

PARTNERSHIP FOR MARKET READINESS (PMR)

Thailand's Draft Market Readiness Proposal (MRP)

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Responsible Agency:



Thailand Greenhouse Gas Management Organization
(Public Organization; TGO)

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ABBREVIATIONS

AEDP	Thailand's 10-year Alternative Energy Development Plan
AIM	Asia-Pacific Integrated Model
AFOLU	Agriculture, Forestry and Other Land Use
BAU	Business as usual
BMA	Bangkok Metropolitan Administration
CDM	Clean Development Mechanism
CERs	Certified Emission Reductions
CPP	Captive Power Plant
CSR	Corporate Social Responsibility
DEDE	Department of Alternative Energy Development and Efficiency
DF&Bs	Designated Factories and Buildings
DIW	Department of Industrial Works
DNA	Designated National Authority
DOE	Designated Operational Entity
DOLA	Department of Local Administration
DSM	Demand-Side Management
EE	Energy Efficiency
EEDP	Thailand's 20-year Energy Efficiency Development Plan
EERF	Energy Efficiency Revolving Fund
EGAT	Electricity Generating Authority of Thailand
ENCON Act	Energy Conservation Promotion Act
ENCON Fund	Energy Conservation Promotion Fund
EPC	Energy Performance Certificate Scheme
EPPO	Energy Policy and Planning Office
ESCOs	Energy Service Company
ESCO Fund	ESCO Venture Capital Fund
ETS	Emission Trading Scheme
FPO	Fiscal Policy Office
FTI	The Federation of Thai Industry
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GPC	Global Protocol for Community-Scale GHG Emissions
GS	Gold Standard
GWP	Global Warming Potential
ICLEI	International Council for Local Environmental Initiatives
INC	The Initial National Communication
IPCC	Intergovernmental Panel on Climate Change
JGSEE	Joint Graduate School of Energy and Environment
KMUTT	King Mongkut's University of Technology Thonburi
ktoe	kilo ton of oil equivalent
LCC	Low Carbon City program
LCC Fund	Low Carbon City Fund
LCC-TVER	Thailand Verified Emission Reductions from Low Carbon City
LCMT	APEC Low Carbon Model Town
LCS	Low Carbon Society
LDCs	Least Developing Countries

LEP	Local Energy Plan Model
LoA	Letter of Approval
MAC	Marginal Abatement Cost
MBI	Market-Based Instrument
MEA	Metropolitan Electricity Authority
MOEN	Ministry of Energy
MOF	Ministry of Finance
MONRE	Ministry of Natural Resources and Environment
MoU	Memorandum of Understanding
MRP	Market Readiness Proposal
MRV	Monitoring, Reporting and Verification
MSW	Municipal Solid Waste
Mton CO ₂ e	Million tons of CO ₂ equivalent
M&V	Monitoring and Verification
NAMAs	Nationally Appropriate Mitigation Actions
NCCC	National Committee on Climate Change Policy
NEPC	National Energy Policy Council
NESDB	National Economic and Social Development Board
NESDP	National Economic and Social Development Plan
NGI	National GHG Inventory
NGOs	Non-governmental organization
NMT	National Municipal League of Thailand
NP	New Policy
ONEP	Office of Natural Resources and Environmental Policy and planning
OP	Official Policy
OPM	Office of the Prime Minister
OTP	Office of Transport and Traffic Policy and Planning
PCD	Pollution Control Department
PDD	Project Design Document
PDMO	Public Debt Management Office
PDP	Power Development Plan
PEA	Provincial Electricity Authority
PMR	Partnership for Market Readiness
PMU	Project Management Unit
PR	Public Relations
PRE	Personnel Responsible for Energy
RE	Renewable Energy
RES	Renewable Energy Sources
SEC	Specific Energy Consumption
SMEs	Small And Medium Enterprises
SNC	Second National Communication
SOP	Standard Offer Program
SP	Stringent Policy
SPP	Small Power Producer Regulation
TCC	The Thai Chamber of Commerce
tCO ₂ e	ton of CO ₂ equivalent
TEI	Thailand Environmental Institute
TGO	Thailand Greenhouse Gas Management Organization

toe	ton of oil equivalent
T-VER	Thailand Voluntary Emission Reduction
TVER	Thailand Verified Emission Reductions
UNFCCC	United Nations Framework Convention on Climate Change
VCS	Verified Carbon Standard
VCU	Verified Carbon Unit under the VCS
VSPP	Very Small Power Producer Regulation

General Information

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Executive Summary

Establishing the Energy Performance Certificate Scheme and the Low Carbon City Program in Thailand

Although Thailand is a Non-Annex I country with no obligatory for implementing measures to reduce GHG emission, Thailand has considered climate change as an important issue and one of the key national priorities. The 11th National Economic and Social Development Plan (NESDP), which is the core plan of Thailand's public policies, adopted Green Growth and Low-Carbon Development as part of its strategy for balanced and inclusive growth. It stresses the importance of environmental management, improving energy efficiency, and low-carbon growth path for cities as key ingredients to move towards green growth. The NESDP also highlights the role of ***local authorities as the key driving units for low-carbon development.***

According to its Second National Communication (SNC), Thailand emitted 281 M tCO₂e/yr, with effective reduction of 52 M tCO₂e due to carbon sinks' absorption effects, resulting in a net balance of 229 M tCO₂e/yr. The energy sector represents the most important source with about 70% of the total amount and will continue, based on projected GHG emission trend assessment, to represent the most important source of GHG emissions contributing at least until the year 2050. Given the historical profile as well as the projected future trajectory of GHG emissions in Thailand, ***the energy sector is the national priority for mitigation efforts. The sector also represents the major abatement potential of GHG emission mitigation.***

Two key policies in the energy sector which have significant impacts on GHG mitigation are the 20-year Energy Efficiency Development Plan (EEDP) and the 10-year Alternative Energy Development Plan (AEDP). The Ministry of Energy's 20-year EEDP (2011-2030) aims to promote the reduction of energy intensity by 25% in 2030 compared with that in 2010 (23.5% of final energy consumption in 2030 or saving of 38,200 ktoe). The highest savings will be contributed by the industry sector (42%), followed by transportation (40%), large commercial building (9%), and small commercial and residential building (9%). The Ministry of Energy's 10-year AEDP (2012-2021) aims to increase renewable energy (RE) share from various renewable sources for power generation and fuel consumption to 25% of final energy consumption in 2021. ***Given their strategic importance, energy efficiency, renewable energy and low-carbon city are identified as priority sectors to target efforts to build market readiness.***

As countries seek to enhance global GHG mitigation efforts post-2012, the government of Thailand has considered the use of *market-based instruments (e.g. the mandatory emission trading system, carbon tax, etc.) to implement cost-effective emission reduction options in the future.* As market-based instruments are relatively new concepts in the country, there is a need to prepare market players in the public and private sector to understand and become familiar with the key elements of market-based schemes to ensure their successful implementation.

As discussed above, ***energy efficiency, renewable energy and low-carbon city are the three national priorities for GHG emission reduction where there is a large room for market-based***

instruments to help address existing policy and implementation gaps and achieve policy objectives and targets. These three measures also provide a suitable institutional and policy platform to lay a long-term foundation of market-based mechanism as the major stakeholders (TGO, MOEN, NESDB, local authorities, large energy consumers) will continue to be the key players in any future mitigation efforts over the long-run.

The use of market-based instruments to drive low-carbon development are expected to not only result in enhanced energy efficiency, increased renewable energy share and GHG emission reductions, but also create an environment that fosters competitiveness, technology transfer, institutional capabilities, research and development, and inclusive growth in the economy.

Despite the policy frameworks and financing mechanisms that the government has put in place to promote EE in Thailand, energy efficiency improvements continue to face challenges. Thus, to achieve the most ambitious target of energy efficiency improvement the country has set so far, innovative measures are required in addition to the existing voluntary measures and input-based approaches used in the past which may have exhausted their potential to incentivize energy savings. Measures which are more market-oriented and output-based are needed to harvest large potential of energy efficiency improvement particularly in the industrial sector which saw little improvement in energy intensity in the last decade. ***Market-based instruments could incentivize large energy consumers to set their energy conservation targets and over-perform in order to be rewarded.*** Actual energy savings will directly contribute to EEDP. Moreover, the market readiness activities will also support EEDP by preparing institutional infrastructure (e.g. baseline data, MRV, policy tracking) that will also enhance the policy effectiveness of EEDP. It will also help prepare large energy consumers to be ready for mandates (whether it be energy-based or emission-based) in the future. It is estimated that the use of market-based instruments can lead to energy savings for selective sectors above and beyond the national goal in the same period.

Although the progress of AEDP is largely on track with substantial private investments in renewable energy projects, there is a greater role for local municipalities to play in renewable energy development especially waste-to-energy projects (for solid waste and wastewater), smaller-scale or community-level renewable energy projects, fuel-switching in public vehicles, and etc. On the other hand, while there is a keen interest to promote low-carbon city nation-wide with efforts by various agencies including NESDB, TGO, and the MOEN to develop national policy and guidelines on low-carbon city, establish local inventory, and pilot low-carbon city projects in targeted municipalities and local communities, the low-carbon city policy is still in an early stage of development. Key challenges which prevent local authorities to implement low-carbon city initiatives include limited technical capacity of local authorities to plan, design and implement low-carbon projects, as well as limited financial capacity to raise fund or secure budget to finance capital investment, and operation and maintenance of these projects.

To scale-up low-carbon city development (there are over 1,100 municipalities nation-wide), it is commonly agreed that efforts to build up local capacity to identify and develop sound GHG mitigation reduction plan and projects in their judicial area will be critical to enable local municipalities to become major players in mitigation efforts in the long-run. ***Market-based instruments are expected to help incentivize local municipalities and communities to implement mitigation actions by filling in local capacity gap and financial gap in project financing*** and thereby support the 11th NESDP plan in achieving sustainable development and low carbon society goals as well as support AEDP by promoting small and micro renewable energy projects under Green City as part of the AEDP.

There is a strong rationale for Thailand to consider adopting market-based instruments to implement cost-effective emission reductions nation-wide in the long-run. Thailand believes that the market-based mechanisms designed for GHG reduction needs to be flexible and aligned with national priorities in order to work. The recent implementation of a variety of carbon pricing schemes around the world illustrates that, to be successful, such initiatives have to be in line with national priorities and, in particular, national economic priorities. New schemes will benefit from the lessons learned under earlier schemes. Considering the above issues into account, Thailand has proposed **Energy Performance Certificate Scheme (EPC)**, **Low Carbon City Program (LCC)** and **Low Carbon City Fund (LCC Fund)** to be implemented under the PMR. These tools are proposed after careful analysis of national priorities, existing relevant policies and political tools of the Thai Government and discussion with several key stakeholders. They are designed to fill in existing policy and implementation gaps and to prepare both private and public sectors to build technical knowledge, lay down institutional and legal infrastructure, and gain broad-based public acceptance before launching full-fledged mandatory schemes in the future.

The Thailand Greenhouse Gas management Organization (TGO) is an agency under the Ministry of Natural Resources and Environment which is mandated to oversee national climate change policy in Thailand. Specifically, TGO was assigned as the designated national authority for CDM and is mandated by the cabinet to lead the national effort on carbon market policy and implementation. The Thai cabinet has approved TGO to participate in this PMR on 15th January 2013 and the Memorandum of Understanding (MoU) was signed between DEDE, Ministry of Energy and TGO to provide a mutual agreement in cooperating and implementing the Energy Performance Certificate Scheme (EPC) together. During the draft MRP development, TGO organized several stakeholder consultation meetings with Ministry of Energy, Ministry of Finance, local municipalities and private sector, Federation of Thai Industry and The Thai Chamber of Commerce.

