Accelerating construction of energy efficient green housing units in Thailand

Part I: Project Information

GEF ID
10189

Project Type
FSP

Type of Trust Fund
GET

CBIT/NGI
☐CBIT
☐NGI

Project Title
Accelerating construction of energy efficient green housing units in Thailand

Countries
Thailand

Agency(ies)
UNEP

Other Executing Partner(s)
National Housing Authority (NHA)

Executing Partner Type
Government

GEF Focal Area
Climate Change

Taxonomy
Focal Areas, Climate Change, Climate Change Mitigation, Energy Efficiency, Sustainable Urban Systems and Transport, Influencing models, Transform policy and regulatory environments, Convene multi-stakeholder

alliances, Demonstrate innovative approache, Deploy innovative financial instruments, Strengthen institutional capacity and decision-making, Stakeholders, Type of Engagement, Participation, Consultation, Information Dissemination, Communications, Awareness Raising, Public Campaigns, Education, Behavior change, Private Sector, Large corporations, SMEs, Financial intermediaries and market facilitators, Capital providers, Individuals/Entrepreneurs, Civil Society, Non-Governmental Organization, Academia, Gender Equality, Gender Mainstreaming, Beneficiaries, Women groups, Gender results areas, Access and control over natural resources, Capacity, Knowledge and Research, Capacity Development, Knowledge Generation, Knowledge Exchange, Innovation, Learning

Rio Markers

Climate Change Mitigation

Climate Change Mitigation 2

Climate Change Adaptation

Climate Change Adaptation 0

Submission Date

4/5/2019

Expected Implementation Start

7/1/2021

Expected Completion Date

6/30/2026

Duration

60In Months

Agency Fee($)

298,408.00

A. FOCAL/NON-FOCAL AREA ELEMENTS

Objectives/Programs	Focal Area Outcomes	Trust Fund	GEF Amount($)	Co-Fin Amount($)
CCM-1-3	Promote innovation and technology transfer for sustainable energy breakthroughs for accelerating energy efficiency adoption	GET	3,141,142.00	28,944,817.00
		Total Project Cost($)	**3,141,142.00**	**28,944,817.00**

B. Project description summary

Project Objective

The objective of the proposed project is to accelerate the process of establishing a labelling scheme for low rise homes in the short term and show case benefits of energy efficient buildings to ?build energy efficient green homes and address the greenhouse emission reduction goal of Thailand and enhance the comfort and living space for low and middle income populations living in low rise housing units?.

Project Component	Financing Type	Expected Outcomes	Expected Outputs	Trust Fund	GEF Project Financing($)	Confirmed Co-Financing($)

Project Component	Financing Type	Expected Outcomes	Expected Outputs	Trust Fund	GEF Project Financing($)	Confirmed Co-Financing($)
1. Energy Efficiency Green Home Design and Labelling Scheme	Technical Assistance	1. Increased availability of NHA?s energy efficient green housing units in the market and the ability to assess emissions reduction in a quantifiable approach	1.1 On-line public database of energy efficiency technologies and measures to achieve energy efficiency and sustainable resource used in low rise and single unit houses and multi-story houses specific to Thailand?s climatic conditions	GET	425,300.00	3,028,849.00
			1.2. Energy efficient green home labelling scheme including process and procedures for implementation by Electricity Generating Authority of Thailand (EGAT) updated and made available for public access			
			1.3 Energy efficient green building standards for low-rise and single-story residential buildings developed and integrated in the design of housing units constructed by National Housing Authority (NHA)			

Project Component	Financing Type	Expected Outcomes	Expected Outputs	Trust Fund	GEF Project Financing($)	Confirmed Co-Financing($)
2. Incentive mechanisms for promoting energy efficient green homes	Investment	2. Financing and incentive mechanisms approved by the Government of Thailand to support affordable green housing for low- and middle-income residents and use of Green funds to support emissions reduction in the residential sector homes	2.1 Incremental costs of energy efficient green homes identified and recommendations on funding to support NHA in construction of energy efficient green homes developed and presented to the Government of Thailand for approval	GET	1,680,000.00	21,661,700.00

Project Component	Financing Type	Expected Outcomes	Expected Outputs	Trust Fund	GEF Project Financing($)	Confirmed Co-Financing($)
2. Incentive mechanisms for promoting energy efficient green homes	Technical Assistance	2 (TA Part) Financing and incentive mechanisms approved by the Government of Thailand to support affordable green housing for low- and middle-income residents and use of Green funds to support emissions reduction in the residential sector homes	2.2 Recommendations on fiscal incentives and/or financial mechanisms to incentivize private sector (developers and construction companies) to participate in energy efficient green home standards and labelling developed and presented to the Government of Thailand for consideration 2.3 Options for mechanisms to aggregate demand for energy efficient green materials to kick start supply chain identified, documented and presented to key stakeholders for adoption 2.4 Options paper prepared elaborating options for raising funds at low interest from markets to finance the energy efficient green home financing mechanisms and submitted to Nationally Determined Contribution (NDC) coordination focal point.	GET	194,100.00	453,849.00

Project Component	Financing Type	Expected Outcomes	Expected Outputs	Trust Fund	GEF Project Financing($)	Confirmed Co-Financing($)
3. Awareness raising and capacity building for promoting energy efficient green homes	Technical Assistance	3. Energy efficient green home concepts and designs increasingly adopted by housing developers and increased demand of energy efficient green homes among home buyers	3.1 Training and technical advice delivered to NHA, EGAT, construction companies and architects on energy efficient green building design 3.2 Curriculum with institutionalization work plan during and beyond the project period developed and implemented for executive course on energy efficient green building design 3.3 Strategy and communication campaigns for creating public awareness designed and implemented	GET	565,100.00	3,028,849.00
Monitoring and Evaluation	Technical Assistance			GET	127,200.00	
				Sub Total ($)	**2,991,700.00**	**28,173,247.00**

Project Management Cost (PMC)

	GET	149,442.00	771,570.00

Project Management Cost (PMC)		
Sub Total($)	**149,442.00**	**771,570.00**
Total Project Cost($)	**3,141,142.00**	**28,944,817.00**

C. Sources of Co-financing for the Project by name and by type

Sources of Co-financing	Name of Co-financier	Type of Co-financing	Investment Mobilized	Amount($)
Recipient Country Government	National Housing Authority (NHA)	Grant	Investment mobilized	1,361,547.00
Recipient Country Government	National Housing Authority (NHA)	In-kind	Recurrent expenditures	229,570.00
Recipient Country Government	Electricity Generating Authority of Thailand (EGAT)	Grant	Recurrent expenditures	3,650,000.00
Recipient Country Government	Electricity Generating Authority of Thailand (EGAT)	In-kind	Recurrent expenditures	542,000.00
Other	King Mongkut University of Technology Thonburi (KMUTT)	In-kind	Recurrent expenditures	1,500,000.00
Recipient Country Government	National Housing Authority	Equity	Investment mobilized	21,661,700.00
			Total Co-Financing($)	**28,944,817.00**

Describe how any "Investment Mobilized" was identified

NHA?s investment of USD 23,023,247 will be mobilized to support the following project activities: ? A total budget of USD 21,661,700.00 will be mobilized by NHA as an equity investment for construction of energy efficiency green homes as part of Component 2 of the project; ? A total budget of USD 1,361,546.67 will be mobilized by NHA as a grant for undertaking research under Component 1 and Component 2 toward energy efficient green home and building design, and construction process, and for awareness raising and capacity building works under Component 3. ? EGAT promotes the use of No. 5 Home label as part of its mandate for promoting energy efficiency on demand side. EGAT has allocated in its budget funds for undertaking research for upgrading the No. 5 Label and also for campaigns to raise awareness. The partners that will be participating in the demonstration of Label No.5 are not yet identified. They will invest in the pilots. Co-finance of these private sector partners will be recorded and reported as part of PIR.

D. Trust Fund Resources Requested by Agency(ies), Country(ies), Focal Area and the Programming of Funds

Agency	Trust Fund	Country	Focal Area	Programming of Funds	Amount($)	Fee($)
UNEP	GET	Thailand	Climate Change	CC STAR Allocation	3,141,142	298,408
				Total Grant Resources($)	**3,141,142.00**	**298,408.00**

E. Non Grant Instrument

NON-GRANT INSTRUMENT at CEO Endorsement

Includes Non grant instruments? **No**

Includes reflow to GEF? **No**

F. Project Preparation Grant (PPG)

PPG Required

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PPG Amount ($)

110,000

PPG Agency Fee ($)

10,450

Agency	Trust Fund	Country	Focal Area	Programming of Funds	Amount($)	Fee($)
UNEP	GET	Thailand	Climate Change	CC STAR Allocation	110,000	10,450
				Total Project Costs($)	**110,000.00**	**10,450.00**

Core Indicators

Indicator 6 Greenhouse Gas Emissions Mitigated

Total Target Benefit	(At PIF)	(At CEO Endorsement)	(Achieved at MTR)	(Achieved at TE)
Expected metric tons of CO?e (direct)	429950	163516	0	0
Expected metric tons of CO?e (indirect)	2096007	1294641	0	0

Indicator 6.1 Carbon Sequestered or Emissions Avoided in the AFOLU (Agriculture, Forestry and Other Land Use) sector

Total Target Benefit	(At PIF)	(At CEO Endorsement)	(Achieved at MTR)	(Achieved at TE)
Expected metric tons of CO?e (direct)				
Expected metric tons of CO?e (indirect)				
Anticipated start year of accounting				
Duration of accounting				

Indicator 6.2 Emissions Avoided Outside AFOLU (Agriculture, Forestry and Other Land Use) Sector

Total Target Benefit	(At PIF)	(At CEO Endorsement)	(Achieved at MTR)	(Achieved at TE)
Expected metric tons of CO?e (direct)	429950	163,516		
Expected metric tons of CO?e (indirect)	2096007	1,294,641		
Anticipated start year of accounting	2022	2021		
Duration of accounting	20	10		

Indicator 6.3 Energy Saved (Use this sub-indicator in addition to the sub-indicator 6.2 if applicable)

Total Target Benefit	Energy (MJ) (At PIF)	Energy (MJ) (At CEO Endorsement)	Energy (MJ) (Achieved at MTR)	Energy (MJ) (Achieved at TE)
Target Energy Saved (MJ)	2,968,016,000.00	10,446,413,577		

Indicator 6.4 Increase in Installed Renewable Energy Capacity per Technology (Use this sub-indicator in addition to the sub-indicator 6.2 if applicable)

Technology	Capacity (MW) (Expected at PIF)	Capacity (MW) (Expected at CEO Endorsement)	Capacity (MW) (Achieved at MTR)	Capacity (MW) (Achieved at TE)

Indicator 11 Number of direct beneficiaries disaggregated by gender as co-benefit of GEF investment

	Number (Expected at PIF)	Number (Expected at CEO Endorsement)	Number (Achieved at MTR)	Number (Achieved at TE)
Female	25,115	2,500		
Male	50,185	2,500		
Total	75300	5000	0	0

Provide additional explanation on targets, other methodologies used, and other focal area specifics (i.e., Aichi targets in BD) including justification where core indicator targets are not provided

The estimated number of beneficiaries include beneficiaries of the training and capacity building efforts, training programmes established by the project as well as the beneficiaries of the pilot NHA green energy efficiency housing units supported through GEF funds. This also includes the awareness creation activities carried out during the project implementation.

Part II. Project Justification

1a. Project Description

1a. Changes in project design

During preparation of the CEO Endorsement Request document, it was evident that NHA and EGAT have made significant progress in developing and piloting the home energy labelling and ECO Village scheme. In view of this, adjustments have been made to descriptions of Outputs to reflect the local situations and conclusions from the stakeholder consultations during the project preparation phase. These are summarized below.

Original Outcome & Output Statement	Revised Outcome & Output Statement	Explanations
Outcome 1: Increased availability of energy efficient housing in the market and the ability to assess emissions reduction in a quantifiable approach	Outcome 1: Increased availability of **NHA's** energy efficient green housing units in the market and the ability to assess emissions reduction in a quantifiable approach	Minor revision to the outcome statement to reflect ownership and where the change will happen
Output 1.1: Database of energy efficiency technologies and measures to achieve energy efficiency and sustainable resource used in low rise and single unit houses and multi-story houses specific to Thailand?s climatic conditions	Output 1.1: **On-line public** database of energy efficiency technologies and measures to achieve energy efficiency and sustainable resource used in low rise and single unit houses and multi-story houses specific to Thailand?s climatic conditions	Minor revision to better relect the proposed project activities
Output 1.2: Green building standards for lowrise and single story residential buildings developed and integrated in the design of social housing units constructed by National Housing Authority (NHA)	**Output 1.3: Energy efficient** green building standards for low-rise and single story residential buildings developed and integrated in the design of housing units constructed by National Housing Authority (NHA)	Output 1.2 was designated as Output 1.3 with minor text revisions to the output statement to better reflect the proposed project activities

Output 1.3: Energy efficient green house labelling scheme including process and procedures for implementing the scheme by Electricity Generating Authority of Thailand (EGAT) developed	**Output 1.2:** Energy efficient green **home** labelling scheme including process and procedures for **implementation** by Electricity Generating Authority of Thailand (EGAT) **updated and made available for public access**	Output 1.3 was designated as Output 1.2 with minor text revisions to the output statement to reflect the energy efficient green home labelling scheme introduced by EGAT in 2019, and the proposed project activities which will help strengthen the existing home labelling scheme inline with the best practices.
Outcome 2: Affordable green housing for low- and middle-income residents and use of Green funds to support emissions reduction in the residential sector homes	Outcome 2: **Financing and incentive mechanisms approved by the Government of Thailand to support** affordable green housing for low- and middle-income residents and use of Green funds to support emissions reduction in the residential sector homes	Outcome statement revised to reflect ownership and where the change will happen
Output 2.1: Green Home Financing Mechanism set-up to provide incentives to home buyers for purchase /developers to develop energy efficient green housing units linked to the labelling scheme for energy efficient green homes	Output 2.1: **Incremental costs of energy efficient green homes identified and recommendations on funding to support NHA in construction of energy efficient green homes developed and presented to the Government of Thailand for approval**	The Output statement was revised to reflect findings from situation analysis and stakeholder consultation which identify that government funding to support NHA will be more effective. Note that financing mechanisms for developers will be addressed by Output 2.2.
Output 2.2: Green Home Financing Mechanism designed and capacities in place for its implementation		Output 2.2 was combined with Output 2.1
Output 2.3: Recommendations on fiscal incentives and/or a financial mechanism to incentivize private construction companies to participate in the voluntary labelling scheme developed and presented to Government of Thailand for consideration	Output 2.2: Recommendations on fiscal incentives and/or financial mechanisms to incentivize **private sector (developers and construction companies) to participate in energy efficient green home standards and labelling** developed and presented to the Government of Thailand for consideration	Output 2.3 was designated as Output 2.2 with minor text revisions to the output statement to reflect the proposed project activities
Output 2.4: Options for mechanisms to aggregate demand for energy efficient materials to kick start supply chain identified	**Output 2.3:** Options for mechanisms to aggregate demand for energy efficient **green** materials to kick start supply chain identified, **documented and presented to key stakeholders for adoption**	Output 2.4 was designated as Output 2.3 with minor text revisions to the output statement to reflect the proposed project activities

Output 2.5: Options paper prepared elaborating options for raising funds at low interest from markets to finance the expansion and continuation of green home financing mechanism	**Output 2.4:** Options paper prepared elaborating options for raising fund at low interest from markets to finance the expansion and continuation of **energy efficient** green home financing mechanisms	Output 2.5 was designated as Output 2.4 with minor text revisions to the Output statement to reflect the proposed project activities
Outcome 3: Increased capacity among key stakeholders on designing green housing unit and public awareness of benefits of green building and fostering energy efficient behaviors in the long term	Outcome 3: **Energy efficient green home concepts and designs increasingly adopted by housing developers and increased demand of energy efficient green homes among home buyers**	Outcome statement revised to better demonstrate the results
Output 3.1: Training and technical advice delivered to NHA, EGAT, Construction companies and architects on green building design	Output 3.1: Training and technical advice delivered to NHA, EGAT, construction companies and architects on **energy efficient** green building design	Minor text revisions to the output statement to reflect the proposed project activities
Output 3.2: Curriculum developed and implemented for executive course on green building design	Output 3.2: Curriculum **with institutionalization work plan during and beyond the project** developed and implemented for executive course on **energy efficient** green building design	Minor text revisions to the output statement to reflect the proposed project activities
Output 3.3: Strategy designed for creating public awareness and communication	Output 3.3: Strategy and communication campaigns for creating public awareness designed and implemented	Output 3.3 was combined with new Output 3.4 with minor text revisions to the output statement to reflect the proposed project activities
Output 3.4: Public awareness campaigns implemented for creating awareness on green building benefits		Output 3.4 was combined with new Output 3.3 with minor text revisions to the output statement to reflect the proposed project activities
Output 3.5: Awareness raising activities undertaken to encourage the state to extend the green Building Energy Code schemes for all low-rise and single story residential buildings	**Output 1.5: Policy makers and policy advocacy groups trained and supported to develop the national roadmap for integration of** Building Energy Code & Green Rating Scheme in low-rise and single story residential buildings	Output 3.5 was moved to Component 1 as the output and acitivities are more relevant to the outcome of Component 1. Output 3.5 is now designated as Output 1.5 with text revisions to the output statement to reflect the proposed project activities

GHG Emissions Estimates: Project Direct ? 304,256 Project Indirect ? 2,226,532	**Project Direct ? 155,960 tCO_2e** **Project Indirect ? 1,294,641 tCO_2e**	The direct emission reductions and the indirect emission reductions reduced primarily because the estimated energy efficiency gains in the PIF were estimated at higher level. During Project more information was collected which resulted in more accurate estimates.
Reduction in co-fiancing from the PIF stage ($31,257,095)	**Revised of co-fiancing in the CEO ER stage to be $28,955,817**	Reduction of about net USD 2.3 million in co-financing is mainly due to the difference between the cost of pilot projects included in the PIF and the final project. The four housing projects proposed in the PIF have already been taken up for construction to meet the internal NHA deadlines. In place the pilot will be carried out at seven housing projects currently approved by the Thai Government (see Annex E for more details). Further, at the PIF stage the pilots were to be EE but not envisaged to achieve the Label No. 5. Thus the current pilots will be more energy efficiency then those envisaged in the PIF.

Allocation of the GEF trust fund to each project component was adjusted to reflect the nature and intensity levels of project activities in each components, as summarized below.

Component	Concept Note	CEO Endorsement
1. Energy Efficient Green Home Design and Labelling Scheme	350,000	425,300
2. Incentive mechanisms for promoting energy efficient green homes	2,010,000	1,874,100
3. Awareness raising and capacity building for promoting energy efficient green homes	631,564	565,100
Monitoring and Evaluation (M&E)		127,200
Project management cost (PMC)	149,578	149,442
Total	**3,141,142**	**3,141,142**

Compared to the Concept Note, the co-finance situation at CEO Endorsement is shown below. Reduction of about USD 2.3 million in co-financing was mainly due to changes in number and types of the pilot demonstration projects. The four large housing projects proposed in the PIF have already moved to the construction phase, and seven smaller housing projects for rent approved by the Thai Government were proposed by NHA as the pilot demonstration projects (see Annex E for more details).

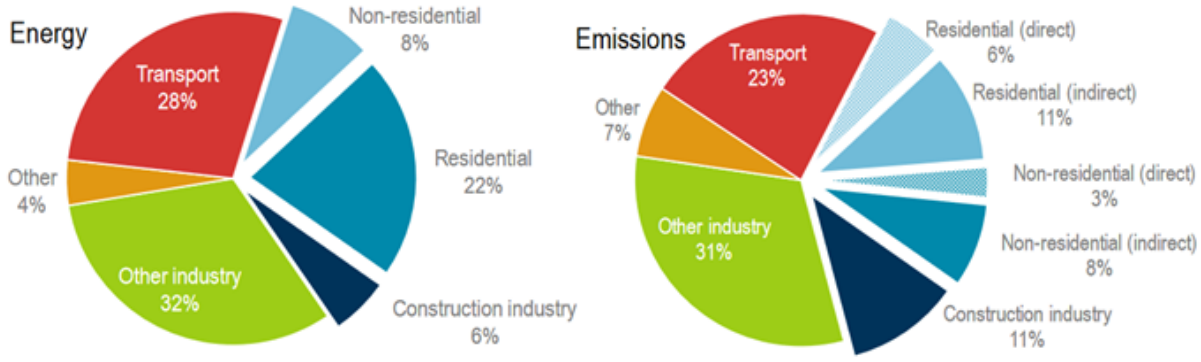
Source of Co-Financing	Concept Note	CEO Endorsement
National Housing Authority (NHA)	29,107,095	23,252,817
Electricity Generating Authority of Thailand (EGAT)	1,190,000	4,192,000
King Mongkut University of Technology Thonburi (KMUTT)	860,000	1,500,000
Total	**31,257,095**	**28,954,817**

1b. Project Description

1) **Global environmental and/or adaptation problems, root causes and barriers that need to be addressed**

Global environmental problem:

Residential buildings accounted for a large share of both global final energy use (22%) and energy-related CO_2 emissions (18%) in 2018, second only to the energy use and emission by the transport sector (Figure 1).



Source: 2019 Global Status Report for Buildings and Construction, the Global Alliance for Buildings and Construction (GlobalABC)

Figure 1: Global share of Residential building Final Energy and Emission, 2018

Electricity - the main energy source for lighting, space cooling, appliances, and equipment - is the fastest-growing energy source in residential and commercial buildings[1][1]. From 2010 to 2018, global electricity use in buildings rose by 19%. Emissions, which result from the fuel sources used for electricity generation and still include high levels of coal, especially in emerging economies, also rose in 2018.

According to the 2019 Global Status Report for Buildings and Construction prepared by the International Energy Agency (IEA), improvements in buildings sector energy intensity per unit of floor area from 2010 to 2018 were largely from lower consumption in space heating (-20%) and lighting (-17%). Light-emitting diodes (LEDs) have played an important role in reducing energy consumption for lighting as floor area increases, while falling consumption for space heating indicates that building envelopes have improved. However, as floor area has been expanding rapidly in hot countries, cooling demand is increasing. As better building envelopes are crucial to reduce energy use for heating and cooling, building codes must remain a policy priority along with technology efficiency improvements.

Based on Thailand?s third national communication report (TNC) issued by the Ministry of Natural Resources and Environment (MONRE) in 2018, Thailand?s greenhouse gas (GHG) emissions, excluding GHG from the Land Use, Land-use Change, and Forestry sector (LULUCF), have increased by more than 300% since 1992, from 100.03 Million ton of CO2 equivalent (Mt-CO2eq) to 226.09 Mt-CO2eq in 2010, and increased to 318.66 Mt-CO2eq in 2013 (Figure 2). The major source of GHG

emissions was the energy sector, which increased from 161.01 Mt-CO2eq in 2010 to 236.94 Mt-CO2eq in 2013, an increase of 47.16%.[2][2]

The Thai Government is strongly committed to addressing its greenhouse gas (GHG) emissions. In accordance with the NDC targets, Thailand intends to reduce its greenhouse gas emissions by 20% from the projected business-as-usual (BAU) level by 2030. The business-as-usual projection is from the base year 2005 and will be around 555 MtCO2. Thailand?s NDC also highlights that an additional 5% GHG reduction, 25% below BAU, would be achieved if support is available.[3][3] Thailand approved the NDC Roadmap on Mitigation 2021-2030 in May 2017[4][4], and the Roadmap aims to achieve a reduction of 113 Mt-CO2eq through energy efficiency (EE) and renewable energy (RE). EE in buildings is regarded as one of the key strategies in delivering the emission reduction target, and it is estimated that around 24 Mt-CO2eq (about 21% of the target) will be contributed by EE measures and sustainable building materials and construction in the building sector.

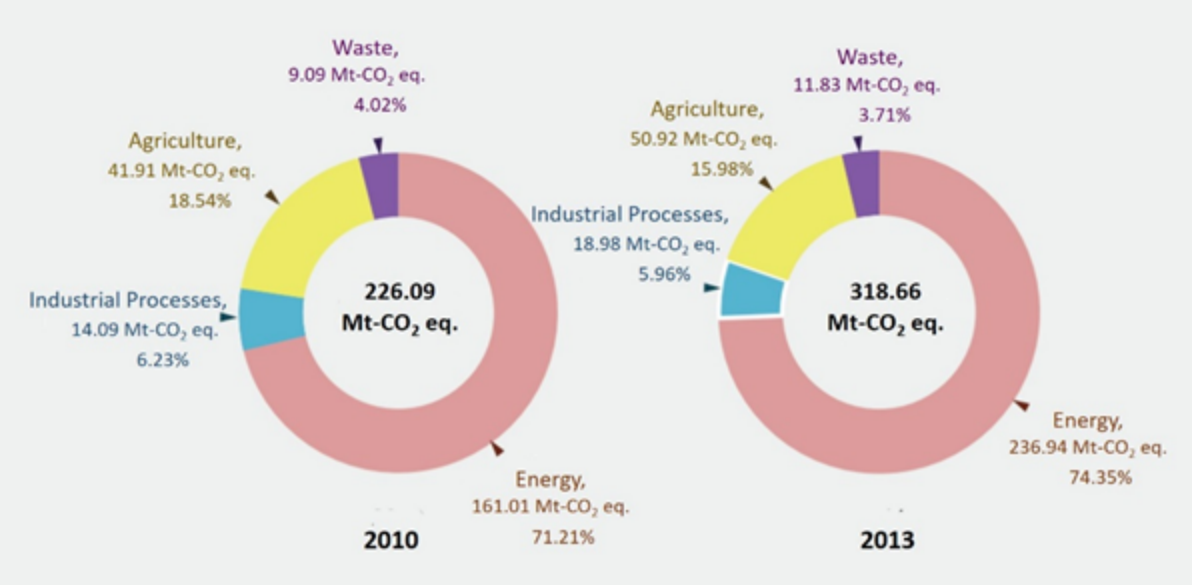
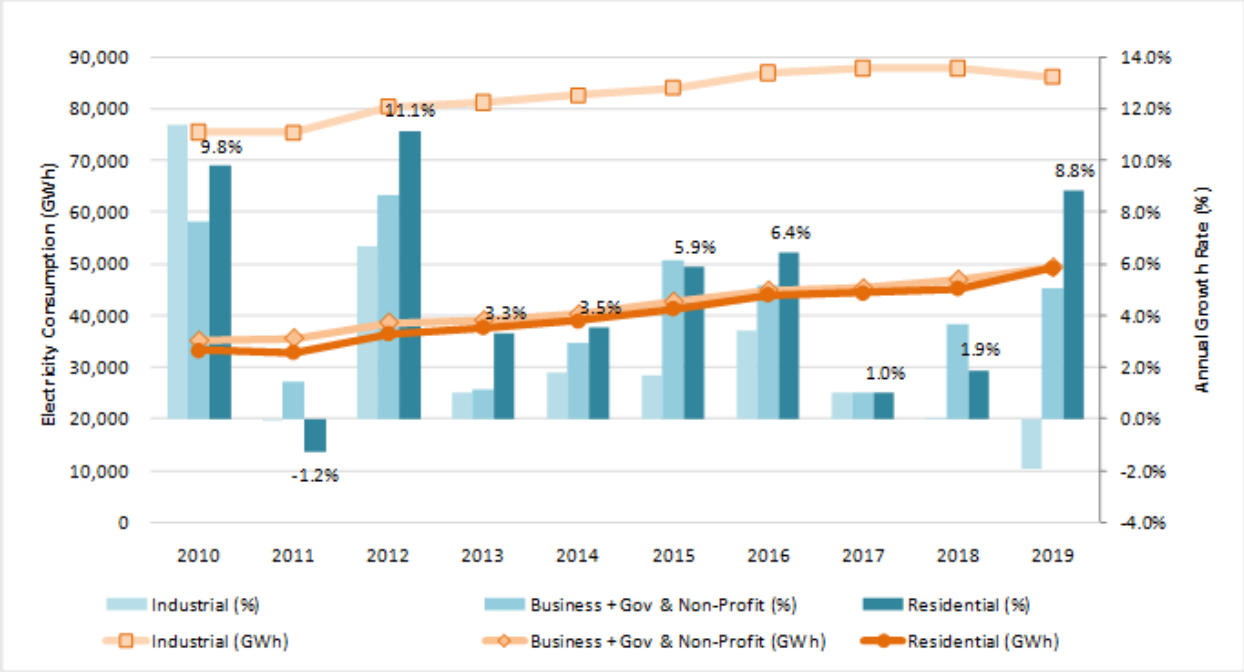


Figure 2: Total GHG Emissions in Thailand by Sector, 2010 and 2013

In 2018, Thailand?s electricity consumption stood at 192,956 GWh, up 2.7% from 2018[5][5]. The residential sector is not the largest electricity end-use sector in Thailand but its shares in the total electricity consumption nationwide have gradually increased from 22% in 2010 to 25% 2019. Over the same period, the residential sector shows the highest growth among all the end-use sectors in the country, with an average annual growth rate of 4%, compared by 3.5% and 1.3% for the commercial and industrial sector respectively. It should be noted that the annual growth rates of the residential electricity consumption have outpaced the growth rates of housing construction in the country, as the number of housing units increases only about 2.5 percent per year[6][6] over the same period.



Source: Energy Policy and Planning Office, Thailand

Figure 3: Growing Electricity Consumption in Thailand

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Root causes:

Over the past three decades, EE efforts in the residential sector in Thailand have been focusing on promoting energy efficient electrical appliances. Efforts in promoting design and construction of better

envelopes for residential buildings have haphazardly been pursued by different agencies in an uncoordinated manner. Adoption of better construction materials appears to be driven by suppliers and manufacturers, rather than government policies. Although Thailand have implemented the Building Energy Code (BEC) for many years, the Thai BEC covers only residential and non-residential buildings with total floor area larger than 2,000 square meters. In general, new and retrofitted low-rise residential buildings in Thailand are not subject to any energy efficiency requirements.

