |
| Cumulative additional resources mobilized (US$) | 1,099,000 | additional resources means beyond the cofinancing committed at CEO endorsement |

**Figure F-2: Screenshot of EE Page of PEECB Tracking Tool**

| **Objective 2: Energy Efficiency** | | |
|---|---|---|
| | | |
| **Please specify if the project targets any of the following areas** | | |
| Lighting | 1 | Yes = 1, No = 0 |
| Appliances (white goods) | 0 | Yes = 1, No = 0 |
| Equipment | 1 | Yes = 1, No = 0 |
| Cook stoves | 0 | Yes = 1, No = 0 |
| Existing building | 1 | Yes = 1, No = 0 |
| New building | 1 | Yes = 1, No = 0 |
| Industrial processes | 0 | Yes = 1, No = 0 |
| Synergy with phase-out of ozone depleting substances | 0 | Yes = 1, No = 0 |
| Other (please specify) | 0 | |
| | | |
| Policy and regulatory framework | 5 | 0: not an objective/component<br>1: no policy/regulation/strategy in place<br>2: policy/regulation/strategy discussed and proposed<br>3: policy/regulation/strategy proposed but not adopted<br>4: policy/regulation/strategy adopted but not enforced<br>5: policy/regulation/strategy enforced |
| Establishment of financial facilities (e.g., credit lines, risk guarantees, revolving funds) | 5 | 0: not an objective/component<br>1: no facility in place<br>2: facilities discussed and proposed<br>3: facilities proposed but not operationalized/funded<br>4: facilities operationalized/funded but have no demand<br>5: facilities operationalized/funded and have sufficient demand |
| Capacity building | 5 | 0: not an objective/component<br>1: no capacity built<br>2: information disseminated/awareness raised<br>3: training delivered<br>4: institutional/human capacity strengthened<br>5: institutional/human capacity utilized and sustained |
| | | |
| Lifetime energy saved ( demo buildings) | 157,968,000 | MJ (Million Joule, IEA unit converter: http://www.iea.org/stats/unit.asp) Fuel savings should be converted to energy savings by using the net calorific value of the specific fuel. End-use electricity savings should be converted to energy savings by using the conversion factor for the specific supply and distribution system. These energy savings are then totaled over the respective lifetime of the investments. |
| Lifetime direct GHG emissions avoided | 1,079,300 | tonnes CO2eq (see Special Notes above) |
| Lifetime direct post-project GHG emissions avoided | - | tonnes CO2eq (see Special Notes above) |
| Lifetime indirect GHG emissions avoided (bottom-up) | 78,999 | tonnes CO2eq (see Special Notes above) |
| Lifetime indirect GHG emissions avoided (top-down) | 1,710,660 | tonnes CO2eq (see Special Notes above) |

# APPENDIX G – REVISED PROJECT PLANNING MATRIX FOR PEECB PROJECT (SEPTEMBER 2017)

| Strategy | Success Indicator | Baseline | Target | | Means of Verification | Remark |
|---|---|---|---|---|---|---|
| | | | At Inception | Revised Target | | |
| **GOAL**: Reduced intensity of GHG emissions from the commercial building sector | • Cumulative $CO_2$ emission reduction from the commercial building sector by End-Of-Project (EOP, Year 2015), kton $CO_2$eq | 0 | 230 | 239 | • CBEEC<br>• DEDE's Energy Reports<br>• Annual reports prepared by project partners (Industry/Professional Associations, Commercial Building Managements and Developers) | **Assumption:**<br>• GOT's commitment to commercial building EE remains firm<br>• Current economic growth at least remains constant |
| | • % reduction in GHG emissions from the commercial buildings sector by EOP | 0 | 1.2% | | | |
| **OBJECTIVE**: Promotion and facilitation of the widespread application of building energy efficiency technologies and practices in commercial buildings in Thailand | • Cumulative energy savings from the commercial building sector by Year 2015, GWh | 0 | 396 | 411 | • CBEEC<br>• DEDE's Energy Reports<br>• Annual reports prepared by project partners (Industry/Professional Associations, Commercial Building Managements and Developers) | **Assumption:**<br>• GOT's commitment to commercial building EE remains firm<br>• Current economic growth at least remains constant |
| | • % Energy savings by EOP | 0 | 1.2% | | | |
| | • % of new buildings that are fully compliant with the new Building Energy Code by EOP | 20% | 60% | 62% | | |
| | • % of new buildings in Thailand that are classified as energy efficient buildings by EOP | 10% | 40% | 42% | | |
| **COMPONENT 1: Awareness Enhancement on Building EE Technologies and Practices** | | | | | | |
| **OUTCOME 1: Enhanced awareness of the government, building sector and banks on EE technologies and practices** | • % of overall commercial building stakeholders that agree to greater availability of pertinent information on EE technologies and practices through the PEECB project activities by Year 2015 | 0 | 80% (at least) | | • Survey of and documented feedback from network members and users | |

| Strategy | Success Indicator | Baseline | Target | | Means of Verification | Remark |
|---|---|---|---|---|---|---|
| | | | At Inception | Revised Target | | |
| | • % of overall commercial building stakeholders that are satisfied with availability and quality of information available from the PEECB project by Year 2015 | 0 | 70% (at least) | | | |
| **OUTPUT 1.1:** Establishment of the Commercial Building EE Information Center (CBEEC) | • % of overall commercial building stakeholders that are satisfied with availability and quality of CBEEC information services by Year 2015 | 0 | 70% (at least) | | • Survey of and documented feedback from network members and users | CBEEC has been established initially as web-based portal at http://dede-peecb.bright-ce.com/<br><br>Link to CBEEC has also been provided through DEDE website and in the process of requesting other related agencies to provide the link from their websites. |
| **OUTPUT 1.2:** A system of information exchange and dissemination on EE technologies and practices for commercial building stakeholders | • % of overall commercial building stakeholders that agree to greater availability of pertinent information on EE technologies and practices through CBEEC as well as promotional and outreach activities by Year 2015 | 0 | 80% (at least) | | • Survey of and documented feedback from commercial building stakeholders, network members and users | |
| | • No. of users of the information exchange system by EOP | 0 | 1,500 | T&S = 2,010 | | |
| | • No. of satisfied users of the information exchange system each year Starting Year 2012 | 0 | 70% (at least) | | | |
| **OUTPUT 1.3:** Developed and Promoted Energy Use Simulation Models for Commercial Building Design | • No. of modified BESMs with additional features (e.g. dual language user interface) by Year 2013 | 0 | 1 | | • Documentation on the improved building simulation model | Development progress is at 100% |
| | • % of overall no. of trainees that are gainfully employing learned skills on EE building design by Year 2015 | 0 | 70% (at least) | | • Post training course evaluation reports | |