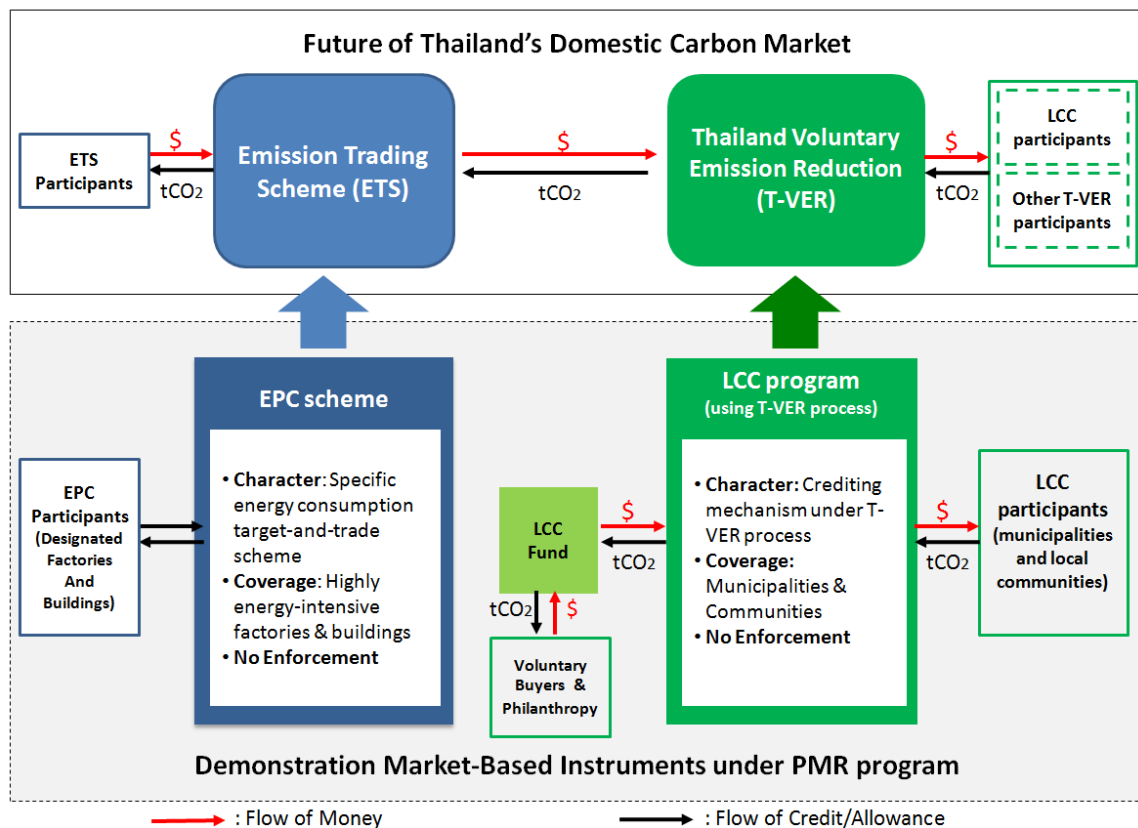
The EPC scheme aims to build market readiness components in energy and intensive industrial units and commercial buildings, major GHG emitters, to be the foundation for establishing the future emission reduction trading scheme in Thailand. The EPC is a target-and-trade scheme designed to enhance energy efficiency and GHG emission reduction and to support achieving the national goal of energy intensity reduction by 25% in 2030, relative to the specific energy consumption levels in 2010. The expected target groups are highly energy-intensive industrial units and commercial buildings. Each of the EPC participants will have the specific energy consumption (SEC) reduction target expressed in “ton of oil equivalent (toe) per unit of product” (e.g. for power production: toe/kWh). The EPC scheme is also designed to improve data accuracy to set energy consumption standards and put in place effective monitoring system which are lacking in the current energy promotional regime. The activities to help set the energy consumption baseline and performance targets and MRV standards will significantly improve effectiveness of the current policy regime.

The LCC program aims to support municipalities and communities in achieving the national goal to shift towards a low carbon society by implementing greenhouse gas emission reduction activities. “Low Carbon City” refers to a province, city, municipality, or community that pursues a systematic process to achieve GHG emission reductions. The projects under the LCC Program, developed by municipalities and communities, will apply the Thailand Voluntary Emission Reduction Program (T-VER) for certifying and issuing carbon credits, TVER credits, generated under the LCC program (LCC-TVERs). The LCC-TVER credits can be used for offsetting carbon

footprints in voluntary market, and once the domestic emission trading scheme in Thailand established, the LCC-TVER credits will be eligible for compliance purpose in the scheme.

The LCC Fund is a carbon fund to be established to support the development of GHG emission reduction projects under the LCC program. The LCC fund are designed to deliver carbon finance and comprehensive technical support to local municipalities and communities to enhance the quality of emission reduction projects and thereby increase market confidence in financing LCC projects. It is also expected to provide credit guarantee to financial institutions in order to bridge the debt financing gap for funding LCC projects.

Although, under the PMR program, the EPC scheme and the LCC program are not designed to link together, the EPC scheme aims to expand and transform into the Emission Trading Scheme (ETS), while the LCC program aims to expand to cover all municipalities and to generate eligible credits for compliance purpose under the ETS (see figure).



The EPC scheme, apart from resulting in energy saving, would lead to strengthened institutional, legal, registry and domestic MRV system so that a mandatory ETS can be established and implemented at the later stage. The LCC program, apart from resulting in GHG emission reduction and generating co-benefits to municipalities and local communities, would provide a basis for building a credible and active domestic GHG crediting mechanism. These proposed tools are expected to help Thailand fill in existing policy and implementation gaps in the current national priorities of EE, RE and low-carbon city and accelerate the implementation of these three national priorities.

Under this MRP, four chapters are outlined as the following:

Chapter 1 (The Big Picture: Policy Context): outlines the big picture and existing relevant policies on climate change in Thailand. It provides an overview of the country's low emissions development strategy and its GHG mitigation plan.

Chapter 2 (The Proposed Programs): is the main chapter which outlines Thailand's vision toward an establishment of the ETS and the three proposed components under this PMR program which are EPC, LCC and LCC Fund. Each sub-chapter covers the contents of the Building Block 2 (Policy Landscape and Objectives and/or Preparatory Work to Support and Inform Policy Decisions), the Building Block 3 (Core Market Readiness components) and the Building Block 4 (Planning for a Market Instrument) of the Tool for Market Readiness Proposal.

Chapter 3 (Organization, Communication, Consultation and Engagement): proposes the organization structure for implementing the PMR activities. In addition, to build further political and technical consensus as well as to increase awareness and engagement among stakeholders, the specific activities to ensure proper communication, consultation and engagement with stakeholders will be continued. The communication will be conducted through various media depending on the identified target audience.

Finally, Chapter 4 (Summary of Schedule and Budget): summarizes the activities and required budgets for PMR activities.

Chapter 1. The Big Picture: Policy Context

1. Development and climate change mitigation plans
2. National Appropriate Mitigation Actions (NAMAs) pledge
3. Historic and projected emissions trends and key drivers of the GHG emissions
4. Mitigation actions and its plan for their implementation
5. Carbon market experience
6. Proposed Activities, Objectives and Budgets

1. Development and climate change mitigation plans

Recognizing the seriousness of climate change, the Government of Thailand signed the UNFCCC in 1992 and ratified the Convention in 1994 as a Non-Annex I country. Thailand's policy on climate change has been drawn up to ensure that the country's commitments and obligations to the UNFCCC and the Kyoto Protocol are fulfilled and are consistent with the national interest.

The Initial National Communication (INC) documented the 1994 inventory of greenhouse gases (GHG) and was submitted in 2000. In 2011, the Second National Communication (SNC) covering the National GHG Inventories (NGI) in 2000, impact, vulnerability, adaptation, and GHG mitigation and prepared through wide cooperation among various government agencies as well as research and academic institutes was submitted to the UNFCCC. As indicated in its Second National Communications (SNC), increasing vulnerability to climate change and climate variability and extreme events remain the biggest challenges of Thailand in addressing climate change. The country has made significant efforts to cope with climate change; however, its sectors of agriculture, water resources, infrastructure, human health and coastal resources are still at risk.¹

National Economic and Social Development Plan

Thailand has integrated climate change issues into the national development planning process since the 7th National Economic and Social Development Plan (NESDP) (1992-1996).

While the core development objective of the 8th NESDP is to ensure the people's welfare applying a holistic bottom-up approach, the Thai Government aims to balance economic, social and environmental affairs including public participation. The subsequent the 9th NESDP adopted sufficiency economy as the guiding national philosophy for development and the 10th NESDP explicitly makes reference to upgrading and protection of environmental resources.

The current 11th National Economic and Social Development Plan (NESDP) has addressed climate change as one of the significant changes that Thailand will encounter during the implementation of the Plan (2012 - 2016). It contains a Green Policy that calls for addressing climate change more rigorously and moving toward a low-carbon economy and society.

¹ Office of Natural Resources and Environmental Policy and Planning (ONEP), 2010. Thailand's Second National Communication under the United Nations Framework Convention on Climate Change. Ministry of Natural Resources and Environment. Bangkok. Thailand. Retrieved from: <http://unfccc.int/resource/docs/natc/thainc2.pdf>



Figure 1: Key national policies with significant impacts on GHG mitigation

National Strategic Plan on Climate Change (2008 – 2012)

The 1st National Strategic Plan on Climate Change Management during 2008 – 2012 was released by the Cabinet in January 2008. The vision statement is that “Thailand is a climate-resilient society and cooperates with the global community to mitigate climate change based on the principle of sustainable development”. The Plan comprises 6 strategies, i.e.

- Strategy 1: Build capacity to adapt and reduce vulnerabilities to climate change impacts,
- Strategy 2: Promote greenhouse gas mitigation activities based on sustainable development,
- Strategy 3: Support research and development to better understand climate change, its impacts and adaptation and mitigation options,
- Strategy 4: Create awareness and participation of problem solving on climate change,
- Strategy 5: Build capacity of relevant personnel and institutions and establish a framework of coordination and integration, and
- Strategy 6: Support international cooperation to achieve the common goal of climate change mitigation and sustainable development.

Thailand Climate Change Master plan (2013-2050)

The Climate Change Master Plan of Thailand (2013-2050) has been developed and approved by the technical sub-committee and is now waiting for a final approval from the Board of National Committee on Climate Change (NCCC).

Thailand Climate Change Master Plan is a framework of integrated policies and action plans relating to climate change with a vision for Thailand to be supportive of climate change impact and move towards sustainable low-carbon society by 2050. It supports climate change preparedness initiatives and aligns with the country's economic and socio-cultural contexts, and sufficiency economy philosophy. The plan includes three key strategies:

1. Mitigation of greenhouse gas (GHG) emissions and increase of GHG sinks to promote sustainable development;
2. Strengthening the capacity of human resources and institutions and to manage the risks from the effects of climate change and cross cutting issues;
3. Adaptation for coping with the negative effects of climate change

In all, the master plan is developed with an integrated approach and with the involvement of various sectors and shareholders.

Specific Plans related to climate change mitigation

Apart from the national plan on climate change, key existing public policies which have significant impacts on GHG mitigation include:

- **Energy Sector:** The Energy Efficiency Development Plan (EEDP, 2011-2030), Alternative Energy Development Plan (AEDP, 2012-2021), and Thailand Power Development Plan (PDP2010: Revision 3, 2012-2030) chiefly aim at strengthening energy security, diversifying energy sources, and reducing dependency on imported energy.
- **Transportation sector:** The National Transport Master Plan (2011 – 2015) aims to promote cost-effective modal shift, urban transport development as well as the gateway for regional connectivity.
- **Industrial sector:** The National Industrial Development Master Plan (2012 – 2031) implemented by The Ministry of Industry focuses on sustainable development of Thailand's industrial sectors via various measures including promoting environmentally friendly production.

The Draft Strategic Plan on Climate Change in the Agricultural Sector as well as the National Agricultural Development Plan (2012 – 2016) by the Ministry of Agricultural and Cooperatives highlighted the climate change mitigation aligning with the creation of a low carbon society in the 11th NESDP.

Institutional arrangement related to Climate Change

After ratification of the UNFCCC in 1994, Thailand established a national sub-committee on climate change under the National Environment Board. The sub-committee served as a climate change policy making body and guided Thailand's positions in the climate change negotiation process. In 2007, the sub-committee on climate change was upgraded to become the National Committee on Climate Change Policy chaired by the Prime Minister. The latest institutional framework undertaking climate change policy planning and coordination management within the national framework and in cooperation with multilateral environmental agreements is illustrated in figure below.

Key institutions include:

- 1. National Committee on Climate Change Policy (NCCC)** – Established in 2007 and chaired by the Prime Minister. Comprising of experts and high-level officials from relevant ministries, the Committee formulates and oversees major climate change policies and provides advice on the national positions when contributing to international texts and forums.
- 2. Office of Natural Resource and Environmental Policy and Planning (ONEP)** – Approved by the Cabinet and acknowledged by the Office of the Prime Minister since 2002, the ONEP is established with a mission to develop policy and planning for managing and conserving the natural resources as well as tackling climate change issue in Thailand.

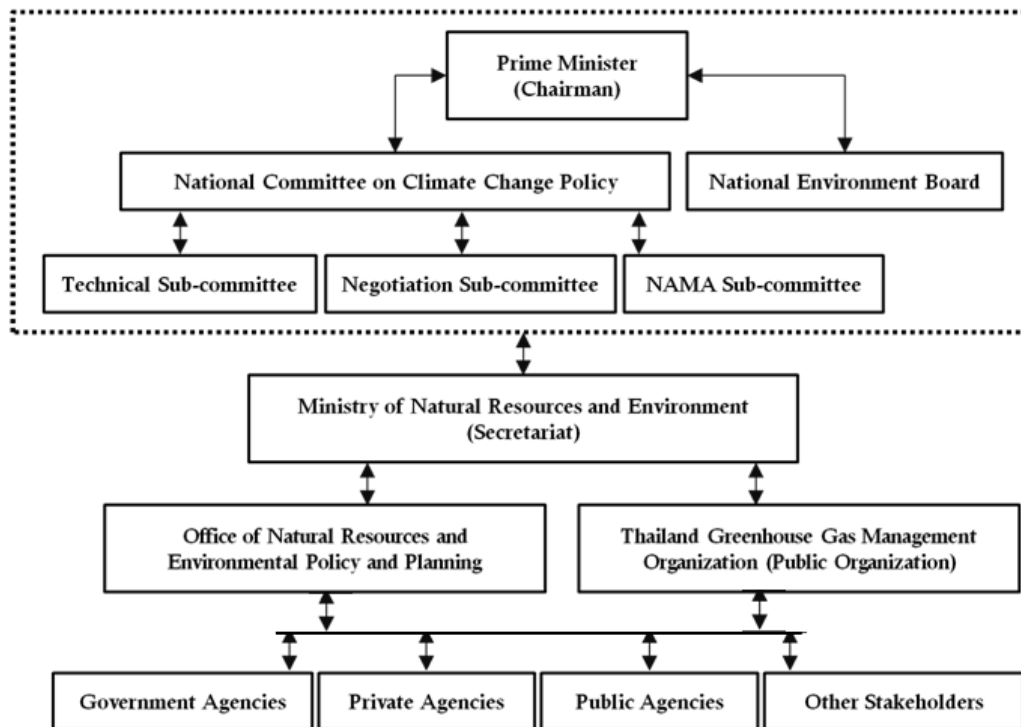


Figure 2: Institutional framework for climate change planning and implementation²

3. **Thailand Greenhouse Gas Management Organization (TGO)** – Established in 2007 as the autonomous governmental organization with a specific purpose as an implementing agency on GHG emission reductions in Thailand. TGO's Members of the Board of Directors comprise of several executive officers from Ministry of Natural Resources and Environment, Ministry of Energy and Ministry of Transport.