In contrary to the high awareness of EE appliances among residential end-users, especially those affixed with the No.5 Energy Labels[7][7], awareness on better building envelope and its associated benefits among Thai households appear to be limited. Homeowners usually leave choices of construction materials with developers and builders, and they end up going for what available in the market at the least cost for their maximum margin. Although some EE and green construction materials are commercially available in the Thai market, some of them, such as lightweight brick, are not suitable for large-scale construction projects due to their labour-intensive construction techniques. As a result, EE and green housing designs have never been the common practices among developers and builders, as well as building designers. Limited market demand of EE and green building materials has resulted in lack of market competition, leading to higher costs of EE and green building materials in Thailand.

Barriers to the adoption of energy efficient green housing units:

EE and green housing design concepts are not new in Thailand. The concepts have been promoted by the building construction industry, and unconnected ad-hoc government activities (such as EE award for residential buildings and voluntary energy efficiency labelling programs for insulation and glass). To date, the Thai government has not yet announced systematic government policies to promote EE and green housing designs in the country. Without government policies and programs, barriers that restrict widespread adoption and investments in EE green housing units occur across a range of areas that need to be strategically addressed. EE and green housing units in Thailand are usually more expensive than standard housing units due to extra costs of EE and green building construction materials, and home buyers who insist on ?green? features are those who understand the benefits and can afford. Although Thai home buyers have good awareness of EE appliances through the No.5 labelling program, the similar level of awareness is not yet realized for the EE and green building construction materials. Without mandatory building codes and regulations and strong market demand, developers and contractors have opted for the standard construction materials that provide lower initial capital costs and shorter construction time.

Key barriers including those related to policy, regulation, institutional coordination, technical and product information, market, and financial, are discussed in Table 1.

Table 1: Summary of Barriers on Implementation of Energy Efficient Green Housing Units in Thailand

Policy, Regulation and Institutional Coordination Barriers
Absence of mandatory energy performance standards and labeling schemes for residential buildings: Although there have been several initiatives on energy performance standards and energy labelling for homes (e.g., No.5 Home Energy Label implemented by the Electricity Generating Authority of Thailand - EGAT, Home Energy Benchmarking and High Efficiency Labels implemented by the Department of Alternative Energy Development and Efficiency - DEDE), these are voluntary schemes. Low-rise residential buildings in Thailand are not subject to any EE requirements. In other words, Thailand does not have any EE codes for low-rise residential buildings. New high-rise residential buildings with an area greater than 2,000 square meters are subject to the Thai Building Energy Code. However small apartment buildings are not subject to the Code and EE requirements.
Insufficient coordination among relevant authorities to support promotion of EE green housing units: Key authorities involved in promoting and regulating design and construction of EE green housing in Thailand include: DEDE under the Ministry of Energy (the EE regulator responsible for development of energy performance for appliances and construction materials, and the Building Energy Code), EGAT (the implementing agency of the No.5 Energy Labelling Program), the Thai Industrial Standards Institute (TISI) under the Ministry of Industry (national standards and certification for appliances/equipment and construction materials), the Department of Public Works and Town & Country Planning (DPT), and local government units under the Ministry of Interior (the regulators for building construction). In addition, the Comptroller General?s Department (CGD) under the Ministry of Finance is the key agency maintaining the list of building construction materials and products eligible for procurement for government funded building construction projects. These agencies are required to coordinate to ensure effective promotion of design and construction of EE green housing units requires, however they tend to work in an uncoordinated manner, and may carry out independent projects that do not align with others.
Technical and Capacity Barriers

Limited knowledge and know-how on mass production of affordable EE building construction materials: EE and green building construction materials are commercially available in the Thai market. Some of these construction materials (such as roof tile, brick and glass wool) are covered by the voluntary High Efficiency Labelling program implemented by DEDE. Unfortunately, these EE and green building construction materials require labour intensive construction techniques, and they are not the preferred materials for large-scale construction projects due to concerns in construction lead time and costs associated. Currently the construction materials which are suitable for large-scale building projects in Thailand, for example precast concrete wall, are not energy efficient, and local manufacturers and developers have limited knowledge and know-how on mass production of affordable EE building construction materials that can facilitate construction of large-scale energy efficient green housing projects.

Lack of systematic measuring and reporting system on low rise housing energy consumption: Local building practitioners and construction sector professionals do not have sufficient tools, guidelines to help them understand the significance of monitoring and evaluating energy savings accrued from EE measures and how it can inform decision making. Implementation experience in many countries have shown that development of tools and guidelines that assist regulators and designers in conducting technical assessments, monitoring and evaluations will greatly improve the effectiveness of implementing EE measures. Standard guidelines and methodologies for monitoring, reporting and verifying (MRV) energy savings and GHG emission reductions are completely absent. This presents the need of having a reliable MRV framework for EE green housing units in Thailand that will ultimately assist in tracking relevant impacts, strategic decision making and action planning.

Financial Barriers

Higher upfront cost of EE green housing units compared with standard designs: High initial cost of green building is one of the top two barriers to green buildings as identified by the industry stakeholders. Suitable and effective financial mechanisms and fiscal products (e.g. off-balance sheet financing, tax incentives) to support EE green housing designs and investments are not available. The financial cost for developers and contractors for construction of EE green housing units is similar to construction of standard housing units. With higher costs of EE green building construction materials, developers and contractors have no choice but to pass on the incremental investments to home buyers. If developers are not able to recoup the incremental investment in EE green housing units, or if they take longer to sell such housing units, developers will naturally be unwilling to further invest in such business propositions.

Limited access to affordable financing for EE green housing units: Home loans in Thailand are primarily furnished by two major groups of loan providers, i.e., commercial banks (60.6% of housing loan market) and Specialized Financial Institutions - SFIs (39.3% of housing loan market). The remaining loan providers comprising insurance companies and other financial institutions (e.g. Finance companies) capture only tiny fraction of the total market. The two SFIs, i.e., Government Housing Bank (GHB) and Government Saving Bank (GSB), have large proportion of housing loan portfolio in the entire market, with the market share of 28% and 9%, respectively. The big four commercial banks - Siam Commercial Bank PCL. (SCB), Krungthai Bank PCL. (KTB), Kasikornbank PCL. (KBANK) and Bangkok Bank PCL. (BBL) - collectively, share 40% of housing loan market. GHB and GSB are focusing on low-, to middle-income homebuyers, whereas commercial banks are competing for higher-income segments. To date, these home loan providers have not supported EE green housing units in Thailand. The recent housing program with a special interest rate of about 3%, introduced in 2019, does not necessarily support EE green housing market as it is not a requirement for the loan program. Affordable financing for EE green housing units would stimulate potential home buyers who are prepared to spend more capital upfront for EE green housing units which will be later offset by lower subsequent running costs.

Market Barriers

Limited choices of certified EE and green building materials: Commercial availability of certified EE and green construction materials is limited. This is more evident with regard to precast concrete walls. There are some local manufacturers who are capable of producing some of these advanced construction materials, but the market demand is still low that manufacturing cannot reach the economy of scale, putting the cost of these materials at unaffordable prices. Although there are multiple certification programs[8][8] for EE and green building construction materials in Thailand, each certification program has certified only few types of building construction materials. In addition, these certification programs have not yet been streamlined to support promotion of EE green housing units, for example the Green Public Procurement scheme (by PCD) has recognized the Green Labelling certification, but there is no linkage with the High Efficiency Labelling program. Moreover, these certifications will not be eligible for government funded projects until they are recognized by CGD. The current situation is unlikely to encourage designers, developers and contractors to seek and recommend EE and green alternatives for building construction materials, even if the demand arises.

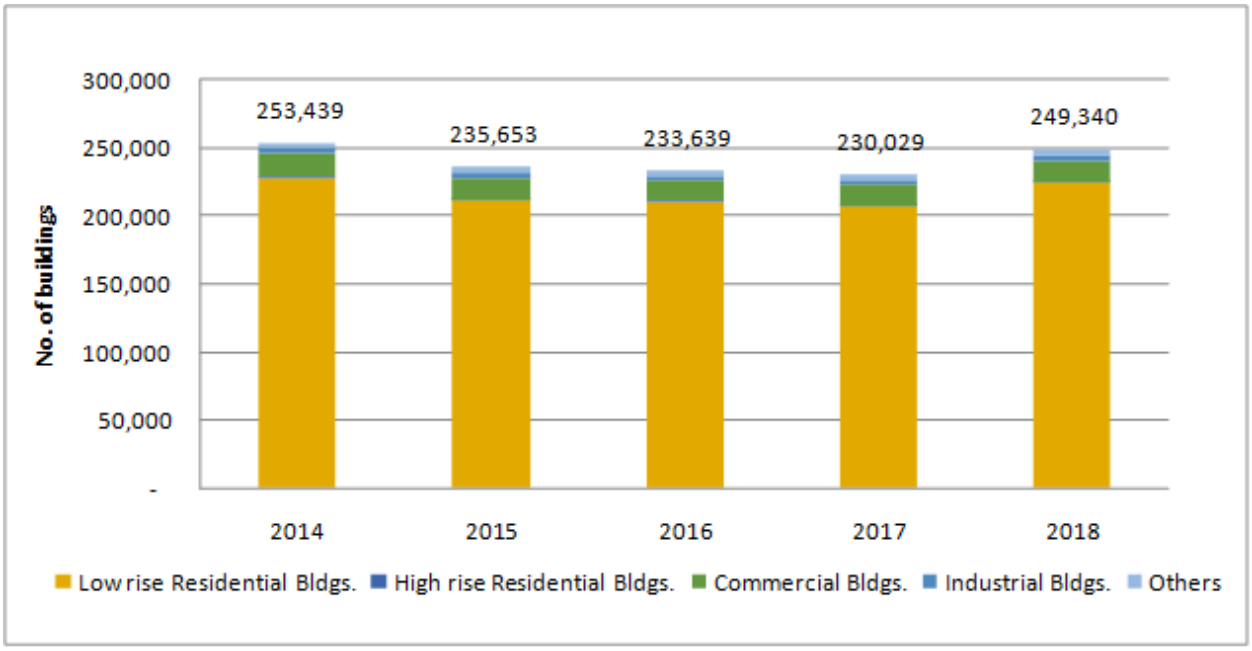
Information and Awareness Barriers
Lack of credible information on benefits of EE green housing units among home buyers, developers and contractors: Lack of motivations from owners is one of the top two barriers to greater adoption of green buildings in Thailand. Home buyers are essentially motivated by environmental and, more importantly, economic benefits of EE green housing units, however real-life demonstration on cost effective, best available technologies and practices to fully comply with and further go beyond the standard EE and green benchmarks are also limited. One pertinent example would be the showcase of improved OTTV precast wall for homes which has not yet been widely adopted in Thailand. This is highly relevant in the current context when the precast wall has been viewed as the solution by developers and contractors for large-scale housing projects. Suitable improved OTTV precast walls must be thermally appropriate for Thailand?s hot and humid climate with acceptable incremental costs. Use of ?foam or cellular lightweight concrete (CLC)? which has higher cement content for pre-casting in a large wall is one of the possible technologies which must be urgently demonstrated. **Lack of information among developers and construction firms on technologies and materials for construction of EE green housing units:** Although the existing certification programs for EE and green building construction materials provide information on EE and green building construction materials, these databases are dispersed among different agencies and organizations involved in promoting EE and green housing units. Therefore there is still a compelling need to provide better access to useful information for stakeholders in the building construction industry, for instance, a centralized database of EE and green construction materials and equipment; index of professional services and suppliers; guidelines for home owners, contractors or developers to select and use these certified EE and green materials. To date there has been inadequate effort in consolidating and verifying such information.

2) Baseline scenario and any associated baseline projects

Based on statistics published by the National Statistical Office (NSO) in 2019[9][9], Thailand has approximately 67.77 million people, and the proportion of men and women in the total population is about 49% and 51% respectively. The Ministry of Social Development and Human Security (MSDHS) estimated about 21.3 million households nationwide in 2015, and about 60% of which are classified as low-income households. Middle-income households and high-income households in Thailand occupy an equivalent share of about 20% each[10][10]. In terms of health, Thai females tend to live longer. In 2019, female?s life expectancy at birth was 80.7 years and male?s life expectancy at birth was 73.2 years. The adolescent birth rate was 44.9 births and fertility rate were 1.5 children (UNDP, 2019b;

World Bank, 2019a).[11][11] Concerning education, Thailand?s adult literacy rate in 2019 was 92.9% (% ages 15 and older). Male has a slightly higher literacy rate at 94.5 percent and female at 91.5%. The country?s mean years of schooling were 7.7 years. Female?s means years of schooling were 7.5 years and male?s mean years of schooling were 8 years[12][12].

Over the past five years, Thailand has seen an average of 240,000 new buildings added into the total building stock annually. About 90% of these new buildings are residential buildings and virtually all new residential buildings constructed are low-rise buildings. In terms of the total building area, the low-rise and high-rise buildings with floor area less than 2,000 square meters each collectively account for about 97% of the total floor areas constructed annually, and these buildings are not subject to the Thai Building Energy Code.



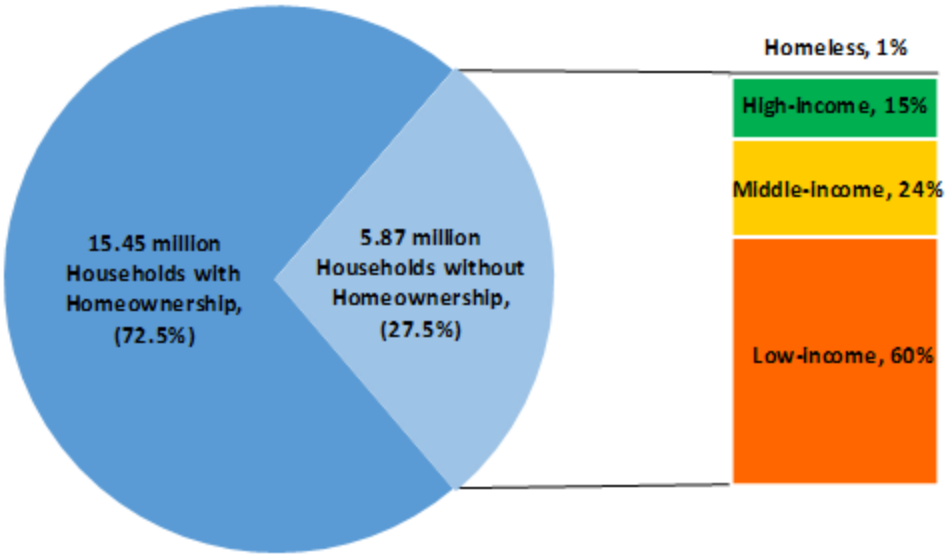
Source: National Statistics Office, 2019

Figure 4: New Building Construction in Thailand, 2014-2018

Annual demands of new residential buildings in Thailand are met by private sector developers, builders and government funded projects. For government funded projects, the National Housing Authority (NHA), a state enterprise under the Ministry of Social Development and Human Security (MSDHS), is

one of the main developers/builders in the Thai housing market, offering various types of homes for buyers of all income levels (i.e., low-, middle- and high-income households). However, housing units developed by NHA to date target primarily on low to middle income households, since the demands from these market segments have not been addressed by the private sector developers/builders. According to NHA, an average of 50,000 housing units for low-income households of which the selling prices are lower than THB 1 million (or about USD 32,000) were supplied to the housing market annually in 2018 and 2019, accounting for about 23% of the total residential market size. For the low-income household segment, NHA is the largest developer in Thailand, and reported an average market share of about 36% in this segment in 2018 and 2019.

Note that not all Thai households own their homes. In 2015, MSDHS estimated that 27.5% of the total 21.32 million Thai households (or about 5.87 million households) do not have homeownerships (see Figure 5). Approximately 60% of households without homeownerships are low-income households, and the remaining households without homeownership are shared by middle-income households (24%) and high-income households (15%).



Source: Ministry of Social Development and Human Security, 2015

Figure 5: Home Ownership in Thailand, 2015

The household socio-economic surveys conducted every 2 years by NSO highlight an alarming trend regarding home ownerships among low-income households in Thailand. As shown in Table 2,

percentages of home ownerships by low-income households have been declining from 79.6% in 2007 to 71.9% in 2015. This is due to several factors including rising land and asset property prices and increase of household debt in Thailand.

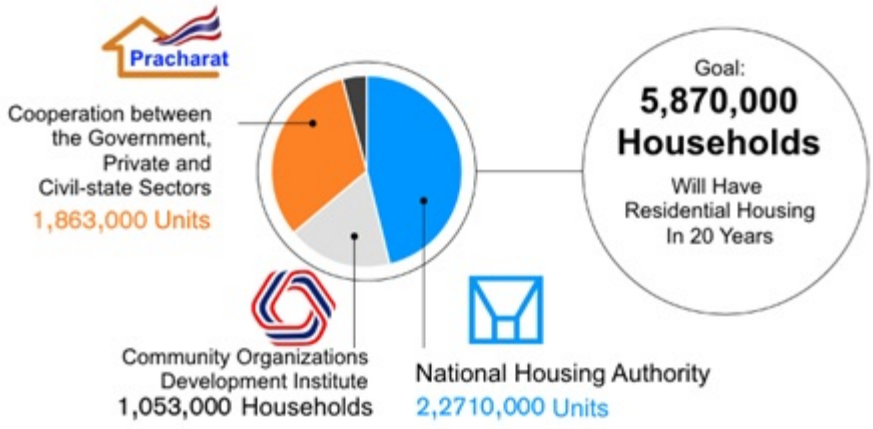
TABLE 2: HOME OWNERSHIPS OF LOW-INCOME HOUSEHOLDS IN THAILAND, 2007 TO 2015

Low Income Households	2007	2009	2011	2013	2015
With Homeownership	8,669,130.1 (79.6%)	9,266,843.0 (79.0%)	9,175,509.4 (77.2%)	9,388,774.2 (77.5%)	9,215,652.0 (71.9%)
Without Homeownership	2,220,677.7 (20.4%)	2,468,160.1 (21.0%)	2,702,241.0 (22.8%)	2,721,689.6 (22.5%)	3,595,581.0 (28.1%)
Total	**10,889,808 (100%)**	**11,735,003 (100%)**	**11,877,750 (100%)**	**12,110,464 (100%)**	**12,811,233 (100%)**

Source: Household Socio-Economic Information Survey, National Statistical Office, 2015

The Thai Government has recognized the homeownership gaps for low-income households, and MSDHS, as the main responsible agency, has developed the 20-Year Housing Development Strategy for 2017 to 2036, which is also in line with the UN Sustainable Development Goal 11: Sustainable Cities and Communities. Under the ?Housing for All? vision, the 20-Year Housing Development Strategy aims to ensure that all Thai households can access to quality homes and have good quality of life by 2036. To meet the committed development goals, Thailand must develop more housing units for those households without homeownerships (5.87 million households in 2015). The responsibilities for development of these future housing units are shared among:

- The National Housing Authority (NHA) - 2.27 million units;
- The Community Organizations Development Institute - 1.05 million units; and
- Government and private sector civil-state projects - 1.86 million units.



Source: Ministry of Social Development and Human Security

Figure 6: Housing Unit Development Goal, 2017-2036

NHA aims to meet the development target under the 20-year strategy through collaboration with other government agencies and private sector in development of housing units for rent, lease and sales. The majority of NHA housing units over the next 20 years (approximately 1.5 million units) will be developed through collaboration with the private sector and the Ministry of Finance. In addition to meeting the goals in terms of housing units built, NHA has aimed to integrate EE and green features into the building design and construction. All the housing units recently built by NHA have adopted LED lighting technologies for all indoor lighting applications. NHA also collaborated with other local authorities, institutes and universities in initiating and promoting the EE green and ECO housing scheme, as summarized below.

•**No. 5 Home Energy Labelling Program:** NHA signed an MOU with EGAT in 2017 to collaborate in piloting and promoting the No. 5 Home Energy Labels. The initial home performance criteria focus mainly on energy performance of building construction materials (e.g., wall OTTV, roof RTTV), air-conditioner (Seasonal Energy Efficiency Ratio ? SEER) and lightings (Lighting Power Density ? LPD). The energy performance of these materials and equipment will be evaluated in conjunction with the potential energy savings simulated by a modelling software. In 2019, ten NHA housing projects were qualified with the Energy Labels. EGAT is currently revising the criteria for the No. 5 Home Energy Labels, and the weighted score approach is being considered where 80% will be given to the energy performance of building construction materials and equipment, and 20% will be given to integration of innovative technologies (e.g., renewable energy and energy management system), and passive building design. The No. 5 Home Energy Labelling certification has not yet been applied to all NHA?s housing projects.

Source: NHA and EGAT

Figure 7: NHA?s Housing Projects Certified by No. 5 Home Energy Label

•**ECO Village:** NHA has collaborated with Chula Uniresearch, an autonomous agency under Chulalongkorn University, to study criteria for ECO Village for NHA in 2013. The main objective of the ECO Village initiative is to develop environmentally friendly housing units and communities, reduce energy consumption and waste. Following the study, the ECO Village criteria was established based on the on the Thailand Rating of Energy and Environmental Sustainability (TREES) system developed by the Thai Green Building Institute (TGBI)[13][13]. The certifications under the NHA?s ECO Village are divided into four levels: Certify, Silver, Gold and Platinum. In 2016, the criteria were revised for pilot demonstration with NHA?s construction projects, and in 2019 one of NHA?s housing projects met the Certify level criteria for ECO Village.

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Source: NHA, 2019

Figure 8: NHA?s Eco Village Certification Levels

•**Baan Kheha Sukhpracha:** In June 2020, the Thai Government approved a new housing program for low-income households, entitled ?One Hundred Thousand Housing Program? or ?Baan Kheha Sukpracha? in Thai. This housing program was proposed by MSDHS as a royal tribute to His Majesty King Maha Vajiralongkorn Bodindradebayavarangkun (King Rama X) on the occasion of His

Majesty?s Birthday on July 28th. The goal of the One Hundred Thousand Housing Program is to provide affordable housing units for low-income households on a rental basis. The low-income household and other vulnerable groups ? including elderly and disabled people, low-rank civil servants, and retired government official - have been greatly impacted by the recent COVID-19 pandemic, and this program aims to improve access to and maintain security in quality homes. The One Hundred Thousand Housing Program will be carried out from July 2021 to July 2025 with 20,000 units constructed annually totalling 100,000 units over a five-year period. The design concept of this program is to maximize the space for common activities for all age groups, providing green and shady areas for community activities, bringing living innovations as part of the project, and reducing residents' expenditure for a sustainable community. In addition, the program will integrate the ?living by walking? concept, in which car park areas will be separated and located at the centre area of the community. Cars will be allowed to enter the community only when required. Transportation within the community focuses on walking and cycling, allowing children and elderly to use the common areas safely.

In addition to NHA?s initiatives on EE green homes and ECO Village, the Department of Alternative Energy Development and Efficiency (DEDE) under the Ministry of Energy (MOE) commenced a preparatory works to promote EE homes as described below.

•**Energy Efficiency Benchmarking for Homes:** The Department of Alternative Energy Development and Efficiency (DEDE) under the Ministry of Energy (MOE) commissioned King Mongkut?s Institute of Technology Ladkrabang (KMITL) to conduct a nationwide market assessment to determine EE benchmarks for low-rise residential buildings. Findings from the assessment were presented to stakeholders in January 2019, and the energy intensity values of 25 kWh/m2/year and 44 kWh/m2/year were proposed as the EE benchmarks for detached houses and twin-houses/townhouses respectively. According to the proposed implementation plan presented by KMITL, the proposed EE benchmarks will be promoted through various supporting programs (e.g., communication and outreach, energy labelling for construction materials, award programs). Based on the proposed implementation plan, the proposed EE benchmarks will be valid until 2021, and the new benchmarks which are more stringent will be adopted until 2026 (20 kWh/m2/year for detached houses and 37 kWh/m2/year for twin-houses/townhouses). However, it is not clear if resources have been allocated for the proposed supporting programs.

NHA also aims to provide better access to affordable home financing for home buyers, and the Housing Fund for Low-Income households was established by NHA and approved by the Cabinet in 2019. The total budget is THB 5,207 million (about USD 165 million) over a 4-year period, starting in 2020 with the initial budget of THB 346 million (about USD 11 million). According to NHA, 90% of the fund will be used for post-financing to home buyers whose loan applications are not approved by banks, and 10% of fund will be used for providing mortgage guarantee, in favour of the finance banks,

for home buyers whose refinance application are approved. NHA targets that the loan tenant will be refinanced within 2 years.

In addition to EE green home related baseline activities, multiple agencies in Thailand have also implemented labelling and certification programs which are important supporting mechanisms in promoting and standardizing EE and green performance of electrical appliances, and building construction materials, as summarized below.

•**No. 5 Energy Labelling Program for Appliances:** Thailand initiated a voluntary energy labeling program for domestic refrigerators in 1995, as a component in their nationwide Demand-Side Management (DSM) project[14][14], implemented by the Electricity Generating Authority of Thailand (EGAT) in collaboration with the Metropolitan Electricity Authority (MEA) and the Provincial Electricity Authority (PEA). Following the conclusion of the DSM project in June 2000, the Thai voluntary energy labelling program, or No. 5 Energy Label, has been continued by EGAT, and the No. 5 Energy Label program has to date covered 18 categories of electrical appliances, including covers all main types of appliances typically used among Thai households (e.g., air-conditioners, lightings, refrigerators/freezers, electric showers, etc.).

•**High Efficiency Labelling Program for Building Construction Materials:** In 2006, DEDE initiated a study on a voluntary high efficiency labelling program for non-electrical appliances/equipment and non-domestic electrical equipment. This new voluntary labelling program was later introduced in 2007 and the first batch of labels was issued in 2009. As of 2019, DEDE?s voluntary No. 5 high efficiency label program has covered 19 product categories, including low-mass bricks, roof tiles, insulations, and glass.

•**Green Label:** The Thai Green Labelling program was initiated in 1993 to reduce pollution in the environment as well as to encourage manufacturers to use clean technology. Development of green labelling criteria, and product certification have been carried out by the Thai Environment Institute (TEI) in cooperation with TISI. As of October 2019, TEI has published criteria for Green Labeling certification for 125 product/service categories[15][15], and these include criteria for different types of building construction materials, e.g., glass wool insulation, roof tiles, fiber cement, glass wall, and cement. However only 32 categories are active with certified products/services.

Figure 9: Energy Efficiency and Green Labels in Thailand

Apart from the existing collaboration between NHA and EGAT on piloting the No.5 Home Energy Labelling program, past and ongoing EE and green efforts related to building design and construction in Thailand appears to be unconnected, and most of them are not targeting at low-rise residential buildings. Considering this, the baseline scenario will most likely be the continuation of the present business-as-usual situation under which new low-rise residential buildings (which are not subject to the BEC) will be built without EE and green considerations, and the energy performance will be more or less similar to the current designs. Although NHA has planned to integrate EE and green designs into their new housing units, there are other main actors in the Thai housing market, and the overall improvements in building energy performance will only come slowly in pace with phasing out of obsolete technologies, rather than being at the forefront of EE and green building construction technology development. This is largely a consequence of the fact that without awareness/knowledge of the EE and green technologies for low-rise building constructions among home buyers and developers, without access to innovative and attractive financing mechanisms to build and enhance access to EE and green housing units, and without supporting networks of information, incentives and expertise, there is little pressure on the market to move faster than the least-construction-cost philosophy would demand.

3) Proposed alternative scenario with a description of project components, outcomes, outputs and deliverables

The proposed ?Accelerating construction of energy efficient green housing units in Thailand? Project seeks to transform the low-rise housing sector in Thailand to EE green housing by supporting NHA in designing and piloting EE green homes, strengthening the home labelling scheme and associated financial mechanisms to create a market for EE green homes. The project has the main objective to build energy efficient green homes to address the greenhouse gas emission reduction goal of Thailand, and to enhance the comfort and living space for low- and middle-income populations living in low-rise housing units. The project aims to achieve the objective through implementation of the following project components:

- Component 1: Energy Efficiency Green Home Design and Labelling Scheme;
- Component 2: Incentive Mechanisms for Promoting Energy Efficient Green Homes; and
- Component 3: Awareness Raising and Capacity Building for Promoting Energy Efficient Green Homes.