| Strategy | Success Indicator | Baseline | Target | | Means of Verification | Remark |
|---|---|---|---|---|---|---|
| | | | At Inception | Revised Target | | |
| | • No. of new buildings that were designed using the modified BESMs by EOP | 0 | 60 | | • A survey report on adoption and utilization among building designers | |
| **OUTPUT 1.4:** Completed training courses on EE technologies and practices, and financial arrangement for commercial buildings | • No. of completed training courses on EE technologies and practices, and financial arrangement for commercial buildings by EOP | 0 | 7 | 16 | • Documentation on the overall training courses/programs | |
| | • % of overall no. of trainees that are gainfully employing learned skills on EE building design, operation and maintenance by Year 2015 | 0 | 70% (at least) | | • Post training course evaluation reports | |
| | • % of trainees that are engaged in EE building project design, implementation and financing by EOP | 0 | 50% | | • A survey report on adoption and utilization knowledge gained from the training | |
| **OUTPUT 1.5:** Completed training courses on financial assessment of EE application projects in commercial buildings | • No. of completed training courses on financial assessment of EE application projects in commercial buildings by EOP | 0 | 7 | 9 | • Documentation on the overall training courses/programs | |
| **OUTPUT 1.6:** Established business linkages between suppliers of EE technologies, building owners, banks and building practitioners | • No. of EE investment projects facilitated through business links by EOP | 0 | 20 | | • List of EE investments in commercial buildings | |
| | • No. of banks/FIs that have financed EE investment projects through the business links by EOP | 0 | 5 | | | |
| **COMPONENT 2: EE Building Policy Frameworks** | | | | | | |

| Strategy | Success Indicator | Baseline | Target | | Means of Verification | Remark |
|---|---|---|---|---|---|---|
| | | | At Inception | Revised Target | | |
| **OUTCOME 2: Effective implementation of favourable policies that encourage EE technologies and practices for commercial building in Thailand** | • No. of new policy measures for commercial building EE approved and implemented by Year 2015 | 0 | 2 | | • Documentation on policy measures adopted by DEDE | 1. Commercial Building Disclosure have been Implemented as a pilot project<br>2. EE Procurement for Government sector concept has been accepted by CGD to integrate to E-Market and E-Bidding |
| | • No. of fiscal policies approved by DEDE for implementation by Year 2013 | 0 | 1 | | • DEDE's report and PEECB project report | 1. Revolving Fund support for new building design which better than BEC (Step-BEC) |
| | • No. of short and long term action plans for commercial building EE integrated into DEDE's national Energy Conservation Program by EOP | 0 | 1 | | • Documentation on DEDE's EE policy and action plan | The formation of short and long term action plans that would integrate into, short term, "5-year DEDE's Action Plan (2017-2021)" and long term, "21-year Energy Efficiency Plan: (2015-2036)" |
| **OUTPUT 2.1:** Updated and More Effective Policy Measures on Energy Efficiency in Commercial Buildings | • No. of new policy measures for commercial building EE approved and implemented by Year 2015 | 0 | 2 | | • Documentation on policy measures adopted by DEDE | 1. Commercial Building Disclosure have been Implemented as a pilot project<br>2. EE Procurement for Government sector concept has been accepted by CGD to integrate to E-Market and E-Bidding |

| Strategy | Success Indicator | Baseline | Target | | Means of Verification | Remark |
|---|---|---|---|---|---|---|
| | | | At Inception | Revised Target | | |
| | • No. of existing policy measures for commercial building EE modified and implemented by Year 2015 | 0 | 2 | | | 1. Revolving Fund support for new building design which better than BEC (Step-BEC)<br>2. 100% grant modified to Matching Fund 70/30 on EE in public hospital including energy audit (Building Type's Specific Financial Support) |
| | • No. of recommendations on improved and innovative implementation approaches for EE rating/labelling/ certification for commercial buildings in Thailand by Year EOP | 0 | 2 | | • Recommendation report on policy options to strengthen EE rating/labelling/ certification for commercial buildings | 1. Commercial Building Disclosure<br>a. Operational rating label<br>b. Asset rating label<br>2. Energy Saving Certificate (supporting EERS policy) |
| **OUTPUT 2.2:** Revised and Up-to-date Data and Information to Facilitate Policy Implementation of Commercial Building EE | • % of overall commercial building stakeholders that are satisfied with availability and quality of the energy performance database by Year 2015 | 0 | 70% (at least) | | • Survey of and documented feedback from network members and users | |
| | • No. of building energy use profiles established by Year 2014 (2016) | 0 | 4 | | • Report on the SEC review and update | 1. Office SEC<br>2. Hospital SEC<br>3. Hotel SEC<br>4. Department Store SEC |
| | • No. of commercial building EE project referencing the improved M&V schemes by EOP | 0 | 20 | | • PEECB project report | |

| Strategy | Success Indicator | Baseline | Target | | Means of Verification | Remark |
|---|---|---|---|---|---|---|
| | | | At Inception | Revised Target | | |
| **OUTPUT 2.3:** Approved and Implemented New and Improved Financing Models for Commercial Buildings | • No. of applicable fiscal policies on commercial building EE identified and formulated by Year 2012 (2014) | 0 | 3 | | • DEDE's report and PEECB project report | 1. Matching 70/30 on EE in public hospital including consultancy fee (Financial Support by specific building type)<br>2. Revolving Fund including new building (Financing model for Stepped BEC)<br>3. Direct Subsidy for RE in building to achieve zero energy building |
| | • No. of fiscal policies approved by DEDE for implementation by Year 2013 (2015) | 0 | 1 | | DEDE's report and PEECB project report | 1. Matching 70/30 on EE in public hospital including consultancy fee (Financial Support by specific building type)<br>2. Revolving Fund including new building (Financing model for Stepped BEC) |
| | • No. of the approved policies that are implemented by EOP | 0 | 1 | | | 1. Matching 70/30 on EE in public hospital including consultancy fee (Financial Support by specific building type)<br>2. Revolving Fund including new building (Financing model for Stepped BEC) |