TGO is a key organization working on climate change in Thailand and act as the committee and assistant secretariat together with ONEP to the National Committee on Climate Change Policy (NCCC) which has the permanent secretary of MONRE act as the committee and secretariat³.

TGO has been active in promoting CDM, other market instruments and working with international organizations on GHG emission reduction activities and also enhancing the capacity building of the government and private sectors on greenhouse gas management. In addition, TGO act as the National information clearing house of greenhouse gas.

2. Nationally Appropriate Mitigation Actions (NAMAs) pledge

On 14th November 2012, National Committee on Climate Change Policy (NCCC) has set up the Sub-Committee, which has the main responsible for developing of the Nationally Appropriate Mitigation Actions (NAMAs) pledge. Thailand is currently evaluating the Nationally Appropriate Mitigation Actions (NAMAs) with a focus on the energy sector.

² Adapted from ONEP& UNDP, 2010, Thailand's National Capacity Self-Assessment: United Nations Framework Convention on Climate Change.

³ Regulation of Prime Minister's Office on Climate Change (B.E. 2550, 2552, 2554, 2556)

The country evaluated the national potential for NAMAs implementation in the energy sector, through the Asia-Pacific Integrated Model (AIM), developed by the National Institute for Environmental Studies in Japan, to analyze the abatement potential on GHG emission mitigation within the areas of renewable energy, energy efficiency improvement, fuel switching and low carbon technologies.

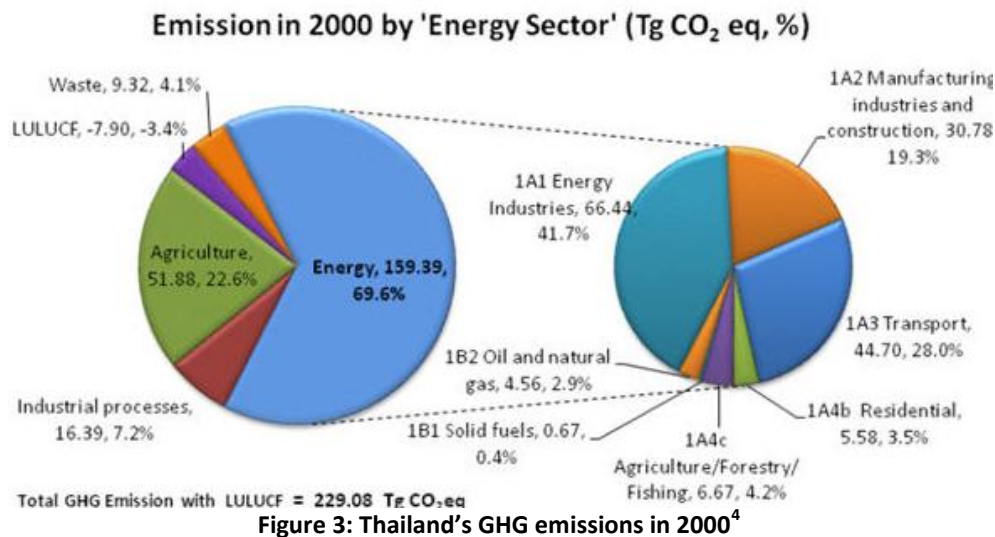
Thailand has not issued any formal pledge for NAMAs implementation. The NAMA pledge is undergoing for approval by the NCCC and then by the cabinet.

The mechanisms developed under PMR, once implemented, can play an important role in helping to achieve target of the forthcoming NAMAs pledge.

3. Historic and projected emissions trends and key drivers of the GHG emissions

Historical GHG emission

Thailand's Second National Communication under the UNFCCC provides information related to the National greenhouse gas inventory for 2000, and shows that Thailand emitted 281 M tCO₂e/yr, with effective reduction of 52 M tCO₂e due to carbon sinks' absorption effects, resulting in a net balance of 229 M tCO₂e/yr (see below figure).



By source of emission, the energy sector represents the most important source, with about 70% of the total amount, followed by agriculture and livestock, which recorded about 23% of the emissions. The remaining 7% was shared among the industrial processes, agriculture, LULUCF and waste management.

The figure shows that energy industries and transport are key drivers, totaling account for almost 70%, of the emissions within the energy sector. In the agricultural sector, rice cultivation is the key driver, accountable for more than 57% within the sector.

According to the SNC, the energy sector emissions vary according to fossil fuel use and pace of

⁴ http://www.tgo.or.th/english/?option=com_content&view=article&id=45&Itemid=37

economic development. For the period 2000-2004, GHG emissions increased at an annual average rate of 6%. Within this sector, CO₂ emissions from power generation, industry and transportation constituted the largest shares, growing steadily.

The emissions generated by the industrial processes showed increasing trends and fluctuations due to economic development, being cement processing the most important emission source in the mineral sub-sector (with emissions increasing over the period except for 2003). On the contrary, chemical and metal production processes produced marginal amounts of GHGs and were not significant to the sector.

Within the agriculture sector, the main sources of GHG emissions come from rice cultivation, livestock, agricultural soils, manure management and field burning. It can be stated that methane emissions related to rice cultivation have remained relatively stable over the years due to limited sets of paddy land, and the same has happened for the field burning. Methane emissions from livestock have increased over time, especially during the period 2000-2004, while emissions derived from manure management have fluctuated partly due to changes in manure management methods.

In the case of land use change and forestry, it is necessary to highlight that both sectors are CO₂ sources and sinks. Due to 1990s aggressive policies to conserve forest areas, CO₂ emissions declined and removals increased. Net emission was converted to net removal in 2000 and, for the period, 2002-2004, emissions and removal trends have remained quite stable.

The waste management sector comprises emissions generated by solid waste landfills, domestic and industrial waste water and solid waste burning. Emissions from this sector tend to increase overtime mainly due to population growth and consumption patterns.

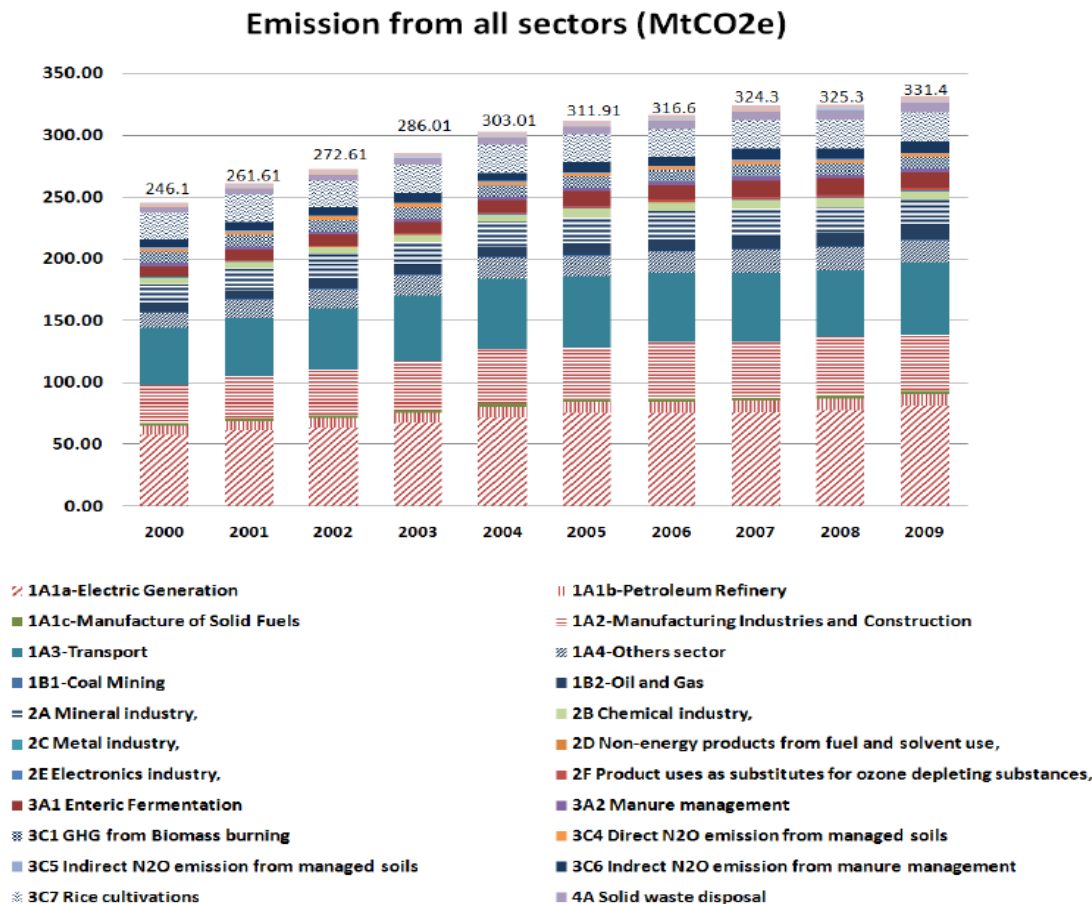


Figure 4: Thailand's GHG emissions in 2000-2009⁵

During the period of 2000-2009, the GHG emissions from all sectors have been increasing at the annual rate of 3.9%. In 2009, the share of the energy sector in GHG emissions was about 68.8%, followed by the agriculture, the industry, and the waste management sector. The growth of GHG emissions from the waste management was the highest at 5.7% per annum while that from the agricultural sector was the smallest at 1.7% per annum. Figure 1-4 shows the emissions from all sectors from 2000-2009.

Projected GHG Emission Trend

Regarding future emission projections, the Joint Graduate School of Energy and Environment (JGSEE) assigned by TGO conducted a research in 2012 to simulate GHG emissions for the period 2012-2050 under 4 scenarios including:

- **Business as usual (BAU)**, considering the annual growth of GDP and population at 4.22% and 0.12% for the period of 2012-2050.
- **Official Policy (OP)**, where the existing measures officially launched by the Government are implemented such as PDP 2010 (Revision 3), Energy Efficiency Development Plan (EEDP), Alternative Energy Development Plan (AEDP), etc.
- **New Policy (NP)**, where both existing, new mitigation measures with technical and financial

⁵ TGO & JGSEE (2012), Final Report on *Projection of Greenhouse Gas Emission and Mitigation and Their Scenario Studies Using Economic Models*.

feasibility are implemented.

- **Stringent Policy (SP)**, where both existing and new mitigation measures with technical and financial feasibility, Nuclear power policy, as well as lab-scale technologies are implemented.

Under different considerations, the total amount of GHG emissions for Thailand in 2050 is valued at: 1,331 M tCO₂e/yr (BAU scenario), 883.5 M tCO₂e/yr (OP scenario), 435.1 M tCO₂e/yr (NP scenario), and 254.6 M tCO₂e/yr (SP scenario).

In BAU scenario, the energy sector continues to represent the most important source of GHG emissions contributing at 76% of the total emissions during the period of 2012-2050, followed by the agricultural, the industrial, and the waste management sectors.

CO₂ eq. emission in the baseline scenario (MtCO₂eq.) : exclude 3B land

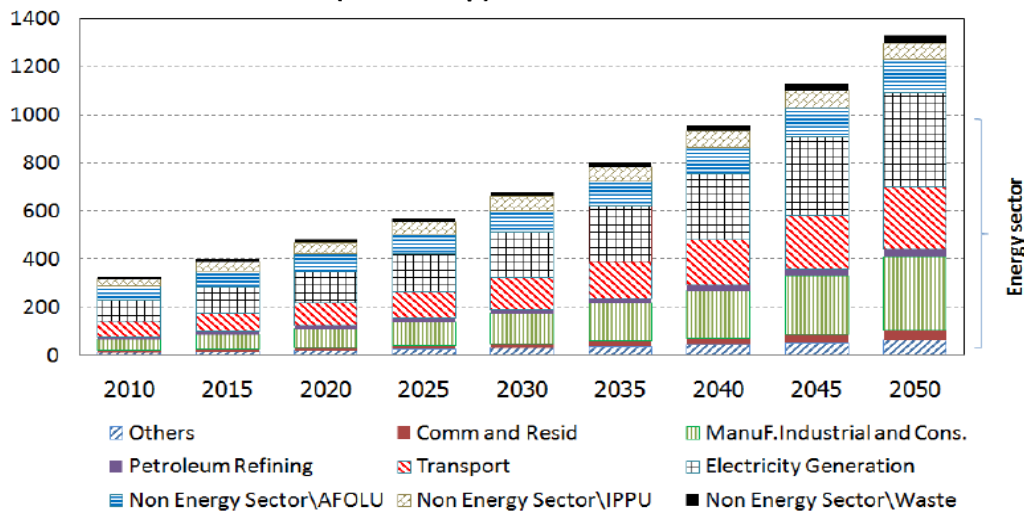


Figure 5: Thailand's GHG emissions 2012-2050 in the baseline scenario⁶

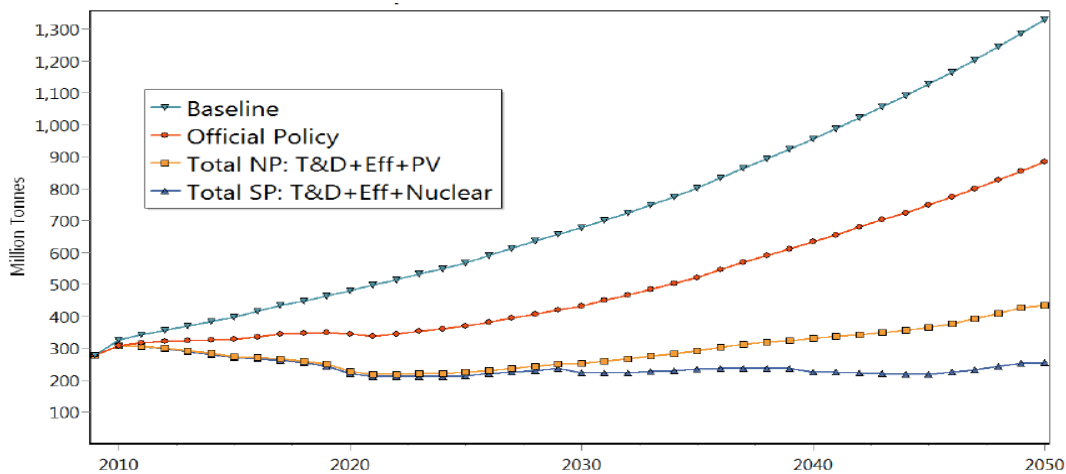


Figure 6: Scenario comparison of Thailand's GHG emissions from 2012-2050

⁶ TGO & JGSEE (2012), Final Report on *Projection of Greenhouse Gas Emission and Mitigation and Their Scenario Studies Using Economic Models*.