The abovementioned components will address the barriers hampering promotion and adoption of EE green housing units in Thailand. The expected outcomes of the three project components are the following:

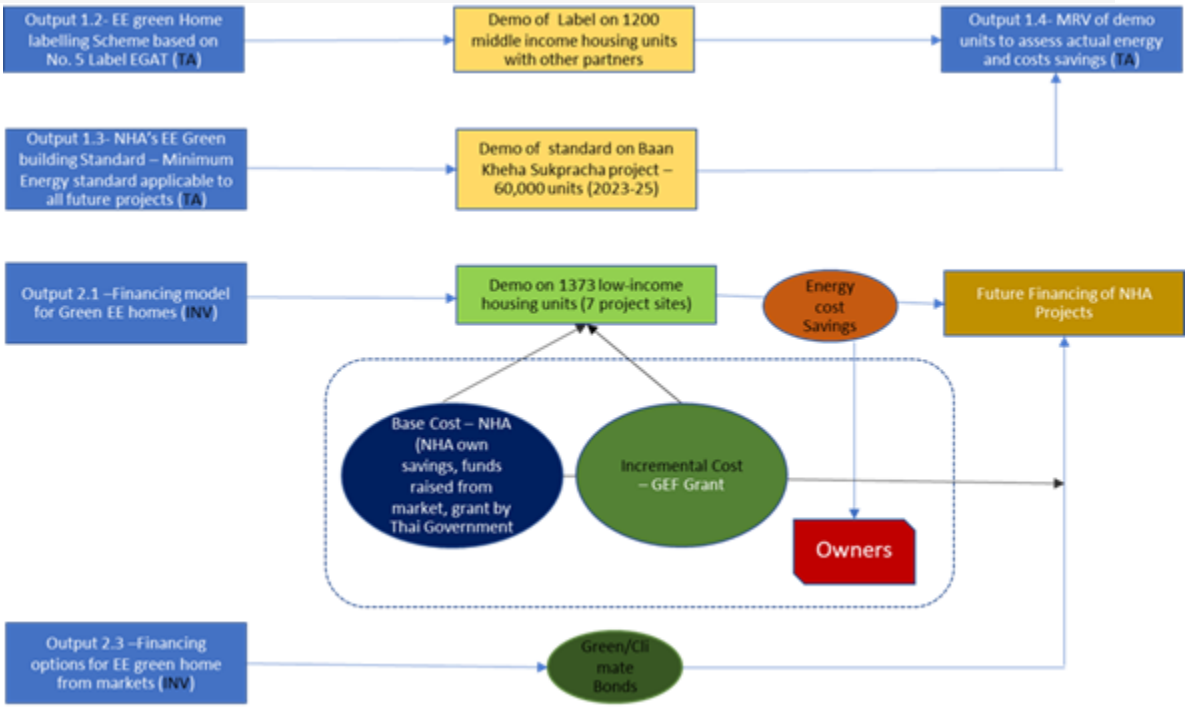
- Increased availability of energy efficient housing in the market and the ability to assess emissions reduction in a quantifiable approach;
- Affordable green housing for low- and middle-income residents and use of Green funds to support emissions reduction in the residential sector homes;
- Increased capacity among key stakeholders on designing green housing unit and public awareness of benefits of green building and fostering energy efficient behaviours in the long term.

The abovementioned outcomes will all collectively lead to greater adoption and construction of EE green housing units in Thailand and will be realized through the delivery of complementary outputs that would result from the activities that will be carried out under the project. Specifically, in the project scenario, about 1,300 of EE green housing units, which meet the No. 5 Home Energy Labelling criteria, will be constructed to show case the benefits of such construction for developers/buildings and tenants, and also serve as the platform for MRV activities to assess costs and benefits. NHA will fund construction costs for basic standard designs of these housing units, and the GEF funds will cover the incremental cost of EE and green innovative technologies to achieve the No. 5 Energy Labelling standard, which is an aspirational EE and green standard promoted by EGAT. The GEF funds will cover the costs of following EE measures applied in the projects: lightweight bricks, Energy saving glass, insulation to the walls, solar rooftop for street lighting and wastewater and other Green measures.

The GEF funds will not only enable NHA to understand the incremental cost of EE and green features, but also generate financial returns for NHA and home tenants. NHA will collect financial returns from these investments, and blend with other resources (government funds or NHA?s market raised fund) to scale up investment in EE green homes. In parallel with the EE green home showcasing activities, certification of EE and green building construction materials, and establishment of EE performance standards for low-rise residential buildings will be streamlined. These expected outputs will be

reinforced by increased capacity and awareness of key stakeholders which will enable the groundwork for implementing mandatory EE and green standards for residential housing units in Thailand.

Project outputs and outcomes are interconnected, and the relationship of the main outputs driving construction of EE and green housing units are illustrated in the diagram below.



Details on outcomes, outputs and activities of each component are discussed below.

Component 1: Energy Efficiency Green Home Design and Labelling Scheme

Outcome 1: Increased availability of NHA?s energy efficient housing in the market and the ability to assess emissions reduction in a quantifiable approach

The component will result in greater promotion and adoption of No. 5 Home Energy Labelling and ECO Village schemes, and development of more stringent but achievable certification criteria. NHA will lead the work and collaborate with EGAT, DEDE, KMUTT and other relevant stakeholders including but not necessarily limited to TISI and CGD in strengthening the energy labelling and eco schemes for low-rise buildings, certifying more EE and green building construction materials, and enabling integration of the EE green features into NHA?s standard designs. The component will

support EGAT in upgrading energy modelling software, performing random measurement and verification, and strengthening criteria of the home energy labelling scheme beyond the current levels. Moreover, the component will support development of the MRV framework to monitor and report GHG emission reductions from construction and operation of EE green homes. The component will provide inputs to support DEDE's work on revision of the EE benchmark for a low-rise residential building (detached houses and twin-houses/townhouses) for post-2021. The component outputs will also strengthen the voluntary No.5 high-efficiency labelling program for building construction materials. These efforts will facilitate policy makers and policy advocacy groups in Thailand to establish mandatory EE standards for low rise housing units through robust databases on building construction materials, as well as energy consumption and GHG emission baselines and benchmarks.

This component will revisit standard designs versus EE green designs of residential housing units in Thailand. Specifically, the EE green features will be designed with commercially available building construction materials in the Thai market. It is envisaged that the EE green design features will not only include the current criteria adopted by the No. 5 Home Energy Labelling program (i.e., thermal performance of walls, roofs and ceilings and EE performance of air-conditioners and lightings), but will also attend to thermal and EE performance of windows and other appliances, such as refrigerators/freezers. The project will also consider the use of renewable energy (RE) integration for meeting various energy needs of the community. In addition, this component will also highlight sustainable management of water and waste in housing community as well as try to accommodate design that enhance well-being of the environment and the tenants. To enable NHA to integrate these EE and green building construction technologies, this component will streamline the existing certification schemes for EE and green building construction materials and ensure that CGD will recognize these new certifications.

Gender needs and preferences will be included when reviewing EE green design standards. In general, the recommended housing designs will accommodate the universal designs for women, elderly, child and vulnerable groups through the availability of green space design and facilities. Results or findings from the gender related surveys and needs assessment under Component 3 will be incorporated into the proposed EE green home design, and development of the MRV frameworks. As a result, gender-related needs and preference is addressed in the design phase of the EE housing projects. Also, as female designers will take part in the housing design activities, therefore, we will make sure that they will be benefited by the added knowledge on EE. In overall, home-buyers who could be either women or LGBTI persons are the indirect beneficiaries of this Component through the green building standards, codes or labelling schemes as proposed by the project.

The above-mentioned outcome will be achieved through following outputs and deliverables:

Output 1.1: On-line public database of energy efficiency technologies and measures to achieve energy efficiency and sustainable resource used in low rise and single unit houses and multi-story houses specific to Thailand?s climatic conditions

Output 1.1 will be delivered through development and operationalization of a database portal which will enable NHA and its contractors, as well as private sector designers and developers/builders to access information on certified high-quality EE and green building construction materials. The database will be developed based on the review of existing (off-line/on-line) databases of building construction materials currently maintained by different agencies, including, TISI, DEDE, PCD, TEI, CGD and other relevant agencies. The review will also identify gaps and potential areas for collaboration. The project will then conduct needs assessment of the potential users (i.e., NHA and its contractors, building designers and developers/builders.), develop an approach for development and operationalization of the database portal, and identify options to ensure the database in maintained after the project period.

To assess the need to enhance the existing list of certified materials and technologies, the project will conduct review and mapping of commercially available EE green technologies/construction materials against common practices by designers, builders and contractors. The review will be extended to include imported EE and green technologies which are suitable with the Thai climatic conditions, and economically feasible for adoption in Thailand. Building construction materials which are commercially available and economically feasible EE and green housing units in Thailand will be classified as priority product categories for certification and inclusion in the database. The project will ensure that at least 3 models/brands are certified under each priority category to enable compliance with the procurement practices adopted by NHA and other public and private sector organizations. All certified products will be proposed to CGD for adoption in their procurement list.

There are multiple EE and green certification programs for building construction materials in Thailand. To ensure that a common basis and harmonized approach for certification process and also develop a common platform the project will establish a Technical Working Groups (TWG) to enable cooperative development of the certification requirements and the data base portal. It will also include other stakeholders, such as testing laboratories and industry representatives to ensure the certification process consider their perspective and requirement, which will increase the ownership, will enhance the effectiveness of EE and green certification in Thailand. The TWG group will continue to operate during the duration of project and project will undertake an assessment will be undertaken to explore the need of continuing the TWG beyond the project.

The database portal/system will be developed to serve users? needs, and all certified products concerning design and construction of EE green housing units will be populated into the database. All certified products will be proposed to CGD for adoption in their procurement list.

Deliverables

1.1.1 A Technical Working Groups (TWG) to streamline coordination among the existing certification programs by different agencies and other stakeholders established to support development of deliverables under this output.

1.1.2 A report recommending priority EE and green building construction materials for certification developed based on review and mapping of commercially available EE green technologies/construction materials, and existing types of certifications and identification of additional certifications required by NHA and private sector developers/builders for both new and retrofitted buildings.

1.1.3 Priority building construction materials certified and proposed for adoption by CGD for their procurement list (aligned with procurement practices adopted by NHA and other public and private sector organizations)

1.1.4 A database system for certified building construction materials and electrical appliances/equipment for design and construction of EE green housing units is operational, based on review of existing (off-line/on-line) databases and needs assessment of potential database users is conducted

Output 1.2: Energy efficient green home labelling scheme including process and procedures for implementation by Electricity Generating Authority of Thailand (EGAT) updated and made available for public access

Under Output 1.2, the project will strengthen collaboration between EGAT and NHA in promoting the No. 5 Home Energy Labelling program and developing more stringent but achievable criteria for the No. 5 Home Energy Label. Considering that the current certification procedures of the No. 5 Home Energy Labelling program are generally based on thermal performance of building construction materials and EE performance of electrical appliances. The project will support EGAT and NHA to review and integrate international experience on EE and green home labelling certifications. The focus of the international review will be on the countries where climatic conditions are similar to Thailand.

The project will collaborate with EGAT to conduct comparative assessment of the current criteria for the No. 5 Home Energy Labels versus findings from the international experience and results of experience of implementing NHA green EE home pilot projects. The comparative assessment will lead to recommendations on revisions of EE and green performance criteria and certification procedures for the No. 5 Home Energy Labelling program. It is envisioned that the revised criteria will properly combine EE and green requirements, based on commercially available construction materials, electrical appliances and technologies for EE green homes (based on work done under Output 1.1). Stringency

of EE and green criteria will be recommended based not only on the technical feasibility of materials and equipment, but also incremental investment costs of better construction materials, electrical appliances and other technologies required (e.g., solar PV and home energy management system), and life cycle costs. The revised criteria will also serve as the key inputs for NHA to deliver Output 1.3. Stakeholder consultation meetings will be organized to discuss and finalize the revised criteria and implementation plan with relevant stakeholders, including but not limited to, EGAT, NHA, DEDE, TISI, industry representatives (developers, builders, manufacturers/suppliers of construction materials) and TGBI.

The project will also collaborate with EGAT to develop an implementation plan including pilot demonstration of the revised No. 5 Home Energy Label on NHA project in Mukdahan Site, which will be constructed starting 2023 (See Annex E for project site information) and promotional activities for the revised criteria. Implementation of the revised No. 5 Home Energy Labelling program will be carried out under EGAT?s leadership, and in collaboration with NHA and other stakeholders as identified during the consultation meetings. EGAT and other partners will implement 1200 housing units with upgraded Label no.5.The construction and incremental costs will be contributed by the partners. The project activities are implementation of EE and green labelling scheme (output 1.2), EGAT?s role and activities are promoting, advertising, verifying data and certifying the participants. The impact results will be included in the project direct emission reduction.

Deliverables

1.2.1 Report recommending more stringent criteria and certification procedures for the No. 5 Home Energy Labelling program, based on review of international experience

1.2.2 Report on recommended technical specifications to update No. 5 Home Energy Labelling Programme covering building construction materials and electrical appliances/equipment for better energy performance

1.2.3 Adoption of the revised No. 5 Home Energy Labelling criteria, and implementation plan for demonstration and promotion of the revised home labelling program

Output 1.3: Energy efficient green building standards for low-rise and single-story residential buildings developed and integrated in the design of housing units constructed by National Housing Authority (NHA)

The project will conduct review of the current design practices of low-rise residential buildings adopted by NHA and private sector developers (including large and small developers) in Thailand. The review will include but not limited to design concepts, choices of building construction materials, and design tools (e.g., design and simulation software). The review will also look into the NHA?s housing design

roadmap (if available) which respond to the 20-Year Housing Development Strategy for 2017 to 2036. The project will identify potential areas for integration of EE and green features into the current design practices of NHA, and, in collaboration with NHA?s technical committee on building designs, the project will prepare draft recommendations of EE green standards for low-rise buildings for NHA. The draft recommendations will also include consideration on features and standards that serve as the cornerstone for future ?Smart Home? and ?Sustainable Community? requirements. The project will also prepare an implementation work plan/roadmap and guidelines for building designers and builders (contractors) to meet the proposed recommended standards. The NHA EE and Green standard will incorporate minimum energy efficiency standard for the designing and constructing the future projects once adopted by the NHA. The NHA EE and green standard efficiency requirement will become the future baseline whereas the No. 5 Home Energy Labelling will be an aspirational standard. This NHA EE and Green standard will be reviewed every 5 years or so and updated based on the market developments. The pilot to demonstrate No. 5 Home Energy Label housing units under Output 2.1 will provide the inputs on establishing the NHA EE and Green standard based on the availability of technologies and material as well as impacts on costs. The NHA EE and Green standard will also be the basis for the construction of 20,000 units per year starting 2023 covering 60,000 units, which is currently approved for funding by the Government of Thailand. The project will support NHA to integrate output 1.3 as the minimum energy efficiency design standard. This minimum energy EE housing design will be prepared and used for construction of 60,000 units of Bann Kheha SukPracha during the course of the project. Approved 5,076 units under additional rent-to-buy projects for next 10 years too will be adopted and constructed using these standards. These new EE and green housing will be financed by NHA, the Thai Government, and other green funds (e.g. green bonds) per output 2.4. The emissions reductions from these units over life time are included as project influenced emission reductions.

The output will also undertake comparative assessment and review of the NHA ECO Village certification levels with the No. 5 Home Energy Labelling program of EGAT. Based on the assessment the building level criteria of Eco Village certification criteria would be aligned ensuring all Eco Village projects are No. 5 Home Energy Labelling compliant.

UNEP is now active as the secretariat of the Global Alliance for Buildings and Construction (GlobalABC), a voluntary partnership of national and local governments, inter-governmental organizations, businesses, associations, networks and think thanks committed to a common vision: A zero-emission, efficient and resilient buildings and construction sector. Considering this, the project will collaborate with GABC to support NHA to appropriately integrate targets for reduction of carbon footprint of NHA?s construction and use of housing units through utilization of EE measures, RE integration, waste recycling and management, etc.

Necessary consultation meetings will be organized within NHA to review and conclude the recommendations, and the project team will prepare a presentation package for NHA?s management to review and approve the recommendations and work plan. It is envisaged that adoption of the EE green building standards by NHA will be in a phase-step manner, and stringency of EE green design features will increase over time.

The project will also support in integrating climate risks assessment into the minimum EE green standard design for NHA housing projects. This will ensure that the future projects are climate resilient.

Deliverables

1.3.1 Assessment of current design practices of low-rise residential buildings in Thailand

1.3.2 Comparative assessment of ECO Village against current design practices and the revised No. 5 Home Energy Label and recommendation for alignment of the two certification systems

1.3.3 Recommendation for EE green standards for low-rise buildings for NHA and implementation guidelines, including reduction of carbon footprint of NHA projects.

1.3.4 Minimum EE green standard design for low-rise buildings and implementation work plan adopted by NHA, including system for periodic review.

Output 1.4: Monitoring, Reporting and Verification (MRV) framework designed for estimating GHG and Sustainable Development impact of green housing construction in Thailand and applied by NHA in the housing schemes

The MRV framework is necessary for ensuring credibility and accountability of the estimated GHG emission reductions, and the proposed activities under Output 1.4 will support development of the MRV framework to monitor and report GHG emission reduction from construction and use of EE green buildings. The development work will be based on international and national experience, as well as the pilot demonstrations implemented by NHA under this project.

The project will conduct review of existing MRV frameworks for low-rise residential buildings in Thailand and other countries with similar climatic conditions. The review would include international best practices on existing MRV methodologies and protocols such as CDM methodologies, IPCC and UNFCCC NAMA guidelines and principles, the International Performance Measurement and Verification Protocol (IPMVP), MRV frameworks prepared by the Thailand Greenhouse Gas Management Organisation (TGO). The draft frameworks and methodologies will consider the economic aspect of MRV (i.e., cost versus accuracy), and specify data to be measured or collected, tools and instruments required, data collection frequency, detailed calculation/estimation methods, approaches for ensuring quality and reliability of data and reporting templates, among others. Based on the review, the project will formulate draft MRV frameworks and methodologies to measure, report and verify the indicators. The draft will be finalized through feedback of and consultation with the stakeholders.

The project will also identify potential MRV practitioners for low-rise residential building in Thailand (e.g., NHA?s project operation unit, EGAT?s DSM unit, community/condominium juristic person), conduct needs assessment and design of training and capacity building programs for MRV

practitioners. A training-for-trainers (TOT) will also be developed for NHA?s personnel to conduct follow-on trainings after the project period.

Once the MRV framework and methodologies are finalized, the project will prepare a work plan for MRV activities for housing projects selected by NHA. The work plan will include training and capacity building activities for MRV practitioners (with priority given to NHA?s staff and women), necessary pre- and post-installation measurements and periodically data collections. The project will support implementation of the MRV activities during the project period. Note that implementation of the MRV activities will also serve as on-the-job training for MRV practitioners, and data from MRV instruments and equipment shall be periodically retrieved, e.g., every quarter, to verify performance of the EE technologies and systems installed. Data from the MRV activities will also serve and the inputs for activities under Output 1.2 and 1.3. A project profile (as a case study) for each housing project will be prepared following the MRV implementation. The work on MRV will be coordinated with Office of the Natural Resource and Environment Policy (ONEP) which is responsible for reporting to the UNFCCC. The methodology will support the reporting on actions for GHG reductions.

Deliverables

1.4.1 A report recommending key elements of MRV frameworks for low-rise residential buildings in Thailand based on national and international experiences

1.4.2 Final MRV frameworks with implementation methodologies

1.4.3 MRV operation manual and maintenance guideline for NHA?s responsible staff to conduct MRV on pilot housing units, and training and capacity building of NHA staff on application of MRV framework

1.4.4 Annual Pilot MRV implementation reports and a final report summarizing documenting the benefits of EE green design using the pilot MRV implementation

Output 1.5: Policy makers and policy advocacy groups trained and supported to develop the national roadmap for integration of Building Energy Code & Green Rating Scheme in low-rise and single-story residential buildings

To date, Thailand has neither developed nor enforced EE and green requirements for low-rise buildings. Considering this, the project will utilize relevant deliverables under Component 1 (No.5 Home Energy labeling, EE green designs, and MRV) and Component 2 (pilot demonstration projects) to develop and implement a dedicated training and capacity building program targeting at policy advocacy groups and policy makers to enhance the Building Energy Code & Green Rating scheme to low-rise buildings.

The project will conduct situation analysis and review existing institutional frameworks as well as regulatory and permission requirements related to construction of low-rise buildings, and existing Building Codes (energy and non-energy related requirements), Green Building Rating, and EGAT?s No. 5 Home Energy Labeling. The project will then conduct a regulatory impact assessment on introduction of EE code, energy labeling, and green rating for low-rise buildings in Thailand. The regulatory impact assessment report which summarizes institutional, technical and economic impacts will be presented to policy makers, policy advocacy groups and other key stakeholders in a consultation workshop for comments. The project will also collaborate with GABC to share international experience in de-carbonizing building and construction sector through implementation of EE and green requirements for low-rise buildings.

Based on the situation analysis and regulatory impact assessment, the project will design a dedicated training and capacity building program targeting at policy makers and policy advocacy groups. The primary objective of this dedicated capacity building and awareness raising program is to enable the policy makers and policy advocacy groups in Thailand to develop and adopt the national roadmap for integration of Building Energy Code & Green Rating Scheme in low-rise buildings. The primary target groups of policy makers and policy advocacy institutions include Ministry of Energy, Ministry of Interior and Local Government Units (LGUs) and industry institutions and associations (e.g., TBGI, Housing Business Association).

Training and capacity building raising activities will be designed and implemented to suit the profiles and roles of each target group. It is anticipated that this dedicated capacity building and awareness raising program will utilize direct communication strategies to interact with policy makers and policy advocacy groups, and the program shall include practical recommendations on inter-ministerial coordination which are crucial to the successful enforcement of the building regulation in Thailand. The project will also collaborate with GABC to provide international experience in developing the national roadmaps on BEC and green ratings for low-rise residential buildings. Following the completion of the training and capacity building program, a policy roadmap for introduction of Building Energy Code & Green Rating scheme for low-rise buildings in Thailand will be prepared with inputs from the policy makers and policy advocacy groups and submitted to the relevant ministries for consideration. It is envisioned that, during the project period, at least 3 training workshops will be organized, and at least 60 trainees representing local policy and regulatory bodies and policy advocacy groups will be invited to these workshops.

Deliverables

1.5.1 A report summarizing current situations of regulations and permissions related to construction of low-rise buildings in Thailand, and regulatory impacts on introduction of EE green standards and labelling for low-rise buildings

1.5.2 A report on training and capacity building activities for policy makers and policy advocacy groups to introduce Building Energy Code & Green Rating Scheme for low-rise buildings, and implementation work plan

1.5.3 A policy roadmap for introduction of Building Energy Code & Green Rating scheme for low-rise buildings in Thailand

Component 2: Incentive mechanisms for promoting energy efficient green homes

Outcome 2: Financing and incentive mechanisms approved by the Government of Thailand to support affordable green housing for low- and middle-income residents and use of Green funds to support emissions reduction in the residential sector homes

Financing EE investments are not new in Thailand. In fact, with financial support from the Energy Conservation Promotion Fund (ENCON Fund), Thailand has implemented a series of financing programs to support investments in EE and RE technologies since 2003. These financing programs have employed different financing schemes including debt financing through the Energy Efficiency Revolving Fund (EERF), subsidies for EE equipment, equity investment and venture capital for ESCOs, credit guarantee mechanism, and equipment leasing. As for the building sector, these financing programs have focused on EE and RE investment support in non-residential buildings, specifically those regulated under the designated building and Building Energy Code regulations. Financing support for the low-rise residential building construction industry in Thailand can be divided into: 1) pre-construction financing support for housing supply (construction businesses ? developers and builders/contractors); and 2) post-construction financing support for housing demand (home buyers). Unfortunately, these previous and ongoing financing programs have not been designed to support pre- and post-financing for low rise EE green homes.

According to NHA, an average investment of a project with 300-400 housing units for low- to middle-income households is about THB 200 to 300 million per project (about USD 6.5 to 10 million). In general, the scales of pre- and post-financing support are somewhat similar, however the number of transactions in the post-financing phase will be much higher, corresponding with the number of housing units and home buyers. Industry assessment during the PPG phase revealed that financial products for the pre-financing phase offered by government and private sector banks in Thailand are very competitive in offering commercial rates. Developers, builders and contractors generally have pretty good access to affordable commercial pre-financing packages. Based on the feedback of the developers, builders and contractors, the major challenge is the effective certification and availability of green and EE material and technologies rather than availability of financial supports. The expectation is that the competition in market once demand picks up will bring cost of EE measures down.

The key factor for the post construction financing is the cost of home ownership. Evaluation of EE green home features shows that the incremental costs are about 6 ? 10% compared with the standard homes currently built in this segment. These incremental costs will eventually be passed on to home buyers, and a 6% increase in home would be a substantial increase for low- and middle-income households. This increases in the total cost affects the equity (Loan to Value) that homeowner must put

upfront for accessing loans. The Loan-to-Value (LTV) practice is imposed by the Bank of Thailand, and is governed by credit / savings records of home owners. For the LTV requirement, low- and middle-income home buyers are required to put down a minimum of 5% of the total selling price, and this upfront payment together with associated fees (appraisal fee, insurance premiums, transfer fees, etc.) are significant burden to low- and middle-income households. Higher cost of EE green homes will increase the total upfront payment required for loan. With higher income house owners, the Banks have more flexibility due to better credit/saving records.

Higher loan also implies higher level of monthly installments for a given length of loan repayment period. One options of reducing monthly payment is to increase the tenure of loan. GHB and GSB are focusing on low-, to middle-income home buyers, whereas commercial banks are competing for higher-income segments. As the competition on pricing (interest rate) becomes more intense, commercial banks tend to lower their loan underwriting standards by offering longer tenors, e.g. from 30 to 35 years, especially for customers with good credit/saving history. With support from the government, recently, GHB and GSB could extend its housing loan up to 40 years. But the option of longer tenure for low- and middle income is limited. Although EE green homes reduce the loan default risks because of energy savings increasing the disposable income of buyers, the banks do not incorporate that in the capacity to pay.

This component aims to utilize its available resources to strengthen the post-construction financing to support home buyers in Thailand to have better access to EE green homes. The three main objectives of this component are to:

1. Support NHA in determining incremental financing required to build EE green homes;

2. Utilizing financial returns from project investments in EE green homes and financial supports from the Thai Government in providing greater access and ownership of EE green homes by low- and middle-income households; and

3. Develop options for mechanisms to aggregate demand for energy efficient green materials, and for raising funds to incentivize greater investments in EE green homes.

NHA receives funds from government to support low-income groups in owning homes thus subsidizing the costs. The balance funds for financing projects are from NHA own savings (equity) and funds raised from market (loan). The funding of the pilot demonstration projects through blend of GEF grant, government funds, and NHA market raised funds will form a basis of assessing the incremental cost of providing EE and green homes for NHA?s customers. To enhance access to affordable financing for low- and middle-income households, the pilot demonstration projects will facilitate NHA to clearly understand financial implications and benefits of different EE green home designs. NHA will utilize financial benefits (savings in community service fees) collected from the pilot demonstration projects and determine the best option to scale up the implementation of their current business models (e.g., rent-to-buy, saving before buying and mortgage insurance) and include EE green homes in the business models.

EE green homes in Thailand are still in the introductory/emerging stage, and the products are generally more expensive than the standard design counterparts due to higher cost of EE and green materials and equipment. In the emerging market, lack of developed market chain to supply EE and green materials leads to higher transaction costs which then reduce the market size. Therefore, creating incentives for buyers or suppliers of EE green housing units is also the key to accelerating the market supply chain for EE material supply. Fiscal incentives to the suppliers of EE materials could reduce the costs. Aggregation of demand of EE and green materials could help reduce transaction costs too.

Considering that 95%[16][16] of low-rise housing units in Thailand are built by private sector developers, transformation of the standard housing market to EE and green housing market will require significant amount of resources. It is estimated that about USD 300 million will be required to incentivize 200,000 homes built annually in Thailand to be EE and green homes. In view of this, the component will identify alternatives for raising funds to incentivize the EE and green investments in the housing sector, capitalize financing mechanisms developed by the project, and ensure sustainability of GEF-supported finance of the pilots after the end of GEF project. This could include assessing climate funds from GCF, funds from multilateral development banks, as well as climate or green bond markets. The project will support assessment of various options and prepare recommendations and proposals for raising funds for the financing mechanisms mentioned above.

Another concern for the project is a limited access to financial services and to green housing units by women and LGBTI members, and it is expected that the project shall improve access to financial services and incentives for the beneficiaries with low and middle income to own or rent the NHA?s EE green housing units. Women in Thailand are facing economic disadvantages compared to men. The Gross National Income per capita by female was lower as they earned $14,320, compared to $18,032 by male. It is viewed that the labor force participation by women and the gender wage are becoming driving force issues hindering their ability to afford a house. One of the key concerns regarding gender for the project is a limited access to financial services and to green housing units by women and LGBTI members. The project?s financial products, services and policy actions will be designed to accommodate women and LGBTI groups as one of the targeted beneficiaries for financial incentives or mechanisms. The number of target beneficiaries will be included of 40-50% men, and 50-60% of women and including all type of LGBTI. It is noted that according to Thai law, the official ID document is not yet clearly identified of LGBTI groups. As a result, it is expected that the beneficiaries with low and middle income will be having improved access to financial services and incentives in order to own or rent the NHA?s green housing units.

The outputs and deliverables of this component to support the above outcomes include:

Output 2.1: Incremental costs of energy efficient green homes identified and recommendations on funding to support NHA in construction of energy efficient green homes developed and presented to the Government of Thailand for approval

The GEF resources will used to support the integration of EE features in the planned NHA projects at seven locations (See Annex E for the locations). NHA will demonstrate the incremental costs and benefits of different EE and green features in its seven sites across Thailand. For the pilot projects scheduled to be constructed before 2023, NHA will build these pilot project to comply with the existing No. 5 Label EE Criteria of EGAT, which have been approved. The remaining pilot sites, where the work will be initiated in 2023, will apply the revised No. 5 Label of EGAT developed under Output 1.2. The pilots in the baseline would have been prepared with the standard design. Please note the No. 5 Label of EGAT is a higher energy efficiency standard then the minimum energy efficiency standard to be adopted by NHA under output 1.3.

The GEF funds (USD 1.6 million) will be combined with the market raised funds (USD 27.03 million) to finance the construction of the pilots. The incremental cost of EE and green features are covered by the GEF funds and the NHA raised loan covers the base costs. The pilot projects are being built under rent-to-buy scheme which removes the need to pay upfront payment for loan purchase. The NHA approach for low- and middle-income housing units is facilitating the purchase of house by enabling the owner to demonstrate paying capacity and thus enabling accessing loan from banks to buy out the unit. The pilot projects will be built under the rent-to-buy scheme. The rent of the NHA units is worked out based on cost of raised funds, administrative costs and government guidelines for establishing rents. NHA also charges community fee to cover the costs for community facilities. The EE and green features will reduce the energy costs for individual renters and for community services.

