

Country	Thailand
Request ID#	2015000086
Title	Fostering Green Buildings in Thailand Towards Low Carbon Society
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Summary of the CTCN Technical Assistance

A substantial share of pledged greenhouse gas (GHG) emissions reductions in Thailand is expected to come from building sector energy efficiency and conservation measures, including minimum performance targets for select components of existing buildings. However, the Energy and Environment Department of the Ministry of Science and Technology and the King Mongkut's University of Technology Thonburi have together identified challenges to implementing these performance targets, including a lack of local capacity to undertake techno-economic analysis of current existing building performance, to identify technological options, and to inform investment decisions.

The purpose of this technical assistance is to support Thailand in assessing the building sector performance through the following tasks:

1. Review the existing energy consumption baseline for selected existing building types and (re)establish that benchmark for different type of buildings according to the Building Energy Code. This will include reviewing the available existing energy consumption baseline of five (out of nine) selected building types that represent high energy-use intensities (e.g., office buildings, educational buildings, shopping centers, hospitals, and condominiums); assessing the energy performance of those prototypes when compared with both the business-as-usual scenario (2007 Building Energy Code) and the 2015 Building Energy Code; and extending the performance assessment results to other building types for which there may not be actual performance data by using building characteristics, statistical methods and modelling.
2. Assess various technological options with respect to building envelope, lighting systems, and air conditioning systems; and propose/map the best possible technologies. This will include researching the available building technologies that are appropriate for Thailand's climate.

3. Carry-out the techno-financial analysis through a life-cycle cost analysis to identify the cost effective technologies that would enable developers to invest in energy saving technologies that are also in line with their business strategy.

Agreement:

(If possible, please use electronic signatures in Microsoft Word file format)

National Designated Entity to the UNFCCC Technology Mechanism for which the Climate Technology Centre and Network is the operative arm

Name: Dr. Surachai Sathitkunararat

Title: Senior Director, Science Technology and Innovation Information and Foresight Centre

Date: April 7, 2017

Signature:



Applicant of the request

Name: Associate Professor Dr. Apichit Therdyothin

Title: Dean, School of Energy, Environment and Materials

Date: April 20, 2017

Signature:



UNFCCC Climate Technology Centre and Network (CTCN)

Name: Jukka Uosukainen

Title: CTCN Director

Date :

Signature:

1. Background and context

The purpose of this technical assistance is to support the achievement of mandatory and voluntary targets set by the government in the Energy Efficiency Plan of 2015, in National Appropriate Mitigation Actions (NAMAs), and in greenhouse gas (GHG) emissions reduction commitments submitted to the United Nations Framework Convention on Climate Change (UNFCCC).

Thailand is striving to meet their pledged COP 20 GHG emissions reduction target, which will require a 7% emissions reduction from the energy and transport sectors by 2020 relative to the 2005 baseline. For energy use, a substantial share of this reduction is expected to come from energy efficiency and conservation measures implemented in the building sector (including large-, medium- and small-scale commercial as well as residential buildings), as presented in the 2012 Technology Needs Assessments for Climate Change Mitigation/Adaptation in Thailand.

To achieve these targets and to address expected building sector growth, the Energy Efficiency Plan of 2015 established 1) key building sector strategies comprising the enforcement of energy conservation standards for designated factories and buildings; 2) a new construction Building Energy Code; and, 3) an energy labelling program for equipment and appliances. The Building Energy Code aspires to shift towards more stringent requirements every 3 years, with the aim of reaching net zero-energy by 2033.

Building-sector specific NAMAs are also being developed in collaboration with the United Nations Environment Programme (UNEP) (See: http://www.unep.org/sbci/pdfs/SBCI_NAMA_2pager.pdf). The NAMA development is being supported by a five-year project (2013-2017) was funded by Germany's Federal Ministry for Environment, Nature Conservation and Nuclear Safety to facilitate building sector mitigation actions by collaborating with Thailand on the development of sectoral approaches in national plans and NAMA strategies. (The technology needs assessment for building sectors was not part of the NAMAs project and had not yet been conducted.)

2. Problem statement

There are several challenges to effective implementation of the Building Energy Code, including:

- (1) A lack of rigorous analysis to inform current baselines and benchmarks as well as cost-effective technology investment options;
- (2) The need for extensive capacity development for implementers, designers, evaluators, and operators as it remains difficult to find knowledgeable architects, contractors, and consultants who are familiar with the solutions that can impact energy efficiency in a building; and
- (3) Non-compliance with the Building Energy Code due to various reasons such as limited building audits as well as financial barriers.