4. Mitigation actions and its plan for their implementation

As the importance of energy security and climate change in Thailand has generated more and more attention at national level, there has been increasing investment in terms of GHG mitigation activities in diverse sectors. In general, it can be stated that most actions in terms of GHG emission reduction efforts have been focused on the energy sector in Energy Demand-Side Management (DSM), Renewable Energy (RE) development.

Several initiatives have been developed in the country to fight and mitigate climate change issue.

Energy

- The 20-Year Energy Efficiency Development Plan (EEDP), targeting a 25 percent energy intensity reduction by 2030.
- The 10-Year Alternative Energy Development Plan (AEDP), with alternative energy comprising 25 percent of total energy consumption in 2021.

Agriculture and Forestry

- Encouraging local authorities to enhance carbon sinks through forestation and sustainable forest resource management
- Allocating national budget to establish an information center and satellite systems to track forest cover, land use, and land-use change

Waste

- Developing an incentive scheme to promote electricity generation from waste
- Promoting the “Clean and Green City” initiatives, providing technical assistance to local governments

Thailand Voluntary Emission Reduction Program (T-VER)

Thailand Voluntary Emission Reduction Program, or the so called “T-VER”, is domestic GHG crediting mechanism in Thailand. It is a project-based program like the Clean Development Mechanism (CDM) of the UNFCCC but with simpler methodologies, less transaction cost, and a creditable MRV system. TGO has studied and developed the MRV system, T-VER general guideline, and registry system to set up operational guidelines and manage greenhouse gas reduction projects under the T-VER program.

T-VER program is a domestic carbon offset program using “baseline and credit” approach to calculate GHG emission reduction from an emission reduction project. Under this program, there is no limitation for size of a project and small projects can be bundled and registered as a single project. Gas coverage under the T-VER program comprises of CO₂, CH₄, and N₂O.

It is important to note that the projects under the Low Carbon City Program (LCC), developed by municipalities and communities, would also apply under T-VER for generating the carbon credits (LCC-TVERs).

Currently, the MRV system for T-VER has been developed follow CDM Methodology concept. The T-VER program will be officially launched by the end of 2013.

Thailand Carbon Offsetting Program (T-COP)

With the rise in awareness and concern about the effects of climate change, Thailand Carbon Offsetting Program (T-COP) has been launched in March 2013.

The T-COP is a carbon offsetting program that each participant (i.e. individuals, organizations, products & services, and events) can voluntarily join. It provides a platform for a participant to offset its own carbon footprint (e.g. GHG emissions from individual/event/organizational activities, product life cycles, etc) by contributing money to retire the certified carbon credits (e.g. VCUs, GS, LCC-TVERs, TVERs, etc) under the program. The carbon offsetting is one of the fastest ways to achieve the deepest reductions for individuals and/or businesses and it also often delivers added benefits at the project site, such as employment opportunities, community development programmes and training and education.

The T-COP aims use the contributions from participants for supporting GHG emission reduction activities, especially for domestic projects under the T-VER program. The T-COP is therefore another demand of carbon credits generated under the LCC (LCC-TVERs). The participants in T-COP can choose to support the LCC program by purchasing LCC-TVERs to offset their own carbon footprints.

Partnership for Market Readiness (PMR)

Sharing a view that the market-based instrument is an important tool to mitigate climate change and scale up mitigation efforts, Thailand is currently promoting four initiatives to develop the domestic voluntary carbon market: 1) Thailand Voluntary Emission Reduction (T-VER), 2) Thailand Carbon Offsetting Program (T-COP), 3) Low Carbon City Program (LCC), a crediting mechanism which is a part of T-VER and aim to achieve GHG reductions implemented by municipalities or communities, and 4) Energy Performance Certificate Scheme (EPC), a target and trade scheme to achieve energy efficiency in energy-intensive factories and buildings. The last two initiatives are being proposed in this Market Readiness Proposal (MRP).

The relationship among EPC, LCC, LCC fund, T-VER and T-COP can be shown in the figure below.

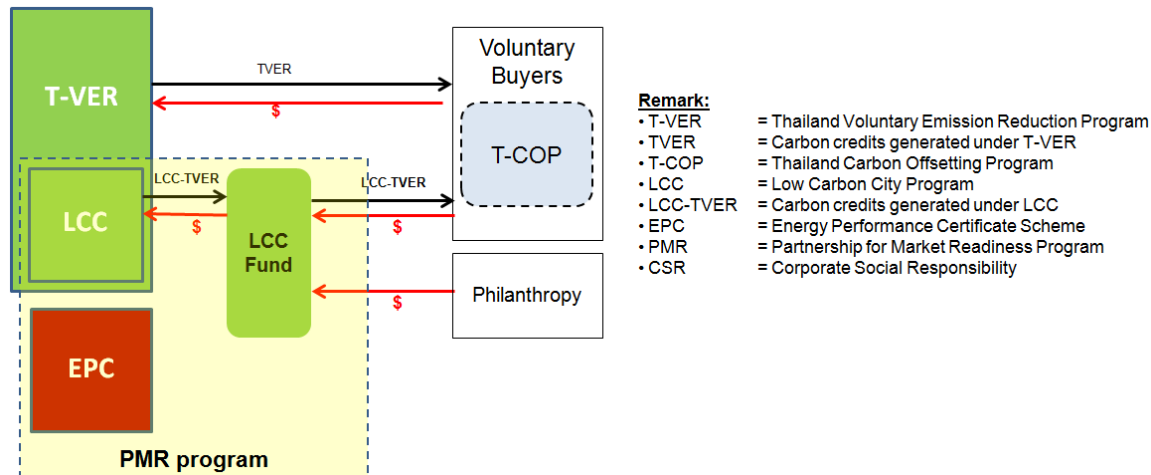


Figure 7: The relationship among EPC, LCC, LCC fund, T-VER and T-COP

Considering this issue seriously, the Memorandum of Understanding (MOU) was signed between Department of Alternative Energy Development and Efficiency (DEDE), Ministry of Energy and Thailand Greenhouse Gas Management Organization (TGO) on 30th November 2012 to provide a mutual agreement in cooperating and implementing the Energy Performance Certificate Scheme (EPC) together. Also, the Thai cabinet has approved Thailand Greenhouse gas Management Organization (TGO) to participate in the Partnership for Market Readiness (PMR) on 15th January 2013 to prepare the market readiness in order to launch the EPC scheme and the LCC program. Regarding to the LCC program, there are at least 8 local municipalities confirming their interest to participate in the program.

During the draft MRP development, TGO organized several stakeholder consultation meetings with Ministry of Energy. Ministry of Finance, local municipalities and private sector, Federation of Thai Industry and The Thai Chamber of Commerce.

5. Carbon market experience

There are currently several initiatives being developed by the public agencies in order to profit from international carbon market experiences to foster GHG emission reduction projects at national level.

Clean Development Mechanism (CDM)

Regarding to the CDM scheme, there is currently a good level of understanding and development by the different public agencies involved in the CDM process. TGO is an autonomous governmental organization with a specific purpose as a CDM-DNA, being the TGO Board the authority to approve CDM projects at national level. There is also a "CDM project approval sub-committee", which is responsible for CDM project screening and providing recommendation on approval for the TGO board of directors.

As of March 2013, TGO has issued Letters of Approval (LoA) for 221 GHG emission reduction projects, which amount to a preliminary annual emission reduction potential of 12,710,309 tCO₂e. From the total amount of projects selected, 53% are related to energy generation through biogas, and 22% to electricity generation using biomass. The remaining amount of

projects comprises areas such as renewable energy generation, sustainable transport, fugitive emission reduction or energy efficiency, among others.

As of June 2013, a total amount of 132 projects have been registered, with an expected annual CER generation capacity valued at 6,331,253 tCO₂e. From this amount of registered projects, 60% refer to energy generation using biogas, while 15% are related to energy generation using biomass. The remaining 25% of projects comprise energy generation through Renewable Energy Sources (RES) (such as hydro, solar or wind), energy efficiency, methane recovery and capture from organic waste and nitrous oxide reduction projects.

International voluntary carbon market

Thailand is also a very dynamic player in the international voluntary markets. According to the Verified Carbon Standard (VCS) project database⁷ (as of June 2013), there are currently 33 projects in Thailand with estimated annual 2,154,723 VCU (tCO₂e). In addition, there are currently 19 projects under the umbrella of the Gold Standard (GS) scheme with estimated annual GHG reduction potential valued at 1,261,399 tCO₂e (as of June 2013)⁸. These projects are mainly focused on the areas of waste water management, biogas generation from waste water treatment and renewable energy generation through biomass.

6. Proposed Activities, Objectives and Budgets

There is no budget request associated to this chapter.

⁷ <https://vcsprojectdatabase2.apx.com/myModule/Interactive.asp?Tab=Projects&a=1&t=1>

⁸ <http://mer.markit.com/br-reg/public/index.jsp?q=Thailand&s=cp>

Chapter 2. The Proposed Programs

The three proposed components under this PMR program are 1) Energy Performance Certificate Scheme (EPC), 2) Low Carbon City Program (LCC) and 3) Low Carbon City Fund (LCC Fund).

This chapter is divided into 4 sub-chapters:

- Chapter 2.1: A vision toward the establishment of the domestic carbon market
- Chapter 2.2: Energy Performance Certificate Scheme (EPC)
- Chapter 2.3: Low Carbon City Program (LCC)
- Chapter 2.4: Low Carbon City Fund (LCC Fund)

Chapter 2.1 presents our vision toward an establishment of the domestic carbon market. It explains the country's necessity and how the proposed components are envisaged to evolve and provide the basis for building Thailand's domestic mandatory scheme in the future.

Chapter 2.2 (EPC), chapter 2.3 (LCC) and chapter 2.4 (LCC Fund) present an assessment and rationale, core readiness components, design and implementation plan of each proposed program. Each chapter covers the contents of the **Building Block 2** (Policy Landscape and Objectives and/or Preparatory Work to Support and Inform Policy Decisions), the **Building Block 3** (Core Market Readiness components) and the **Building Block 4** (Planning for a Market Instrument) of the Tool for Market Readiness Proposal.

Chapter 2.1 A vision toward Mandatory Carbon Market

1. Background and Country's Necessity
2. A vision toward the establishment of Mandatory Carbon Market
3. Proposed Activities and Budgets

1. Background and Country's Necessity

No mandatory target for GHG emission reduction Thailand

Being a Non-Annex 1 country, there is no obligatory push for the Thai government to implement compulsory measures to reduce GHG emissions. The implementation of measures to reduce GHG emissions in Thailand has to depend on and be carried out simultaneously with policies and measures on such aspects as energy, environmental management, agriculture, and economic and social development of the country. Although GHG emission reduction is mentioned in the national development plan or the government policy, it is not stated as an explicit policy or measure to specifically address the GHG issue. In general, GHG emission reduction is merely a by-product of the implementation of measures pursuant to various policies, for instance, energy efficiency improvement and renewable energy promotion chiefly aim at strengthening energy security, diversifying energy types and sources and reducing dependency on imported energy. Consequently, efficient implementation of GHG management could only be met through other variety of policies and measures related to the national economic and social development, agriculture, environmental management and energy must also be implemented efficiently.

Fragmentation of Global Carbon Market

It is a well-recognized fact that GHG emissions can be reduced at most cost-effectively through "market-based" approaches that put a price on carbon.

Several carbon pricing initiatives have been introduced and emerged in various countries, particularly in the non-Annex I parties under the UNFCCC; e.g. pilot Emission Trading Scheme (ETS) in China, Domestic ETS in South Korea, etc. It becomes clear that the global carbon market is fragmented and the climate change mitigation measures will be implemented more and more at the domestic level in coming years (see figure below).