The project will support NHA in working out the rent and the community service fee for the pilot project sites to enable NHA recover its own loan as well as to evaluate the feasibility to recover the incremental cost through the savings in energy costs of individual owners and reduced cost of community service. The actual costs of construction of these pilot units will be finalized through the bidding process of the pilots for construction. The savings will be based on estimates. The estimated energy savings and cost savings as well as the rebound effect will be verified through the MRV of pilot sites (Output 1.4). This information will be used to develop compelling arguments on EE green home construction, and possible financing mechanisms to incentivize future EE green home construction. NHA will set up a dedicated bank account for savings from the pilot demonstration projects, and the funds will be blended with other sources for scaling up of EE green homes.

This pilot will also form the basis for recommending and securing government funds (grants or low-cost funds) to enable NHA to integrate the higher energy efficiency standards of revised No. 5 Home Energy Label of EGAT. NHA has committed that at least 6.34% of the new rent-to-buy housing units will meet the No. 5 Home Energy labelling requirements, in addition to adopting energy efficiency features as developed under Output 1.3. Output 2.4 will provide options for NHA to raise funds from available green/climate funds to expand the mechanism to offer EE and green home units at lower cost. The results of the pilot demonstrations will also support implementation of capacity building and awareness activities under Component 3.

In addition, the project will support NHA to explore other appropriate financial mechanisms, for example a credit guarantee mechanism which allows low- and middle-income households to gain ownerships of EE green homes, and/or on-bill financing which enable tenants to own energy efficient appliances and enjoy energy savings without upfront investments. NHA will also use its experience of

raising social bonds for lower cost funds to finance affordable housing schemes, supported by Asian Development Bank (ADB), to raise green bonds using the energy efficiency and green features of its projects.

In terms of gender focus, this Component will also collect and track data of women and LGBTI groups as one of the key beneficiaries of the Component?s activity. The result will be recorded at an outcome indicator level during the implementation phase that reads ?the number of the targeted beneficiaries including women and LGBTI groups for financial incentives or mechanisms.? It is important to disaggregate women and the LGBTI numbers for this target indicator. It is also possible that the designed financial incentives and mechanisms will give preferential treatment for women and the LGBTI groups as the tenants and including NHA staff and the sub-contractor?s staff.

Considering that NHA will be the main agency in delivering this output, the project will conduct a comprehensive review of NHA?s regulatory and operational frameworks for new and retrofitted housing projects and the newly established housing fund. Following the review, detailed financial mechanisms will be designed, and implementation work plan, as well as operational, evaluation and reporting guidelines for each financial mechanism will be prepared and finalized in close consultation with relevant departments within NHA and other stakeholders. Gender related issues will be included during the reviews and/or consultations before conclusion of the detailed design of the financial mechanisms. It is also possible that the designed activities will be given preferential treatment for women and the LGBTI groups as the tenants and including NHA staff and the sub-contractor?s staff. The project will support NHA to establish a dedicated implementation support unit/committee within NHA to manage and monitor the implementation of the financial mechanisms. The project will also develop and implement specific intra-organizational training programs for operationalization of the financing mechanisms. The specific training programs will link with the development of MRV frameworks under Component 1 and the training and capacity building program under Component 3.

Construction of the pilot sites involves several steps, including confirmation with NHA on the pilot selection and construction work plan, conclusion of EE and green design features which meet or even exceed the No. 5 Home Energy Labelling criteria, preparation of detailed technical specifications of EE and green designs and technologies, preparation of the implementation work plan for each pilot site including measures to minimize environmental and social impacts during the construction phase, and preparation of monitoring and evaluation approach and work plan. After completion of the pilot site construction, the project will implement promotional activities targeting at low- and middle-income households, monitoring and evaluation activities, and prepare the pilot demonstration project profiles (as case studies) for awareness and capacity building activities under Component 3. The monitoring and evaluation results of all the pilot sites will be reviewed, and the scaling-up potential will be evaluated and included in the final report for the design and operationalization of financial mechanisms.

Deliverables

2.1.1 Reports summarizing calculation of cost of implementing pilot sites with identified EE and green features for selected pilot sites.

2.1.2 Final detailed designs with overall implementation strategy and operational frameworks to develop NHA EE and green housing units

2.1.3 Final reports on the design and construction of EE and green housing units integrating climate resilient measures and recommendations for improving cost effectiveness of EE green housing unit construction

2.1.4 Recommendations on financing scheme to scale up construction of EE green homes by NHA for submission to the Thai Government to support 6.34% target of No. 5 Labels for NHA projects.

Output 2.2: Recommendations on fiscal incentives and/or financial mechanisms to incentivize private sector (developers and construction companies) to participate in energy efficient green home standards and labelling developed and presented to the Government of Thailand for consideration

The project aims to accelerate transition of the EE green homes market from the introductory/emerging stage to the growth stage, through development of effective fiscal incentives and/or financial mechanisms which are suitable with the Thai context to incentivize private sector actors (developers and construction companies, and financial institutions), and enable them to drive the EE green home market in Thailand. The Board of Investment (BOI) recently implemented a tax incentive scheme for developers of low- and middle-income housing projects, however the criteria of home selling prices are considered unrealistic as they did not reflect the actual costs. Moreover, EE green home criteria were not included in the scheme. The project will collaborate with the relevant stakeholders for adoption of the No.5 Home Energy labeling scheme (Output 1.2) of EGAT as the tool to certify eligibility in participating in fiscal incentives and/or financial mechanisms. The work will be undertaken in close collaboration with the banks financing housing loans as well as those providing finance to developers. The output will also explore the possibility of linking Energy Conservation Fund (ECF) of Thailand with the financial mechanism/fiscal incentives scheme.

Considering limited experience in Thailand, international and regional experience will be reviewed, and potential fiscal incentives and/or financial mechanisms will be identified. The recommendations on fiscal incentives and/or financial mechanisms (e.g., tax exemption, fee exemption, and direct subsidy) will be developed and a consultation workshop will be organized to discuss the recommendations with relevant stakeholders, specifically private sectors (developers and construction companies), and seek initial endorsement. The project will then finalize the recommendations as a formal proposal, and present to the Ministry of Finance, the Ministry of Energy, MONRE and other relevant ministries for consideration.

Deliverables

2.2.1 A report summarizing international and national experiences and recommending priority fiscal incentives and/or financial mechanisms for promoting EE green homes in Thailand

2.2.2 A proposal on priority fiscal incentives and/or financial mechanisms for promoting EE green homes in Thailand for submission to the Thai Government

Output 2.3: Options for mechanisms to aggregate demand for energy efficient green materials to kick start supply chain identified, documented and presented to key stakeholders for adoption

The project will also prepare options for mechanisms to aggregate demand for certified EE and green materials to support the industry and stimulate market competition for better product quality at more affordable prices. The potential implementing agencies of these demand aggregation mechanisms would include but not limited to industry associations, NHA, Community Development Organization Institute, as well as other government agencies and state enterprises. The proposed options will be presented to key stakeholder for adoption and implementation.

Deliverables

2.3.1 A report recommending options for mechanisms to aggregate demand for energy efficient green materials

Output 2.4: Options paper prepared elaborating options for raising fund at low interest from markets to finance the energy efficient green home financing mechanisms

The project will also develop funding proposals for submission to potential funders to finance the scaling-up phase of EE green home construction in Thailand, and to support implementation of the fiscal incentive and/or financial mechanisms. NHA has raised funds through social bonds with the assistance of ADB. As the asset created by NHA will be energy efficiency and include green features (renewable energy, sustainable waste management, green spaces, etc.), raising of green funds will be explored to finance the future EE and green projects of NHA. An initial discussion was held on 5th March 2021 with the Finance department of NHA and ADB team to explore the possibility of raising funds through green/climate bonds. This option will be pursued further in cooperation with ADB. The project will conduct evaluation of potential climate finance resources including but not limited to Green Climate Fund (GCF), multilateral development banks, climate or green bond markets, and foundations; assessment of feasible fund-raising options; and preparation of recommendations and proposals for funding. The feasible funding options will be determined in consultation with the Thai national climate change focal point, UNEP. All details pertaining to administrative requirements and procedures of each funding source, priority funding focuses, funding cycle, and resources required for preparation of funding proposals will be determined. Preparation of funding proposals will be undertaken through a consultative process, and all relevant stakeholders will be engaged to provide inputs on the draft proposals before submission to the relevant in-country focal points for endorsement, and then to potential funders.

Deliverables

2.4.1 A report summarizing potential international and national sources of fund and recommending priority funding sources

2.4.2 Funding proposals approved by relevant stakeholders for submission to funders

Component 3: Awareness raising and capacity building for promoting energy efficient green homes

Outcome 3: Energy efficient green home concepts and designs increasingly adopted by housing developers and increased demand of energy efficient green homes among home buyers

Development and promotion of green rating systems and standards for residential buildings in Thailand are in a nascent stage, and there are limited capacity and low awareness among key industry players on the supply side (NHA, builders/contractors that participate in NHA construction contracts, building design practitioners, e.g., architects and engineers, private sector developers, etc.), demand side (home buyers), financiers, facilitators (EGAT, TISI), and regulators (DEDE, MOI). This component aims to achieve the Outcome of ?increased capacity among key stakeholders on designing green housing units and public awareness of benefits of green building and fostering energy efficient behaviors in the long term? through implementation of a multiple sets of activities which will address capacity and awareness gaps identified.

Activities under this component will be synchronized with activities under Component 1 and 2. The proposed activities will capture both non-technical and technical aspects of EE green homes, e.g., concepts and elements of EE green building designs, benefits of the EE green housing schemes, and choices of construction materials and techniques for EE green homes, and EE and green construction project management. Training and capacity building for key project stakeholders, consumer awareness and communication campaigns, and direct communication with policy makers and regulators will collectively deliver the expected outcome.

Previous and ongoing efforts on promoting EE and green buildings in Thailand have focused on large non-residential buildings, and industry stakeholders have limited access to useful resources necessary to enhance their capacity and awareness. Under this component, a comprehensive training and capacity building program will be developed to address needs of different groups of stakeholders. The training and capacity building program will be designed based on results and outputs from Component 1 and 2 (such as construction material database, and pilot demonstration projects), and implemented in collaboration with local institutions and agencies. A specific management-level course on EE green homes will also be developed in collaboration with the ENCON lab under KMUTT to ensure the sustainability beyond the project period.

The communication and awareness campaigns will aim at persuading home buyers and relevant stakeholders in the building construction industry in Thailand to change or modify their behaviors by providing information about EE green homes and their benefits. The communication and awareness campaigns will be tailored for each group of target audience, addressing the economic implications of EE green homes versus standard designs, and the environmental and social benefits of EE green homes. Effective combination of traditional communication channels such as television, radio, printed materials, press releases and pamphlets as well as social media will be explored. The project will also

ensure collaboration among NHA and other potential partners, such as EGAT, manufacturers/ suppliers of EE and green building construction materials, private sector EE green home developers, etc. It is envisioned that EGAT will use it experience in running public awareness campaigns through different media channels to reach out to the wider public and home buyers. Over the past three decades, EGAT released a series of more than 50 television advertisements that have been successful in reaching out to consumers and creating social awareness on its No. 5 Energy Labeling programme.

This component will also advocate inclusion of low-rise residential buildings in the existing Building Energy Code and Green Rating scheme in Thailand, and activities which will collectively enhance awareness and capacity of policy makers and regulators will be implemented. Through implementation of the component activities, capacity among key industry stakeholders and public awareness of benefits of EE green homes will be enhanced. Partnership with

KMUTT in establishing a sustainable training and capacity building platform and with EGAT who runs one of the most successful EE campaign in Thailand will ensure that capacity and awareness on green residential buildings can be sustained leading to EE green behaviors in the long term.

The outputs and deliverables which will contribute to the component outcome include:

Output 3.1: Training and technical advice delivered to NHA, EGAT, construction companies and architects on energy efficient green building design

Output 3.1 will be delivered through implementation of a comprehensive training and capacity building program which consists of different training modules designed and developed to address training and capacity building needs of different groups of stakeholders. Development and implementation of the training and capacity building program will be undertaken in collaboration with local institutions and agencies actively involved in EE green building designs in Thailand, such as Siamese Architects Association, Thai Green Building Institute ? TGBI, DEDE, KMUTT. Evaluation of the results and impacts of the training and capacity building program will be part of the implementation phase.

Prior to development of the training and capacity building program on EE green building design and work plan, the project will conduct training and capacity building needs assessment of target stakeholders - NHA, EGAT, building design practitioners, i.e., architects and engineers, developers, builders/contractors, and local manufacturers of building construction materials. The needs assessment will include gender aspect. In addition, existing off-line and on-line programs on EE green buildings offered by local and international institutes will be reviewed to understand the current situation of training and capacity building activities related to EE green homes in Thailand. Based on this background research, the project will develop the training and capacity building program which consists of multiple training modules targeting different groups of key stakeholders, as summarized in the Table 3 below, will be designed in collaboration with the existing programs carried out by relevant institutions (e.g., Siamese Architects Association, Thai Green Building Institute ? TGBI, DEDE, KMUTT). A work plan for implementation of the training and capacity building program will also be prepared as part of the program development. The preliminary design of the training and capacity building program are shown in the table 3 below.

Table 3: DESCRIPTION OF TRAINING MODULES

Module	Contents	Target Trainees
Basic Training	Concepts and features of EE green building designs and benefits	Non-technical personnel (e.g., NHA PR team, marketing personnel, financial institutes)
EE & Green Design and Project Management Training	EE green building designs, integration of EE & Green features in the design of new buildings and retrofit of existing low-rise buildings, project management, MRV and benchmarking systems including instruments and equipment training, climate resilient and eco-efficiency construction management	NHA, EGAT, building design practitioners (architects, engineers), builders/contractors
EE & Green Material Compliance Training	Requirement of NHA?s EE green building standards, EE green building construction materials ? manufacturing and construction	Local manufacturers, builders/contractors

The project will design and produce training tools and materials for the above training modules. The training tools and materials will address core elements in each training module, for example, the core elements of the technical training module would include: BEC and EE green building designs, passive design, EE and green construction materials/electrical appliances, renewable energy technologies for homes, smart homes and energy management system, and MRV systems. It is envisioned that the training tools and materials will be in both online and offline formats, and the online tools and materials shall be dynamic and able to link with the database developed under Component 1. Implementation of the training and capacity building program will be carried out in collaboration with NHA, EGAT, relevant institutions (e.g., TGBI, DEDE, KMUTT).

Evaluation of effectiveness and assessment of the impact of the training and capacity building program will be carried out to measure different parameters, including but not limited to, trainees? reactions, learning from the training, application of skills acquired from the training, and long term impacts/results of the training. Immediately after the conduct of the training, the project will carry out an evaluation to assess the trainees? reaction to the training and also assess the amount of learning that has taken place. The number of female trainees in these training and capacity building activities will be recorded and monitored. Subsequent evaluations on application of skills and long-term impacts will be conducted at a later stage, and the results of all evaluations will be included in the annual and final training and capacity building reports prepared by the project.

Deliverables

3.1.1 Training and capacity building program with detailed designs of training modules for each group of key stakeholders, and training implementation work plans based on the needs assessment of target stakeholders

3.1.2 Training tools and materials for each training module

3.1.3 Training programmes for each of target stakeholders and reports for training module/workshops completed, and a final report summarizing overall results and impacts of the training and capacity building program

Output 3.2: Curriculum with institutionalization work plan during and beyond the project period developed and implemented for executive course on energy efficient green building design

In addition to the above training and capacity building program, the project will develop an executive training course for management level personnel of developers, builders/contractors, NHA, EGAT and also for other key stakeholders in the building construction industry in Thailand. The project will utilize findings from activities implemented under Output 3.1 to support development and implementation of the executive course in collaboration with relevant institutions (e.g., KMUTT and Thai Green Building Institute - TGBI). It is envisioned that the executive training course will be structured as short-term training courses (non-formal learning) focusing on different elements of energy efficient green building designs for management level personnel, including but not limited to concepts and features of EE green building design, construction materials and techniques. The executive course will be a combination of knowledge sharing techniques, e.g., classroom lectures, practical learning through site visits, and group discussions. The project will prepare the overall work plan for institutionalization (possibly through KMUTT and TGBI) and implementation of the executive course during the project period and beyond. A report summarizing results and impacts of the executive training course will prepared as part of project deliverables. Concerning gender, the project will make sure that the number of training participants have female executive levels to participate; either from the private sector, relevant stakeholders, including NHA staff. It is expected that the portion of the male and female training participants will be about at least 40-50 male and 50-60 female including all LGTBI groups. It is note that according to Thai law, the official ID documents is not yet clearly identified of LGBTI groups, therefore the number of LGBTI could be recorded as well if the participants are keen to identify and record as LGTBI.

Deliverables

3.2.1 Final design of the executive training course

3.2.2 Implementation of Training Workplan

3.2.3 A report summarizing results and impacts of the executive training course

Output 3.3: Strategy and communication campaigns for creating public awareness designed and implemented

The project will build a platform for communication and outreach for home buyers and other stakeholders in the building and construction industry in Thailand, including setting up an information repository of EE green homes to support social media campaigns. Development of strategy and communication campaigns will begin with reviewing profiles, level of awareness and recognition of target audience, and the project will conduct surveys and assessment to review profiles and levels of awareness and recognition of target audience (NHA, EGAT, architects, developers and builders, target home buyers). Gender and needs assessment survey(s) with potential home buyers (or tenants) with gender specific questions, such as women?s needs, preferences, awareness or concerns regarding EE design and housing function, or ability to access affordable financial services of women and LBGTI, will also be included in the survey. The project will also conduct reviews of previous and ongoing public communication and awareness campaigns related to energy efficient green low-rise buildings, and the results of the review, survey and assessment exercises will serve as the bases for the design of communication and awareness strategy and campaigns for each main group of target audience, as well as development and production of marketing and promotional materials.

The project will develop communication and awareness strategy, campaigns, and annual work plans which will include gender aspects, and potential collaboration with manufacturers and suppliers of EE and green building construction materials. The campaigns will also be tailored to suit profiles, information needs, and gender-specific issues of: home buyers, developers, practitioners (architects and engineers), contractors, EE technologies and application suppliers. Specific communication and awareness activities targeting at tenants of the EE green housing units developed by NHA and this project will be implemented to ensure efficient operation of EE green housing units and minimize rebound effects.

In designing the promotional tools and materials, the project will take into account the characteristics of the target consumer groups, cultural acceptance, as well as pre-production tests, to ensure the effectiveness of the materials, as well as available promotional and marketing materials on EE green homes developed by other parties. It is envisaged that a variety of promotional materials and tools will be designed and produced to support the communication and awareness campaigns. These may include but not necessarily be limited to advertorial videos, TV and radio commercials, brochures and leaflets, posters and event banners. The project aims at utilizing successful case studies on pilot demonstration projects (under Component 2) for communication and awareness raising through: Information dissemination for public awareness; and Seminars/workshops to specifically discuss and promote the results of the pilot demonstration projects (e.g., highlights of EE/green technologies, financing options, energy/GHG savings achieved).

The communication and awareness campaigns will be implemented in collaboration with key stakeholders, including but not limited to NHA ? PR department, EGAT, manufacturers/suppliers of EE/green materials, and developers of EE green homes. The project will ensure the coverage through the right and effective combination of communication channels, including but not limited to large scale/mass media (EGATTV), social media, and focused outreach activities (e.g., informal round table or luncheon meetings, a series of workshops/ seminars/meetings). A post- campaign survey before end-of-project will be conducted to evaluate how well the campaigns have met the objectives, and a report summarizing the effectiveness and impact of the campaigns will be prepared.

Deliverables

3.3.1 A survey report summarizing profiles, level of awareness and recognition of target audience

3.3.2 Final design of communication and awareness strategy, campaigns and work plan

3.3.3 Promotional tools and materials in accordance with the designed campaigns (both printed and electronic media)

3.3.4 Delivery of the campaign and annual reports summarizing implementation results of the communication and awareness campaigns, and a final report summarizing the post-campaign survey results

4) Alignment with GEF Focal Area and/or Impact Program strategies

This project is aligned with Objective 1 and 2 of the Climate Change Focal Area. The project aims to meet Objective 1on ?Promote innovation and technology transfer for sustainable energy breakthroughs? through accelerating energy efficiency adoption in low-rise residential buildings (including multi-family residential buildings), equipment and appliances. As for Objective 2 on ?Demonstrate mitigation options with systemic impacts?, the project will help implementation of low-carbon technologies and practices in the residential building designs and ECO village certifications which encompass energy efficiency, renewable energy and waste management.

5) Incremental/additional cost reasoning and expected contributions from the baseline, the GEFTF, LDCF, SCCF, and co-financing

•

The main focus of EE in the building sector in Thailand has been on large buildings, as clearly demonstrated by the existing government policy and regulatory framework (e.g., BEC, designated building regulation, and incentives), and associated design and analysis works (e.g., EE building demonstration and MRV framework) carried out by in-country stakeholders. Although Thailand has attempted to promote EE green designs in low-rise residential buildings for over a decade, most of the past and ongoing efforts have been undertaken in an uncoordinated manner, and a true national champion has never been identified and supported to drive the initiative. As a result, the overall progress of EE green home promotion in Thailand has been slow, and adoption of EE and green designs and building construction materials is primarily pushed by manufacturers/suppliers of EE and green technologies, rather than government policies.

GEF incremental activities in this project will accelerate the works on EE green housing designs and construction in Thailand by: enhancing EE and green certification schemes of building construction materials in Thailand; developing a comprehensive database system for certified EE and green building construction materials and appliances; increasing standards for EE green home designs; strengthening the No. 5 Home Energy Labeling program; designing and implementing financial mechanisms to enhance access to and ownership of EE green homes, specifically, for Thai low- and middle-income households; implementing pilot demonstration projects to showcase actual socio-economic benefits of EE green homes; developing and implementing capacity building and training programs for NHA, EGAT, KMUTT and private sectors on EE green home designs, construction, and cost effective MRV

activities; and enhancing awareness of government agencies/authorities, industries and general public on EE green homes. Without the GEF support, the comprehensive database of certified EE and green construction materials and appliances for low-rise housing units, and the training and capacity building programs on EE green homes will not be developed and implemented.

The recent collaboration between NHA and EGAT on developing and piloting the No. 5 Home Energy Labelling program has demonstrated the intention of these two main actors in promoting greater adoption of EE green homes, however, unless the other main actors (e.g., DEDE, TISI, CGD, TGBI, local manufacturers/suppliers, etc.) are connected, it is very unlikely for Thailand to formulate and introduce a national-scale program to transform the residential building market to the EE green market. These uncoordinated baseline activities previously discussed are only expected to contribute marginally to the promotion of EE green homes in Thailand. Without the GEF intervention actions that will remove the identified barriers, it will likely take several more years for Thailand to build a clear and effective coordination framework to achieve benefits of energy savings and corresponding GHG emission reductions from the widespread adoption EE green homes.

NHA will provide co-financing for implementation of all the project components, specifically on activities that will collectively deliver Output 1.3, 2.1, 3.1 and 3.3. The local project partners, EGAT and KMUTT, will provide in-kind contributions in implementation of project activities that will deliver Output 1.2, 1.4, 3.1, 3.2 and 3.3. UNEP will provide co-financing in project management and advisory support and coordination with ongoing UNEP initiatives and projects in the regional. Overall, the project will provide vital support to NHA and other local stakeholders in accelerating construction and adoption of EE green homes in Thailand.

6) Global environmental benefits (GEFTF) and/or adaptation benefits (LDCF/SCCF)

The project is expected to contribute to both global environmental and national benefits, and the direct emission reduction of 67,711 tCO2is estimated from adoption of EE green home designs and another 14,022 tCO2 from solar rooftop in pilot demonstration projects directly financed by the project using GEF funding and project co-financing. Additionally, the project has direct post-project GHG emissions savings of 81,784tCO2 as a result of EE green home standards and labelling that will lead to the transition of the standard design housing market towards the EE green housing market (cumulatively over the period 2026 ? 2045). The project?s expected overall direct emission savings (i.e. direct + direct post-project) are therefore 163,516 tCO2 between 2021 and 2045. The Indirect emissions, from all NHA construction as EE units and influence on the non-NHA market will result in reduction of 1,294,641 tCO_2e. The cost effectiveness of the project is 2.29 USD/tCO_2e. Details of these impact estimations are detailed in Annex M ? Estimates of Direct and Consequential Greenhouse Gas Emission Reductions.

Summarized in the table 4 below are the target implementation timeline and estimated impacts of EE green home standards and labelling and implementation of the pilot demonstration projects.

Table 4: ESTIMATED IMPACTS OF PILOT DEMONSTRATION PROJECTS

No.	Description	Scope/Target Effective Date	Expected Impacts
1	Revised Voluntary No. 5 Home Energy Labelling program for low-rise residential buildings	Utilization of EE construction materials (wall, roof, insulation, etc.), EE appliances and RE systems to meet the No. 5 Home Energy Labelling requirements / Target Effective Date: June 2022 (adoption), January 2023 ? December 2025 (certification of 1,200 housing units)	Annual energy savings: 280,560 kWh.
2	EE green home design standards	Utilization of EE construction materials (wall, roof, insulation, etc.), EE appliances and RE systems to meet NHA?s minimum requirements for EE green homes / Target Effective Date: June 2022 (standard adoption), January 2023 ? December 2025 (EE green design of 1373 housing units)	Annual energy savings: 480,222 kWh
3	ECO Village	Utilization of EE street lighting, Solar rooftop and EE wastewater systems in 7 ECO villages	Annual energy savings: 10,464 kWh from EE lighting 1,402,513 kWh from Solar rooftop
4	Bann Kheha Sukpracha Project	Utilization of EE construction materials, EE appliances to improve to more efficient homes design/Target Effective :2023-2025 (60,000 EE housing units)	Annual energy savings: 6,001,200 kWh

7) Innovativeness, sustainability and potential for scaling up

Innovativeness:

The project is a first of its kind in Thailand to promote design and construction of EE green homes, and to enhance access of low- and middle-income households to high quality EE green housing units. Although the latest national Energy Efficiency Plan published in 2015 (EEP 2015) highlights the importance of the Building Energy Code (BEC) and green buildings in achieving the national energy savings targets, over 200,000 residential building units constructed in Thailand annually have not yet been addressed by the existing BEC and green building schemes. The proposed project features, among others, work towards the introduction of one of the most cost-effective energy efficiency programs, energy standards and labelling, in the low-rise residential building sector.

Without the EE and green codes for low-rise residential buildings, the project will collaborate with NHA, one of the main actors in the housing construction industry in the country, to accelerate transformation of the housing market in Thailand to the EE and green housing market. This project will introduce a concerted effort to encourage NHA, other government agencies, and private stakeholders in promoting thermal energy performance standards and labelling schemes for construction materials, integrating EE and green certified construction materials into procurement rules and practices, strengthening implementation of home energy labels, and promoting the ECO Village concept in Thailand. The project aims at achieving EE green home design features and construction techniques that consider the country?s specific conditions, such as market availability of EE and green construction materials suitable for different scales of construction projects, and capacity of builders/contractors to complete EE green construction projects within a given timeline. In addition, no project in Thailand has focused on establishing a benchmark on energy consumptions in low-rise residential buildings.

The proposed project will also introduce for the first time in Thailand the operation of pilot EE green homes and communities with robust MRV frameworks. The financial mechanisms developed by the project will enable NHA to integrate EE and green features to their housing projects and enable low- and middle-income households to gain access to these high-quality EE green homes. The economic and environmental impacts of these pilot demonstrations will be properly documented to establish reference data for relevant capacity building and communication activities. The project will aggregate demand of home appliances from low- and middle-income households and collaborate with manufacturers and suppliers to develop an appropriate financial mechanism, such as on-bill financing, to assist these households to own EE models without high upfront costs.

Environmental Sustainability:

Around 70% of the total emissions in Thailand are from the energy sector. About 44.3% of electricity generation in Thailand is generated from combine cycle power plant using natural gas, and 18.6% is

still generated from thermal power plant using coal/lignite. Thailand still regards promotion of EE and RE as the main strategies to reduce emissions from the energy sector, especially to replace the power generation from the existing coal fire thermal power plant. The national Energy Efficiency Plan 2018-2037 (EEP 2018) emphasizes a target of reducing energy intensity by 30% in 2037, and the residential sector is one of the five target sectors to reduce energy consumption. Once EE and green technologies integrated into the design and construction of low-rise residential buildings, they will benefit building tenants in terms of lower electricity consumptions and associated environmental benefits will be sustained throughout the building lifetime of 30 to 50 years. According to the Thailand Power Development Plan 2018-2037 (PDP2018), coal/lignite power plants are still included in the new power plant generating capacities,, therefore reduction of power and electricity consumption in the residential sector will reduce air and water pollution associated with the power generation from coal/lignite and other traditional fossil fuels, and greatly benefit the environment.

EE home appliances and lighting products generally have shorter lifetime than the buildings, and replacements these appliances and lighting products are inevitable. Disposal of discarded and end-of-life home appliances and lighting products may pollute the environment if not undertaken in an environmentally sound manner. Under this project, potential environmental pollution from disposal activities is minimized through adoption of energy efficient LED lights, which contain no mercury, and refrigeration/ cooling appliances with low global warming potential (GWP) refrigerants, e.g., refrigerators/freezers with R600a and room air conditioners with R32. The project also ensures the environmental sustainability aspect in a long-term by following the global best practice and relevant U4E Policy Guides on safe disposal of discarded and end-of-life lamps and appliances.