| Strategy | Success Indicator | Baseline | Target | | Means of Verification | Remark |
|---|---|---|---|---|---|---|
| | | | At Inception | Revised Target | | |
| **OUTPUT 2.4:** Approved energy efficient promotion action plan (short and long term) to supplement DEDE activities | • No. of short and long term action plans for commercial building EE integrated into DEDE's national EE policy by EOP | 0 | 1 | | • Documentation on DEDE's EE policy and action plan | The formation of short and long term action plans that would integrate into, short term, "5-year DEDE's Action Plan 2560-2564 B.E. (2017-2021)" and, long term, "21-year Energy Efficiency Plan: EEP 2558-2579 B.E. (2015-2036)" |
| | • No. of activities in the action plan that were considered for inclusion in the National Energy Conservation Program by EOP | 0 | 5 | | • DEDE's report and PEECB project report | 1. Commercial Building Disclosure<br>2. Step-BEC<br>3. Building specific type's financial support<br>4. SEC updated in Commercial Building<br>5. M&V |
| | • No. of activities in the approved action plan incorporated in the National Energy Conservation Program that were implemented by EOP | 0 | 2 | | • Documentation on DEDE's EE policy and action plan | 1. Commercial Building Disclosure<br>2. SEC updated in Commercial Building |
| **COMPONENT 3: EE Building Technologies and Applications Demonstrations** | | | | | | |
| **OUTCOME 3.1: Improved confidence in applying EE technologies and practices in commercial buildings in Thailand** | • No. of commercial building owners/managers expressing interests and commitments in implementing EE investments by EOP | 10 | 40 | | • Reports of surveys conducted as parts of information dissemination activities<br>• PEECB project reports | |
| | • No. of building EE projects that adopted EE measures and designs being demonstrated and promoted by EOP | 5 | 10 | | | |
| **OUTPUT 3.1.1:** Installed and operational | • No. of demonstration project implemented and regularly monitored starting Year 2012 (2014) | 0 | 7 | | • Documentation of each demonstration project | |

| Strategy | Success Indicator | Baseline | Target | | Means of Verification | Remark |
|---|---|---|---|---|---|---|
| | | | At Inception | Revised Target | | |
| demonstration projects in selected buildings | • No of completed M&V exercises in accordance with the M&V guideline updated by the PEECB Project | 0 | 7 | | • Annual M&V report of each demonstration project being implemented | |
| **OUTCOME 3.2: Improved local technical and managerial capacity to design, manage and maintain EE technologies and practices** | • % of overall no. of demo building personnel that are gainfully employing learned skills on EE building design, operation and maintenance by Year 2015 | 0 | 70% (at least) | | • Post training evaluation report | |
| | • No. of new buildings constructed that are partly or entirely based on the information regarding success of the demonstrations by EOP | 0 | 20 | | • PEECB project report | |
| **OUTPUT 3.2.1:** Documentation of the demonstration projects and available EE technologies in the markets and dissemination of demo project results | • % of overall no. of building practitioners that are aware of EE technologies/techniques available and applied in demo projects by Year 2015 | 0 | 70% (at least) | | • PEECB project report | |
| **OUTPUT 3.2.2:** Completed training courses for personnel attached to the demo project | • % of overall no. of demo building personnel that are gainfully employing learned skills on EE building design, operation and maintenance by Year 2015 | 0 | 70% (at least) | | • Post training course evaluation reports | |
| **OUTPUT 3.2.3:** Completed demonstration projects on building EE that adopted recommended EE Policies for demonstration and promoted by EOP | • No. of building EE Projects that adopted EE Policy on Energy Consumption Disclosure Program and promoted by EOP | | | 5 | • PEECB Project Report | |

| Strategy | Success Indicator | Baseline | Target | | Means of Verification | Remark |
|---|---|---|---|---|---|---|
| | | | At Inception | Revised Target | | |
| | • No. of building EE Projects that adopted EE Policy on Specific Energy Consumption and promoted by EOP | | | 50 | • PEECB Project Report | |
| **OUTCOME 3.3: Replication of demonstration projects within the commercial building sector** | • No. of new EE building projects designed based on, or influenced by, the results of the demonstration projects by EOP | 0 | 20 | | • Documentation of completed replication projects | |
| **OUTPUT 3.3.1:** Completed project documents/recommendations for EE project replication in the commercial building sector | • No. of identified proven and feasible EE technologies and techniques that are applicable and applied in the Thai commercial building sector by EOP | 0 | 5 | | • An assessment report | 1. Magnetic Bearing Chiller<br>2. Solar PV Chiller<br>3. LED<br>4. Heat Pump<br>5. Solar Hot Water |

# APPENDIX G - EVALUATION QUESTIOANNAIRE

| Evaluative Criteria Questions | Indicators | Sources | Methodology |
|---|---|---|---|
| **Relevance: How does the project relate to the main objectives of the GEF focal area, and to the environment and development priorities at the local, regional and national levels?** | | | |
| • Does the project's objective fit within the priorities of the government? | • Alignment of Project activities with "Thailand National Climate Change Strategies (2008-2012), Office of Natural Resources and Environmental Policy and Planning Ministry of Natural Resources and Environment, January 2008", specifically Strategy 2 on Climate Change Mitigation (emphasizing the need to support improvement and building of energy-saving buildings at the household, office, and commercial levels; as well as provide incentives and create awareness to increase energy efficiency in production and consumption;<br>• Alignment with any updated program beyond 2016 | • ProDoc<br>• Government website on any updated energy conservation programs | • Document review |
| • Does the project's objective fit within Thailand's national energy conservation strategies? | • Alignment of Project activities with "Thailand's Eleventh NESDP (2012-2016) and the Energy Conservation Program, Phase 4 (2012-2016)", and any updated program beyond 2016 | • ProDoc<br>• Government website on any updated energy conservation programs | • Document review |
| • Does the project's objective fit GEF strategic priorities and operational principles? | • Alignment of Project activities with GEF-4 Strategic Programme #1 | • ProDoc | • Document review |
| **Effectiveness: To what extent have the expected outcomes and objectives of the project been achieved?** | | | |
| • Is the project objective likely to be met? To what extent and in what timeframe? | • Energy savings in commercial building sector by EOP<br>• % of new buildings that are fully compliant with new Thai New Building Energy Code (BEC), published in 2010<br>• % of new buildings in Thailand that are classified as energy efficient buildings by EOP;<br>• Amount of reduced $CO_2$ emissions compared to the target of 230,000 tonnes $CO_2$. | • DEDE personnel who were beneficiaries of Project training<br>• Monitored energy savings | • Document review<br>• Stakeholder discussions |