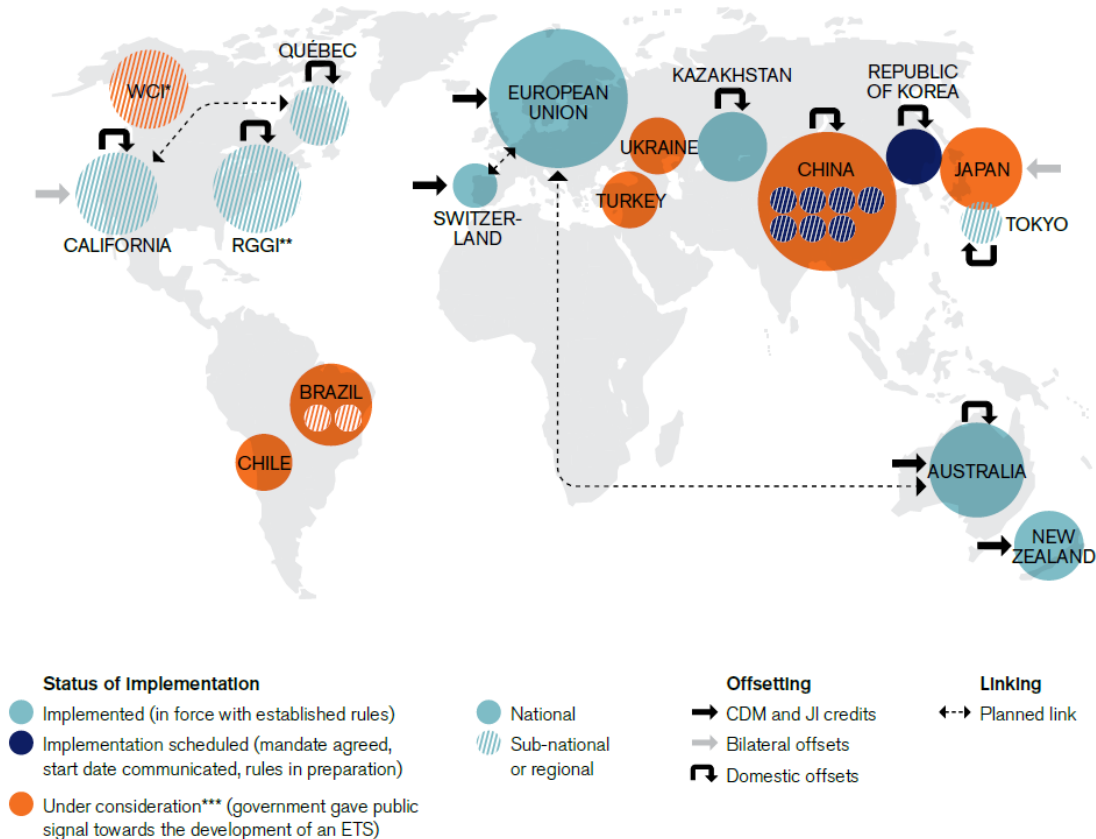


Figure 8: Mapping Carbon Pricing Initiatives, the World Bank (2013)

Thailand shares the above view that establishing the domestic carbon market (with a possible link to other schemes) could be one of cost-effective mitigation tools to flight with climate change problem in coming years.

Establishing voluntary carbon market with a view moving toward mandatory ETS

It is noticeable that a mandatory emission trading scheme can be materialized effectively in countries with a government imposed regulatory mechanism to reduce GHG emissions. Thailand, without any obligatory emission reduction targets, has no legislation requiring national GHG emission reduction.

In principle, the market-based mechanisms for GHG reduction needs to be flexible and aligned with national priorities in order to work. The recent implementation of a variety of carbon pricing schemes around the world illustrates, that to be successful, such initiatives have to be in line with national priorities and, in particular, national economic priorities. New schemes benefit from the lessons learned under earlier schemes.

Most market-based mechanisms in place or being planned involve a staged approach, allowing for the gradual introduction of a scheme with consecutive compliance periods or using piloting approaches. Schemes that allow learning can also adjust themselves better to changes in the economy and national priorities.

Thailand shares this fundamental and plans to establish and operate the voluntary market-based schemes aiming to build capacity and readiness components for Thailand to be ready for the mandatory scheme in the future.

2. A vision toward the establishment of Mandatory Carbon Market

With a view to establish a mandatory domestic carbon market, Thailand has considered to establish both Emission Trading Scheme and GHG crediting mechanism.

- **Emission Trading Scheme:** Considering Thailand's policy context and landscape illustrated in the policy mapping, the ***energy efficiency trading should be introduced as an initial stage*** since the energy sector is the largest GHG emitter and the Thai Government has made substantial efforts to promote energy efficiency (EE). Despite the policy frameworks and financing mechanisms that the government has put in place to promote EE in Thailand, energy efficiency improvements continue to face challenges. Thus, to achieve the most ambitious target of energy efficiency improvement the country has set so far, innovative measures are required in addition to the existing voluntary measures and input-based approaches used in the past which may have exhausted their potential to incentivize energy savings. Measures which are more market-oriented and output-based are needed to harvest large potential of energy efficiency improvement particularly in the industrial sector which saw little improvement in energy intensity in the last decade. Market-based instruments could incentivize large energy consumers to set their energy conservation targets and over-perform in order to be rewarded. Actual energy savings will directly contribute to EEDP. Moreover, the market readiness activities will also support EEDP by preparing institutional infrastructure (e.g. baseline data, MRV, policy tracking) that will also enhance the policy effectiveness of EEDP. It will also help prepare large energy consumers to be ready for mandates (whether it be energy-based or emission-based) in the future.
- **GHG crediting mechanism:** An offsetting mechanism can be introduced for the **development of low carbon activities in municipalities and communities** since the country, according to the 11th NESDP, is moving towards a low carbon society and it is essential to prepare the readiness of the local authorities who play significant roles in local development and planning. Although the progress of AEDP is largely on track with substantial private investments in renewable energy projects, there is a greater role for local municipalities to play in renewable energy development especially waste-to-energy projects (for solid waste and wastewater), smaller-scale or community-level renewable energy projects, fuel-switching in public vehicles, and etc. On the other hand, while there is a keen interest to promote low-carbon city nation-wide with efforts by various agencies including NESDB, TGO, and the Ministry of Energy to develop national policy and guidelines on low-carbon city and pilot low-carbon city projects in selected municipalities, the low-carbon city policy is still in an early stage of development. Key challenges which prevent local authorities to implement low-carbon city initiatives include limited technical capacity of local authorities to plan, design and implement low-carbon projects, as well as limited financial capacity to raise fund or secure budget to finance capital investment, and operation and maintenance of these projects.

Considering Thailand's priorities and readiness, the Energy Performance Certificate Scheme (EPC), Low Carbon City Program (LCC) and Low Carbon City Fund (LCC Fund) are proposed.

The EPC scheme aims to build market readiness components in energy and manufacturing sectors, major GHG emitters, to be the foundation for establishing the future emission reduction trading scheme in Thailand. The EPC is a target-and-trade scheme designed to enhance energy efficiency and GHG emission reduction and to support achieving the national goal of energy intensity reduction by 25% in 2030, relative to the specific energy consumption levels in 2010. The expected target groups are highly energy-intensive industrial units and commercial buildings. Each of the EPC participants will have the specific energy consumption (SEC) reduction target expressed in "ton of oil equivalent (toe) per unit of product" (e.g. for power production: toe/kWh). The EPC scheme is also designed to improve data accuracy to set energy consumption standards and put in place effective monitoring system which are lacking in the current energy promotional regime. The activities to help set the energy consumption baseline and performance targets and MRV standards will significantly improve effectiveness of the current policy regime.

The LCC program aims to support achieving the national goal to shift towards a low carbon society by implementing greenhouse gas emission reduction activities in municipalities and communities. "Low Carbon City" refers to a province, city, municipality, or community that pursues a systematic process to achieve GHG emission reductions. The projects under the LCC Program, developed by municipalities and communities, will apply the Thailand Voluntary Emission Reduction Program (T-VER) for certifying and issuing carbon credits, TVER credits, generated under the LCC program (LCC-TVER). The LCC-TVER credits can be used for offsetting carbon footprints in voluntary market, and once the domestic emission trading scheme in Thailand established, the LCC-TVER credits will be eligible for compliance purpose in the scheme.

The LCC Fund is a carbon fund to be established to support the development of GHG emission reduction projects under the LCC program. The LCC fund are designed to deliver carbon finance and comprehensive technical support to local municipalities and communities to enhance the quality of emission reduction projects and thereby increase market confidence in financing LCC projects. It is also expected to provide credit guarantee to financial institutions in order to bridge the debt financing gap for funding LCC projects.

Although, under the PMR program, the EPC scheme and the LCC program are not designed to link together, the EPC scheme aims to expand and transform into the Emission Trading Scheme (ETS), while the LCC program aims to expand to cover all municipalities and to generate eligible credits for compliance purpose under the ETS by 2026 (see figure).

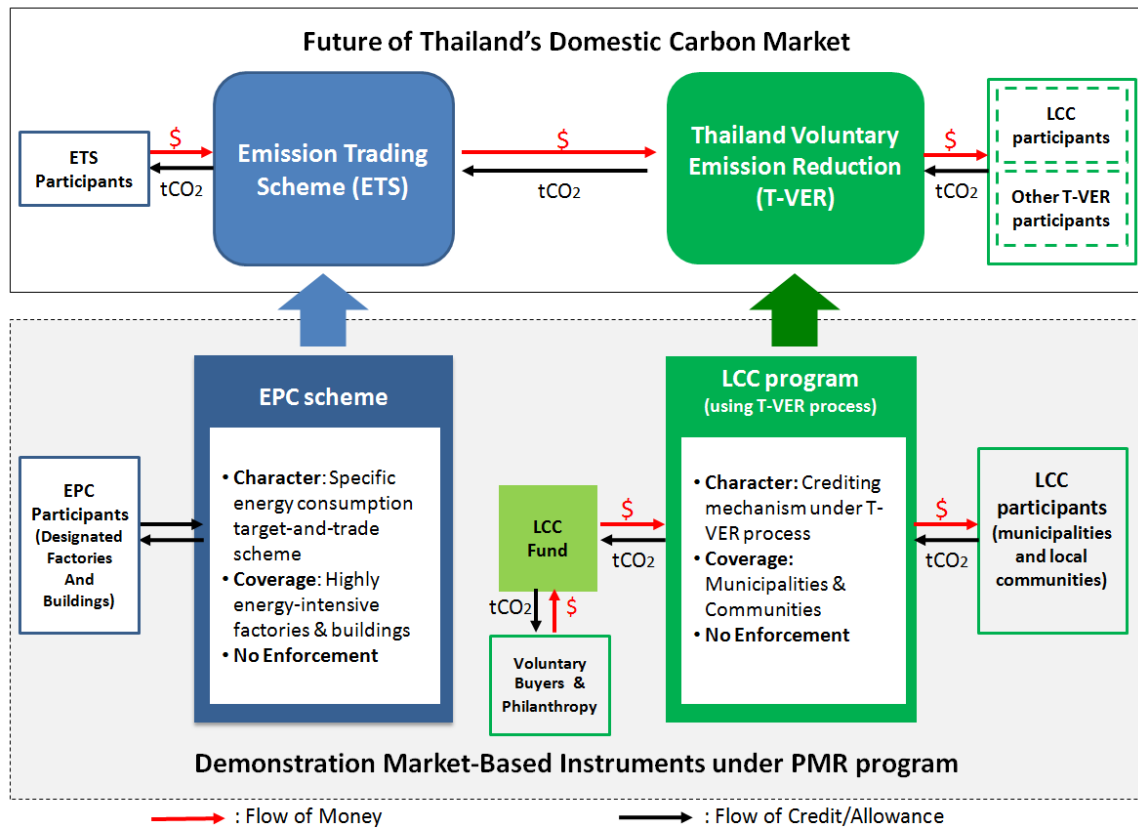


Figure 9 a plan toward Thailand Domestic Carbon Market

The Thai cabinet has considered the PMR program with important and has approved TGO to participate the program by proposing the EPC and the LCC. This shows the support from Thai government in pursuing toward this direction. In addition, the Memorandum of Understanding (MOU) was signed between DEDE and TGO to provide a mutual agreement in cooperating and implementing the EPC scheme together.

In sum, there is a strong rationale for the country to consider adopting market-based instruments to implement cost-effective emission reductions nation-wide in the long-run. Thus, it will be vital to prepare the market players in both private and public sectors to build technical knowledge, lay down institutional and legal infrastructure, and gain broad-based public acceptance before launching full-fledged mandatory schemes in the future. In the short-term, these market readiness efforts will help incubate and develop voluntary domestic markets. Under the targeted scope of PMR activities, the market-based instruments are expected to help fill in existing policy and implementation gaps in the current national priorities of EE, RE and low-carbon city and accelerate the implementation of these three national priorities. The EPC scheme, apart from resulting in energy saving, would lead to strengthened institutional, legal, registry and domestic MRV system so that a mandatory ETS can be established and implemented at the later stage. The LCC program, apart from resulting in GHG emission reduction and generating co-benefits to municipalities and local communities, would provide a basis for building a credible and active domestic GHG crediting mechanism.

3. Proposed Activities, Objectives and Budgets

Objective: To move toward an establishment and operation of mandatory emission trading scheme (ETS), Thailand need a proper legal framework. In principle, the legal framework shall be developed with basic rules to provide institutional safeguards for emission trading and ensure a fair, open and equitable market.

Although the EPC scheme aims to expand and transform into the Emission Trading Scheme (ETS) by 2026, the study to propose the legal framework for establishing the ETS in Thailand should be started as soon as possible.

There will be a need to amend certain provisions of the existing law in order to accommodate the authority in launching and operating the ETS. This requires tremendous time not only to prepare the legal framework but also to gain acceptance from relevant stakeholders and finally be approved by the Parliament.