Sustainability of market development after the project:

The project is designed to ensure that Thailand has enabling environments for EE and green building construction materials and appliances to be integrated into design, construction and operation of low-rise residential building, and these environments are sustained well after the project completion. Sustainability is an integral element of the project activities and is ensured through the outputs of most of the project components. The project lays a concrete platform for the sustainability through the following three pillars:

? Championing and institutionalizing design, construction, operation, and MRV of EE green low-rise residential building through NHA so that other government and private sector organizations involved in the future EE green home projects can draw from.

? Creating a list of certified EE and green construction materials and establishing the database of the certified EE and green materials which will enable easy access to information for EE and green designs for government and private sector projects so that the sustainability is reinforce.

? Establishing the training programmes and technical guidelines on EE green home designs, construction, operation and maintenance with the local universities which will educate consumers, and construction industry stakeholders, and enhance capacities of EE and green construction material manufacturers and suppliers fostering sustainability in the long term.

The project will closely work with DEDE, which is in the process of developing EE standards for low rise residential buildings. The outputs of component 1 and the experience of pilot projects will feed into the DEDE process of developing and recommending EE standards.

Potential for scaling-up:

The key features that will certainly enhance replicability and scaling-up potential of this project are the standard EE green home designs to be adopted by NHA, the robust home energy labelling program implemented by EGAT, and the financial mechanisms that allow NHA to include EE and green features into their housing projects, and enable low- and middle-income households to access to these high quality homes. Under the Thailand?s 20-Year Housing Development Strategy, NHA will be responsible for constructing more than 2 million homes by 2036 for low- and middle-income households. Through implementation of the pilot projects, the project can demonstrate cost effectiveness of EE and green features in existing and new low-rise residential buildings, as well as in ECO communities. Note that construction of NHA?s EE and green building projects are carried out by private sector construction companies, and, through these direct involvements, the project will enhance awareness, knowledge, and capacity of these key stakeholders enabling greater diffusion of EE and green measures beyond the project. The monitoring and evaluation through the established MRV frameworks will enhance credibility of the energy saving results and further increase confidence of the private sector developers/builders in EE green homes. The project will also support DEDE to enhance the scope of BEC to cover low-rise residential buildings, which will help stimulate the demand of EE and green building construction materials and lower the cost from the economy of scale.

The project will share the experience of integrating energy efficiency measures and technologies into low- and middle-income housing construction with the countries in the region through the Global ABC events and workshops as well as regional activities of Sustainable Cities Impact project of GEF. Both of these are led by UNEP. Apart from experience sharing, the project will also share the knowledge products and lessons learned from the project with other countries through the above-mentioned initiatives.

NHA currently finances its projects from following funds ? Government grants as per the government norms and the category of housing project (affordable housing, low income housing, etc.); NHA?s own income; and finance raised by NHA from market. NHA will be adopting NHA EE green standard for all its future projects and a certain percentage of that will be Label No.5. Based on the evidence generated by project on environmental and climate gains, NHA will open discussion with the government to revise its norms to partially cover the incremental costs. Further, NHA will be using EE housing stock to raise green/climate bonds from the market. As mentioned earlier NHA will also use its experience of raising finance through social bonds and work with ADB in designing its green bond issue which will finance future construction projects. Further, as part of output 2.4 climate finance sources (e.g., carbon finance) will be explored to finance the EE housing units. It is envisaged that in

time NHA initiative and the Government mandates for minimum energy efficiency standards will lower the cost of EE materials and technologies to enable provide EE units at competitive prices.

EGAT allocates annual budget to promote adoption of No. 5 home energy labelling to fulfil its mandate given by Govt of Thailand for promoting energy efficiency. This budgetary allocation will be used by EGAT during the course of the project to provide incentives for partners in demonstrate application of enhanced EGAT No. 5 House Energy Label for 1200 units. The remaining costs are financed by the project partners. This funding will continue to be provided by EGAT post project period.

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[1] International Energy Outlook 2019, U.S. Energy Information Administration

[2] https://unfccc.int/sites/default/files/resource/Thailand%20TNC.pdf

[3] https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Thailand%20First/Thailand_INDC.pdf

[4] Thailand?s third national communication report (TNC), Ministry of Natural Resources and Environment, 2018

[5] Electricity consumption statistics for 2002-2019 published by the Energy Policy and Planning Office (EPPO), http://www.eppo.go.th/index.php/en/en-energystatistics/electricity-statistic?orders[publishUp]=publishUp&issearch=1

[6] National Statistical Office of Thailand

[7] The No.5 Energy Labelling Program is a voluntary energy labelling program implemented by the Electricity Generating Authority of Thailand (EGAT). The No.5 Energy Labelling Program has covered 30 products, and more information on the program can be found on http://labelno5.egat.co.th/new58/. EGAT is currently piloting the No.5 Home Energy Labelling program with NHA.

[8] There are three main certification programs providing information on EE and green construction materials in Thailand, i.e., the High Efficiency Labelling program (http://labelling.dede.go.th/survey/site/main) implemented by DEDE, the Green Labelling program (http://www.tei.or.th/greenlabel/en/) implemented by the Thai Environment Institute (TEI), and the Green Public Procurement schemes (http://gp.pcd.go.th/) managed by the Pollution Control Department (PCD).

[9] http://www.nso.go.th/

[10] MSDHS has classified household income levels based on income percentiles: low-income households: percentiles 1- 60; middle-income households: percentiles 61- 80; and high-income households: percentiles >80. In 2020, MSDHS estimated that households with monthly income less than THB 26,601 as low-income households. Middle-income households are those with monthly

incomes between THB 26,601 and THB 41,100, and high-income households are those with monthly incomes exceeding THB 41,100 (Source: 20 years strategic development plan for 2017 to 2036, MSDHS).

[11] See more information from UNDP. (2019b) Human Development Report: Thailand Human Development Indicators. Retrieved from http://hdr.undp.org/en/countries/profiles/THA# and World Bank. (2019a) Thailand: Country Profile. Retrieved from https://databank.worldbank.org/views/reports/reportwidget.aspx?Report_Name=CountryProfile&Id=b450fd57&tbar=y&dd=y&inf=n&zm=n&country=THA

[12] See the information from UNDP. (2019b) Human Development Report: Thailand Human Development Indicators. Retrieved from http://hdr.undp.org/en/countries/profiles/THA#

[13] The Thai Green Building Institute (TGBI) was established in 2010 under cooperation between the Engineering Institute of Thailand under H.M. the King?s Patronage (EIT) and the Association of Siamese Architects under Royal Patronage (ASA).

[14] EGAT launched a US$189 million DSM program in 1993 with financing from an automatic tariff mechanism (Ft), US$9.5 million grant from the Global Environment Facility (GEF), US$6 million grant from the Government of Australia, and a US$25 million concessional loan from the Overseas Economic Cooperation Fund of Japan (OECF).

[15] http://www.tei.or.th/greenlabel/download/2019-10-Name-GL-th.pdf

[16] The NHA projects too are bid out to the private sector construction companies.

1b. Project Map and Coordinates

Please provide geo-referenced information and map where the project interventions will take place.

The proposed pilot EE green low-rise residential buildings are located in six provinces in the central and northeastern region of Thailand (i.e., Ayutthaya, Loei, Mukdahan, Nakhon Sawan, Phetchaburi, Sakon Nakhon, and Samut Sakhon) as shown in the figure below. All the proposed project locations are in Thailand and these areas not disputed with the neighboring countries.

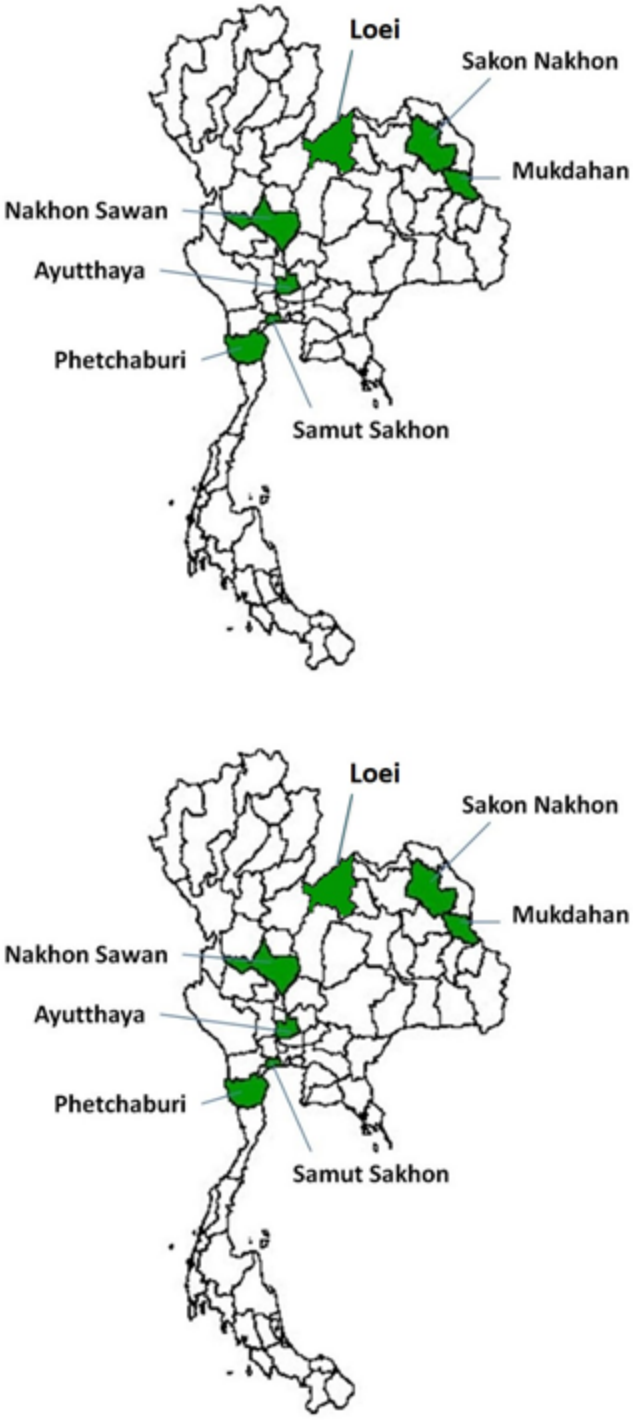

Figure 10: Location of Pilot Demonstration Sites

Brief details of each pilot projects are outlined in the table 5 below, and more details are given in Annex E.

Table 5: PILOT PROJECT LOCATIONS

Demonstration sites	Housing Unit	Latitude	Longitude
1. Pho Rai Wan community housing in Phetchaburi Province (Rental)	246	13.0899	99.9634
2. The Community housing in Mukdahan Province (Rental)	78	16.323356	104.401694
3. The Community housing in Nakhon Sawan Province, Phase 2	196	15.718573	100.092954
4. The Community housing in Samut Sakhon Province (Krathumban 3)	196	15.653469	100.247974
5. The Community housing in Phra Nakhon Si Ayutthaya Province (Rojana, Phase 1)	441	14.180667	100.395020
6. The Community housing in Sakon Nakhon Province	146	17.157796	104.130027
7. The Community housing in Loei Province (Rental)	70	17.486278	101.718222

1c. Child Project?

If this is a child project under a program, describe how the components contribute to the overall program impact.

NA

2. Stakeholders

Select the stakeholders that have participated in consultations during the project identification phase:

Civil Society Organizations Yes

Indigenous Peoples and Local Communities

Private Sector Entities Yes

If none of the above, please explain why:

Please provide the Stakeholder Engagement Plan or equivalent assessment.

During the PPG phase, the project engaged all key stakeholders through bilateral meetings and consultation workshops, and these took place during the design and final validation of project approach and activities. From October 2019 to April 2020, two stakeholder consultation workshops and one online validation meeting were organized and participated by more than 20 national and international organizations. These key stakeholders during the PPG phase will also be engaged during the project implementation phase together with other important stakeholders as described below.

Stakeholder main group	Stakeholder name	Existing activities with potential to be leveraged	Content engagement, contributions to the project (identified by Component)

Stakeholder main group	Stakeholder name	Existing activities with potential to be leveraged	Content engagement, contributions to the project (identified by Component)
Government	National Housing Authority (NHA) - Ministry of Social Development and Human Security (MSDHS)	NHA is a state enterprise under MSDHS , established in 1973. NHA is one of the key actors in the Thai housing market, offering various types of homes for buyers, primarily low to middle income households, civil servants, and government employees. NHA is the market leader in the low-income housing market segment in Thailand. It is appointed by the Thai Government as the main agency to develop housing units to meet the targets set out by the 20-Year Housing Development Strategy for 2017 to 2036. Through its mandates, and ongoing/planned housing projects, NHA can be the initiator of EE green homes in Thailand, and also the influencer to other local low-income housing developers to transform the low- to middle-income housing market to EE green homes	NHA will be the main executing agency of the project, and responsible for project management and implementation of all project components and activities. NHA will sit in the Project Steering Committee (PSC), be responsible for communication and coordination with the office of the GEF OFP and UNEP on project managements, and coordinate with project partners (EGAT and KMUTT), and relevant national government agencies in project implementation. NHA aims to establish and adopt EE green home designs as the standard designs for their future housing projects.

Stakeholder main group	Stakeholder name	Existing activities with potential to be leveraged	Content engagement, contributions to the project (identified by Component)
Government	Ministry of Social Development and Human Security (MSDHS)	Thailand?s Gender Equality Act B.E. 2558 (2015), which was adopted on 9 September 2015, aims to promote gender equality in various aspects including social, economic and political rights. Department of Women's Affairs and Family Development under MSDHS has been responsible for promotion of women?s development and gender equality.	Through NHA, relevant departments under MSDHS will be engaged to support and ensure integration of gender equality in project activities and outputs. The agency will be a member of the Technical Working Group (TWG).

Stakeholder main group	Stakeholder name	Existing activities with potential to be leveraged	Content engagement, contributions to the project (identified by Component)
Government	Electricity Generating Authority of Thailand (EGAT) ? Ministry of Energy (MOE)	EGAT is a state enterprise under the MOE responsible for electricity generation and energy security in Thailand. EGAT is also the implementing agency of the voluntary No. 5 Energy Labelling program for home appliances which was initiated as a component under the nationwide Demand-Side Management (DSM) program, and now is a part of corporate social responsibility (CSR) activities. EGAT has recently developed the No. 5 Home Energy Labelling program for detached houses and townhouses. EGAT has signed an MOU with NHA to pilot the No. 5 Home Energy Labelling certification for low-rise housing projects. EGAT also has extensive experience in implementation of public awareness campaigns on energy efficiency, and several studies have confirmed that majority of the Thai consumers recognize the No. 5 Energy Labels. EGAT recently implemented a rebate program for EE appliances in collaboration with department stores and modern trades in Thailand.	EGAT will collaborate with NHA to support implementation of project activities under Component 1, 2 and 3. Under Component 1, EGAT will strengthen the criteria for the No. 5 Home Energy Label, and support development and implementation of EE green home design standards, and MRV frameworks. EGAT?s experience in rebate program and implementation of public awareness campaigns will contribute to the implementation of activities under Component 2 and 3. EGAT will be a member of the PSC.

Stakeholder main group	Stakeholder name	Existing activities with potential to be leveraged	Content engagement, contributions to the project (identified by Component)
Government	Office of Natural Resources and Environmental Policy and Planning (ONEP) - Ministry of Natural Resources and Environment (MONRE)	ONEP is the focal point for GEF on climate change and UNFCCC in Thailand, responsible for scrutinizing the PIF on climate change; communication and coordination with Thailand?s GEF Operation Focal Points.	ONEP will provide guidance and information on the energy project compliance with environmental regulations. The agency will be a member of the PSC.
Government	Energy Policy and Planning Office (EPPO) ? Ministry of Energy	EPPO oversees the ENCON Fund to ensure effective usage of energy and environmentally friendly measures that can yield long term sustainability for Thailand.	EPPO is the key stakeholder in implementation of project activities on development and recommendation on fiscal incentives and/or a financial mechanism to support EE green home standards and labeling and incentivize private sector to participate in the voluntary labeling scheme. (Component 2). EPPO can also contribute in development of funding proposals to support scaling up of EE green home construction in Thailand. EPPO will also be a member of the PSC.

Stakeholder main group	Stakeholder name	Existing activities with potential to be leveraged	Content engagement, contributions to the project (identified by Component)
Government	Department of Alternative Energy Development and Efficiency (DEDE) ? Ministry of Energy	DEDE is an agency under MOE, responsible for implementing the BEC for large buildings (>2,000 square meters), including high-rise condominiums. DEDE has also implemented the High Efficiency Labelling program (thermal energy performance) for building construction materials, such as low-mass bricks, roof tiles, glass wool insulation, etc. In 2019, DEDE conducted assessment of electricity consumption benchmarks of detached houses and townhouses in Thailand, and DEDE is currently developing a program to promote EE benchmarks for residential buildings.	DEDE will support implementation of EE and green certifications, database development activities, and EE and green standards and labelling for low-rise residential buildings under Component 1. DEDE will benefit from the MRV frameworks for low-rise residential buildings developed by the project. DEDE will be the key agency to support activities on expanding the scope of BEC to cover low-rise residential buildings under Component 3. DEDE will be a member of the PSC, and also a member of the Technical Working Group (TWG) on EE and green standards and labelling for low-rise residential buildings. .

Stakeholder main group	Stakeholder name	Existing activities with potential to be leveraged	Content engagement, contributions to the project (identified by Component)
Government	Thai Industrial Standard Institute (TISI) - Ministry of Industry	TISI is the national standards body for Thailand, responsible for development of both mandatory and voluntary Thai Industrial Standards (TISs) to suit the need and the growth of industry, trade and economy of the country, as well as to correspond with the government policy in consumers protection, industrial promotion to be competitive in the world market, environmental protection and natural resources preservation. TISI has carried out the product certification schemes and issued voluntary and mandatory certification marks which are recognized by CGD. TISI has also collaborated with the Thai Environment Institution in implementation of the Green Label Scheme to reduce pollution in the environment as well as to encourage manufacturers to use clean technology.	TISI will support and advise development and implementation of the EE green certification scheme and database system (Component 1). The agency will be a member of the Technical Working Group (TWG) on standardization and certification of EE green products.

Stakeholder main group	Stakeholder name	Existing activities with potential to be leveraged	Content engagement, contributions to the project (identified by Component)
Government	Pollution Control Department (PCD) - Ministry of Natural Resources and Environment (MONRE)	PCD is responsible for implementation of the Green Public Procurement (GPP) scheme in Thailand to support public procurement and purchasing on products and services that are eco-friendly. PCD uses the GPP experience to stimulate the green procurement practice in the private sector. PCD also collaborates with other agencies and authorities in drafting criteria of the Green Cart products/services certification scheme and ensures inclusion of green certified products on the list of eligible products issued by the CGD.	PCD will support development and certification of EE green building construction materials and ensure necessary recognition by CGD (Component 1) PCD will also contribute in promoting eco-friendly and sustainable products, including eco-friendly construction materials and energy efficient electrical appliances (Component 3). PCD will be a member of the Technical Working Group (TWG) on EE and green certifications.
Government	Comptroller General's Department (CGD) ? Ministry of Finance	CGD is responsible for monitoring, control and administration of public funds and public expenditure to ensure all government agencies comply with all rules and regulations related to public finances, government procurement and expenditure. CGD maintains a list of products and services eligible for procurement by public funded project.	CGD will be the key stakeholder in development and certification of EE green building materials, and appliances for construction and operation of EE green homes (Component 1). New/updated certified EE green products must be registered and listed on the CDG?s procurement list before NHA can consider such EE green products in their EE green housing projects. CGD will be a member of the Technical Working Group (TWG) on standardization and certification of EE green products.

Stakeholder main group	Stakeholder name	Existing activities with potential to be leveraged	Content engagement, contributions to the project (identified by Component)
Government	Department of Public Work and Town & Country Planning (DPT) ? Ministry of Interior	DPT is responsible for town and country planning at every level, public works; building design, building construction control. Moreover, it carries out and supports local administrative authorities on town, area and rural development by formulating and supervising land use policies, relocation system and infrastructure. DPT also direct and ensure compliance with relevant building regulations, and DPT is supporting DEDE in enforcement of BEC in Thailand.	DPT will be the key agency to support activities on developing EE and green standards for low-rise residential buildings (Component 1) and expanding the scope of BEC to cover low-rise residential buildings (Component 3). DPT will be a member of the Technical Working Group (TWG) on EE and green standards and labelling for low-rise residential buildings.
Government	Thailand Greenhouse Gas Management Organization (TGO)	TGO was established to serve as the information center on GHG operations and develop a database on authorized projects and the approved trading of GHG quantity, among others. TGO has also developed MRV Methodologies for different types of GHG reduction projects.	TGO will be involved in formulation of the MRV frameworks for low-rise residential buildings (Component 1). The agency will be a member of the Technical Working Group (TWG) on MRV frameworks for low-rise residential buildings.
Government	Metropolitan Electricity Authority (MEA) ? Ministry of Interior	MEA is responsible for distribution of electricity in Bangkok and two surrounding provinces (Samutprakarn and Nonthaburi). MEA has implemented an award program for EE building, ?MEA Energy Saving Building Awards?, since 2012. Under the EEP 2015, MEA is required to implement the Energy Efficiency Resource Standard (EERS) measure to improve EE for their customers.	MEA will be involved in implementation of MRV frameworks (Component 1) and public awareness campaigns (Component 3).

Stakeholder main group	Stakeholder name	Existing activities with potential to be leveraged	Content engagement, contributions to the project (identified by Component)
Government	Provincial Electricity Authority (PEA) ? Ministry of Interior	PEA is responsible for distribution of electricity in all the provinces in Thailand, except Bangkok, Samutprakarn and Nonthaburi. Similar to MEA, PEA is required to implement the Energy Efficiency Resource Standard (EERS) measure to improve EE for their customers, and PEA is currently developing various EE service models, including on-bill financing, for their customers in different end-use sectors.	PEA will be involved in implementation of MRV frameworks (Component 1) and potentially in development and implementation of financial mechanisms for low- and middle-income households to purchase EE appliances (Component 3).
Government	Government Housing Bank (GHB), and Government Savings Bank (GSB)	GHB and GSB are the government home financing arms and considered as the Special Financial Institute (SFIs) for the housing loan market in Thailand. GHB and GSB are focusing on low-, to middle-income homebuyers and account for almost 40% of the total housing loan market. GHB and GSM are currently implementing various financial products with special interest rates to finance low- and middle-income households to purchase homes.	The two SFIs will be involved in activities under Component 2, including development and implementation of financial mechanisms, and evaluation of options for raising additional fund from potential funders for expansion and continuation of EE green home financing mechanisms.

Stakeholder main group	Stakeholder name	Existing activities with potential to be leveraged	Content engagement, contributions to the project (identified by Component)
Government	Real Estate Information Center (REIC)	The REIC was established in 2004 and has been operated under supervision of the GHB with support from the Ministry of Finance and private sector organizations. The REIC acts as a central repository that collects accurate, reliable and up-to-date real estate data and other pertinent information.	The REIC will provide relevant data during the implementation of monitoring and evaluation activities.
Academic Institute	King Mongkut University of Technology Thonburi (KMUTT), Thailand	KMUTT is one of the leading universities in the country, actively working on research in the fields of building and industrial EE. The Energy Conservation Laboratory (EnConLab) under KMUTT has extensive experience in development of training programs on EE and training tools, as well as preparation of awareness and communication materials on EE. EnConLab will also act as a repository of all project deliverables.	KMUTT will primarily be involved in Component 1 and 3. Under Component 1, KMUTT will collaborate with NHA and EGAT to support reviewing of existing database and material standards and certifications, EE green home standards and labelling, and the MRV frameworks for low-rise residential buildings in Thailand and other countries. Under Component 3, KMUTT will support development of the training and capacity building programs for local stakeholders and executive personnel, as well as development of training tools and marketing materials.

Stakeholder main group	Stakeholder name	Existing activities with potential to be leveraged	Content engagement, contributions to the project (identified by Component)
Private sector	Thai Green Building Institute (TGBI)	TGBI was established in 2010 under cooperation between the Engineering Institute of Thailand under H.M. the King?s Patronage (EIT) and the Association of Siamese Architects under Royal Patronage (ASA). TGBI focuses on promoting research and development in architectural and engineering professional standards for the design, construction and building management of green buildings. TGBI developed the Thai?s Rating of Energy and Environmental Sustainability standards (TREES).	TGBI will be involved in development and implementation of EE green design standards for low-rise residential buildings (Component 1), and the training and capacity building programs (Component 3). TGBI will be a member of the Technical Working Group (TWG) on EE green standards and labelling for low-rise residential buildings.
Private sector	Thailand Environmental Institute (TEI)	TEI has been supporting the government in environment strategy, and development and implementation of the voluntary Green Label Certification scheme to ensure environmental and energy efficiency performance of products and services.	TEI will be involved in development and implementation of EE green certification schemes for building construction materials (Component 1), and implementation of awareness campaigns to boost demand for sustainable goods and products in the residential market (Component 3). TEI will be a member of the Technical Working Group (TWG) on standardization and certification of EE green products.

Stakeholder main group	Stakeholder name	Existing activities with potential to be leveraged	Content engagement, contributions to the project (identified by Component)
Private sector	Commercial Banks and Financial Institutes	Commercial banks and financial institutions in Thailand account for more than half of the total housing loan market. The big four commercial banks (Siam Commercial Bank PCL. (SCB), Krungthai Bank PCL. (KTB), Kasikornbank PCL. (KBANK) and Bangkok Bank PCL. (BBL), collectively, share about 40% of the housing loan market. Commercial banks generally offer options of home loans to match their customers? needs. Each bank?s policy on interest rate (deposit / lending) depends on several factors, including prevailing economic conditions, inflations, the monetary policy of the Bank of Thailand (BOT) and competition from other banks.	Commercial banks and financial institutes will participate in development of financial mechanisms under Component 2 and will receive trainings related to EE green homes design, construction and promotion from the project. It is envisaged that participating banks and financial institutions will provide financial supports for potential buyers of EE green homes.
Civil Society	Housing Business Association	The Housing Business Association was established in 1981 to promote business within the housing sector in Thailand. The Association cooperates with government agencies in putting forth policies and regulations which effectively promotes the industry?s growth and prospects. Over the past two decades, the Association has been involved in drafting several regulatory frameworks, such as the Land Development Act, City Plan Act and Land and Building Tax Act. In addition, the Association has actively supported organization of the annual exhibition entitled ?Housing and Condominium Exhibition? for more than four decades.	The Association will be involved in development and conclusion of EE green home standards and labelling (Component 1), preparation of fiscal incentives to promote EE green homes (Component 2), and implementation of public awareness campaigns (Component 3). The agency will be a member of the Technical Working Group (TWG). The Association members (i.e., housing project developers) will also benefit from capacity building, training, workshops and seminars implemented under Component 3.

Stakeholder main group	Stakeholder name	Existing activities with potential to be leveraged	Content engagement, contributions to the project (identified by Component)
Civil Society	Habitat for Humanity Thailand (HFHT)	HFHT was established in 1998 to improve the quality of Thai people by building homes and transforming communities. HFHT work with partners, focusing on holistic development and sustainable change to achieve a positive and lasting impact. HFHT build, repair and rehabilitate houses throughout the country, and boost families economic and educated opportunities, improve health and social integration. Based on the needs of the families and communities, HFHT and its partners will facilitate job training; encourage home-based business, set up health centers, community centers and libraries, among others.	HFHT will be engaged and consulted on EE green home design standards under Component 1, as well as communication and awareness, and gender related activities under Component 3. The agency will be a member of the Technical Working Group (TWG). The member of HFHT and other civil society organizations similar to HFHT will also be engaged during the implementation phase, they will gain benefit from capacity building, training, workshop and seminars implemented under Component 3.
Civil Society	The Foundation for Women (FFW)	FFW is a non-governmental organization established in 1984 in Bangkok Thailand to provide services to women. FFW works toward gender equality/equity and social justice and encourages the participation of women and community in solving their problems and collaborating with authorities at all levels in shaping plans and policies that affect the lives of women and children.	FFW will be engaged in communication, awareness and gender related activities in Component 3. FFW will also benefit from capacity building, training, workshop and seminars implemented under Component 3.

Stakeholder main group	Stakeholder name	Existing activities with potential to be leveraged	Content engagement, contributions to the project (identified by Component)
International Organization	UNEP	UNEP?s Asia and the Pacific Office has been working toward prosperity, resilience and resource efficiency across the region. UNEP is now active as the secretariat of the Global Alliance for Buildings and Construction (GlobalABC), a voluntary partnership of national and local governments, inter-governmental organizations, businesses, associations, networks and think thanks committed to a common vision: A zero-emission, efficient and resilient buildings and construction sector. In addition, UNEP recently developed new guidelines for integrated approaches for sustainable neighborhoods.	As a GEF Implementing Agency, UNEP will be responsible for the provision of technical and operational oversight support throughout the project implementation phase. UNEP will share global experience from past and ongoing projects to ensure that relevant international best practices are considered and incorporated in project activities and outputs. UNEP will be a member of the PSC.

In addition, provide a summary on how stakeholders will be consulted in project execution, the means and timing of engagement, how information will be disseminated, and an explanation of any resource requirements throughout the project/program cycle to ensure proper and meaningful stakeholder engagement

Key stakeholders will be engaged and consulted through participation in the Project Steering Committee (PSC) and Technical Working Group (TWG). The PSC members will receive periodic reports on progress, and full project updates will be provided during the PSC meetings which will be organized at least once per year. It is envisaged that the TWG members will be more frequently engaged through the working group meetings in which specific technical matters related to project activities will be discussed. Other project stakeholders will be engaged through organization of consultation meetings which will be organized during the course of project implementation period.