This technical assistance response seeks to address this first challenge through the following activities:

**Technical Assistance
Response Plan – Terms of Reference**

3. Logical Framework for the CTCN Technical Assistance:

<p>Objective: Through the establishment of energy consumption benchmarks for existing building infrastructure types based on the Building Energy Code of Thailand, building component technology assessments, and techno-financial analysis, Thailand will have the building blocks to support market transformation, sustainable development, and workforce development that will eventually contribute to meet national emissions and energy-use reduction targets.</p>
<p>Outcome: This assistance supports Thailand in developing the knowledge essential for GHG emissions reductions commitments through the adoption of suitable building sector technologies, market transformation, job creation, and reduced energy consumption.</p>

	Month											
	1	2	3	4	5	6	7	8	9	10	11	12
Mandatory Output: Development of implementation planning and communication documents												
<p>Mandatory Activities: All implementers must undertake the following activities at the beginning and at the end of the CTCN technical assistance.</p> <p>i) A detailed work plan of all activities, deliveries, outputs, deadlines and responsible persons/organisations and detailed budget to implement the Response Plan. The detailed work plan and budget must be based directly on this Response Plan;</p> <p>ii) Based on the work plan, a monitoring and evaluation plan with specific, measurable, achievable, relevant, and time-bound indicators used to monitor and evaluate the timeliness and appropriateness of the implementation. The monitoring and evaluation plan should apply selected indicators from the Closure and Data Collection report template and enable the lead implementer to complete the CTCN Closure and Data collection report at the end of the assignment (please refer to item iv below and section 14 in the Response Plan);</p> <p>iii) A two-page CTCN Impact Description formulated in the beginning of the technical assistance and update/revised once the technical assistance is fully delivered (a template will be provided);</p> <p>iv) A Closure and Data Collection report completed at the end of the technical assistance (a template will be provided).</p>												

**Technical Assistance
Response Plan – Terms of Reference**

	Month											
	1	2	3	4	5	6	7	8	9	10	11	12
Mandatory Deliverables:												
i) Detailed work plan												
ii) Monitoring and evaluation plan												
iii) CTCN Impact Description												
iv) Closure and Data Collection report												
Output 1: Establish building energy consumption baselines												
Working together with the Proponent, the CTCN will validate the available data sets and required supplementary information necessary for the establishment of baseline energy consumptions for select existing building prototypes as identified under the Building Energy Code.												
Activity 1.1: Review and validate data sets and supplementary information and begin establishing the baseline energy consumptions.												
Deliverable 1.1: Conference call or web meeting with the NDE and proponent to discuss the methodology for establishing baseline energy consumptions. Address any questions regarding building types, data sets, and supplementary data.												
Activity 1.2 Conduct assessment of baseline energy consumptions of five selected building types when compared with both the business-as-usual (2007 Building Energy Code) and 2015 Building Energy Code scenarios												
Deliverable 1.2 Summary document with baseline energy consumption of select building prototypes												
Deliverable 1.3: Webinar with the NDE and proponent to present the baseline building energy consumptions												
Output 2: Develop energy consumption benchmarks												
Conduct a review of relevant past and continuing policies and regulations for select building prototypes applicable to building energy codes and voluntary measures. These efforts are to include current and future policies and standards as detailed in documents including the Energy Efficiency Plan (2015-2036), the Building Energy Code of Thailand, and building sector NAMAs. From the review and building upon the baseline energy consumption, the team will develop energy consumption benchmarks of the five selected building types given the implementation and compliance with the relevant standards in Thailand.												
Activity 2.1: Identify and collect relevant past, current, and future applicable building energy codes, standards, and voluntary measures for other selected building types along the planning horizon.												