Proposed Activities

1. To study the legislative practices in overseas emission trading schemes (e.g. EU ETS, China ETS, Korea, ETS etc) and to research the legal nature of the legislative package for establishing the ETS and present the basis legal system required for establishing ETS in Thailand.

Activities and proposed budget:

Section	Activity	Time Required (months)	Estimated budget requirement (Million USD)	Year of funding required
ETS preparation			0.20	
Legal Framework	1. A study to propose the legal framework for establishing the ETS in Thailand	24	0.20	2014-16

Chapter 2.2 Energy Performace Ceritificate Scheme (EPC)

1. Assessment and Rationale for establishing the EPC scheme
2. Design of the Energy Performace Ceritificate Scheme scheme
3. Proposed Activities, Objectives and Budgets

The EPC scheme aims to build market readiness components in energy and manufacturing sectors, major GHG emitters, to be the foundation for establishing the future emission reduction trading scheme in Thailand. The EPC is a target-and-trade scheme designed to enhance energy efficiency and GHG emission reduction and to support achieving the national goal of energy intensity reduction by 25% in 2030, relative to the specific energy consumption levels in 2010. The expected target groups are highly energy-intensive industrial units and commercial buildings. Each of the EPC participants will have the specific energy consumption (SEC) reduction target expressed in “ton of oil equivalent (toe) per unit of product” (e.g. for power production: toe/kWh). The EPC scheme is also designed to improve data accuracy to set energy consumption standards and put in place effective monitoring system which are lacking in the current energy promotional regime. The activities to help set the energy consumption baseline and performance targets and MRV standards will significantly improve effectiveness of the current policy regime.

Over the years, many countries have come forward with market based mechanisms to accelerate the implementation of Energy Efficiency measures in a cost-effective way. The Perform, Achieve & Trade (PAT) scheme of India, CRC energy efficiency scheme and Climate Change Agreement scheme of UK, Top 1000 energy consuming enterprise program of China are a few good examples which have been very successful or are expected to bring the desired results in the near future. Such innovative schemes not only result in enhanced energy efficiency and GHG emission reductions, but also create an environment that fosters competitiveness, technology transfer, institutional capabilities, research and development, and inclusive growth in the economy.

The EPC scheme will primarily focus on improving Energy Efficiency of energy intensive manufacturing sectors and commercial buildings in Thailand. The conceptual design of the EPC scheme has been reviewed after careful analysis of various scenarios, trends, and future energy policy of the Thai Government and discussion with several stakeholders.

Chapter 2.2 EPC

1. Assessment and Rationale for establishing the EPC scheme

- i. Background
- ii. Existing relevant policies and political tools
- iii. The outline and rationale of the EPC
- iv. How the EPC would evolve into the ETS

i. Background

In foreign countries, there are a number of measures to promote energy efficiency improvement, i.e. provision of incentives or financial support in various forms, mandatory establishment of a target or quota of energy saving/energy efficiency improvement (Energy Efficiency Portfolio) – this mandatory measure has led to the emergence of a trading market of energy-saving units achieved, or Energy Efficiency Certificate, between those who fail to meet the saving target and those who has achieved energy saving in excess of the specified quota. The amount of energy saving achieved, which has added value from such trading, has brought about a higher rate of return on investment, and thus shortening the payback period for energy efficiency improvement project.

As for the energy efficiency improvement in Thailand, although there are numerous measures providing financial incentives similar to those in other countries, the creation of a market system for energy-saving unit trading cannot yet be materialized due to lack of mandatory measures to push ahead the implementation. In addition, in providing financial support, there is no requirement for measurement, reporting and verifying (MRV) of the actual energy-saving outcome, which has prevented the government from obtaining accurate assessment of cost-effectiveness of the supportive measures. Therefore, the MRV system development that does not create a burden on entrepreneurs is essential as it will help the government to efficiently manage energy policy. The MRV system needed for verifying the EPC amount can be developed automatically. Entrepreneurs will gain additional income from selling the surplus of EPC units after having deducted the MRV cost.

In 2011, final commercial energy consumption in Thailand was at 61,370 kiloton oil equivalent (ktoe). The shares of energy consumption in the transport, industrial, household, and other sectors were 36%, 36%, 22% and 6%, respectively. Considering energy efficiency in each consumer sector, based on the energy intensity, it is found that during 1991-2010 energy efficiency in the transport sector had continuously improved, having the energy intensity reduced from 72.7 toe/MB (ton oil equivalent per million baht) to 58.2 toe/MB; this resulted from continuously upgraded vehicle standards. However, when considering the energy intensity of the Thai industrial sector during the past decade, it remained at 12.1 toe/MB, which indicated that energy efficiency in the industrial sector had not been significantly improved. The Ministry of Energy then recognized the necessity to improve energy efficiency; as a result, the 20-year Energy Efficiency Development Plan (EEDP) has been established.

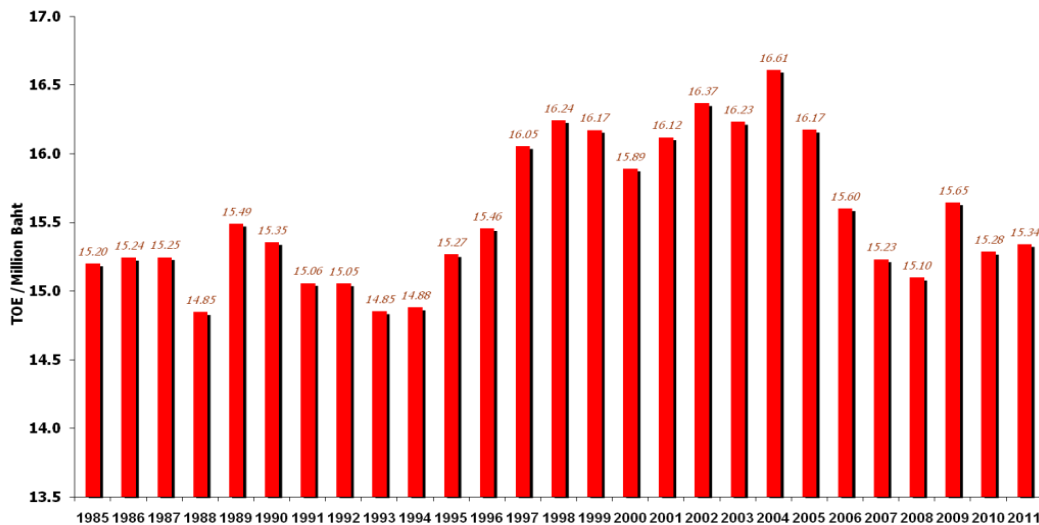
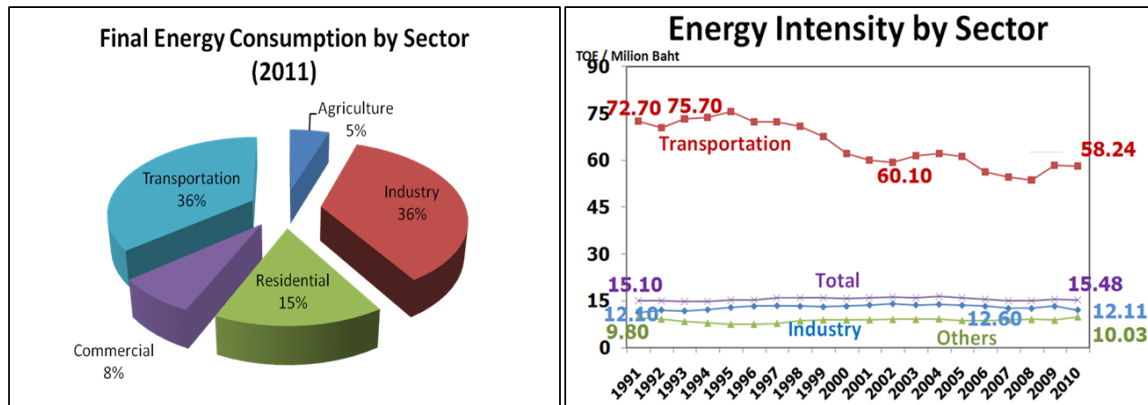


Figure 10: Thailand's Energy intensity 1985-2011 (source EPPO, 2013)

Figure 10 shows that although the Thai Government has implemented various measures to promote EE for decades, the energy intensity of the country has not improved significantly and the past achievement has not been substantial as intent. Despite the formulation of an action plan with definite strategies, the MOEN still faces a number of challenges to achieve EEDP's target. Such challenges include:

- Lack of continuous monitoring systems and verification standards for energy savings despite the government support:** About THB 2,000 million (USD 70 million) has been spent every year to provide financial supports for various energy conservation programs. Most types of the financial supports have been provided at the first year of installation and the measurement of energy savings was conducted only in the first year. This has hindered the MOEN in evaluating the continued effectiveness of those supportive measures and in obtaining the information about the actual energy saving achieved. Therefore, the development of management systems as well as management tools, e.g. the development of an energy consumption database and the reporting, verification and assessment systems, is one of its key success factor.
- Lack of mandatory targets on energy performance:** Many EE measures are already financially viable for investors at current prices, yet are not fully realized due to many market

failures and barriers. In particular, adopting EE measures in the building, industry, and transport sectors is a function of the preferences of, and requires action by, many decentralized individuals, energy demand is less responsive to price signals, and regulations tend to be more effective. To achieve the national energy savings targets, **mandatory specific enterprise energy saving or energy performance targets for top energy-intensive enterprises can be a more effective policy option particularly when combined with penalties for noncompliance and financial incentives for exceeding the target.**⁹ Although the ENCON Act allows the MOEN to stipulate energy performance standards, criteria and methods for large energy consumers defined as Designated Factories and Designated Buildings (DF&Bs) as well as the penalties for those who fail to comply with, the current mandates cover only reporting energy consumption, establishing energy management target and plan, appointing personnel responsible for energy, and conducting energy audits. The key barrier for setting mandatory targets on energy performance is that existing data are insufficient, unsystematic, and lacks of a data verification standard.

- **Limited awareness and information:** Consumers have limited information on EE costs, benefits and technologies. Moreover, many energy service companies (ESCOs) in Thailand, which have been promoted to provide a broad range of comprehensive energy solutions, are not publicly recognized and also less qualified energy service companies exist. Although there is an ESCO registration system supervised by the Institute of Industrial Energy under the Federation of Thai Industries (FTI), no close monitoring on the ESCOs' performances has been conducted; as a result, some ESCOs cannot guarantee energy savings throughout the payback period.
- **Capped amount of financial support for each facility:** Various forms of financial instruments including subsidies, soft loans, tax incentives as well as venture capital have been adopted for EE; however, all of the instruments have criteria to limit the amount of financial support for each facility. Mostly this mainly encourages small-scale project investments.

ii. Existing relevant policies and political tools

Energy Conservation Promotion Act (ENCON Act)

Thailand's Energy Conservation Promotion Act (ENCON Act) has been in place since 1992. The objectives of the Act are to promote energy-efficient production and consumption, to promote the production of energy-efficient equipment and machinery and to promote concrete energy conservation and renewable energy development by providing financial support for implementing such a program. Under the Act, the Energy Conservation Promotion Fund is established and supervised by the Energy Conservation Promotion Fund Committee. The Fund is a financial tool to promote and support the undertaking of energy conservation measures and renewable energy development.

The Act also contains compulsory provisions, setting the duty for designated buildings and designated factories to comply with. Pursuant to the law, designated buildings and factories are determined according to type of energy consumption by one of the following three types: having installed power meter with a capacity of no less than 1,000 kW, having a total transformer capacity of no less than 1,175 kVA, or having annual energy consumption more

⁹ The World Bank Group & Office of National Economic and Social Development Board (NESDB) (2011) "Thailand: Clean Energy for Green Low-Carbon Growth". Retrieved from <http://www-wds.worldbank.org>

than 20 million mega-joules. Owner of a designated building and designated factory shall have major duties to conserve energy, including implementing energy conservation in accordance with specified standards, establishing an energy conservation target and plan of the facility for submission to DEDE, and auditing and analyzing the implementation of energy conservation plan to achieve the established target.

The Thai government gave a lead time for designated facility owners to get prepared for compliance to the Act, by not mandating specific standards of energy conservation or of energy efficiency as the duty of designated factories or buildings. Later, with the promulgation of the Energy Efficiency Development Plan (2011-2030) to be implemented in the next 20 years, measures have been introduced by providing financial incentive.

The 20-Year Energy Efficiency Development Plan

The 20-year Energy Efficiency Development Plan (EEDP), implemented during 2011-2030 by the Ministry of Energy (MOEN), aims **to promote** the reduction of energy intensity by 25% in 2030 compared with that in 2010 (23.5% of final energy consumption in 2030 or saving at an average of 38,200 kilo ton of oil equivalent (ktoe) per year and cumulative CO₂ emission reductions at an average of 126 M tCO₂/year).

It is targeted that the energy consumption reduction in the industry sector is the highest, followed by transportation, large commercial building, and small commercial and residential building. (Figure 11) The MOEN plans to use a mix of compulsory and voluntary measures to achieve the target. Policy instruments will include strengthening regulations and enforcement and intensifying the use of price and market incentives and raising public awareness. The main tool for the implementation of such measures is the Energy Conservation Promotion Act (ENCON Act), in place since 1992, empowering the MOEN to set up compulsory measures for large energy consumers as well as to provide financial support on energy conservation activities through the Energy Conservation Promotion Fund (ENCON Fund).