Select what role civil society will play in the project:

Consulted only; Yes

Member of Advisory Body; Contractor;

Co-financier;

Member of project steering committee or equivalent decision-making body;

Executor or co-executor;

Other (Please explain)

3. Gender Equality and Women's Empowerment

Provide the gender analysis or equivalent socio-economic assesment.

Gender analysis:

Overall global context

Thailand was ranked at 84 out of 162 countries in 2018 on the UN?s Gender Inequality Index (GII) that looks into three dimensions of empowerment, reproductive health and economic activity. The World Economic Forum puts Thailand in 75th place, out of 153 countries, in its 2020 Gender Gap Index, measuring gender parity in four dimensions of economic participation and opportunity; educational attainment; health and survival; and political empowerment. While Thailand?s Human Development Index (HDI) value for 2018 was 0.765, with female at 0.763 compared to male at 0.766. This HDI value has put the country in the high human development category, ranking it at 77 out of 189 countries.

Country context

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Key government agencies responsible for gender issues in Thailand are the Ministry of Social Development and Human Security (MSDHS) and its Department of Women?s Affairs and Family Development (DWAFD). Since 2010, ministries and departments are required to appoint Chief Gender Equality Officer (CGEO) and Gender Focal Point (GFP). The CGEOs and GFPs are expected to work as an institutional mechanism to pass through gender sensitivity and to promote gender mainstreaming into government?s policies, planning and budgeting processes. The Thai Government has claimed that it has put great emphasis on social equality and mainstreamed gender aspects into national policies, regulations and actions to promote gender equality at all levels. (Government of Thailand, 2014). The efforts by the Government also included the promulgation of the 2015 Gender Equality Act and the development of the Women?s Development Plan under the 12th National Development Plan. The Law has been implemented through the Committee to Promote Gender Equality and the Committee to Rule on Cases of Discrimination Based on Gender. The gender-responsive budgeting was piloted in

government departments, and plans were underway to develop a gender-disaggregated database within the national statistical system.

Apart from gender policies and laws, there are some gender specific issues and impacts in relation to the proposed project, Firstly, women in Thailand are facing economic disadvantages compared to men. Thailand?s labour force participation rate by female was lower than that of male at 67.2 and 82.4 percent respectively. The Gross National Income per capita by female was also lower as they earned $14,320, compared to $18,032 by male. Women in Thailand also tended to get paid less than men for similar jobs, and highly educated women at the executive level were also facing the same dilemma. ?Women continue to make just 77% of the average male salary when performing the same work? (PKF, 2016). It is viewed that the labor force participation by women and the gender wage are becoming driving force issues hindering their ability to afford a house. In Thailand, women still require supports for their improved economic empowerment in order to have better access to livable housing or property.

Secondly, households in Thailand will become smaller as an average household size was down from 3.6 people in 2000 to just 2.7 people in 2014. Thailand is facing a changing pattern of family types to become more as nuclear families, one-person households, single-parent families and skipped-generation families. According to the National Economic and Social Development Council (NESDC), the majority of the single-parent households are single-mother families, having poverty and accommodation arrangement problems. The NESDB also noted that more than half of the 400,000 skipped-generation household heads were older than 60 years, and almost 90 percent of them were women. Further, one notable change is an increase number of women as household heads and who are not married. These trends will have some impacts on the demands and supplies of housing units for low- and middle-income women in the future.

Thirdly, in Thailand, women working as unpaid family members are accounted for 30% versus 16% by men. This has led to their disadvantages since those in the information sector are normally not under legal and social protection or not covered by other benefits. In addition, Thai social security laws fail to provide the informal workers with treatment of work-related accidents, diseases and injuries, unemployment and retirement insurance, and workers' compensation. All these could become additional negative factors for women?s earning capacity and the ability to purchase or own a house.

Fourthly, to own a house in the municipal area, total income, age and number of family members are among key factors to be considered. It was noted that a person will have more likeliness to own a house when his/her total income and age increase. . In contrary, when the number of family member increases, it is less likely for him/her to own a house[1]. In addition, it was stated that women?s income

level, their responsibilities and life cycle stage all are contributing factors when it comes to women?s preferred housing type and location.[2]

Lastly, according to Kring (2017, p. 28), in general, access to financial services by women has been viewed as limited compared to men. [3] However, it should also be noted that a survey by the Bank of Thailand in 2016 noted that there was no difference between male and female in accessing financial services at the percentage of 97% and 97.6% respectively.

Referring to the interviews and a stakeholders? consultation meeting, it was found out that approximately 20% of the NHA?s housing units are designed based on a universal design that provides sufficient good living environment features for vulnerable groups, such as children, woman and elderly. According to the NHA, there are currently two local contractor companies with female leadership/owner working as its registered venders. The interviews with the construction contractors indicated that the hiring of female workers varied from 15% to 40% of their total hire depending on the availability, especially of those who are female migrants. It seems the differences of skills, efficiency and performance between male and female workers were observed differently. In addition, based on the conversation with NHA?s subcontractors on their experience with home buyers in Thailand, it seems the contractors have not been aware of gender significance. They only expressed their views that there was no gender-specific needs or awareness among the home buyers in relation to EE housing. What they noted of more importance was price This has shown a lack of awareness on the possibility of specific needs by women with regard to EE homes.

To conclude, the analysis explicitly addresses key gaps for gender integration, . Women and other vulnerable groups in Thailand should not face any forms of discrimination when accessing social and financial services. It can be said that the access to EE green housing units and financial services by women and vulnerable groups are still limited due to many reasons. There is also a potential lack of sufficient reports, indicating strong awareness (or needs or willingness to pay) on green housing sector by low- and middle-income home buyers, especially women. It should be mentioned that although there are no potential negative effects on women by the proposed project activities; yet, women?s participation in the activities should be adequately covered, reinforcing their empowerment and equality. With better understanding of women?s disadvantages and adequate women?s participation in the project activities, it is also expected that gender initiatives activities can be addressed at different level throughout the project life. So, the gender goal of gender quality and empowerment will be fully addressed and achievable.

Gender Action Plan:

Component/Activities	Gender Design Feature activities	Gender output indicator
Cross-component	From the gender perspective, the overall goal of gender equality and women?s empowerment will be contributed by the proposed project through three ways (three technical approaches), comprised of: 1) improved capacity of these groups who are directly and indirectly involved in the project; 2) increased access to EE green housing units and/or access to financing mechanisms to finance purchasing of EE green housing units by low- and middle-income women and other vulnerable groups; 3) increased awareness, knowledge and behaviour changes concerning EE green homes among these groups and members of the general public. The three approaches are mainstreamed into a cross-cutting gender theme that will support the project?s components and activities. Overall, women and vulnerable groups will be targeted as direct and indirect beneficiaries throughout the project implementation process. In terms of monitoring and evaluation, the project should track all expected outputs and outcomes with **gender-disaggregated** data as much as possible for the reporting purpose. The LGBTI data will also be included as well if the participants of LGBTI groups are keen to identify.	Target: at least 50% of women and including all types of LGBTI members as the project?s total direct and indirect beneficiaries.

Component/Activities	Gender Design Feature activities	Gender output indicator
Component 1: Energy Efficiency Green Home Design and Labelling Scheme	Results or findings from the gender related surveys and needs assessment under Component 3 will be incorporated into the proposed EE green home design, and development of the MRV frameworks. NHA?s EE green housing designs will accommodate the universal designs for women, elderly, child, and vulnerable groups through availability of EE and green design and facilities. As a result, women and vulnerable groups will be directly benefited from the EE and green building standards and labelling scheme. Development and implementation of the training program for MRV frameworks consider gender-specific needs and regard women and vulnerable groups as the priority targeted beneficiaries or participants.	Target: At least 30% of target trainees and beneficiaries are women (25%) and LGBTI members (5%) who are capable of designing EE green homes and conducting MRV activities.

Component/Activities	Gender Design Feature activities	Gender output indicator
Component 2: Incentive Mechanisms for Promoting Energy Efficient Green Homes	As the NHA?s potential buyers or renters, women and other vulnerable groups will directly get involved in owning or living in the EE green housing units. The gender aspect well be included in the development and implementation of financial mechanisms and the good proportion of women and other vulnerable groups (the ratio of Male 40-50%, Female and all types of LGBTI 50-60%)-in the overall beneficiaries will be ensured during the implementation phase of the shared benefit model, and credit guarantee/mortgage insurance mechanism. As a result of project activities, women and LGBTI beneficiaries with low and middle income will gain better access to financial services and incentives in order to own or rent the NHA?s green housing units., These beneficiaries number will be recorded and monitored during the course of project implementation; the number of beneficiaries recording will be based on the registration ID document. Specific communication programs and materials for the financial mechanisms will also consider women and LGBTI members and will be made available to women and LGBTI members as the targeted beneficiaries, participants and resources. Preparation of communication materials will consider gender-specific needs, while women and other vulnerable groups will be considered as the key resources for the implementation phase of the communication programs.	Percentage of women and LGBTI members who have access to EE green housing units or to financial supports. Number of women and LGBTI members (50-60%) who gain benefits from development and implementation of the communication programs specifically designed for the financial mechanisms.

Component/Activities	Gender Design Feature activities	Gender output indicator
Component 3: Awareness Raising and Capacity Building for Promoting Energy Efficient Green Homes.	One of the key concerns regarding gender for the project is a lack of awareness on EE green homes among potential home buyers in general. Under this component, the project plans to conduct multiple surveys and assessments to understand profiles, capacities and needs of target groups. These exercises will include gender and needs assessment with gender specific questions, and ensure proper records of gender-disaggregated data It is envisaged that the exercises will help increase the better understanding of needs, concerns and awareness on EE green housing among women and LGBTI. Results or findings from the gender related surveys and needs assessment under this component will be incorporated into the proposed EE green home designs or inform other project components and activities on specific gender issues. The comprehensive training and capacity building programs under this component will target women and members of other vulnerable groups working with NHA, EGAT, developers, builders, construction companies, and other partner organizations and stakeholders. The training and capacity building programs will enhance technical knowledge and capacity of women, LGBTI and other vulnerable groups in EE green construction materials and appliances, construction techniques, construction project managements, and these will eventually support greater participation of women and other vulnerable groups in accelerating construction of EE green housing units in Thailand. The provision of communication and awareness campaigns on EE green housing will consider gender aspects in collaboration potential collaboration with manufacturers and suppliers of EE and green building construction materials. The campaigns will also be tailored to suit profiles, information needs, and gender-specific issues of: home buyers, developers, practitioners (architects and engineers), contractors, EE technologies and application suppliers. Specific communication and awareness activities targeting at tenants of the EE green housing units developed by NHA and this project will be implemented to ensure efficient operation of EE green housing units and minimize rebound effects.	Number of women (out of total 100 women can be 50) and LGBTI members (10) as training resources and beneficiaries. 10% improvement in awareness and knowledge among women and LGBTI members based on gender disaggregated data from different project partners and stakeholders (e.g., NHA, EGAT, developers, builders, contractors, residents or tenants).

Overall, negative impacts on gender are not anticipated through implementation of project activities. The gender GAP analysis was designed to address the gender-related gaps and needs. By targeting gender groups during the implementation of the proposed activities, a number of positive outcomes and impacts are expected as follows:

? It is expected that the availability of EE and green design and facilities will increase to accommodate universal needs and designs for women, elderly, child, and vulnerable groups. Living in the NHA?s housing projects, these groups will have better living conditions and hence overall improved livelihoods.

? As home buyers, women and other vulnerable groups, such as LGBTI, elderly and children will have increased access to energy-efficient houses that they can afford. These groups, especially those with low and middle income will have more and better opportunities in accessing reasonable financial-supported mechanisms.

? Through the proposed communications program and by participating directly and indirectly in the project activities, these groups will have better awareness and understanding of living in the energy-efficient housing, contributing to the reduction of GHSs emissions and the increased percentage of EE in the Thai energy usage sector. Through training, those women and other gender groups have improved knowledge and capacity in designing EE green homes and conducting MRV activities.

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[1] The discussion here is based on a study by Limskul and Pattanapong (2018) as cited in Denpaiboon, C., Limsakul, K., & Chotipanich, S. (2018) A Low Income Housing Needs and Affordability for Thailand?s Strategic National Plan during 2017-2037. Nakhara: Journal of Environmental Design and Planning, 15, 119-136. Retrieved from https://www.tci-thaijo.org/index.php/nakhara/article/view/131667

[2] See Rakodi, C. (2014) Gender Equality and Development: Expanding women?s access to land and housing in urban areas. Women?s Voice and Agency Research Series 2014 No.8. Retrieved from https://www.worldbank.org/content/dam/Worldbank/document/Gender/Rakodi%202014.%20Expanding%20women's%20access%20to%20land%20and%20housing%20in%20urban%20areas.pdf

[3] See more information in Kring, S. (2017) Gender in Employment Policies and Programmes: What works for women? Working paper No. 235. Geneva: International Lobour Organization. Retrieved from https://www.ilo.org/wcmsp5/groups/public/---ed_emp/documents/publication/wcms_613536.pdf

Does the project expect to include any gender-responsive measures to address gender gaps or promote gender equality and women empowerment?

Yes

Closing gender gaps in access to and control over natural resources;

Improving women's participation and decision making Yes

Generating socio-economic benefits or services or women Yes

Does the project?s results framework or logical framework include gender-sensitive indicators?

Yes

4. Private sector engagement

Elaborate on the private sector's engagement in the project, if any.

The private sector will play the multifaceted roles in the proposed project, and these include provision of technical advice and consultation, policy and regulatory advisory support, implementation of specific project activities, and being the beneficiaries of the project activities. Under Component 1, the private sector will be engaged in development and implementation of the certification program for EE and green building construction materials, and establishment of the database system. The private sector will also be consulted during the development and implementation of the EE green home design standards and labelling undertaken by NHA and EGAT. As for the MRV frameworks, the private sector can act as both resources for development of the MRV frameworks, and beneficiaries from adoption and implementation of the robust MRV frameworks developed by the project. It is envisaged that interaction with the private sector under Component 1 will be primarily through establishment and operation of different Technical Working Groups (TWGs) in which representatives from the private sector organizations will be invited to collaborate with international and local experts, international and local project partners, and relevant government agencies/authorities. The TWGs will meet regularly during project implementation.

The private sector has important roles in delivering outputs under Component 2, as they supply EE and green construction materials and appliances for the pilot project, and also construct the EE and green building pilot projects in accordance with the EE and green designs developed by the project in consultation with NHA. Interested financial institutes will also be the beneficiaries of the mortgage insurance/credit guarantee mechanism which will be implemented by NHA with support from the project. The private sector will be consulted through consultation workshops during the preparation of appropriate fiscal incentives and funding proposals to stimulate demand and accelerate construction of EE green housing units in Thailand. In Component 3, the private sector will mainly act as the beneficiaries from implementation of the training and capacity building programs, specifically the executive training course which will be developed to meet the needs of private sector developers and builders, and communication and awareness campaigns. It is envisaged that the private sector could support development of training tools and marketing materials related to application and utilization of EE and green building construction materials and appliances, and the potential contribution will be during the course of project implementation.

5. Risks to Achieving Project Objectives

Elaborate on indicated risks, including climate change, potential social and environmental risks that might prevent the project objectives from being achieved, and, if possible, the proposed measures that address these risks at the time of project implementation.(table format acceptable):

The project is subject to possible risks that can be managed and mitigated to ensure successful project implementation. The possible risks and mitigation measures as well as more detailed assessments of possible risks associated with climate change and COVID-19 are summarized below.

Risk description	Main categories	Risk level rating	Risk Mitigation Strategy and Safeguards	By Whom / When?
Changes in management of main project partners and priority of the Thai Government	Political / Institutional	Low	The project will conduct direct consultation with key project partners to secure commitments in strengthening institutional coordination	NHA, EGAT, KMUTT, UNEP/ Throughout the project
Limited choices of certified EE green building materials, imported EE and green technologies are not cost effective and suitable with the Thai context (construction techniques, and climatic conditions)	Technical	Moderate	The project will collaborate with the project partners (e.g., TGBI, KMUTT, EGAT, TEI), industry experts, and local manufacturers to identify technical and economic feasible EE and green technologies for different scales of NHA?s new and retrofitted construction projects.	NHA/ Throughout the project

Risk description	Main categories	Risk level rating	Risk Mitigation Strategy and Safeguards	By Whom / When?
Local manufacturers/ suppliers are not interested to participate in project activities, specifically in provisions and certification of EE and green materials for NHA?s housing projects due to limited knowledge and know-how on production of building construction materials.	Capacity/ Technical	Moderate	The project will identify needs and demands through continuous dialogue to scoping out and design of the capacity building for local manufacturers/ suppliers. The project will also implement capacity building programs for local manufacturers of EE green building construction materials and utilize the pilot project to create demand of EE green building construction materials. In addition, the success of the NHA?s pilot implementation will be disseminated to other local manufacturers/ suppliers.	NHA/ Throughout the project period

Risk description	Main categories	Risk level rating	Risk Mitigation Strategy and Safeguards	By Whom / When?
Delay in pilot project construction leading to project cost overrun due to limited knowledge and experience of developer/construction company in construction of EE green housing units in timely and cost-efficient manners.	Technical/ Financial	Moderate	The project will collaborate with the potential construction companies and suppliers of EE and green materials to ensure that EE and green designs and selection of building construction materials are cost-effective. In addition, the project will mobilize technical expertise from international and national experts, and relevant TWGs to mitigate the risk pertaining to the construction techniques and construction project management.	NHA/ During the design and construction phase of pilot projects

Risk description	Main categories	Risk level rating	Risk Mitigation Strategy and Safeguards	By Whom / When?
More stringent loan evaluation criteria adopted by local banks and financial institutions leading to Limited of access to affordable home financing for potential low- and middle-income home buyers due to whose loan applications are not approved by bank.	Financial	Low/ Moderate	The project will mobilize the NHA Housing Fund to support low- and middle-income households to access EE green homes on a rental basis, and screen those well performed potential borrowers for banks. The project will facilitate implementation of NHA?s mortgage insurance/ credit guarantee mechanism to enable low- and middle-income households to access affordable home financing from banks. .	NHA/ Throughout the project period

Risk description	Main categories	Risk level rating	Risk Mitigation Strategy and Safeguards	By Whom / When?
Higher construction cost of EE green housing units compared with the standard design may prevent scaling up of EE green home construction.	Financial/ Market	Low	The project will utilize the pilot demonstration project under Component 2 to demonstrate that investment of EE and green features can deliver the reasonable payback through lower operating expenses, and employ additional funds from the Thai Government and funding proposals under Component 3 to support the scaling up phase. Construction of the pilot projects is expected to stimulate awareness and competition of EE and green material supplies at the national and provincial level, hence incremental costs of EE green homes are expected to be reduced, and the funding available will be able to support more scaling up.	NHA/ Throughout the project period

Risk description	Main categories	Risk level rating	Risk Mitigation Strategy and Safeguards	By Whom / When?
Energy savings and associated climate benefits delivered EE green homes decline over time due to the rebound effect	Capacity	Low/ Moderate	The rebound effect in the pilot demonstration projects will be mitigated through the proposed awareness activities under Component 3. Results of the pilot project MRV activities will be used to confirm the rebound effect and modify the awareness activities to ensure their effectiveness accordingly. Lessons learned from the pilot project awareness activities will be expanded to include other EE green housing projects developed by NHA and other private sector developers.	NHA/ Throughout the project period

Risk description	Main categories	Risk level rating	Risk Mitigation Strategy and Safeguards	By Whom / When?
Construction wastes from the pilot projects are not properly managed creating negative environment, climate and social impacts.	Environmental/ Climate/ Social	Low/ Moderate	The project will collaborate with the construction companies to ensure development of the work plans to reduce the on-site generated waste to minimize the impact of construction waste on the environment, and gains the economic benefits through reduction the construction cost; possible by three approaches: Reducing, Reusing, and Recycling. The training module on proper waste management that highlights the benefits of waste management will be included in the capacity building and training program for the construction companies	NHA/ During the design and construction phase of pilot projects

Risk description	Main categories	Risk level rating	Risk Mitigation Strategy and Safeguards	By Whom / When?
Interruption of supply chain, logistic and on-site activity during the construction phase due to storm, continuous heavy rainfall, flood, etc., and reduction of construction workforce?s productivity due to heat stress and vector-borne diseases especially during summer months in Thailand	Environmental/Climate change	Low/ Moderate	The environmental impact assessment (EIA) will be conducted during the NHA?s processes for determination of construction locations, as specified in the relevant Thai?s law. [1] The project will collaborate with the construction companies to ensure proper planning of construction landscape and building design to reduce the potential physical risks from climate change on the construction buildings and site location. The construction sub-contractors hired by NHA under this project will be required to participate in the capacity building and training program on climate resilient construction project management under Component 3, and the construction sub-contractors must demonstrate that all possible risks are considered and practical response measures are adopted during the construction management planning and operation phase.	NHA/ During the design and construction phase of pilot projects

Risk description	Main categories	Risk level rating	Risk Mitigation Strategy and Safeguards	By Whom / When?
Physical risk from climate change impact that could affect household life and assets (e.g. floods, droughts, landslide, etc.),	Environmental/Climate change	Low/ Moderate	NHA and developers will identify the critical environmental-climate risk factors per zoning of each construction site in the EIA report. The climate risks mitigation measures of pre- and post-construction will be designed and planned in the EIA to reduce the risk. Include in the capacity building and training program for the residential tenants under Component 3; it could be exercise with training for climate change and disaster risks mitigation measures. The climate risk assessment at the pilot projects will be used to inform a standard screening process for NHA projects.	NHA/ Throughout the project period

Risk description	Main categories	Risk level rating	Risk Mitigation Strategy and Safeguards	By Whom / When?
Delay in construction of the energy efficiency green housing pilot projects due to impacts of the COVID-19 pandemic.	Project Implementation and changes in Timelines	Low/Moderate	The budget for construction of the pilot projects has already been approved by the Thai Government, and the construction phase should be commenced in accordance with the approved work plan. Prior to the construction phase, NHA/PMU will review the construction work plans with appointed subcontractors and reflect any possibly delays and financial impacts due to COVID-19 in the work plans. During the construction phase, NHA/PMU will ensure timely updates from the appointed subcontractors to minimize any financial implication and significant deviation from the agreed work plans.	NHA / Throughout the project

Risk description	Main categories	Risk level rating	Risk Mitigation Strategy and Safeguards	By Whom / When?
Lack of knowledge and capacity to respond to the COVID-19 outbreak among developers and subcontractors	Availability of Technical Expertise and Capacity and Changes in Timelines	Low/Moderate	Experience and lessons learned from managing NHA?s ongoing construction projects during the COVID-19 outbreak in 2020 will be compiled and disseminated to all stakeholders and subcontractors to be engaged during the project period through capacity building and awareness activities under Component 3. The project will collaborate with the Ministry of Health to produce COVID-19 safety policies, guidelines and best practices to contain and combat the spread of COVID-19 at sites. The potential mitigation measures would include proper hygiene and social distancing standards during working hours, health safety policies at worker dormitories, and provision of access to personal protective equipment, such as masks and hand sanitizers.	NHA and the EE green construction sub-contractors / Throughout the project

Risk description	Main categories	Risk level rating	Risk Mitigation Strategy and Safeguards	By Whom / When?
Pilot demonstration projects cancelled by NHA and abandoned by subcontractors due to financial burden caused by COVID-19	Financing risk/ National debt/fiscal crises and impacts on GEF projects	Low/Moderate	NHA has already secured budgets for construction of 5 of the 7 projects (see Annex E) for construction, and 2 remaining projects will be approved by 2020. If there is an unforeseen circumstance where the approved budget is relocated to other priority areas, PMU will immediately coordinate with responsible units within NHA to identify new pilot sites. Subcontractors are allowed to request 15% down payment from NHA upon the contract signing. In addition, the contract with NHA can serve as a collateral to get financial supports from local FIs. These arrangements can alleviate financial burden to subcontractors during the construction phase of the pilot projects.	NHA / Throughout the project

Risk description	Main categories	Risk level rating	Risk Mitigation Strategy and Safeguards	By Whom / When?
The second round of the COVID-19 infections becomes uncontrollable and continues throughout the project period. All project partners and stakeholders are in a wait-and-see situation, causing delay in overall project implementation and outputs.	Stakeholder Engagement Process	Low/Moderate	The proposed response measures include the followings: ? Regular quarterly review of the situation as needed. ? Maintaining regular dialogues and meetings with all project partners and stakeholders through an appropriate communication channels or IT online platforms. ? Creation of matrix of outputs and measures to adjust project implementation timeline and budget to reflect the situations and mitigate delays as needed. ? To mobilize the stakeholder engagement process, proactive stakeholder management and health safety precautions are needed.	NHA, EGAT, KMUTT, UNEP/ Throughout the project

Risk description	Main categories	Risk level rating	Risk Mitigation Strategy and Safeguards	By Whom / When?
Shortage of workforces (men and women) causing delays in construction projects	Enabling Environment	Low/Moderate	The project will closely monitor the workforce situation, specifically migrant workers, and seek updates from subcontractors engaged by NHA. Number of male and female workers involved in construction of the pilot projects will also be utilized as the workforce indicators. The project, through NHA, will inform the responsible agencies in the Thai Government on the workforce situation, and the MOUs which Thailand signed by the three neighboring countries will be considered as one of the potential response measures.	NHA and the EE green construction sub-contractor / Throughout the project

Climate Change Risk Assessment

Thailand is located in a tropical region with 3 seasons: rainy season from mid-May to mid-October; winter from mid-October to mid-February, and summer from mid-February to mid-May (April is the hottest month). Average annual mean maximum temperatures in Thailand have shown an upward trend over the past six decades. The highest temperature ever recorded in Thailand was 44.6 ?C, recorded in Mae Hong Son province in 2016. The number of days with the maximum temperature greater than 40?C is projected to increase in the lower part of Northern Thailand and upper part of Central Thailand. The rising trend of

temperatures could be one of the factors driving greater air conditioner utilization in the commercial and residential buildings, leading to an average annual growth rate of 4% in the residential electricity energy consumption in building sector.

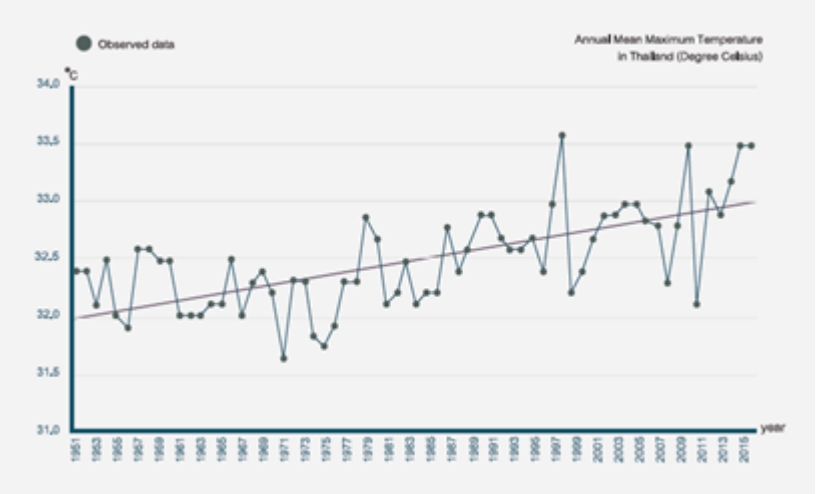

Figure 11: Trends of annual maximum mean air temperatures 1951 - 2015

In addition to impacts of climate change on building energy use, changing weather patterns and extreme weather events, such as storm and flood, can directly affect the building construction industry, and these lead to higher risks in construction project managements and businesses. The Thailand's Second Assessment Report on Climate Change highlights no significant long-term change in the annual rainfall in Thailand. However, due to the lack of a fully developed water infrastructure, deforestation, and climate changed, Thailand has become particularly vulnerable to drought and flooding; this has resulted in several extreme climatic events. In 2011, Thailand faced major flooding that impacted over 13 million people and cost more than THB 1.44 trillion (USD 48 billion) in economic losses (estimated by the World Bank).

According to Thailand?s Department of Disaster Prevention and Mitigation, risks of flood and drought in Thailand during 2016-2045 and 2071-2100 were analyzed under different climate change and socio-economic scenarios, as shown in the analysis maps with locations of the seven pilot demonstration sites under the project. Direct impacts caused by extreme weather events to the proposed demonstration projects, and also other construction projects include disrupted supply chains, damage to vital infrastructure and utilities, disrupted transport and logistics routes, heightened construction material price and market volatility, and other unpredictable physical, health and safety impacts on workforce and consumers.