**Technical Assistance
Response Plan – Terms of Reference**

	Month											
	1	2	3	4	5	6	7	8	9	10	11	12
Activity 2.2: Identify data and supplementary information required to establish the energy consumption benchmarks. Establish methodology for development of benchmark and design the energy consumption benchmark of five select building types to modeled simulations of a baselined building built to future energy codes such as BEC+, HEPS and HEPS+. Models used will be those that are existing or are publicly available, e.g., U.S. Department of Energy prototypical models modified to Thailand building characteristics.												
Deliverables 2.1: Webinar to present the benchmark methodology. Discuss questions regarding relevant building energy codes, standards, and voluntary measures.												
Deliverables 2.2: Webinar presentation of the established benchmark energy consumptions for the select building prototypes												
Output 3: Techno-economic Assessment and Analysis												
A techno-financial assessment of proposed building technologies with the potential to support efforts to reduce carbon emissions from the building energy sector and meet energy efficiency targets is to be completed. The techno-financial assessment will use a life-cycle cost methodology, will be conducted for the building energy systems identified within the Building Energy Code (e.g., for building envelop, lighting, and air conditioning), and will be based on the previously determined baselines and benchmarks. Results of techno-financial analyses of cost-effective technologies can be shared with developers, architects, and investors to help inform investment decisions in the building sector.												
Activity 3.1: Identify the relevant building component system technologies and cost data (e.g. building envelope, lighting systems and air conditioning systems) to be evaluated. Begin the techno-financial assessment.												
Deliverables 3.1: Webinar presentation to present the techno-financial assessment methodology and initial questions regarding the relevant scope, criteria and technologies to be included in the evaluation.												
Activity 3.2: Conduct the technology assessment and techno-financial analysis of the results to support the proposal of suitable technologies.												
Deliverables 3.2: Summary report on the technology assessment and techno-financial analysis results and a proposal of suitable technologies.												
Deliverables 3.3: Webinar of technology results and proposal of suitable technologies for decision making and investment strategies.												

**Technical Assistance
Response Plan – Terms of Reference**

4. Resources required and itemized budget:

Please provide an indicative overview of the resources required and itemized budget required to implement the CTCN assistance, including for M&E-related activities, using the table below. Once the Response Plan is completed, a Response Implementation partner(s) will be selected by the Climate Technology Centre (CTC). A detailed activity-based budget for the CTCN assistance will be finalized by the CTCN and selected Response Implementer.

Outputs	Human Resources <i>(Type, profile/level, role, estimated number of days)</i>	Travel <i>(Purpose, national vs. international, number of days)</i>	Meetings/ events <i>(Meeting title, number of participants, number of days)</i>	Equipment/ Material <i>(Item, purpose, buy/rent, quantity)</i>	Estimated cost <i>Please accumulate the costing at Output level and provide an estimated costing range for the total Response Plan</i>	
					Minimum	Maximum
Output 1: Establish building energy consumption baselines	Senior buildings engineer, 30-50 hours Policy analyst, 30 hours Junior buildings engineer or researcher, 80 hours Project manager specializing in technical assistance, 8-16 hours Project assistant, 16-24 hours	One 8 to 10 business day trip for two persons (Senior buildings energy, Policy analyst/Project manager), US\$10,000	Deliverable 1.1: Webinar to discuss the methodology for establishing baseline energy consumptions. Address any questions regarding building types, data sets, and supplementary data. Deliverables 1.3: Webinar presentation of the established baseline energy consumptions for selected buildings.		US\$50,000	US\$60,000

**Technical Assistance
Response Plan – Terms of Reference**

Outputs	Human Resources <i>(Type, profile/level, role, estimated number of days)</i>	Travel <i>(Purpose, national vs. international, number of days)</i>	Meetings/ events <i>(Meeting title, number of participants, number of days)</i>	Equipment/ Material <i>(Item, purpose, buy/rent, quantity)</i>	Estimated cost <i>Please accumulate the costing at Output level and provide an estimated costing range for the total Response Plan</i>	
					Minimum	Maximum
Output 2: Develop energy consumption benchmarks	Senior buildings engineer, 24-38 hours Policy analyst, 16 hours Junior buildings engineer or researcher, 60-120 hours Project manager specializing in technical assistance, 12 hours Project assistant, 16 hours		Deliverables 2.1: Webinar to present the benchmark methodology. Discuss questions regarding relevant building energy codes, standards and voluntary measures. Deliverables 2.3: Webinar presentation of the established benchmark energy consumptions for selected buildings to modeled simulations of a baselined building built to future energy codes.		US\$20,000	US\$30,000

**Technical Assistance
Response Plan – Terms of Reference**

Outputs	Human Resources <i>(Type, profile/level, role, estimated number of days)</i>	Travel <i>(Purpose, national vs. international, number of days)</i>	Meetings/ events <i>(Meeting title, number of participants, number of days)</i>	Equipment/ Material <i>(Item, purpose, buy/rent, quantity)</i>	Estimated cost <i>Please accumulate the costing at Output level and provide an estimated costing range for the total Response Plan</i>	
					Minimum	Maximum
Output 3: Techno-economic Assessment and Analysis	Senior buildings engineer, 24-40 hours Policy analyst, 16 hours Junior buildings engineer or researcher, 60-120 hours Project manager specializing in technical assistance, 9 hours Project assistant, 20 hours	One 8-10 business day trip for one person (Senior buildings engineer), U\$5,000	Deliverables 3.1: Webinar presentation to present the technology assessment methodology and initial questions regarding the relevant scope, criteria and technologies to be included in the evaluation. Deliverables 3.3: Webinar of technology results and proposal of suitable technologies.		US\$25,000	US\$35,000
Estimated range of costing including mandatory CTCN activities and deliveries					US\$95,000	US\$125,000