| Evaluative Criteria Questions | Indicators | Sources | Methodology |
|---|---|---|---|
| • What are the key factors contributing to project success or underachievement? | • Supportive legislation promulgated<br>• Adoption of new energy efficiency policies and standards by building practitioners and construction companies;<br>• Successfully completed demonstration buildings that comply with new policies and standards;<br>• Energy saved and GHG emissions reduced in demonstration buildings. | • Legislative documents<br>• PIRs<br>• MBEPS authors and users<br>• Demonstration building owners | • Document review<br>• Stakeholder discussions |
| • Is adaptive management being applied to ensure effectiveness? | • Number of adaptive management changes during project;<br>• Number of buildings using MRV guidelines (prepared by Project) for monitoring primary energy usage and reducing GHG emissions in buildings. | • PIRs<br>• Demonstration building designers | • Document review<br>• Stakeholder discussions |
| • Is monitoring and evaluation used to ensure effective decision-making? | • Number of issues identified in PIRs. | • PIRs<br>• PSC meeting minutes | • Document review<br>• Stakeholder discussions |
| **Efficiency: Was the project implemented efficiently, in-line with international and national norms and standards?** | | | |
| • Is the project cost-effective? | • Financial disbursements;<br>• Outputs delivered;<br>• Outcomes achieved. | • Financial reports<br>• PIRs | • Document review<br>• Stakeholder discussions |
| • Are expenditures in line with international standards and norms for development projects? | • Financial disbursements;<br>• Outputs delivered;<br>• Outcomes achieved | • Financial reports<br>• PIRs | • Document review<br>• Stakeholder discussions |
| **Efficiency: Was the project implemented efficiently, in-line with international and national norms and standards?** | | | |
| • Are management and implementation arrangements efficient in delivering the outputs necessary to achieve outcomes? | • PMU personnel expenditures | • Financial reports<br>• PIRs | • Document review<br>• Stakeholder discussions |
| • Was the project implementation delayed? If so, did that affect cost-effectiveness? | • Timing of delivery of outputs<br>• Disbursements versus outputs | • Financial reports<br>• PIRs | • Document review<br>• Stakeholder discussions |
| • What is the contribution of cash and in-kind co-financing to project implementation? | • Co-financing amounts and details | • Financial reports<br>• PIRs | • Document review<br>• Stakeholder discussions |

| Evaluative Criteria Questions | Indicators | Sources | Methodology |
|---|---|---|---|
| • To what extent is the project leveraging additional resources? | • Co-financing amounts and details | • Financial reports<br>• PIRs | • Document review<br>• Stakeholder discussions |
| **Sustainability: To what extent are there financial, institutional, social-economic, and/or environmental risks to sustaining long-term project results?** | | | |
| • To what extent are project results likely to be dependent on continued financial support? What is the likelihood that any required financial resources will be available to sustain the project results once the GEF assistance ends? | • Co-financing amounts and details;<br>• Number of subscribers to financing mechanisms of the GoT to encourage the development of energy efficiency in buildings. | • Financial reports<br>• PIRs | • Document review<br>• Stakeholder discussions |
| • Do relevant stakeholders have or are likely to achieve an adequate level of "ownership" of results, to have the interest in ensuring that project benefits are maintained? Do relevant stakeholders have the necessary technical capacity to ensure that project benefits are maintained? | • Number of building owners familiar with new BEC and updated EE building policy measures;<br>• Number of architects and designers familiar with new BEC and updated EE building policy measures;<br>• Number of commercial building stakeholders using MRV tools provided by the Project to monitor energy usage in their buildings | • Demonstration building owners<br>• Architects and designers who were beneficiaries of Project training | • Stakeholder discussions |
| • To what extent are the project results dependent on socio-political factors? | • Public awareness of with new BEC and updated EE building policy measures. | • Public opinion surveys of EE in buildings | • Stakeholder discussions |
| • To what extent are the project results dependent on issues relating to institutional frameworks and governance? | • Updated EE building policy measures that are adopted;<br>• Public official knowledge of these standards and their enforcement tools. | • Gazetted standards<br>• Public officials managing building assets | • Document review<br>• Stakeholder discussions |
| • Are there any environmental risks that can undermine the future flow of project impacts and Global Environmental Benefits? | • Energy savings of buildings in compliance with new BEC and updated EE building policy measures;<br>• GHG emission reductions from demonstration buildings. | • Demonstration building design reports<br>• Demonstration building managers | • Document review<br>• Stakeholder discussions |
| **Impact: Are there indications that the project has contributed to, or enabled progress toward, reduced environmental stress and/or improved ecological status?** | | | |
| | • Public opinions on EE buildings<br>• Opinions and knowledge of public officials and owners and users of demonstration EE buildings | • Public opinion surveys of EE buildings<br>• Demonstration building managers | • Stakeholder discussions |

# APPENDIX H – RESPONSES TO COMMENTS RECEIVED ON DRAFT TE REPORT

**To the comments received on 28 May 2018 from the Terminal Evaluation of UNDP-GEF PIMS 3937: *Promoting Energy Efficiency in Commercial Buildings in Thailand (PEECB Project)***

*The following comments were provided in track changes to the draft Terminal Evaluation report; they are referenced by institution ("Author" column) and track change comment number ("#" column):*

| Author | # | Para #/ Comment location | Comment/Feedback on draft TE report | TE response and actions taken |
|---|---|---|---|---|
| *Manuel Soriano* | *1* | *Page iv, Executive Summary* | *Noted that in the PEECB's Brief Description in the ProDoc, the goal is the reduction in the annual growth rate of GHG emissions from the Thai commercial building sector. The reduction of intensity of GHG emissions can lead to such goal. The objective statement is the same as that in the ProDoc.* | *The Evaluation Team has been consistently using the wording of the goals and objectives from the Project Results Framework (PRF) which differs from the opening page of the ProDoc. As such, we have not made any changes throughout the document in this context.* |
| *Manuel Soriano* | *2* | Page v, Executive Summary | *With regards to the statement "during the period of 2010 to 2015, Thailand's annual electricity consumption grew at an average rate of 3.2% annually", how much of this reduced growth is due to EC&EE overall, and how much from EC&EE efforts in the commercial buildings sector?* | *This information was sourced from the IEA website. To the knowledge of DEDE, the disaggregation of electricity consumption into EC&EE is not available.* |
| *Manuel Soriano* | *3* | Page v, Table A | *Goal: Did the project has in any way assisted or was influential in the achievement of this GHG emission reductions? Please clarify in the appropriate section of this report how this is attributable to the PEECB. How much was the actual achieved % reduction in GHG emissions from the commercial buildings sector by EOP?*<br><br>*Objective: It would be very good to explain the PEECB's contribution or influence in the development of the new BEC, as well as in the increased compliance of the new buildings, and in the increase in the number of EE buildings.*<br><br>*Actual Outcome 2: Please explain in the appropriate sections of the report the actual magnitude of effectiveness* | *Edits made to improve all outcome descriptions* |