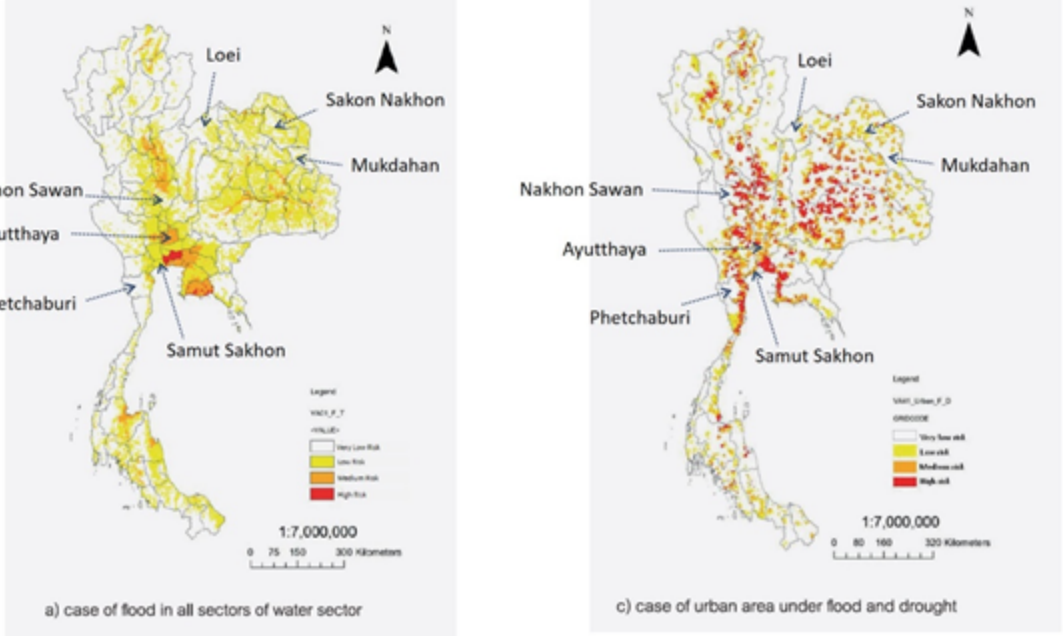

Figure 12: Risks of flood and drought in Thailand

COVID-19 Risk Assessment

As of October 2020, the COVID-19 pandemic situation within Thailand is entirely under control, and local businesses have been fully open. The Thai Government will be likely to continue with cautions in opening up the country for business travelers and tourists. It is expected that the project will start in June 2021 with little or no impact on local travel restriction. Impacts of the COVID-19 pandemic on the Thai building construction industry and response measures implemented to date by Thailand are briefly described below.

? COVID-19 impacts on the Thai Construction Industry

According to KResearch[2], the housing market in Q1 2020 in Thailand declined due to COVID-19 pandemic impacts. New home purchases fell by approximately 75% YoY on average during Q2/May 2020, while the number of homeownership transfers dropped 3.4% YoY. Besides, the decision of Thai consumers to buy homes, has already been pressured by weak purchasing power, the Loan-to-Value (LTV) ratio measure, as well as land and building law. It is expected that new home purchases may not resume growth in 2020 with 62,000-67,000 units of new homes will be purchased by the end of the year, shrinking 37.9-32.9%YoY.

Another assessment, conducted by SCB EIC[3], estimated that in 2020 the market value of the construction industry would likely shrink somewhat by 1% YOY to approximately THB 1.29 trillion. SCB EIC separately analyzed the private sector construction and the government projects as summarized below.

1) Private sector construction projects are expected to shrink by 7.8% YOY to THB 5.28 billion; the assessment was based on the issuance number of residential and the commercial building construction permits that continued to decline since the second half of 2019.

2) The government construction projects are expected to continue to grow at 4.5% YOY to THB 7.62 billion, driven by large transportation and infrastructure projects.

In the short term, it is anticipated that the growth and investment across all the sectors in Thailand will be affected by the COVID-19 outbreak, and investment in the construction industry will be primarily driven by government spending in the infrastructure project. Various research and market reports viewed that the construction industry in Thailand is expected to record a CAGR of 9.4% to reach THB 1,849.9 billion by 2024.[4]

Despite the near-term challenges, the medium to long term outlook remains positive. Amid the current sluggishness seen in home demand, many residential developers have scaled back their investment pending the economic recovery. However, it will help correct the demand-supply balance and stabilize their home inventories amid the supply glut in the residential market.

? Thai Government economic/financial remedial measures to mitigate impacts of COVID-19

Taking into consideration the liquidity concerns of several businesses; the Thai Government, through MOF and BOT, announced several measures to minimize any subsequent impacts of the COVID-19. The Thai Government approved 3 phases of stimulus packages to mitigate the impact of the COVID-19 outbreak. On 7 April 2020, the Thai Government announced an injection of THB 1.9 trillion to boost the economy that accounts for 9% of the country?s GDP.

Meanwhile, on 20 May 2020, the Monetary Policy Committee (MPC) of BOT announced its decision to further cut the policy rate from 0.75% to 0.5%. This action follows the second cut from 1% to 0.75% announced on 20 March 2020 and the first cut from 1.25% to 1% announced on 5 February 2020. MPC expects this to reduce the interest burden on borrowers affected by the COVID-19 pandemic and to alleviate liquidity strain in the financial markets.[5]

Highlights of the Thai Government financing policy supports to cove with the COVID-19 pandemic impacts are as follows:

- An executive decree to borrow THB 1 trillion to boost the economy, of which THB 400 billion to strengthen the community economy and boost local infrastructure development, and THB 600 billion to support general households, farmers, and public health services.

- An executive decree to authorize the Bank of Thailand (BOT) to issue soft loans of THB 500 billion at a 2% interest rate to SMEs, with a 6-month debt moratorium on principal and interest for SMEs (for loans not exceeding THB 100 million).

- The Government Saving Bank (GSB) will provide a low-interest loan of THB 150 billion to financial institutions with the interest of 0.1% per annum, and the financial institutions shall give a loan to enterprises with an interest rate of 2% on the first THB 20 million loans for the first two years.

- The Social Security Office (SSO)?s measures to promote employment, including THB 30 billion in soft loans starting at 3% interest for SSO-registered entrepreneurs.

? Impacts of COVID-19 on NHA?s construction business and pilot project implementation

According to NHA, additional low-cost housing units for rent will be constructed by NHA, under the ?Suk Pracha? project, to support the Thai Government policy on mitigation of the COVID-19 impacts. The Suk Pracha project aims to support low-to middle-income households which have been economically affected by the COVID-19 pandemic, and unable to pay rental fees for private sector owned apartment/housing units. As for the proposed pilot projects, the construction budgets for 5 of the proposed 7 pilot projects have already been approved by the Thai Government (as of November 2020). Considering that the construction budgets have already been committed and all the pilot projects are in the NHA?s construction pipeline for 2021 to 2025, the impacts of COVID-19 on financing the pilot project implementation is minimal.

? COVID-19 impacts on workforce

The Thai construction sector is heavily dependent on migrant workforces. The economic disruptions caused by COVID-19 are having a considerable impact on business and supply chain operations. The Migrant Working Group, a member-based organization that advocates for the rights of migrant workers in Thailand, estimated that as many as 700,000 migrant workers have lost their jobs since the lockdown started in late March 2020 - mostly in tourism, services and construction industries. [6]

The COVID-19 pandemic has also forced many migrant workers, mainly from Myanmar, Cambodia and Lao PDR, to leave Thailand back to their home countries. The full return of these migrant workers is hard to predict due to travel restriction imposed by Thailand and neighboring countries, and this might result in labor shortages in the Thai construction business in a short term. The Thai Government recognizes the importance of migrant workers for Thai businesses, and, in June 2020, Thailand signed MOUs with Cambodia, Lao PDR and Myanmar, temporarily permitting migrant workers from these three countries to continue staying and working in Thailand.

Managing construction workforce during the COVID-19 pandemic can be very challenging, since it is not always practical to maintain social distancing and face mask wearing for construction workers. In

addition, construction workforces, especially migrant workers, usually live worker dormitories which make social distancing and isolation even more difficult.

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[1] The EIA and environmental risks mitigation measure is required to comply for requesting of the construction licensing permit in Thailand in according to the Building Control Act B.E. 2535 and the Environmental Quality Promotion and Conservation Act 1992.

[2] https://kasikornresearch.com/en/analysis/k-econ/business/Pages/z3119.aspx

[3] https://techsauce.co/pr-news/scb-eic-covid-19-construction-business-analysis, (May 19, 2020)

[4] https://www.businesswire.com/news/home/20200903005576/en/Thailand-Construction-Industry-Valuation-Trends-Amid-COVID-19---ResearchAndMarkets.com

[5] Measures to aid and relieve the impact of the COVID-19 outbreak on the Thai economy: Phase 1, 2 and 3 (The Ministry of Finance), and Monetary Policy Committee?s Decision 3/2020

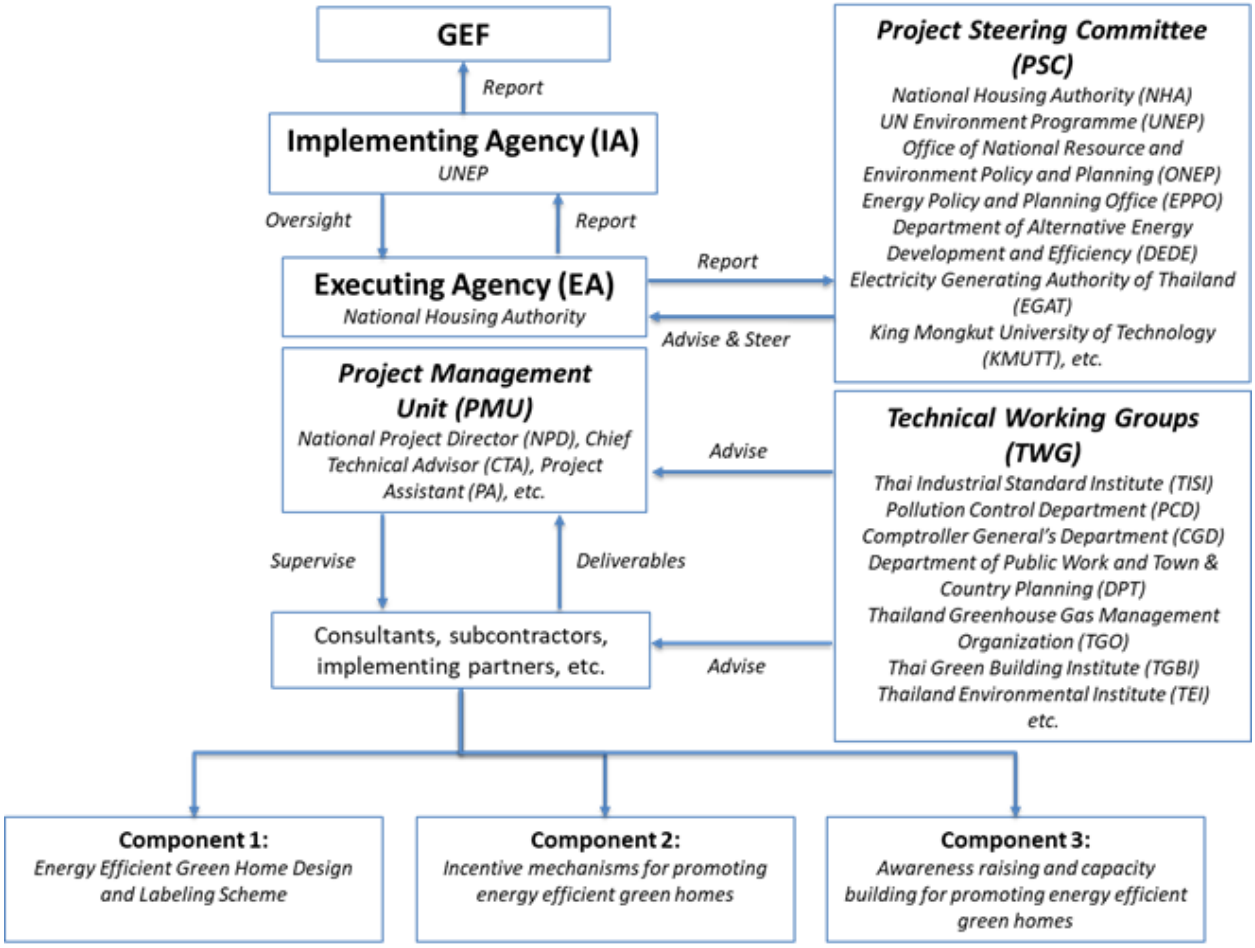
[6] COVID-19: Impact on migrant workers and country response in Thailand, International Labor Organization, (ILO, July 2020) https://www.ilo.org/wcmsp5/groups/public/---asia/---ro-bangkok/---sro-bangkok/documents/briefingnote/wcms_741920.pdf

6. Institutional Arrangement and Coordination

Describe the institutional arrangement for project implementation. Elaborate on the planned coordination with other relevant GEF-financed projects and other initiatives.

? Institutional arrangements:

This project is funded by the GEF and co-financed by the National Housing Authority (NHA), the Electricity Generating Authority of Thailand (EGAT), and King Mongkut University of Technology Thonburi (KMUTT). Institutional arrangement and coordination are illustrated in the diagram below. Please refer to Annex K for further details on the roles and responsibilities of organizations and bodies involved in the project implementation.



UNEP is acting as the GEF Implementing Agency (IA) and will be responsible for the following:

? Ensure timely disbursement/sub-allotment to executing agency, based on agreed legal document and in accordance with UNEP and GEF fiduciary standards;

? Follow-up with Executing Agency for progress, equipment, financial and audit reports;

? Provide consistent and regular oversight on project execution and conduct project supervisory missions as per Supervision Plans and in doing so ensures that all UNEP and GEF criteria, rules and regulations are adhered to by project partners;

? Technically assess and oversee quality of project outputs, products and deliverables ? including formal publications;

? Provide non-objection to main TORs and subcontracts issued by the project, including selection of Chief Technical Advisor or equivalent;

? Attend and facilitate inception workshops, field visits where relevant, and steering committee meetings;

? Asses project risks, and monitor and enforce a risk management plan;

? Regularly monitors project progress and performance and rates progress towards meeting project objectives, project execution progress, quality of project monitoring and evaluation, and risk;

? Monitor reporting by project executing partners and provides prompt feedback on the contents of the report;

? Promptly informs management of any significant risks or project problems and acts and follows up on decisions made;

? Apply adaptive management principles to the supervision of the project;

? Review of reporting, checking for consistency between execution activities and expenditures, ensuring that it respects GEF rules;

? Clearance of cash requests, and authorization of disbursements once reporting found to be complete;

? Approve budget revision, certify fund availability and transfer funds;

? Ensure that GEF and UNEP quality standards are applied consistently to all projects, including branding and safeguards;

? Certify project operational completion;

? Link the project partners to any events organized by GEF and UNEP to disseminate information on project results and lessons;

? Manage relations with GEF.

The National Housing Authority (NHA) will be the lead Executing Agency and will ensure for the following:

? Ensure technical execution according to the execution plan laid out in the project document;

? Ensure technical quality of products, outputs and deliverables;

? Ensure compilation and submission of progress, financial and audit reporting to IA;

? Submission of budget revisions to IA for approval;

? Addressing and rectifying any issues or inconsistencies raised by the IA;

? Bringing issues raised by or associated with clients to the IA for resolution;

? Facilitating Steering Committees and other oversight bodies of the project;

? Day to day oversight of project execution;

? Submit all technical reports and completion reports to IA (realized outputs, inventories, verification of co-finance, terminal reporting, etc.)

? Proper achievement of the objectives of the Project;

? Monitoring and evaluation of the project outputs and outcomes;

? Effective use of both international and national resources allocated to it;

? Timely availability of financing to support project execution;

? Proper coordination among all project stakeholders; in particular, national parties;

? Timely submission of all project reports, including work plans and financial reports

A **Project Steering Committee (PSC)** will be established to provide overall guidance and oversee the progress and performance of the project as well as to enhance and optimize the coordination and contribution with various project partners. The PSC will be chaired by a high level government official from the Ministry of Social Development and Human Security (MSDHS) nominated by NHA, and will convene at least once per year.

A **Project Management Unit (PMU)** will be established within NHA to manage day-to-day operation of the project. The PMU will be headed by the National Project Director (NPD) and will include the Chief Technical Advisor (CTA), the Project Assistant (PA) and the Project Accounting and Finance Officer.

Multiple **Technical Working Groups (TWGs)** will be formed as needed by PMU to work on specific technical matters to facilitate the implementation of the project components. TWGs? members are invited representatives from the key project partners, relevant government agencies/authorities, private sector (developer, manufacturer, designers and contractors), universities/institutes and NGOs. TWGs will meet regularly during project implementation to work inter alia on the following topics:

•Priority EE and green building construction materials and technologies that suit well with the EE green home design and construction in Thailand;
•Development of the energy efficient green home building design and labeling schemes for low-rise residential buildings, including updated of the EGAT?s home labeling No.5 criteria;

•Adoption of NHA?s Eco-village with the energy efficient green home labeling schemes;
•Development of the MRV frameworks for low-rise residential buildings in Thailand, and implementation of MVE activities.

? Coordination with other initiatives:

The project will coordinate with the following national and global GEF projects.

•**The Strengthening Thailand's institutional and technical capacities to comply with the Enhanced Transparency Framework of the Paris Agreement Project** is funded by the Capacity-Building Initiative for Transparency (CBIT) and executed by the Office of Natural Resources and Environmental Policy and Planning (ONEP). This CBIT project will enhance the capacity of the country to implement the NDCs and have an evidence-based system for preparing NDC and climate change policies. The CBIT project will help Thailand strengthening its nascent MRV system that was developed for the preparation of National Communications (NCs) and Biennial Update Reports (BURs) as well as tracking of Nationally Appropriate Mitigation Actions (NAMAs), NDC and make the institutional arrangements permanent. The MRV related activities under the CBIT project will be directly relevant to the development and implementation of the MRV frameworks for low-rise residential buildings under Component 1 of the project and sharing of relevant information and resources between these two GEF national projects will be executed throughout the project period.

•**The Sustainable Cities Impact Program (SCIP)** brings together global, national and local champions to work together towards a common vision of sustainable, inclusive, gender sensitive, and integrated development, with the support of significant financial and technical resources. The SCIP has a two-pronged approach, that brings together investments for more integrated sustainable cities (Child Projects), with a knowledge sharing and learning platform (the Global Platform), to build momentum, raise ambitions, secure commitments and implement integrated solutions on the ground that require new behaviors by all actors. Drawing on the power of networks, the SCIP bridges the incoming cohort of countries (Argentina, Brazil, China, Costa Rica, India, Indonesia, Morocco, Rwanda, and Sierra Leone) with the existing Sustainable Cities Integrated Approach Pilot (SC-IAP) countries (Brazil, China, India, Ivory Coast, Malaysia, Mexico, Paraguay, Peru, Senegal, South Africa, Vietnam) and cities, and the broader City-based Organizations (CBOs) networks, allowing for faster and wider spread adoption of ideas and information. The programmatic approach of the SCIP is shown in the figure below.

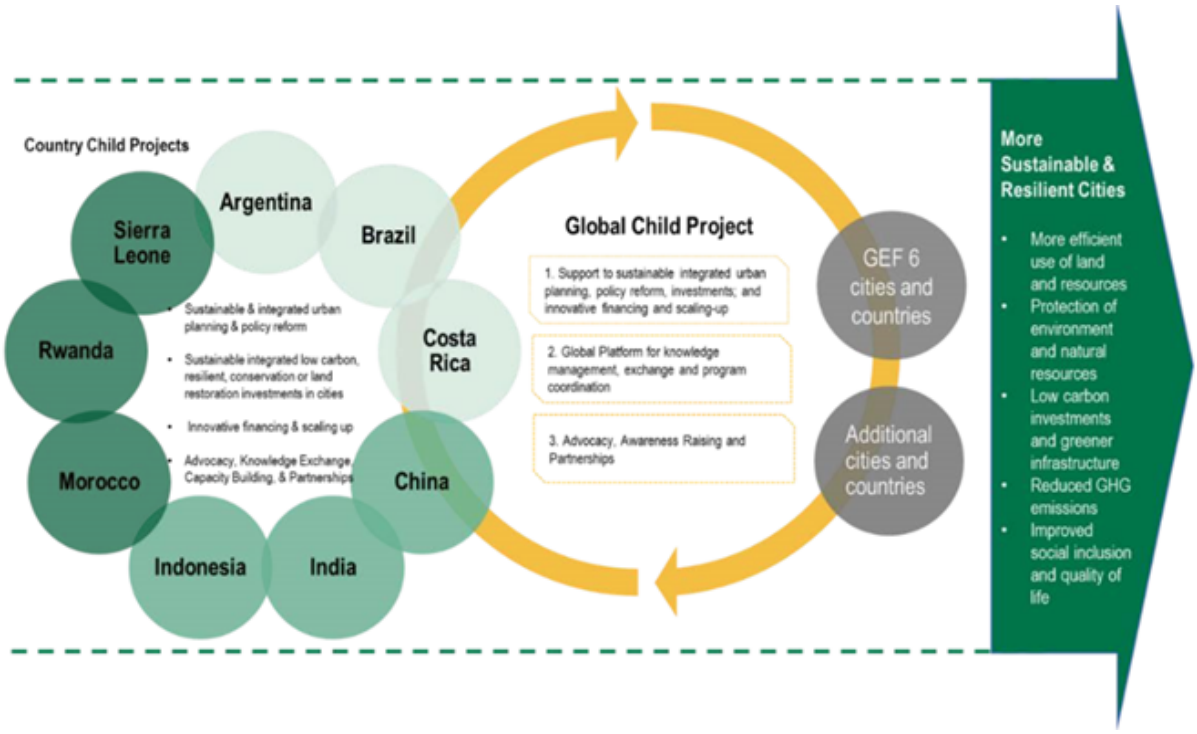


Figure 13: SCIP Programmatic Approach

The SCIP is solidly positioned to help cities build experiences and advocate for best practices with a growing partnership, and all the project components, as shown below, are relevant to the project.

1. Strengthening governance, institutions, processes, and capacities to undertake evidence-based, sustainable, inclusive, integrated planning and policy reform (Component 1);
2. Undertaking sustainable integrated low carbon, resilient, conservation or land restoration investments in cities (Component 2);
3. Initiating innovative financing and business models for scaling-up sustainable urban solutions (Component 3); and
4. Influencing policy making and actions at local, regional and national levels to promote sustainable and inclusive cities (Component 4);

The project will utilize resources and lessons learned produced by the SCIP?s executing entities, i.e., World Resources Institute (WRI), ICLEI - Local Governments for Sustainability (ICLEI), C40 Cities, UNEP, and Governments of participating countries and cities to support development and implementation of all relevant project activities.

•**Global Programme to Support Countries with the Shift to Electric Mobility** or the Global Electric Mobility Programme has an objective to support countries to design and implement electric mobility programs as part of an overall shift to sustainable, low carbon transport sector. The Global Electric Mobility Programme will be implemented at the global and national level (through child projects). Electric mobility is another way to reduce GHG emissions and improve air and noise pollution at the community level, and the enabling environments created at country and city level for the introduction of electric mobility demonstration projects, and wider up take of electric mobility can be reviewed and integrated into the expansion of the ECO village initiative under the project.

•**Global Alliance for Building and Construction (Global ABC) -** UNEP is now active as the secretariat of the Global Alliance for Buildings and Construction (GlobalABC), a voluntary partnership of national and local governments, inter-governmental organizations, businesses, associations, networks and think thanks committed to a common vision: A zero-emission, efficient and resilient buildings and construction sector. Considering this, the project will collaborate with GABC to support NHA to appropriately integrate targets for reduction of carbon footprint of NHA?s construction and use of housing units through utilization of EE measures, RE integration, waste recycling and management, etc.

The project will also coordinate with the UN Resident Coordinator of Thailand and UN Country Team for Thailand to brief them on the project development and explore synergies with other UN initiatives being implemented in the country.

7. Consistency with National Priorities

Describe the consistency of the project with national strategies and plans or reports and assesments under relevant conventions from below:

NAPAs, NAPs, ASGM NAPs, MIAs, NBSAPs, NCs, TNAs, NCSAs, NIPs, PRSPs, NPFE, BURs, INDCs, etc.

As a non-annex I party, Thailand submitted its Third National Communication (TNC) to the United Nations Framework Convention on Climate Change (UNFCCC) in August 2018. Thailand?s intended nationally determined contribution (INDC) was also submitted in 2015, aiming ambitiously to reduce its greenhouse gas emissions by 20-25 percent from the projected business as usual level by 2030. Both NDC and TNC emphasize the importance of energy efficiency measures specified under the Energy Efficiency Plan 2015 (EEP 2015) to reduce CO2 emissions from the energy sector. The proposed project is fully aligned with the EEP 2015, and alignments with the national priorities and plans are briefly described below:

Nationally Determined Contribution (NDC)

Thailand intends to reduce its greenhouse gas emissions by 20% from the projected business-as-usual (BAU) level by 2030. The level of contribution could increase up to 25%, subject to adequate and enhanced access to technology development and transfer, financial resources and capacity building support through a balanced and ambitious global agreement under UNFCCC. Thailand's INDC was developed through participatory process, and INDC was formulated based on multiple national plans targeting different end-use sectors, including but not limited to:

- Power Development Plan (PDP) B.E. 2558?2579 (2015-2036);
- Thailand Smart Grid Development Master Plan B.E. 25582579 (2015-2036);
- Energy Efficiency Plan (EEP) B.E. 2558?2579 (2015-2036); and
- Alternative Energy Development Plan (AEDP) B.E. 2558?2579 (2015-2036).

Specifically, for the energy sector, the ambitious targets are defined in PDP, AEDP and EEP. For example, the PDP sets a target to achieve a 20% share of power generation from renewable sources in 2036. The AEDP aims to achieve a 30% share of renewable energy in the total final energy consumption in 2036. The EEP plans to reduce the country?s energy intensity by 30% below the 2010 level in 2036. The EEP for 2015-2036 or EEP 2015 identifies the industrial, building (commercial and government), residential and transportation sectors as the priority sub-sectors for energy efficiency implementation. For the residential sector, the EEP 2015 plan reduce 2,153 ktoe of energy consumption (or about 8% compared with the baseline) by 2036. The following energy efficiency measures are highlighted as the key measures for the residential and building sector:

? Enforcement of the Building Energy Code (BEC) for new and retrofitted buildings;

? Development and implementation of Energy Efficiency Standard and Labelling for appliance, equipment and materials. These include setting High Energy Performance Standards (HEPS) and enforcement of Minimum Energy Performance Standards (MEPS);

? Implementation of Energy Efficiency Resource Standards (EERS) for electric utilities to support end-users in implementation of energy efficiency measures;

? Implementation of financial mechanisms and fiscal incentives such as subsidy, soft loans, ESCO revolving fund, and tax incentives to facilitate energy efficiency investments

? Promotion of greater use of LED lighting technologies through lighting retrofits in government buildings and stimulate market competition to reduce market prices of LED lights.

Third National Communication (TNC)[1]

Thailand?s TNC submitted to UNFCCC in August 2018 is fully aligned with the NDC roadmap on mitigation (2021-2030) approved by the cabinet in May 2017. The NDC roadmap[2] prepared by MONRE is based on the national level sectoral plans including the EEP 2015 discussed above.

20-Year Housing Development Strategy for 2017 to 2036

The 20-Year Residential Housing Development Strategy Plan (2017 ? 2036) was developed by the Ministry of Social Development and Human Security (MSDHS) as a framework for long-term residential housing development to achieve the national vision of ?Housing and Good Quality of Life for all Thais in 2036 (Housing for All)?. Main objectives of the 20-Year Housing Development Strategy are to: enhance access to housing for all target groups and reduce inequality; promote better quality of life for all target groups through quality housing units with necessary utility services; and collaborate with other partners and stakeholders in public and private sector to develop housing units for all target groups. To meet the said objectives, Thailand must develop more than five million housing units over the next 20 years, and NHA is responsible for development of 2.27 million housing units under this 20-Year Strategy.

United Nations Partnership Framework (UNPAF) 2017-2021

Through the UN-Thailand partnership framework, the UN will provide policy advice and support Thailand to become an inclusive and equitable high-income country that leaves no one behind, as well as a development partner in the region and globally by sharing technical expertise, strategic networks and supporting South-North, South-South and trilateral cooperation, and making use of the UN?s convening power in bridging partnerships, and fostering positive lasting change for all people in Thailand and the region. The proposed project is consistent with Outcome Strategy 1: Collaborate at national and sub-national levels to strengthen systems, structures and processes for effective, inclusive, and sustainable policymaking and implementation, and Outcome Strategy 3: Collaborate at national and sub-national levels to build systems, structures and processes that recognize and engage the private sector as a collaborator in national development. The project will also liaise with the UN Country team to contribute the upcoming UNPAF.

Sustainable Development Goals

The proposed GEF project directly contributes to the UN Sustainable Development Goal 10: Reduced Inequalities, and Goal 11: Sustainable Cities and Communities. Indirectly, the greater use of more home appliances and lighting products in low-rise residential buildings which are designed in accordance with the EE green design standards can help strengthen achievements under ?Goal 12: Responsible consumption, production - Ensure sustainable consumption and production patterns?. Finally, the project, given its explicit gender-related outputs can also be one way to achieve ?Goal 5: Gender equality - Achieve gender equality and empower all women and girls?.

The 2015 Gender Equality Act

The Gender Equality Act (2015) is one of the key regulations that recognizes women and other vulnerable groups in the Thai society. Under this Act, the Committee for the Promotion of Gender Equality was set up to promote gender equality through established policies, measures and action plans at the national, provincial and local levels. The Act also supported the prevention of unfair gender discrimination, while providing assistance, compensation and remedy or relief to victims of the unfair discrimination through the establishment of the Committee on the Determination of the Unfair Gender Discrimination. One other main mechanism of the Act was the launch of the Gender Equality Fund.

The Women?s Development Strategies under the 12th National Economic and Social Development Plan (2017-2021). The current 12th National Economic and Social Development Plan provides an overarching direction for the betterment of women and other groups in the Thai society. Through its ?Key Integrated Development Issues?, the Plan recognizes the needs for ?Creating a Just Society and Reducing Inequality?. Under this scheme, it puts an emphasis on the improvement of public services on education and healthcare for the disadvantaged and the rural people; the support for job and income generating; as well as the enhanced productivity for the disadvantaged, women and the elderly. The Women?s Development Strategies were then identified after the National Development Plan with five key gender-related strategies, including 1) promote a paradigm shift to recognize gender equality in the Thai society; 2) empower women for their increased participation and better quality of life; 3) develop enabling conditions for women?s development and gender equality; 4) identify protective and corrective measures against the violence or discrimination against women; and 5) strengthen women in development processes and mechanisms.