Strategies to Achieve the Targets are as follows:

- Strategy 1: **The application of combined measures, i.e. mandatory measures via rules, regulations and standards; and promotional and supportive measures via incentive provision.**
- Strategy 2: The introduction of measures which will bring about a wide impact in terms of awareness raising and change in energy consumption behavior of energy consumers, including decision making behavior of business operators, as well as market transformation, by incorporating innovations into awareness raising campaigns and public relations activities, for example, the interrelationship between energy conservation and environmental protection as well as global warming alleviation.
- Strategy 3: Potential and important role of the private sector in the public private partnership to promote and implement energy conservation measures.
- Strategy 4: Distribution of energy conservation promotion work to public and private agencies/organizations which are readily equipped with resources and expertise, such as power utilities and industrial associations, with backup support from the Ministry of Energy.

- Strategy 5: The use of professionals and Energy Services Companies (ESCO) as an important tool to provide consultancy and to implement energy conservation measures in which the use of more advanced technology is involved.
- Strategy 6: Increase in self-reliance on indigenously developed technology to reduce technological costs and to increase access to energy efficiency technology, including promotion of highly energy efficient product manufacturing businesses.

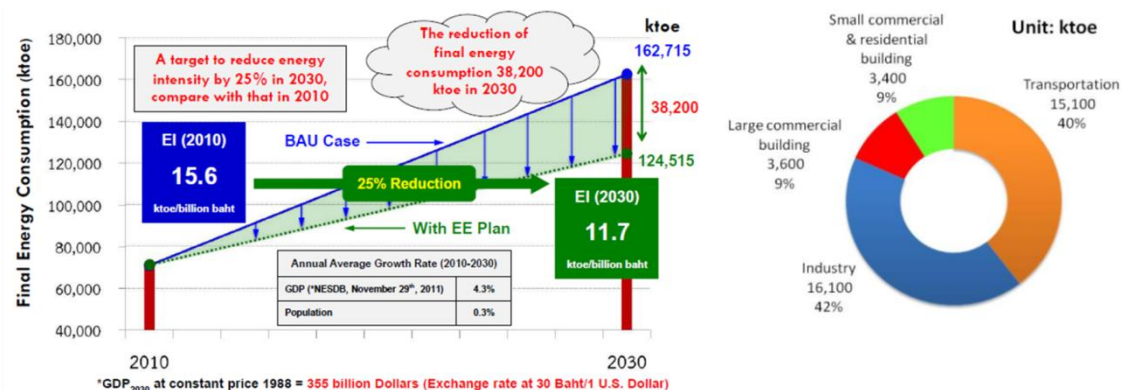


Figure 11: Target of the 20-year Energy Efficiency Development Plan (EEDP), EEPO 2013

Financial Incentives to support EE development

Since the establishment of the Energy Conservation Promotion Fund in 1995, financial incentives have been used as an important measure to support energy efficiency projects. Current financial incentive types used for supporting energy efficiency projects comprise the following:

- **Revolving Fund:** Providing soft loans (at a low interest rate) through commercial banks to boost energy efficiency investment
- **Tax Incentive:** Providing tax rebate based on either investment cost or performance
- **20% Investment Subsidy:** Providing 20% investment subsidy to specific energy efficiency investment
- **DSM Bidding:** Providing subsidy based on actual units of energy saving achieved in a year via bidding mechanism (i.e. the company requesting the lowest weighted subsidy will be subsidized first)
- **ESCO Venture Capital Fund:** Promote energy efficiency and renewable energy investment through various measures, including equity investment and equipment leasing.

In implementing all of the above-mentioned financial incentive measures, except the DSM Bidding, the Ministry of Energy has not set up any monitoring system and reporting of actual energy saving outcome through a standard method to avoid additional cost of M&V. This has hindered the Ministry of Energy in evaluating the effectiveness of those supportive measures and in obtaining the information about the actual energy saving achieved. As for the DSM Bidding measure, a standard monitoring system has been established to measure and verify the actual saving achieved in a year because the subsidy will be provided based on the actual units of energy saved.

iii. The outline and rationale of the EPC

The Final Energy Consumption by Economic Sectors of Thailand shows that the Industrial sectors constitute the maximum share followed by transportation and buildings. Both building and industrial sectors together contribute over 75% share of GDP with about 60% share in final energy consumption. As the economy is growing in Thailand, it is also expected that manufacturing (hence industry sector) and building sector would continue to be the major energy consuming sectors due to aggressive commercial activities in the coming years.

From the supply side, the energy sector i.e. the electricity generation from power plants and the petroleum refineries consume a huge amount of primary energy. The electricity generation is primarily coming from thermal power plants (hence combustion of fossil fuel) which consume about 85% of total input energy in the supply side. This shows a clear concern about the GHG emission from energy sector. From the Second National Communication, the reported national net GHG emissions in 2000 totaled 229.1 M tCO₂e. It may be noted that emissions were primarily dominated by the energy sector, which is responsible for about 70% of total emissions. At the same time, the emissions from industrial processes stood at 16.39 M tCO₂e (i.e. about 7.2%). That means the energy sector and the industrial processes (precisely manufacturing sector) contribute over 77% of total GHG emission.

The energy end users like manufacturing and building sectors consume various forms of energy (primary and secondary) to produce end-product or have comfort respectively. As the economic activities go on, the absolute energy consumption would also rise. Now, Thailand has set goal of reducing 25% in energy intensity by 2030 from the base year which estimates a saving target of 16,257 ktoe and 3,630 ktoe by 2030 from industry and large commercial building sector respectively. This implies that the industries and buildings will have to reduce their energy intensity at about 2.1 % per year. Traditionally, as per practices across the region, industries are reducing their energy intensity of their own by about 0.5 to 1.5% every year with implementation of energy efficiency and conservation measures. The same may be the case in Thailand also. As of now, there is no policy which defines target to reduce energy intensity for any industry. ***So, a policy push is required to accelerate the yearly reduction in energy intensity in a time bound manner which can ensure the national goal by 2030.***

Setting a target reduction of energy intensity in industrial and building sector within a time frame may be one of the initiatives to accelerate the energy efficiency program of the country. The sectors will have to take action / measures to achieve the target which may require investment at their part. Few industries/buildings may achieve more than the set target and few may not. For those who can achieve more than the target will have the surplus of energy consumption allowance and therefore can sell it to the sink fund. This is a performance incentive based to promote the industries/buildings to be more efficient in energy consumption. Hence, this will create a market-based approach to attract the investment by the sector. This seems to give a double benefit to the industries/buildings, as (1) energy efficiency would result in less energy bill and (2) additional revenue may be generated by selling the surplus of energy consumption allowance. The nation will also be benefited by overall energy saving and resulting reduction in GHG emission.

Apart from this the following consultations at different levels and stakeholders have been taken up by TGO to see the benefit of the scheme.

- (i) **Extensive Working Sessions with DEDE, Ministry of Energy:** DEDE has already formulated the 20-year energy plan (EEDP) and draft Energy Efficiency Action Plan (EEAP). It is highly believed that such a scheme would definitely augment the other existing initiatives by government to achieve the national goal by 2030. However, there may be requirement of certain regulatory and institutional mechanisms in place.
- (ii) **Discussion with Industry Associations:** As per the number of consultation with industry stakeholders, Thai industry believes that this scheme would infuse competitiveness among themselves in achieving energy efficiency. However, they may require technical support (in identifying energy saving potential, energy efficient technology and technology providers) and financial support (in the form of soft loans, subsidies, tax benefits etc.).
- (iii) **Discussion with Ministry of Finance:** Ministry of Finance has been appraised of the proposed scheme and possible financial support that may be required to prepare and operationalize the scheme.
- (iv) **Consultation with Indian experts on PAT Scheme:** TGO had organized workshop where Indian expert from Bureau of Energy Efficiency, India had presented the various aspects of PAT scheme. The lesson learnt and experience of successful launch of PAT scheme in India is very much helpful in conceptualizing a similar scheme in Thailand.

In summary, there is a clear agreement and in-principle consent by various stakeholders like Government departments, industries, building authorities, experts, and industry associations etc. to have such innovative scheme that will be driven by market conditions. It is viewed that there is a solid demand / requirement of a performance based and trading system in Thailand because of the following:

- This will drive energy efficiency in energy intensive manufacturing, building and energy sector in a cost-effective manner
- This will promote technology transfer and adoption of energy efficient best practices
- This will create job opportunities of energy professionals at different levels
- This will infuse more fiscal transactions by bankers or financial institutions by lending fund to deserving factories/building who takes initiatives in implementing the energy efficiency projects.
- This will pave way for linking with other climate change mitigation schemes , hence creation of a wider market for emission trading

Therefore, considering the above points, **Energy Performance Certificate (EPC)** scheme is one such measure that will complement the already envisaged activities under the plan as it will set energy consumption reduction target for energy consuming factories and buildings while attracting participation from industries to implement energy conservation measures through the market component of the scheme. The basic aim of such programs is to reward the efforts (implementation of energy conservation measures) of those participants who over-achieve their targets. Thailand under its long term plans for energy conservation aims to target energy intensive industries and large scale enterprises through several regulatory, financial, technical and market mechanisms. EPC Scheme if targeted towards large and energy intensive sectors will

help Thailand in accelerating energy efficiency initiatives and contribute towards climate change mitigations.

Interaction of EPC scheme with other policy instruments

From a policy perspective, energy policy instruments in Thailand are established as the promotional policy. As a result, the establishment of EPC scheme would not only work well with other policy instruments (e.g. EEDP, ENCON Act, etc), but also enhance and fill in the implementation gaps of the existing instruments.

The successful implementation of the EPC scheme will support EEDP in various aspects. Firstly, the actual energy savings from the program will contribute to 3.6% of the national targets. The EPC scheme is also designed to improve data accuracy to set energy consumption standards and put in place effective monitoring system which are lacking in the current energy promotional regime. The activities to help set the energy consumption baseline and performance targets and MRV standards will significantly improve effectiveness of the current policy regime.

A standard MRV system developed from the EPC scheme can bridge the data gaps and allows the establishment of mandatory specific enterprise energy savings or energy performance targets with penalties for noncompliance as stipulated in the ENCON Act. It is also presumed that the MRV cost will be diminishing, and it becomes viable to add MRV system in any promotional measures launched by the MOEN. This will provide the MOEN tools for evaluating the effectiveness of its measures in promoting energy efficiency.

The MOEN will benefit from the experiment using market-based mechanisms, which will provide even more encouragement on investing in energy efficiency improvement. Also, a number of best practices can be addressed and showcased to the public to encourage the awareness on energy savings. Ultimately, the country will benefit from cost savings through reducing energy, which helps lowering energy imports, and through postponement of the investment costs of building additional power plants.

The outcome from the implementation of EPC scheme will be basis to design and build the domestic emission trading scheme in the future.

Please note that at this stage, the EPC has no relationship with the LCC program, LCC fund, T-VER program or T-COP (see Figure 7).

iv. How the EPC would evolve into the ETS

International experience suggests that energy trading/emission scheme should be mandatory to ensure participation and achieve the objective. However, the EPC scheme, if launched mandatory, would require a number of issues to be addressed in terms of data availability, data authenticity, human resource requirement, institutional arrangement, legal provisions, financial arrangements, most importantly the acceptance of all relevant stakeholders, before the EPC scheme is announced as a mandatory scheme. By consulting with DEDE and industry association made it clear that Thailand, with its present institutional, regulatory and administrative set-up would find it extremely difficult to start the scheme as mandatory. Thailand, for the PMR therefore, proposes the EPC scheme to be rolled into a voluntary scheme initially with due preparation. The objective of voluntary nature of the scheme is to establish a robust

institutional, procedural and legal platform which would be very useful in the long run when the scheme is made mandatory.

Also, to launch the EPC scheme voluntary and make it successful, there must be a good preparation by the Thai government in the following areas:

- *Institutional Preparedness* : Scheme administration, facilitation, monitoring, data management, financial and technical support
- *Technical Preparedness* : Data, baseline and target setting methodology, MRV system, database system
- *Human Resource Preparedness* : Verifiers, Energy Auditors
- *Legal Preparedness*

These preparedness and readiness components will be a fundamental and basis for Thailand to expand and build the ETS in the future.

It is therefore necessary that Thailand should be fully prepared in all above aspects before launching the voluntary EPC scheme. So, in this PMR proposal, a phased approach for the EPC scheme is proposed as per the following:

2014-2016: EPC Preparation Phase

Objective: This phase would focus on the detail assessment of the various preparedness level, identify and bridge the gaps, develop methodology and procedures, establish MRV system and develop detail operational guidelines of EPC scheme, convince all stakeholders regarding the scheme.

Activity Areas: The broad activities would range from feasibility studies, stakeholder consultations, data compilation & analysis, capacity building etc.

2017-2019: EPC Demonstration Phase

Objective: This phase would focus on launching the scheme on a demonstration basis where the design framework of the EPC scheme will be tested. The learning and gaps (if any) will be the key take away of the demonstration scheme to take necessary corrective action for launching a mandatory ETS system in the future.

Activity Areas: The broad activities would range from technical and financial support, MRV, capacity building, assessment of the efficiency of the demonstration study etc.