| Author | # | Para #/ Comment location | Comment/Feedback on draft TE report | TE response and actions taken |
|---|---|---|---|---|
| | | | *of the policies, the % increase in interest in EE (and how was that measured), and improved compliance to the policies (and how was that measured).*<br><br>*Actual Outcomes 3.1 and 3.2: Please explain the actual magnitude of improvement of the confidence of building owners and operators on the application of EE technologies and practices. How was the level of confidence and level of improvement measured?* | |
| *Manuel Soriano* | *4* | *Para 5* | *The comments and recommendations on this in the MTR should also be considered.*<br><br>*In fact, the findings and recommendations of the MTR in the 5 bullet points should also be considered in the TE. That means, evaluation of whether these were followed or not, and the results of the actions taken in response to the MTR findings and recommendations..* | *Review of the MTR actions can be found in Para 41.* |
| *Manuel Soriano* | *5* | *Para 10* | *In which bullet below, was the review/assessment of the actions taken to incorporate the findings and recommendations of the MTR in the implementation of the project? Looks like the MTR was not considered in this terminal evaluation.* | *See Comment 4.* |
| *Manuel Soriano* | *6* | *Para 13* | *What is the meaning of this? The implementation of the project during the extension period always entail costs.* | *This refers to an extension of the Project with no additional budget.* |
| *Manuel Soriano* | *7* | *Para 25* | *Please provide the reasons why Outcome 3.3 (Replication of Demo EECBs) could have been combined with Outcome 3.1* | *Edits provided.* |
| *Manuel Soriano* | *8* | *Para 25* | *Agree on statement that "designers of PPMs need to be cognizant of the efforts and costs required to monitor indicators in a PPM". A properly defined PPM will include means of verifications for the proposed indicators that will duly consider these. For example, if the means of verification is a survey, such survey could be included as part of the project activities so that it can be budgeted.* | *As noted. No changes were made in report.* |
| *Manuel Soriano* | *9* | *Para 26* | *Were these issues also found out during the MTR? Did the MTR recommend something like adjustment of the target* | *The MTR did not recommend an adjustment of the GHG emission reduction target. We* |

| Author | # | Para #/ Comment location | Comment/Feedback on draft TE report | TE response and actions taken |
|---|---|---|---|---|
| | | | *since the set target is questionable? Have the assumptions used in the GHG ER estimation changed significantly? Was the project designer, IIEC, which is based in Bangkok, consulted regarding this?* | *surmise this was because they felt this target could not be changed. IIEC were consulted and did mention that direct GHG emission reduction targets did consider ERs from policy work undertaken by PEECB. No additions were made to the report in this regard.* |
| *Manuel Soriano* | *10* | *Para 28* | *Is that the lack of clarity in the calculation of the GHG emission reduction target the reason why the impact of the project is only <0.1% of the building?* | *The Project is dealing with the largest commercial buildings in Thailand. As such, this would represent a very small percentage of the country's building stock.* |
| *Manuel Soriano* | *11* | *Para 29* | *Does this mean the PEECB activities are able to mitigate these 6 risks?* | *Edits made in this Para for clarification.* |
| *Manuel Soriano* | *12* | *Para 30* | *What does this mean? Does this mean the PEECB project design didn't build on, or didn't make use of the results and findings of other EE building projects or programs in Thailand? Please clarify. This section should be consistent with Sec. 3.1.7.* | *The Evaluation Team's understanding of this section is the naming of other projects that have influenced the design of PEECB. It does not have any linkage with Section 3.1.7 which is about collaboration of PEECB with other projects.* |
| *Manuel Soriano* | *13* | *Para 32* | *But were there stakeholder consultations done, and whether stakeholders were adequately involved during the course of the PEECB project implementation? Please clarify by stating the actual roles and involvement of each stakeholder groups stated below.* | *All these stakeholders were consulted during the PPG phase. Changes made to this Para for this clarification.* |
| *Manuel Soriano* | *14* | *Para 35* | *Was the potential coordination realized? How and why? Please clarify.* | *Para edited to respond to this question.* |
| *Manuel Soriano* | *15* | *Para 39* | *Please comment on the effectiveness of engaging the services of a private entity to carry out project management tasks as compared to hiring individual members of the PMU.* | *This is already mentioned in Para 40 under Adaptive Management.* |
| *Manuel Soriano* | *16* | *Para 39* | *Please indicate rationale given for these additional activities for the Project period extended from September 2017 to 30 April 2018, and the TE's comment and recommendation on these additional activities, particularly the rationale provided.* | *This is already mentioned in Paras 40, 86 and 99.* |

| Author | # | Para #/ Comment location | Comment/Feedback on draft TE report | TE response and actions taken |
|---|---|---|---|---|
| *Manuel Soriano* | *17* | *Para 40* | *Did the priorities change, so much so that the activities have to be adjusted/modified? Or is it because the original design didn't take into account the priorities of DEDE?*<br><br>*For the Project extension to 2018, was the plan intended to achieve the EOP targets the goal and objective indicators? Please explain in the appropriate section of the report why the impact o the PEECB is only to <0.1% of the country's commercial building stock.* | *Edits made to reflect that more details were needed for activities for PEECB.*<br><br>*Plan was to strengthen Project goals and objectives that will serve to strengthen DEDE with their mandate. Edits provided to clarify this point.* |
| *Manuel Soriano* | *18* | *Para 41* | *Please explain why the result is that the impact is only to <0.1% of the building stock.* | *Please see Comment 10.* |
| *Manuel Soriano* | *19* | *Para 43* | *Please indicate, where appropriate, the % of the buildings stock that are fulfiling commitments regarding submissions of commercial building designs and their compliance to SEC guidelines as well as the BEC by EOP.* | *Edits provided in this Para as requested.* |
| *Manuel Soriano* | *20* | *Para 45* | *Please indicate how this have improved (or not improved) the number of buildings that fulfill their commitments to their submissions of commercial building designs, and their compliance to SEC guidelines and BEC.* | *These improvements have already been mentioned in Para 45 as the selection of commercial building owners who managed several other buildings where "self-replication" of EE practices was possible.* |
| *Manuel Soriano* | *21* | *Para 47* | *Please provide evidence, based on the TE findings, that these efforts should be rated highly satisfactory. Please refer also to the 2 previous comments.* | *This is based on strategic partnership selection of commercial building owners as described in Para 45 and 46.* |
| *Manuel Soriano* | *22* | *Para 48* | *The Paras 48-50 do not say whether the bases of the adaptive management actions that were done on the PEECB are based on the project's M&E findings. Please say something about that.* | *Updated information has been added to Para 48 to respond to the reviewer's concerns.* |
| *Manuel Soriano* | *23* | *Para 49* | *I think the GHG ERs were estimated based on the GEF prescribed methodology that was used by the project designers. Such methodology was approved by the GEFSec when the PEECB was CEO-endorsed. I suppose the project designer (IIEC) followed the guidance that was provided to them. Hence, evaluate this based on such methodology.* | *Edits have been provided to Para 49 as well as Paras 64-66 based on clarifications from the Project designers on their approaches to GHG emission reduction estimates.* |
| *Manuel Soriano* | *24* | *Table 3* | *Please state what was or what is being demonstrated in each demo. It would also be good to state (in another* | *Changes made to Table 3.* |