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[1] Thailand?s third national communication report (TNC) [MONRE, 2018]

[2] Thailand?s third national communication report (TNC), Ministry of Natural Resources and Environment, 2018

8. Knowledge Management

Elaborate the "Knowledge Management Approach" for the project, including a budget, key deliverables and a timeline, and explain how it will contribute to the project's overall impact.

An overview of existing lessons and best practice that inform the project concept

Although Thailand has implemented the Building Energy Code (BEC) for over the past three decades, the Thai BEC covers only commercial buildings and is not subject to the new and retrofitted low-rise residential buildings. In general, the low-rise residential buildings in Thailand are neither subject to any energy efficiency requirements, nor Energy Labels. As a result, EE and green housing designs in the residential sector have never been the common practices among developers, builders and building designers. Limited market demand for EE and green building materials has resulted in a lack of market competition, leading to higher EE and green building materials cost in the Thai market. EE and green housing units in Thailand are usually more expensive than standard housing units due to extra costs of EE and green building construction materials.

Plans to learn from relevant projects, programs, initiatives & evaluations

As outlined in ?6 Institutional Arrangement and Coordination?, the project plans to coordinate with various national and global projects and initiatives to share relevant information and resources. Learning from others will also be achieved through establishment and operationalization of the Project Steering Committee (PSC) and Technical Working Groups (TWGs). The proposed M&E plan as described in ?9. Monitoring and Evaluation? aims to review quality of project outputs, provide feedback to the project partners, and establish peer review procedures to ensure adequate quality of scientific and technical outputs and publications.

Proposed processes to capture, assess and document info, lessons, best practice & expertise generated during implementation

The project will generate and capture expertise, lessons learned, and best practices during the project implementation through multiple sets of project activities which will review available online and offline resources, and stimulate interactions between the project and target stakeholders. Lessons learned on designing and constructing green housing units will be documented through a review and assessment of international and national experiences, best practices, and the pilot demonstration projects implemented by NHA and other project partners. Specific outputs are assigned to each of these activities to ensure that all key findings are properly reviewed and documented. Additional lessons learned and experience shared by all relevant stakeholders during meetings and workshops will also be compiled.

Local best practices and expertise will also be captured through a comprehensive training and capacity building program, which will enable trainees to share their lessons learned and experience. This local knowledge will be utilized in updating training tools and materials for both technical and non-technical aspects.

Proposed tools and methods for knowledge exchange, learning & collaboration

The project will develop an online database system for certified building construction materials and electrical appliances/equipment suitable for designing and constructing EE green housing units. The project will also establish a project website, and a repository of all project deliverables for public access during the project and beyond. Project materials produced by GEF incremental activities and in-kind contributions from project partners, such as of the pilot demonstration project case studies with MRV results will be compiled and disseminated through the project website and the online database system.

In addition, knowledge gained from implementation of the project activities will be properly documented and integrated into the relevant capacity building programs for local government agencies/authorities and private sector stakeholders. Sharing of knowledge will also be undertaken through regular meetings organized by the PMU for the PSC, TWGs and other stakeholders. Ongoing cooperation with other international initiatives on EE green homes will also serve as the communication channel for the project share and exchange these knowledge materials international energy efficiency communities.

Proposed knowledge outputs to be produced and shared with stakeholders

The proposed knowledge outputs to be produced and shared with stakeholders would include but not necessarily limited to:

? Online database system for certified building construction materials and electrical appliances/equipment suitable for designing and constructing EE green housing units;

? Designs and specifications of basic EE green homes, and more EE and environmental friendly homes that meet No.5 Home Energy labeling;

? MRV frameworks for low-rise residential buildings;

? Case studies of EE green housing projects with details on techno-economic benefits;

? Documents on training and capacity building programs on EE green homes together with training tools;

? Marketing tools and materials for communication and awareness campaigns.

A discussion on how knowledge and learning will contribute to overall project/program impact and sustainability

Knowledge and learning in the proposed project will be the results of project activities integrated into all the project components, and the abovementioned knowledge outputs will collectively deliver the overall project impact. Knowledge and learning also play an important role in sustaining the project impact as all knowledge outputs will be owned and managed by project partners and stakeholders who will directly contribute and enhance the impacts beyond the project period. For example, training and capacity building programs, and training tools on EE green homes will be managed by the Energy Conservation Laboratory (EnConLab) under KMUTT where technical assistance and training on energy efficiency are regularly organized for relevant stakeholders in Thailand. Through this arrangement, knowledge and lessons from the project will be updated and passed on to stakeholders who will be engaged in the EE and green housing industry after the project period, hence the sustainability will be strengthened.

The knowledge generated from the pilots on the technical issues of meeting the Label No. 5 standards and NHA green EE standards as well as the energy/cost savings will feed into the finalization of the standards as well as financing policy of NHA. Further, the output 1.1 will instil system capacity in NHA and EGAT to enable regularly review the standards in view of the developments in the region and technology available in the market. The knowledge generated from the pilots will also be shared with DEDE which is responsible for setting the minimum energy efficiency standards. DEDE is a partner in the project and will use this information to design EE standards for low rise housing units in Thailand, a sector which currently has no standards.

The knowledge and experience generated, and capacity provided to private sector contractors that will construct the pilots will inform them of the benefits of EE projects and is expected to result in application of this knowledge in projects beyond NHA. This will also help facilitate the work of DEDE in promoting EE standards for this segment of buildings.

Plans for strategic communications

The plan for strategic communications will be prepared as part of Output 3.3 of the project, which will include gender aspects, and potential collaboration with manufacturers and suppliers of EE and green building construction materials.

9. Monitoring and Evaluation

Describe the budgeted M and E plan

Monitoring and Evaluation (M&E) activities and related costs are presented in the M&E Budget and Workplan (Annex J) and are fully integrated in the overall project budget.

The project will comply with UNEP standard monitoring, reporting and evaluation procedures. Reporting requirements and templates are an integral part of the legal instrument to be signed by the Executing Agency and the Implementing Agency.

The project M&E plan is consistent with the GEF Monitoring and Evaluation policy. The Project Results Framework presented in Annex A includes SMART indicators for each expected outcome as well as end-of-project targets. These indicators along with the key deliverables and benchmarks included in Annex L will be the main tools for assessing project implementation progress and whether project results are being achieved. The means of verification to track the indicators are summarized in Annex A.

The M&E plan will be reviewed and revised as necessary during the project Inception Workshop (IW) to ensure project stakeholders understand their roles and responsibilities vis-?-vis project monitoring and evaluation. Indicators and their means of verification may also be fine-tuned at the inception workshop. General project monitoring is the responsibility of the Project Management Unit (PMU) but other project partners could have responsibilities in collecting specific information to track the indicators. It is the responsibility of the Chief Technical Advisor to inform UNEP of any delays or difficulties faced during implementation so that the appropriate support or corrective measures can be adopted in a timely fashion.

The project Steering Committee (PSC) will receive periodic reports on progress and will make recommendations to UNEP concerning the need to revise any aspects of the Results Framework or the M&E Plan. Project oversight to ensure that the project meets UNEP and GEF policies and procedures is the responsibility of the UNEP Task Manager. The UNEP Task Manager will also review the quality of draft project outputs, provide feedback to the project partners, and establish peer review procedures to ensure adequate quality of scientific and technical outputs and publications.

Project supervision will take an adaptive management approach. The UNEP Task Manager will develop a project Supervision Plan at the inception of the project, which will be communicated to the Project Management Unit and the project partners during the Inception Workshop. The emphasis of the Task Manager?s supervision will be on outcome monitoring but without neglecting project financial management and implementation monitoring.

Progress vis-?-vis delivering the agreed project global environmental benefits will be assessed with the Steering Committee at agreed intervals. Project risks and assumptions will be regularly monitored both by the Project Management Unit, the project partners and UNEP. Risk assessment and rating is an integral part of the Project Implementation Review (PIR). The PIR will be completed by the Chief Technical Advisor and ratings will be provided by UNEP?s Task Manager. The quality of project monitoring and evaluation will also be reviewed and rated as part of the PIR. UNEP?s Task Manager will have the responsibility of verifying the PIR and submitting it to the GEF. Key financial parameters will be monitored quarterly to ensure cost-effective use of financial resources.

Since this is a Full-Size Project (FSP), resources are set aside for a Mid-Term Review (MTR) or Mid-Term Evaluation (MTE). The purpose of the Mid-Term Review (MTR) or Mid-Term Evaluation (MTE) is to provide an independent assessment of project performance at mid-term, to analyze whether the project is on track, what problems and challenges the project is encountering, and which corrective actions are required so that the project can achieve its intended outcomes by project completion in the most efficient and sustainable way. The review will include all parameters recommended by the GEF Evaluation Office for Terminal Evaluations and will verify information gathered through the GEF tracking tools, as relevant. The review will be carried out using a participatory approach whereby parties that may benefit or be affected by the project will be consulted. Such parties were identified during the stakeholder analysis (see section 2. above). Members of the project Steering Committee could be interviewed as part of the MTR/MTE process and the Project Management Unit (PMU) will develop a management response to the evaluation recommendations along with an implementation plan. It is the responsibility of the UNEP Task Manager to monitor whether the agreed recommendations are being implemented.

In-line with the GEF Evaluation requirements, the project will be subject to an independent Terminal Evaluation (TE). Additionally, a performance assessment will be conducted at the project?s mid-point. The Evaluation Office will decide whether a Mid-Term Review, commissioned and managed by the Project Manager, is sufficient or whether a Mid-Term Evaluation, managed by the Evaluation Office, is required.

The TE will provide an independent assessment of project performance (in terms of relevance, effectiveness and efficiency), and determine the likelihood of impact and sustainability. The project performance will be assessed against standard evaluation criteria using a six-point rating scheme. It will have two primary purposes: (i) to provide evidence of results to meet accountability requirements, and (ii) to promote learning, feedback, and knowledge sharing through results and lessons learned among UNEP staff and implementing partners. The direct costs of the evaluation will be charged against the project evaluation budget. The TE will typically be initiated after the project?s operational completion. If a follow-on phase of the project is envisaged, the timing of the evaluation will be discussed with the Evaluation Office to feed into the submission of the follow-on proposal.

The draft TE report will be sent by the Evaluation Office to project stakeholders for comment. Formal comments on the report will be shared by the Evaluation Office in an open and transparent manner. The final determination of project ratings will be made by the Evaluation Office when the report is finalised.

The evaluation report will be publicly disclosed and will be followed by a recommendation compliance process. The evaluation recommendations will be entered into a Recommendations Implementation Plan template by the Evaluation Office. Formal submission of the completed Recommendations Implementation

Plan by the project manager is required within one month of its delivery to the project team. The Evaluation Office will monitor compliance with this plan every six months for a total period of 12 months from the finalisation of the Recommendations Implementation Plan.

The GEF Core Indicator Worksheet is attached as Annex F. It will be updated at mid-term and at the end of the project and will be made available to the GEF Secretariat along with the project PIR report. As mentioned above, the MTR/MTE and TE will verify the information of the tracking tool.

The direct costs of reviews and evaluations will be charged against the project evaluation budget. A summary of M&E activities envisaged is provided in Annex J. The table below gives an estimated value of the M&E activities budget.

M&E Activity	
Project Steering Committee Meetings and Project review meetings	4,000
Project progress reports (half yearly report, PIR, quarterly expenditure reports)	USD 43,200 (20% of the CTA time will spent on reporting and monitoring)
Audits	5,000
MTR/MTE and TE	75,000
Total	127,200

10. Benefits

Describe the socioeconomic benefits to be delivered by the project at the national and local levels, as appropriate. How do these benefits translate in supporting the achievement of global environment benefits (GEF Trust Fund) or adaptation benefits (LDCF/SCCF)?

The proposed project aims to provide socioeconomic benefits at the national and local level. Enabling access to high quality housing units with sustainable communities for low- and middle-income households will improve quality of life. EE green homes improve living comfort and environment and provide long term reduction of energy cost to households which help lessen household expenditure and thus better financial conditions. Reduction of electricity consumption contributes to lower energy and power demand from power plants, hence lower air pollution. This leads to improvements in health benefits for the entire population. By the end of the project, more than 43,126 EE green homes will be constructed to benefit low- and middle-income households. It is estimated that utilization of these EE green home will deliver cumulative electricity savings of 5,708 MWh and reduce GHG emission of about 2,854 tCO_2.

EE green home standards and labelling promoted by the project will increase demand of EE and green construction materials/technologies which will support local manufacturers and businesses leading to better employment prospects and eventually improved local economy. The capacity building and training program will enhance capacities and skills of people, specifically women, employed in the building construction sector. The project aims to put in dedicated efforts to strengthen and enhance equal participation from women and men in the technical design and implementation of EE green designs and labelling for low-rise residential building through capacity development trainings. Gender integration will be equally pronounced in key decision-making processes during project implementation. It is envisioned that the project will stimulate at least 10% increase in the number of male and female building designers employed by government and private sector. Moreover, environmentally sound management of hazardous wastes from discarded and end-of-life lighting products and home appliances will significantly reduce the risk of mercury contamination and other hazardous substances for all citizens as well as global warming potential from refrigerant gasses.

11. Environmental and Social Safeguard (ESS) Risks

Provide information on the identified environmental and social risks and potential impacts associated with the project/program based on your organization's ESS systems and procedures

Overall Project/Program Risk Classification*

PIF	CEO Endorsement/Approval	MTR	TE
	Low		

Measures to address identified risks and impacts

Elaborate on the types and risk classifications/ratings of any identified environmental and social risks and impacts (considering the GEF ESS Minimum Standards) and any measures undertaken as well as planned management measures to address these risks during implementation.

This is a low safeguard risk project. The project addresses the gap and niche in the current policy and market condition through standards, labelling, tools, financing mechanism and monitoring measures with the intention of making the housing more energy efficient and green. The primary beneficiary is National Housing Authority (NHA) which is mandated to build housing units for low- and middle-income group who have challenge accessing affordable accommodation in private sector, thus it

benefits poorer communities. The pilots under the project will follow the EIA assessment as per the regulations of Government of Thailand as well as meet all the social safeguards. The pilot projects are being built on government approved land parcels and doesn't displace any communities.

Supporting Documents

Upload available ESS supporting documents.

Title	Module	Submitted
SRIF (17 July 2020)_NHA project_2020	**CEO Endorsement ESS**	

ANNEX A: PROJECT RESULTS FRAMEWORK (either copy and paste here the framework from the Agency document, or provide reference to the page in the project document where the framework could be found).

Please refer to page 68 and 69 of project document

Project Objective	Objective level Indicators	Baseline	Mid-Point Target (if applicable)	End of project Target	Means of Verification	Assumptions & Risks	UN Environment MTS reference
To build energy efficient green homes to address the greenhouse gas emission reduction goal of Thailand, and to enhance the comfort and living space for low- and middle-income populations living in low-rise housing units	Indicator A: Cumulative number of low- and middle-income households accessing to and own EE green homes	Baseline A: 254 Households (see Note 1)	Mid-point target A: 1,327 Households (see Note 2)	End-of-project target A: 25,875 Households (see Note 3)	Official government journals, publications, documents and news bulletins issued by NHA, EGAT, NSO and other relevant government agencies Project mid-term and terminal evaluation reports Project Activities reports M&E report of the program Regulatory documents Agreement documents	Assumption: Commitment and efficient collaboration of all the relevant ministries and national agencies to carry out the project activities remain unchanged. Risks: - Policies might be recommended and reconciled but not implemented; - Weak government support; - Delayed implementation of activities; - Low participation from the private sectors	UNEP MTS 2018-2021 Climate Change Objective: Countries increasingly transition to low-emission economic development and enhance their adaptation and resilience to climate change
	Indicator B: Cumulative net energy savings and GHG emission reductions	Baseline B: Net Direct energy savings: 0 MWh Net Direct GHG emission reductions: 0 tCO_2	Mid-Point-project target B: Net Direct energy savings: 1,302 MWh Net Direct GHG emission reductions: 651 tCO_2	End-of-project target B: Net Direct energy savings: 5,708 MWh Net Direct GHG emission reductions: saving 2,853 tCO_2			

Project Outcomes	Outcome level Indicators	Baseline	Mid-Point Target (if applicable)	End of project Target	Means of Verification	Assumptions & Risks	MTS Expected Accomplishment
Outcome 1: Increased availability of NHA's energy efficient green housing units in the market and the ability to assess emissions reduction in a quantifiable approach	Indicator 1.1: Cummulative number of low-rise and single story residential buildings constructed in accordance with NHA's EE green standards, and the No. 5 Home Energy Labelling requirements	Baseline 1.1: 953 units (as of March 2020)	Mid-point target 1.1: 2,212 units (by 2023)	End-of-project target 1.1: 43,126 units (by EOP)	· Official government journals, publications, documents and news bulletins issued by NHA, EGAT, NSO and other relevant government agencies · Project mid-term and terminal evaluation reports · Project Activities reports · Regulatory documents · Agreement documents	Risks: - Standards and frameworks might be recommended and reconciled but not implemented; - Delayed implementation of activities (e.g., pilot projects) - Low participation from the private sectors (developers, builders/contractors, building construction material manufacturers/suppliers)	Expected Accomplishment (b): Countries increasingly adopt and/or implement low greenhouse gas emission development strategies and invest in clean technologies
	Indicator 1.2: Number of MRV frameworks for low-rise residential buildings developed and adopted for implementation by local stakeholders	Baseline 1.2: 0 (no MRV framework) 0 (no local stakeholder adopted the MRV framework)	Mid-point target 1.2: 1 (The MRV framework developed) 2 (two organizations adopted the MRV framework)	End-of-project target 1.2: 1 (The MRV framework developed) 5 (two organizations adopted the MRV framework)			
Outcome 2.: Financing and incentive mechanisms approved by the Government of Thailand to support affordable green housing for low- and middle-income residents and use of Green funds to support emissions reduction in the residential sector homes	Indicator 2.1: Number of financial mechanisms approved by the Thai Government to support construction of affordable EE green homes for low- and middle-income households	Baseline 2.1: 0 (no financial mechanism)	Mid-point target 2.1: 1	End-of-project target 2.1: 2	· Official government journals, publications, documents and news bulletins issued by NHA, EGAT and other relevant government agencies · Project mid-term and terminal evaluation reports · Activities reports · Regulatory documents · Agreement documents	Risks: - Policies might be recommended and reconciled but not implemented; - Delayed implementation of activities (e.g., pilot projects) - Low participation from the private sectors (developers, builders/contractors, building construction material manufacturers/suppliers)	Expected Accomplishment (b): Countries increasingly adopt and/or implement low greenhouse gas emission development strategies and invest in clean technologies
	Indicator 2.2: Number of fiscal incentives to incentivize affordable EE green homes adopted by the Thai Government	Baseline 2.2: 0 (no fiscal incentive)	Mid-point target 2.2: 1	End-of-project target 2.2: 2			
	Indicator 2.3: Number of EE green homes with women and LGBTI beneficiaries inclusive supported by financial and incentive mechanisms	Baseline 2.3: 0	Mid-point target 2.3: 0	End-of-project target 2.3: 216			

Project Outcomes	Outcome level Indicators	Baseline	Mid-Point Target (if applicable)	End of project Target	Means of Verification	Assumptions & Risks	MTS Expected Accomplishment
Outcome 3: Energy efficient green home concepts and designs increasingly adopted by housing developers and increased demand of energy efficient green homes among home buyers	Indicator 3.1: Increase in the number of male & female building designers employed by government and public sector for EE green homes	Baseline 3.1: Baseline to be determined as part of the training and capacity building need assessment	Mid-point target 3.1: At least 5% increase in the number of male & female building designers employed by government and private sector	End-of-project target 3.1: At least 10% increase in the number of male & female building designers employed by government and private sector	· Project activity report; · M&E report of the program · Awareness survey and training needs assessment reports; · Interviews and meeting with the industry; · Evaluation report of communication campaign;	Risks: · Low participation from the private sectors (developers, builders/contractors, building construction material manufacturers/suppliers)	Expected Accomplishment (b): Countries increasingly adopt and/or implement low greenhouse gas emission development strategies and invest in clean technologies
	Indicator 3.2: Number of No of private developers constructing EE green homes for low- and middle-income households	Baseline 3.2: 0 (no private sector developer supplying EE green homes in Thailand)	Mid-point target 3.2: 2	End-of-project target 3.2: 5			
	Indicator 3.3: % of low- and middle-income Thai households expressing intension to rent or buy EE green homes	Baseline 3.3: Baseline to be determined as part of the awareness survey	Mid-point target 3.3: At least 10% increase in potential renters or buyers of EE green homes	End-of-project target 3.3: At least 30% increase in potential renters or buyers of EE green homes			

Note:

1 Based on 27% occupancy rate of EE green homes constructed by NHA as of March 2020.

2 Based on 60% occupancy rate of EE green homes contracted by NHA & other stakeholders til the end of 2023.

3 Based on 60% occupancy rate of EE green homes contracted by NHA & other stakeholders til the end of project.

ANNEX B: RESPONSES TO PROJECT REVIEWS (from GEF Secretariat and GEF Agencies, and Responses to Comments from Council at work program inclusion and the Convention Secretariat and STAP at PIF).

No.	STAP comment on PIF document	Response to STAP comment on CEO packages

No.	STAP comment on PIF document	Response to STAP comment on CEO packages
1	This project has a fairly linear trajectory for improving energy efficiency of low?rise housing projects in Thailand. These are often the lower to middle income units and thus the project could have a positive energy justice dimension as well. The creation of markets that support such efficiency uptake are well?described and there is considerable attention paid to linkage with existing government institutions. Although a theory of change is not explicitly described there is a market?driven theory of change that is predicated on green labeling and consequent branding attraction for developers and consumers. The proposal revisions could more explicitly address this theory of change and acknowledge its potential pitfalls. As with all projects involving energy efficiency, attention needs to be paid to rebound effects which could potentially lead to higher aggregate consumption of energy even with more efficient buildings on the market. Some recognition of latent demand by consumers who might end up consuming more energy as prices decline should be noted. We refer the project proponent to the following literature on the rebound effect:	The recommended literatures on the rebound effect were reviewed and the rebound effect has been included in the estimates of direct and consequential greenhouse gas emission reductions as shown in Annex M. In addition, proposed activities under Component 3 were designed to mitigate impacts of the rebound effect. It should be noted that information on the rebound effect related to consumer's behaviors in consuming more energy as a result of economic benefits from efficiency improvement in low- to middle-income households in Thailand is limited. Considering this, studies in OECD and Korea are used as the reference[1], and the project assumed 30% of direct rebound effect in the annual estimation of electricity saving generated of each energy efficiency green housing unit built and operated.
2	The refinement of a green building standards system with the Thailand Green Building Institute is an important component of this project to ensure longer term sustainability of the outcomes. However, it would be worthwhile for the proponents to consider some of the studied pitfalls of standards and green building certification systems ? in particular the work of the US Green Building Council which developed the Leadership in Energy and Environmental Design (LEED) standard.	The the Thailand Rating of Energy and Environmental Sustainability (TREES) system developed by the Thai Green Building Institute (TGBI) is generally aligned with the LEED certification. NHA has already developed its ECO Village criteria based on TREES, and TGBI is one of the key stakeholders in the proposed project, and will be involved as a member of the Technical Working Group (TWG) to support development and implementation of EE green design standards for low-rise residential buildings (Component 1), and the training and capacity building programs (Component 3). The project will collaborate with TGBI to review various aspects (including strengths, weaknesses and implementation issues) related to certification works for residential buildings promoted by TREES and LEED, and reflect in the relevant outputs under Component 1 and 3.

No.	STAP comment on PIF document	Response to STAP comment on CEO packages
3	The partnership with KMUTT ? a university with expertise in this arena ? is a positive attribute. However, further details on how prototypes would be developed by such partnerships with the National Housing Authority should be further described.	Building prototypes which demonstrate benefits of EE green building construction materials and renewable energy have already been developed by NHA, but it is more in a disintegrated manner, e.g., one prototype for EE building materials and one prototype for renewable energy. Under the proposed project, NHA will construct the EE and green integrated prototypes under Component 2, and the prototypes will be operationalize to support implementation of all project components. The project activities which link to the prototypes include but not limited to development of EE green home design standards and utilization of the MRV framework under Component 1; operationalization of financial mechanisms under Component 2; and demonstration of EE green home benefits for the training and capacity building program under Component 3.
4	STAP recommends that project proponents review the following key articles in terms of contingency planning and barriers to upscaling of the project. a. Li, Y., Song, H., Sang, P., Chen, P.?H. & Liu, X. Review of Critical Success Factors (CSFs) for green building projects. Building and Environment 158, 182?191 (2019). b. Shen, W. et al. Understanding the green technical capabilities and barriers to green buildings in developing countries: A case study of Thailand. Sustainability (Switzerland) 10, (2018).	The recommended articles were reviewed, and barriers to upscaling of construction of EE green housing units highlighted in the articles will be addressed by the project, specifically through the following outputs. 1) Improved capacity of the all key stakeholder and target audience who are directly and indirectly involved in the project; 2) Increased market demand through improved access to EE green housing unit and financing mechanisms for low-and middle-income households to purchase EE green housing units; 3) Increased awareness, knowledge and, eventually, EE green adoption behaviour concerning EE green homes among direct and direct beneficiary groups.

No.	STAP comment on PIF document	Response to STAP comment on CEO packages
5	Comment on PIF- page 29 Climate risk: the project indicates that ?there is no foreseen environmental or social risk of implementing the project?. However, the potential impacts of climate change on the achievement of project outcomes/outputs and their long?term durability need to be considered. The projected effect of climate change in Thailand includes higher surface temperatures, floods, droughts, severe storms and sea level rise. These need to be taken into consideration in the determination of the location, design and construction of the energy efficient buildings. It is recommended that a detailed climate risk screening should be carried out at the PPG stage to identify all possible climate risks, and management plans should be developed to mitigate identified risks.	Risks associated with location, design and construction of EE green buildings were reviewed, and there are risks pertaining to business operation of construction companies, and climate change impact that could affect household life and assets (e.g. floods, droughts, landslide, etc.). For any NHA housing projects, NHA is required to conduct an environmental impact assessment (EIA) and prepare environmental risks mitigation measure prior to applying for a construction permit as per the Building Control Act B.E. 2535 and the Environmental Quality Promotion and Conservation Act 1992. The application process for construction permission serves as part of overall mitigation measures to reduce impacts from climate change during the EE green housing project development. The project will also collaborate with the construction companies to ensure proper development planning of construction landscape and building design to reduce the potential climate change risk on the construction buildings and site location, including to ensure development of the work plans to reduce the on-site generated waste to minimize the impact of construction waste on the environment. More details on the risk mitigation strategy and safeguards for the Environmental- Climate and Social Risk was addressed in the risk management plans in the CEO package document, Session 5: Risk:
6	Some reference to earlier demand side management by EGAT is provided. However, there is no clear theory of change diagram to link outputs to outcomes apart from the template tables which provide this linkage in matrix format.	The theory of change diagram was prepared and included in the CEO package.
7	The global environmental benefits will need to consider rebound effect of efficiency and also the energy source to be most operationally impactful in terms of carbon mitigation value.	The project has included the rebound effect in the estimates of direct and consequential greenhouse gas emission reductions in the calculation (see Annex M).

No.	STAP comment on PIF document	Response to STAP comment on CEO packages
8	Risk analysis is provided but is somewhat dated. Table 5 indicates election reference to ?early 2018? ? needs to be updated.	The Risk analysis table has been updated.
9	Yes ? there is some level of coordination with other GEF projects region but could perhaps benefit from further interface with GEF China as there is considerable experience there.	The project intends to utilize experience and lessons learned from the GEF and non-GEF projects implemented in countries and regions of which climatic conditions are similar to Thailand, and all relevant GEF projects are highlighted in Section 6. Institutional Arrangement and Coordination. The project will also coordinate with the Global Alliance for Buildings and Construction (GlobalABC), a voluntary partnership of national and local governments, inter-governmental organizations, businesses, associations, networks, and think thanks committed to a common vision: A zero-emission, efficient and resilient buildings and construction sector.

[1] Sang-Hyeon Jin reported rebound effect of 30% and 38% for long term and short term effect in residential sector in South Korea in ?The effectiveness of energy efficiency improvement in a developing country: Rebound effect of residential electricity use in South Korea?, https://doi.org/10.1016/j.enpol.2007.05.028

Steve Sorrel (2007) found that that in OECD countries, direct rebound effect is less than 30% in individual home heating, home cooling and personal automobile transportation. https://ukerc.rl.ac.uk/UCAT/PUBLICATIONS/

ANNEX C: Status of Utilization of Project Preparation Grant (PPG). (Provide detailed funding amount of the PPG activities financing status in the table below:

PPG Grant Approved at PIF: **US$**	
Project Preparation Activities Implemented	***GETF/LDCF/SCCF Amount (US$)***

	Budgeted Amount	*Amount Spent to date*	*Amount Committed*
GEF Document Preparation Expert	37,000	37,000	
Finance Expert	15,000	15,000	
Gender Expert	6,000	6,000	
Residential housing sector assessment and workshops	37,000	37,000	
Contingency	15,000	0	0
Total	**110,000**	**95,000**	

ANNEX D: CALENDAR OF EXPECTED REFLOWS (if non-grant instrument is used)

Provide a calendar of expected reflows to the GEF/LDCF/SCCF/CBIT Trust Funds or to your Agency (and/or revolving fund that will be set up)

Not Applicable

ANNEX E: Project Map(s) and Coordinates

Please attach the geographical location of the project area, if possible.

Attached in Project Document page 76 to 79.

ANNEX F: Project Budget Table

Please attach a project budget table.

Project Budget attached as separate document (Annex I-1 GEF Budget in GEF template.pdf)