5. Intended contribution to impact over time

The outputs expected from the CTCN technical assistance including building consumption baseline of select Building Energy Code building types and a techno-economic assessment of building technologies will aid Thailand in achieving the targets established as part of the Energy Efficiency Plan (2015), the forthcoming NAMA for the building sector, and other relevant national initiatives. These outputs will also, in the medium-term, support the adoption of suitable building sector technologies which meet the Building Energy Code standards. The adoption of the identified suitable technologies will potentially lead to market transformation in the building sector. In addition, the aggregated energy savings will help the country to defer the need to install additional electricity generation capacity.

6. Relevance to NDCs and other national priorities

Thailand's Nationally Determined Contribution (NDC) submitted in 2015 at COP 21 in Paris intends to reach a target of 20% reduced GHG emissions from the projected business-as-usual baseline by 2030. Through the EEP of 2015 Thailand is striving to meet GHG emissions reduction targets previously submitted to the UNFCCC in COP 20. This will require a 7% emissions reduction from the energy and transport sectors by 2020 relative to the 2005 baseline. A substantial share of these reductions are expected to come from energy efficiency and conservation measures taken in the building energy sector (including large, medium and small-scale commercial as well as residential buildings) as presented in the 2012 Technology Needs Assessments for Climate Change Mitigation/Adaptation in Thailand (TNA).

7. Linkages to relevant parallel on-going activities:

The EEP established key building sector strategies comprising the enforcement of energy conservation standards for designated factories and buildings, a Building Energy Code for new construction, and an energy labelling program for equipment and appliances. The Building Energy Code shifts targets every three years, aiming towards net zero-energy buildings in the future. Additionally, Thailand has initiated voluntary measures and regulatory and financial incentives such as the labelling of home appliances and buildings. Building sector specific NAMAs are also being developed with UNEP.

Two years ago, UNDP supported DEDE for studying building energy data disclosure scheme. DEDE under Ministry of Energy continues to work with the Bureau of Budget to revise a law to allow a government building to get into an energy savings performance contract (ESPC) with an energy service company (ESCO). If this barrier is overcome, private contractors and financial institutes can take part in a building energy retrofit renovation for government buildings that leads to a whole energy efficiency market transformation in Thailand. Another attempt is a collaboration of DEDE and the Department of Public Works to fully enforce the BEC, which is currently at an early stage.

In term of related activities, KMUTT is currently assigned by the Encon fund to serve as a center point for research topics in zero energy building for the next 5 years and a research center under the Joint Graduate School of Energy and Environment (JGSEE) conducted several research studies in building energy efficiency.

8. Anticipated follow up activities after this technical assistance is completed:

KMUTT will organize the meeting with DEDE, deliver the reports to policy implementers (such as DEDE, EGAT, TGBI, TGO, and ONE), and organize a public seminar with key stakeholders.

9. Gender considerations:

Imbedded in design of the activities:	The CTCN will seek to engage all genders in the provision and receipt of this technical assistance.
Co-benefits intended as result of the activities:	Enhanced capacity in the building sector in Thailand will provide economic and job opportunities to all genders.

10. Main in-country stakeholders in implementation of the technical assistance activities:

Using the table below, please list and describe the role of in-country stakeholders, participants and beneficiaries who will be involved in or directly consulted during implementation of the assistance.

In country stakeholder	Role in implementation of the technical assistance
National Science Technology and Innovation Policy Office, Ministry of Science and Technology (NDE)	Ensures that the CTCN is meeting Thailand’s needs regarding this request; Optional: participates in meetings and discussions. (All outputs)
King Mongkut’s University of Technology Thonburi (Proponent)	Provides quality assurance on the technical assistance response, reviewing outlines and drafts and providing timely feedback; Participates (or delegates) in all discussions and meetings with the CTCN; Provides in-country stakeholders contacts and supports coordination and travel visits by the CTCN response expert team. (All outputs)
Electricity Generation Authority of Thailand (EGAT) Metropolitan Electricity Authority (MEA) Provincial Electricity Authority (PEA)	King Mongkut’s University of Technology Thonburi with work closely with EGAT, MEA, and PEA to collect energy use data, load profiles, disaggregation of building sectors of their customers.