| Author | # | Para #/ Comment location | Comment/Feedback on draft TE report | TE response and actions taken |
|---|---|---|---|---|
| | | | *column) the energy saved and GHG emissions reduced to date.*<br><br>*Looks like that most are still yet to operate. So how come the target levels for the cumulative GHG ER and energy saved by EOP target are already achieved?*<br><br>*Does the PEECB provide TA in the design of each demo? Is there incremental funding for hardware for each demo? Please clarify.* | *Operational status is also on Table 3.*<br><br>*PEECB provided TA for each demo. While incremental funding was offered for each demo, this was not required due to the availability of financing with all commercial building owners.* |
| *Manuel Soriano* | *25* | *Para 52* | *Noted that in the TBWP, bulk of the project budget was allocated to local consultants. The TBWP also shows that there is a significant equipment budget in Component 3.1? What happened to that?* | *The equipment budget was re-allocated to TA. A bullet point was added to Para 51 on this issue.* |
| *Manuel Soriano* | *26* | *Para 54* | *How is this defined? Is this US$/ton CO2? Please clarify further the satisfactory rating. If the impacts is only to <0.1% of the building stock, is that considered significant?* | *Clarifications have been made in this Para as requested.* |
| *Manuel Soriano* | *27* | *Para 55* | *Please clarify here and in Sec. 3.2.3 whether the M&E findings were used in coming up with the adaptive management actions that were done for this project. The bullets below does not include M&E for the demos.* | *These bullets were taken out of the ProDoc which did not include M&E of demo projects. This was added to Para 55.* |
| *Manuel Soriano* | *28* | *Para 56* | *Please describe how the individual demos were monitored, by who and how? Were there regular reports submitted to the PMU by each demo host/implementer. Please clarify.* | *Requested information has been provided in Para 56.* |
| *Manuel Soriano* | *29* | *Para 58* | *When was this done? BMC was not mentioned in the ProDoc. Hence, that was not the intial plan during the project design. Was that part of adaptive management? Please comment on that decision, particularly on the impact on the project implementation.*<br><br>*The project implementation period was extended. Please explain the minimized delays.*<br>*But can we say that DEDE ensured that the project outcomes were realized and project objective achieved, and in so doing the project adequately contributed to the* | *This was already mentioned in Para 40 under Adaptive Management. The impact of this decision is already covered in this bullet point.*<br><br>*Minimized delays have already been explained in Para 40.*<br><br>*This is already mentioned in Para 58.* |

| Author | # | Para #/ Comment location | Comment/Feedback on draft TE report | TE response and actions taken |
|---|---|---|---|---|
| | | | *achievement of the project goal? Please explain further the HS rating.*<br><br>*Please explain if the DEDE monitors and evaluates the demos regularly. This is not mentioned in the above bullets* | *There was joint monitoring of the demos. This has been added as an additional bullet point.* |
| *Manuel Soriano* | *30* | *Para 59* | *With regards to DEDE to outsourcing PEECB management, was that UNDP's decision or DEDE? Please clarify I think the above bullets are not enough to explain the HS rating. Please elaborate further.* | *Clarifications have been made in this Para to address these concerns.* |
| *Manuel Soriano* | *31* | *Para 63* | *The goal and objective of a project are never designed. The project is designed to achieve the objective and contribute to the realization of the goal. In the case of PEECB, I suppose the issues stated in the first 2 sentences of Para 63 are the ones that caused or influenced the DEDE to come up with the project objective. And since the intended funder is the GEF, the GHG ER goal was set since that is the goal of the GEF in the climate change mitigation focal area.* | *The evaluation team appreciates the comment.* |
| *Manuel Soriano* | *32* | *Para 64* | *Were these verified during the TE? How do these data compare to the M&E reports of the PEECB Project? Please explain how these energy savings and GHG ERs are attributable to the PEECB Project. This Para 64 does not fully explain the "Status of Target Achieved" entries in Table 5.*<br><br>*Why is it difficult to monitor GHG emission reductions from the entire building sector? Please clarify. Aren't the suggested means of verification (MOVs) not available/applicable?* | *These were verified by the evaluators.*<br><br>*DEDE does not provide sector-wide figures on the entire building sector on an annual basis, making it difficult for the PMU to monitor and report in PIRs* |
| *Manuel Soriano* | *33* | *Table 5* | *How much of this is from the collective 12 demo buildings? Please explain the attribution to the PEECB of the rest of the energy savings.* | *See Para 64* |
| *Manuel Soriano* | *34* | *Para 66* | *Please justify further this HS rating in the light of the comment on attribution and no verification of some of the reported info, some of which are, as per the TE, are disputable* | *Edits provided in Para 66.* |

| Author | # | Para #/ Comment location | Comment/Feedback on draft TE report | TE response and actions taken |
|---|---|---|---|---|
| *Manuel Soriano* | *35* | *Para 64* | *This is **Output 1.1: Established Commercial Building EE Information Center (CBEEC).** Please use the original name of the output. **Important**: Unless officially changed during the project implementation, please use the actual name/title of the project goal, objective, outcomes, outputs and activities as stated in the GEF-approved ProDoc.* | *As noted. Throughout the TE report, we have been consistently using the wording from the September 2017 PRF which is in Appendix F.* |
| *Manuel Soriano* | *36* | *Table 6* | *With regards to the statement that Para 77 does not explain why the level of achievement was 20 projects and 5 banks/FIs, please clarify* | *It is explained in Para 77 and also refers to Para 84 for additional details. No changes were made.* |
| *Manuel Soriano* | *37* | *Para 78* | *Please qualify this further in the light of the issue of attribution of reported accomplishments to the PEECB* | *Edits have been made to this Para.* |
| *Manuel Soriano* | *38* | *Table 7* | *Is CBECD, EE Public Procurement and Step-BEC part of the PEECB? If its not part of the PEECB, please clarify the attribution to the project.*<br><br>*For purposes of PIR reporting, outcome indicators are necessary since the reporting is only up to the Outcome level. This applies to the next 2 rows.* | *These are part of PEECB.*<br><br>*The elimination of outcome indicators was suggested as a means of reducing the number of indicators being monitored, and thus reducing M&E efforts.* |
| *Manuel Soriano* | *39* | *Para 82* | *Is this an activity of the PEECB under Component 2? In the ProDoc, there is a mention of an activity in Component 1 called information disclosure program. Are these 2 the same? Please clarify. Clarify also if CBECD is an external program that was assisted by PEECB, or is it part of the PEECB and implemented with incremental GEF funds.* | *CBECD is a not the same activity as the information disclosure program of Component 1. CBECD is not external to PEECB and was supported by GEF funds.* |
| *Manuel Soriano* | *40* | *Para 83* | *With regards to the statement that "the outcome of these actions should accelerate the deployment of EE appliances into public buildings throughout Thailand", based on the TE, did they?* | *We do not know as it is still too early to make this determination.* |
| *Manuel Soriano* | *41* | *Para 84* | *With regards to the statement that "PEECB also assisted DEDE in designing and implementing fiscal policies using ENCON funds", what does this mean? Is the design and implementation of fiscal policies using ENCON funds a PEECB activity? There's no mention of this in the ProDoc. Again, please clarify the attribution.* | *The answers to the questions of the reviewer are clearly explained in Para 84.* |

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| *Manuel Soriano* | *42* | *Para 85* | *Is this a different equation that is used in the calculation of EnPI (based on how ENPI is defined in Thailand)?* | *No, same equation.* |
| *Manuel Soriano* | *43* | *Para 86* | *I understand, but for a non-technical person reading this report, this sentence would be hard to understand, particularly when the explanation in Para 85 about the equations are not clear. Please re-state this clearly.* | *Edits done for clarification.* |
| *Manuel Soriano* | *44* | *Para 92* | *The ProDoc does not mention this as a barrier. Is this a finding during the project implementation or during the TE? Does this mean a special demo building? Or different demo buildings?* | *Despite not being mentioned in the ProDoc, the Evaluation Team feels it is worth mentioning this as a barrier. This means a demonstration building that is fully invested into EE measures that can be monitored for informing EE policy in Thailand.* |
| *Manuel Soriano* | *45* | *Para 93* | *The way this is stated it is construed that the PEECB is just providing support to an activity that is outside of the PEECB. Is the survey of baseline energy consumption not part of the PEECB? Please revise.* | *Baseline energy surveys are part of an energy audit are a part of PEECB.* |
| *Manuel Soriano* | *46* | *Para 94* | *Please clarify what are being demonstrated in these 12 demo buildings. In the TE contect, does completion of EE investment means completion of the demo? Please clarify.* | *A reference is made to Table 4 with those details.* |
| *Manuel Soriano* | *47* | *Para 96* | *Since demos are part and parcel of the PEECB, it means that TA on these are also part of PEECB. The way this written is again construed as the monitoring of EE savings and GHG ERs is outside of the PEECB. Please revise.* | *The description does not imply that monitoring of EE savings was outside of PEECB. No changes were made by the Evaluation Team.* |
| *Manuel Soriano* | *48* | *Para 97* | *Are the demos, or some of the demos already compled by mid-2016? Please clarify, at least in the TE context, what does "completed demo" means? In my view the demo is completed if at the very least the demo investment is already recovered (paid back).*<br>*Please provide the relevant references to substantiate the claim that "a substantial increase in the number of building personnel gainfully employed with new skills on EE that were acquired through PEECB training programmes".* | *In the context of this report, completed demos mean installation is complete and demonstrating energy savings.*<br><br>*This was done in Footnote 50.* |
| *Manuel Soriano* | *49* | *Para 99* | *Does this mean that the project was already completed by end 2016? Where did the surplus funds come from? What were the names of the additional PEECB activities that were* | *The addition of a reference to Paras 40 and 51 has been added to provide the responses to the comment.* |

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| | | | *funded by the surplus funds? In what Components were these included?* | |
| *Manuel Soriano* | *50* | *Para 105* | *Was this the primary view of the DEDE about what the PEECB Project is all about? Or does DEDE acknowledges the PEECB goal and objective, and this view that they have is more of a benefit of the PEECB for DEDE?*<br><br>*Wouldn't the direct management of the project by DEDE manifest their strong ownership of the project instead of outsourcing such responsibility? Does that mean DEDE has no capacity to do the PM work and to facilitate good implementation of this project, it hired somebody else to do the work?* | *This was DEDE's primary view.*<br><br>*The outsourcing of GEF project management does not necessarily mean it does not have strong ownership of the project. DEDE essentially outsourced much of the documentation to BMC who have a consultant whose command of spoken and written English was better than anyone within DEDE. The outsourcing then allowed DEDE personnel to focus more on their EE work which was being strengthened by the PEECB Project. The absence of outsourcing this work would have resulted in very poor reporting to UNDP due to poor English skills of DEDE personnel.* |
| *Manuel Soriano* | *51* | *Para 110* | *Don't some of these points reflects a less successful awareness raising campaigns on EE in commercial buildings?* | *There is a strong fiscal mindset of building owners, and hence their understanding of environmental benefits of EE measures is not a reflection of a less successful raising campaign on EE in commercial buildings. It only indicates sustained efforts are required to bring more attention to the environmental benefits of EE measures for commercial buildings.* |
| *Manuel Soriano* | *52* | *Para 111* | *This is not the main impact. <u>This is something that the PEECB project should deliver or bring about</u>. The main impact is what would happen (e.g., higher numbers of EE buildings in the commercial buildings sector, higher investments in EE projects in commercial buildings, etc.) with the creation of the enabling investment environment* | *Agreed. Changes have been made in this Para.* |

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| | | | *for commercial building owners for EE measures and technologies.* | |
| *Manuel Soriano* | *53* | *Para 112* | *How does this square with, or be consistent with, the claim of effectiveness of the PEECB Project. Please clarify.* | *Edits have been made in Para 112 to clarify the evaluation statement that PEECB only affects 0.1% of all commercial buildings in Thailand.* |
| *Manuel Soriano* | *54* | *Table 9, Outcomes 3.2 and 3.3.* | *There is no follow-up nor replication/scale-up plan for the demonstrations, particularly on the institutional arrangements, Without such plan, how will the results and best practices from the demos be sustained?* | *Edits made in the assessment of sustainability to include these comments.* |
| *Manuel Soriano* | *55* | *Para 114* | *Is there a scale-up plan that the PEECB has produced to assist the GOT in the scale-up? Please clarify.* | *Clarifications provided.* |
| *Manuel Soriano* | *56* | *Para 115* | *Apart from what was done on this under the project, what was the linkage and coordination arrangement on this with the GHG inventory work of the country under the National Communications to UNFCCC?* | *ONEP is the agency responsible for reporting GHG emissions to UNFCCC. They had a representative on the PEECB Board to liaise with the Ministry of Energy and DEDE to strengthen reporting functions of GHG emission reductions from 5 sectors including the building sector (with transport and industry amongst some of the other sectors). The Project also had 2 ONEP staff go to BESM training to improve their understanding of determination of energy savings from EE measures in buildings.* |
| *Manuel Soriano* | *57* | *Para 116* | *There seems to be a misunderstanding here of the LFA process that produces a PPM that embodies the theory of change that the project will aim to bring about.*<br><br>*Isn't the M&E Plan and the PIR Process enough for doing this? What is the difference between this, and the project M&E plan and annual PIR reporting? Please clarify especially in the context of the PEECB implementation.*<br><br>*That's what the LFA should have done. Not sure if an actual LFA was done on this or the PPM template was just filled-in with the required outcome and output statements,* | *The intention of this recommendation is to encourage future project designers with a changed approach to preparing PPMs that are clear and well thought out. The Evaluation Team has some experience on the TOC approach in the design of projects which is useful in the strengthening of a PPM by examining causal pathways to intended project impacts. With time limitations limiting the Evaluation Team from writing several paragraphs on this approach, edits have been made in Para 116* |