11. SDG Contributions:

Instructions: Please complete the grey section below for a maximum of 3 SDGs that will be advanced through this TA. A complete list of SDGs and their targets and indicators is available here:

<https://sustainabledevelopment.un.org/partnership/register/>.

Goal	Sustainable Development Goal	Direct contribution from CTCN TA (1 sentence for top 1-4 SDGs)
1	End poverty in all its forms everywhere	
2	End hunger, achieve food security and improved nutrition, and promote sustainable agriculture	
3	Ensure healthy lives and promote well-being for all at all ages	
4	Ensure inclusive and equitable quality education and promote life-long learning opportunities for all	
5	Achieve gender equality and empower all women and girls	

Goal	Sustainable Development Goal	Direct contribution from CTCN TA (1 sentence for top 1-4 SDGs)
6	Ensure availability and sustainable management of water and sanitation for all	
7	Ensure access to affordable, reliable, sustainable, and modern energy for all (consider adding targets for 7)	Implementation of the response plan will help reduce energy needs in existing buildings, thus lowering energy costs
	7.1 - By 2030, ensure universal access to affordable, reliable and modern energy services	
	7.2 - By 2030, increase substantially the share of renewable energy in the global energy mix	
	7.3 - By 2030, double the global rate of improvement in energy efficiency	
	7.a - By 2030, enhance international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology	
	7.b - By 2030, expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries, in particular least developed countries, small island developing States, and land-locked developing countries, in accordance with their respective programmes of support	
8	Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all	Implementation of the action plan provided through this response would provide for new and decent employment opportunities
9	Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation	
10	Reduce inequality within and among countries	
11	Make cities and human settlements inclusive, safe, resilient and sustainable	
12	Ensure sustainable consumption and production patterns	
13	Take urgent action to combat climate change and its impacts	
	13.1 - Strengthen resilience and adaptive capacity to	

Goal	Sustainable Development Goal	Direct contribution from CTCN TA (1 sentence for top 1-4 SDGs)
	climate-related hazards and natural disasters in all countries	
	13.2 - Integrate climate change measures into national policies, strategies and planning	The recommendations from the technical assistance could also contribute to climate policy development.
	13.3 - Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning	Capacity building on implementation of energy saving measures in existing buildings will be enhanced
	13.a - Implement the commitment undertaken by developed-country parties to the United Nations Framework Convention on Climate Change to a goal of mobilizing jointly \$100 billion annually by 2020 from all sources to address the needs of developing countries in the context of meaningful mitigation actions and transparency on implementation and fully operationalize the Green Climate Fund through its capitalization as soon as possible	
	13.b - Promote mechanisms for raising capacity for effective climate change-related planning and management in least developed countries and small island developing States, including focusing on women, youth and local and marginalized communities	
14	Conserve and sustainably use the oceans, seas and marine resources for sustainable development	
15	Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss	
16	Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels	
17	Strengthen the means of implementation and revitalize the global partnership for sustainable development	

12. Classification of technical assistance:

Please indicate primary type of technical assistance. Optional: If desired, indicate secondary type of technical assistance.

<i>Please tick off the relevant boxes below</i>	<i>Primary</i>	<i>Secondary</i>
<input type="checkbox"/> 1. Technology identification and prioritisation	<input checked="" type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> 2. Research and development of new climate technologies	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> 3A. Feasibility studies for specific known climate technology options	<input type="checkbox"/>	<input checked="" type="checkbox"/>
<input type="checkbox"/> 3B. Piloting of known technologies in local conditions	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> 4A. Law, policy and regulatory reform recommendations	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> 4B. Sector specific roadmap or strategy design	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> 5. Finance facilitation and market creation	<input type="checkbox"/>	<input type="checkbox"/>

13. Monitoring and Evaluation expectations

Upon contracting of the implementing partners to implement this Response Plan, the lead implementer will produce a detailed work plan of activities, deliveries, outputs, dates and specific responsibilities. This detailed work plan will be based directly on this Response Plan. The CTCN Technology Manager responsible for this Technical Assistance will monitor the timeliness and appropriateness of the Response Plan implementation. Upon completion of all activities and outputs, evaluation forms will be completed by the (1) NDE about overall satisfaction level with the technical assistance service provided; (2) the Lead Implementer about the knowledge and learning gained through delivery of technical assistance; and (3) the CTCN Director about timeliness and appropriateness of the delivery of the activities and outputs.