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| | | | *indicators and targets, MOVs and critical assumptions based on the Results Framework in the GEF-approved PEECB PIF. Was this found out by the TE?*<br><br>*Does this mean this ROtI is done during project design? That would be great. Nonetheless, the LFA process that produce the PPM also does this even at the early stage of the Objective Analysis. It would be good to provide the steps in doing this to possibly incorporate these in the Objective Analysis* | *to recommend a TOC approach to preparing PPMs, and its importance to ensuring the highest likelihood that the GEF investment will achieve its intended outcome. This could include an ROtI though the project designer would need to determine if this would be useful.* |
| *Manuel Soriano* | *58* | *Figure 3* | *This does not even show the most important LFA steps of situation analysis, problem analysis (Problem Tree), and objective analysis (Objective Tree). The project goal, objective, outcomes, outputs, and activities are derived and deduced from the Objective Tree. The assumptions for the realization of each output and outcome are also determined based on the Objective Tree. It would be interesting to know the TE's comments on the comparison between the well-proven LFA and ToC (which is actually part of LFA), and its recommendations on how to improve the Objective Analysis stage with the ROtI process.* | *See Comment 57.* |
| *Manuel Soriano* | *59* | *Para 117* | *What is meant by strengthened linkages? How will this be gauged? Please provide the specific actions to be carried out to achieve this. These are very good suggestions to enhance efforts to regularly determine the status of the energy utilization performance of the commercial buildings sector. But it would be good to recommend also how the BMA, EAT and municipal partners will be involved in these actions.* | *Edits have been made changing "linkages" to "collaboration". BMA should be strengthened and in a position to enforce BEC standards as they do issue building construction permits.* |
| *Manuel Soriano* | *60* | *Para 118* | *This is rather vague if the target level (magnitude) is not mentioned, and for what purpose. Better suggest something that will, based on the PEECB results and TE findings, will have better chances of achieving the objective of regular tracking of the energy utilization performance of the commercial buildings sector.* | *Edits have been made in this Para to clarify the intentions of this recommendation.* |

| Author | # | Para #/ Comment location | Comment/Feedback on draft TE report | TE response and actions taken |
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| *Manuel Soriano* | *61* | *Para 121* | *Better recommend something like this in the context of the Sustainable Cities impact program under GEF-7. That would be a very good future direction.* | *Edits completed as requested.* |
| *Manuel Soriano* | *62* | *Para 122* | *Does TGO agree to this? Please clarify.*<br><br>*Weren't these done already under the PEECB? Why these again?* | *Yes. However, resources will be required to implement this action by DEDE.*<br><br>*From our interview with TGO, they have not yet raised awareness of VERs for EECB owners due to a paucity of resources to promote. This could be done in a subsequent scaled-up phase.* |
| *Manuel Soriano* | *63* | *Para 123* | *Would this be possible if the conclusion is that less than 0.1% of the buildings sector was impacted by the demos? Please clarify.* | *It should be possible based on discussions with various EECB building owners, DEDE and BMC and a strong sense of corporate social responsibility in Thailand.* |
| *Manuel Soriano* | *64* | *Para 124* | *Please clarify this declared primacy of this aim to that in the results framework in the GEF-approved PEECB PIF and in the PPM in GEF CEO-endorsed PEECB ProDoc, i.e., GHG ER and energy savings through EE in commercial buildings. Isn't this more of a benefit to DEDE of the PEECB that was designed to reduced GHG ER from the commercial buildings in Thailand?* | *Edits of this Para are provided for clarification.* |
| *Manuel Soriano* | *65* | *Para 125* | *Does this mean for future UNDP-GEF EE projects, we should engage the services of a project manager who has both management and technical skills? Not a PM that is very good in project management and supported by a CTA who will look after the technical aspects of the project implementation. Please clarify.* | *Edits of this Para are provided for clarification.* |
| *Manuel Soriano* | *66* | *Para 126* | *A discussion with the IIEC should further provide evidence on the ownership aspect by DEDE to this project, particularly in the project design.*<br><br>*Aren't there any bad/worst practice to mention that we should avoid in similar ongoing projects, and in future similar projects to be designed?* | *IIEC confirmed strong DEDE participation during the Project design phase.*<br><br>*None identified.* |

# APPENDIX I - EVALUATION CONSULTANT AGREEMENT FORM

**Evaluators:**

1. Must present information that is complete and fair in its assessment of strengths and weaknesses so that decisions or actions taken are well founded.
2. Must disclose the full set of evaluation findings along with information on their limitations and have this accessible to all affected by the evaluation with expressed legal rights to receive results.
3. Should protect the anonymity and confidentiality of individual informants. They should provide maximum notice, minimize demands on time, and respect people's right not to engage. Evaluators must respect people's right to provide information in confidence, and must ensure that sensitive information cannot be traced to its source. Evaluators are not expected to evaluate individuals, and must balance an evaluation of management functions with this general principle.
4. Sometimes uncover evidence of wrongdoing while conducting evaluations. Such cases must be reported discreetly to the appropriate investigative body. Evaluators should consult with other relevant oversight entities when there is any doubt about if and how issues should be reported.
5. Should be sensitive to beliefs, manners and customs and act with integrity and honesty in their relations with all stakeholders. In line with the UN Universal Declaration of Human Rights, evaluators must be sensitive to and address issues of discrimination and gender equality. They should avoid offending the dignity and self-respect of those persons with whom they come in contact in the course of the evaluation. Knowing that evaluation might negatively affect the interests of some stakeholders, evaluators should conduct the evaluation and communicate its purpose and results in a way that clearly respects the stakeholders' dignity and self-worth.
6. Are responsible for their performance and their product(s). They are responsible for the clear, accurate and fair written and/or oral presentation of study imitations, findings and recommendations.
7. Should reflect sound accounting procedures and be prudent in using the resources of the evaluation.

**Evaluation Consultant Agreement Form**[64]

**Agreement to abide by the Code of Conduct for Evaluation in the UN System**

**Name of Consultant:** __Roland Wong_____

**Name of Consultancy Organization** (where relevant)**:** _____

**I confirm that I have received and understood and will abide by the United Nations Code of Conduct for Evaluation.**

Signed at *Surrey, BC, Canada* on *28 June 2018*

[64]www.unevaluation.org/unegcodeofconduct

**Evaluators:**

8. Must present information that is complete and fair in its assessment of strengths and weaknesses so that decisions or actions taken are well founded.
9. Must disclose the full set of evaluation findings along with information on their limitations and have this accessible to all affected by the evaluation with expressed legal rights to receive results.
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**Evaluation Consultant Agreement Form**[65]

**Agreement to abide by the Code of Conduct for Evaluation in the UN System**

**Name of Consultant:** Walaitat Worukul

**Name of Consultancy Organization** (where relevant)**:** _____

**I confirm that I have received and understood and will abide by the United Nations Code of Conduct for Evaluation.**

Signed at *Chang Mai, Thailand* on *28 June 2018* 

[65] www.unevaluation.org/unegcodeofconduct