The outcome of the EPC scheme will be evaluated and applied to be the basis for building the nation-wide Emission Trading Scheme (ETS). It is planned that number of studies must be performed in order to analyze the potential implications from launching the ETS. Also it would take time to prepare Thailand in term of nation-wide targeting setting and other infrastructures. Therefore a way toward the establishment of ETS is proposed per the following:

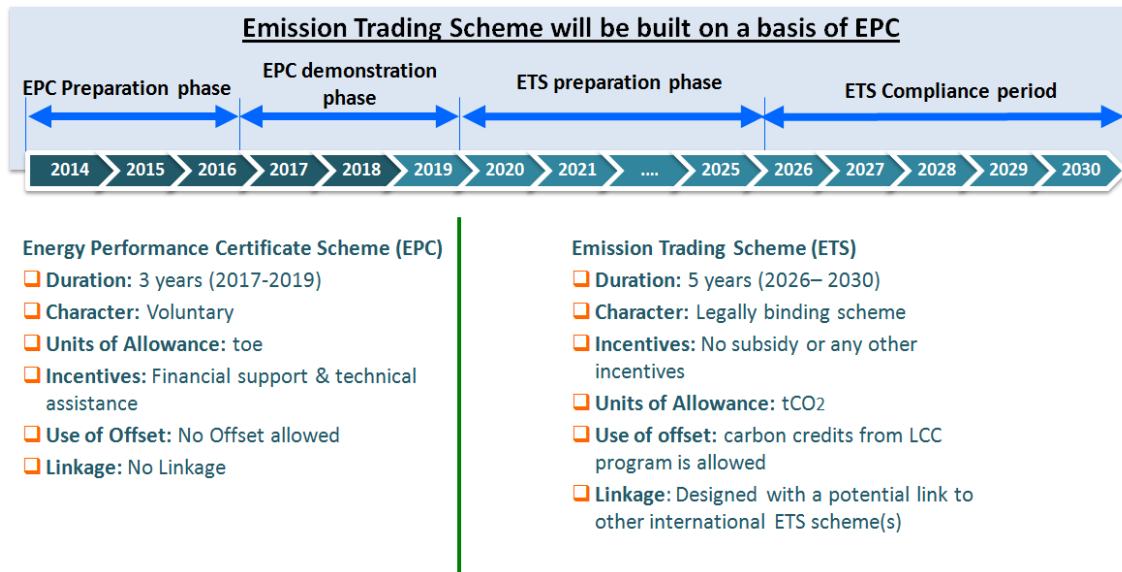


Figure 12: A plan to transform EPC to ETS

2019-2025: ETS preparation phase

Objective: This phase would focus on preparing for a mandatory ETS system from the learning of the demonstration scheme. The preparation may be in the form of regulatory changes, institutional capabilities, MRV system, legal systems, trading system etc.

Activity Areas: The broad activities would range from setting up of new base line & target, capacity building, stakeholder consultations, setting-up of registry.

2026-2030: ETS compliance Period

Objective: This phase would focus on actual implementation by participating units to comply with the norm set.

Activity Areas: The broad activities would range from providing technical support, MRV, provision of financial support (if required), allocation of allowances, enforcement of penalties etc.

This PMR proposal is seeking partial financial support from World Bank for the EPC scheme only. Fund requirement for establishing the ETS would be mobilized from Thailand government and other international support at the later stage.

Chapter 2.2 EPC

2. Design of the Energy Performance Certificate scheme

- i. Conceptual framework of the EPC scheme
- ii. Scope and coverage
- iii. Target setting methodology
- iv. Allocation of Allowances
- v. System for Domestic MRV and Compliance
- vi. Fostering Stability
- vii. Regulatory Framework and Institutional Arrangement
- viii. Use of Offset and/or Linking Consideration
- ix. Incentives for EPC participants

The design of the Energy Performance Certificate scheme (EPC) has been completed. This chapter presents the design of the EPC as well as the challenges and barriers in each of the design components.

The design of the EPC has been suggested after careful analysis of various scenarios, trends, and future energy policy of the Thai Government and discussion with several stakeholders. This scheme would initially focus on the high energy intensive and energy consuming industrial units and commercial buildings to participate in the scheme considering various energy, economic and social indicators.

Please note that all proposed activities, objectives and budget **for preparing and implementing the demonstration EPC scheme** are presented in the next section.

i. Conceptual framework of the EPC scheme

Preface of the Conceptual Framework

Over the years, many countries have come forward with market based mechanisms to accelerate the implementation of energy efficiency measures in a cost-effective way. The Perform, Achieve & Trade (PAT) scheme of India, CRC energy efficiency scheme and Climate Change Agreement scheme of UK, Top 1000 energy consuming enterprise program of China are a few good examples which have been very successful or expected to bring desired result in the near future.

All the above schemes, which have been internationally implemented so far, have similar conceptual attributes with following components associated:

- a) *Participants of the Scheme* : Who would participate or to be targeted
- b) *Goal of the Scheme* : Savings to be achieved within a timeframe
- c) *Administration of the scheme* : Institutional arrangement, Regulatory requirements
- d) *Credibility of the scheme* : Independent Monitoring & Verification mechanism

The international experiences have shown pros & cons in each component of the scheme. Therefore, the methodology, framework, mechanism and lessons of these schemes have been referred to while preparing the conceptual design of the EPC scheme.

Various features of the EPC scheme and its relevance with respect to the lessons learnt from different international schemes are presented in the table below.

Table 1: Major takeaways from International Schemes

Features of the Scheme	International Schemes		
	PAT (India)	CRC (UK)	Top 1000 (China)
Participants	478 Designated Industries selected from 8 energy intensive sectors by specifying a threshold annual energy consumption criteria for each sector	Large public and private organizations having > 6000 MWh annual electricity consumption and responsible for 10% of the UK's emissions. Scheme to affect 5000 organizations	1,000 largest enterprises that together consume one-third of China's total primary energy and about 47% of industrial energy
Participation type	Mandatory	Mandatory	Mandatory
Tenure	Cycle based approach with 3 years as compliance cycle (2012-15)	Split into phases. 1 st phase of 4 years from 2010-14 then 5 subsequent phases each of 5 years.	Five years to achieve targets (2006-2010)
Goal	National goal in terms of absolute energy saving in million tons of oil equivalent (6.6 million toe)	CRC aims for a carbon reduction of 1.2 million tonnes by 2020 and an 80% cut in UK's carbon emissions by 2050.	Savings of 100 million toe contributing to China's 5 year target of 20% Energy intensity reduction
Target for Participants	Individual target (in %) to reduce the Specific Energy Consumption (SEC) within the tenure of the scheme.	Allowance based on the annual emissions	Individual targets for each enterprise of the nine major energy consuming sectors
Administration of the Scheme	Administered by a dedicated agency Bureau of Energy Efficiency, appointed by Central Government under Energy Conservation Act	Scheme administered by a government body, 'Environment Agency' which is responsible for monitoring and enforcement of scheme.	Administered by the government agencies National Development & Reform Commission (NDRC). Enforcement is the responsibility of central, state & provincial governments.
Credibility	Independent verifiers for Monitoring &	Self-certification scheme with rolling audit of up to 20%	Energy savings reports to be submitted to NDRC for verification.

	Verification process during baseline and compliance year	participants is done	
Provision of Trading	Energy saving certificates (ESCerts) would be traded among the 8 participating sectors only. No offset whether domestic or international	Trading of allowances permitted for participants and third parties to enable participants to comply. Use of CERs permitted.	NA
Certificate Issuance	Certificate issuance post verification	Allowances are purchased by participants in the beginning of compliance year.	NA

Major Building Blocks of the Framework

The lessons learned from these global schemes have been utilized to suggest conceptual design of EPC in Thailand. From the finalization of participating sectors in the EPC scheme to the target setting and administrative set up, the broad framework of the scheme includes the following building blocks, as shown in the **Figure 13** below:

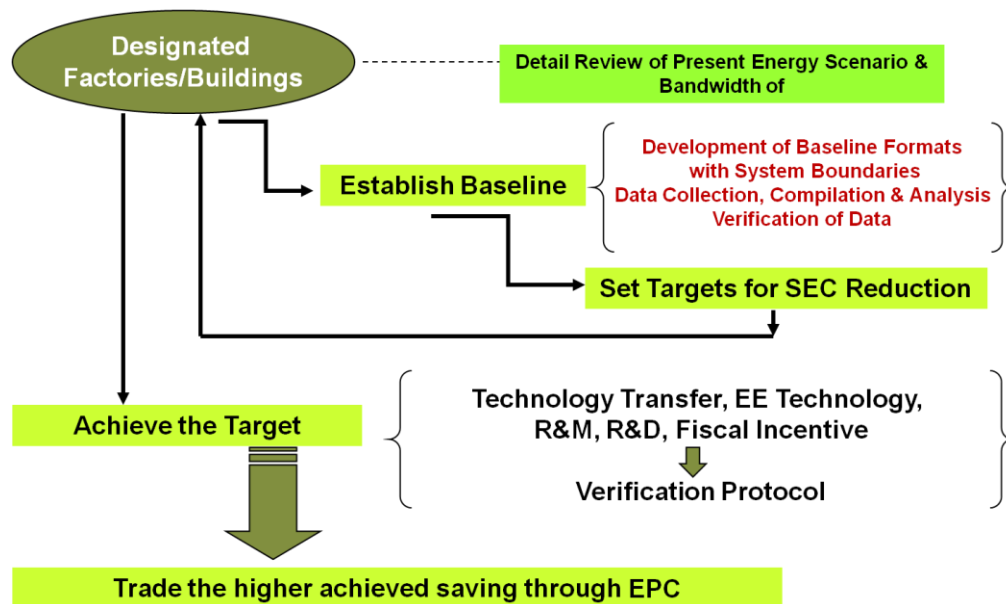


Figure 13: Major Building Blocks of the EPC Framework

Defining Participating Sectors

A qualification criterion to select the eligible participants to the EPC scheme needs to be set. This qualification criterion could be energy consumption, energy intensity, production output, etc.

In Thailand, at present, the designated factories and buildings (mentioned as DF&Bs from hereon in the report) have been identified with an installed transformer capacity no less than

1MW or 1,175 KVA and an annual energy consumption of greater than or equal to 20 million mega-Joules. This threshold can be taken as the criteria for defining the participating factories and buildings. The other criteria could be the installed capacity or building size, vintage or year of commissioning or based on the annual turnover, etc. However, these parameters do not depict a clear picture of the actual energy consumption or energy efficiency of factories and buildings. Since the EPC scheme is based on energy consumption, thus the existing threshold for DF&Bs seems to be appropriate criteria which can limit the number of eligible participants and also capture the high-energy-consuming factories and buildings in the scheme.

Defining Baseline

Establishment of baseline is an important aspect of setting improvement target. A clear and robust baseline should be set in the base year for successful implementation of the scheme. The methodology to set the baseline should also be clearly defined. Absolute energy consumption, specific energy consumption or energy intensity, production output, technology used in the base year may be studied to define the baseline. For example, in India, the baseline is determined by the sectoral study of various indicators such as energy usage pattern, specific energy consumption trends, production output, and energy management practices of designated consumers in different sectors for three years including the base year.

Target

Definition of target and establishment of the same is the key component in such schemes. The target must be defined to align with the EPC scheme and prevalent international practices. The target should be such that it would create enough room for enhanced energy efficiency at the macro level and a sustained market based mechanism. The methodology to set the target should be simple and clear. The targets should be realistic and achievable, should attract technology transfer opportunities and be supported by a robust financial mechanism.

Administration of the scheme

The administrative framework of the EPC scheme should include the institutional and regulatory framework. The existing institutional and regulatory frameworks should be utilized after modification, as necessary. Under the institutional structure, the scheme administrator needs to be selected with clear roles and responsibilities. The scheme administrator has the overall responsibility of managing the entire scheme dealing with facilitation for participation and monitoring and verification.

The regulatory framework on the other hand should ensure that the scheme is prepared under the provision of law i.e. the Energy Conservation Act of Thailand and is harmonized with the energy conservation plan i.e. the Energy Efficiency Development Plan (EEDP). The dispute resolution framework should also be specified in the scheme as part of its regulatory structure.

ii. Scope and coverage

The objective of the EPC scheme is to accelerate the energy efficiency in selective sectors of economy through a market based mechanism. Since the scheme is to be introduced for the first time in Thailand, it is planned to be launched as voluntary. Still, there must be a definite scope and coverage of the scheme in order to achieve good administration, management and control by the scheme administrator. The scope and coverage of the EPC scheme should be defined in such a way that:

- There must be a clear rationale in selection of scope and coverage.
- It must address the very objective of the scheme i.e. energy saving.
- The present provisions of the Energy Conservation Act are followed.
- The implementation of the scheme would be simple and transparent.
- There should be flexibility of expansion of scope and coverage, if needed.
- To facilitate learning of key stakeholders to lead to an emission trading scheme.

Keeping the above key points in view, the participants of the EPC scheme among various economic sectors of Thailand are suggested based on a judicious analysis. Apart from drawing on international experience, various indicators like annual energy consumption, contribution to the gross domestic product (GDP), energy intensity, carbon intensity etc. are considered while defining the scope and coverage of EPC scheme.

Criteria for Selection of Sectors

Step 1: Selection of Economic Sector

For the selection of sectors to be included in EPC scheme, the economic and energy indicators have been looked into. Sectors like industry, transportation, building and agriculture are analyzed with respect to their share in energy consumption and the national GDP as shown in table below. It may be seen from **Table 2** that the industry and building sectors have accounted for more than half (58.1%) of total energy consumption and national GDP. Therefore, these two economic sectors are the obvious choice for the EPC scheme. Transport sector, although having a large share in energy consumption, is excluded from EPC because enforcement of mandatory energy efficiency labeling for vehicles and minimum fuel economy standards for vehicles are planned as part of the EEDP. Under EEDP, there are other measures/work plans for energy efficiency improvement in transport sector including support for travelling via mass transit systems and goods transport via highly energy-efficient logistics systems. Hence the transport sector has not been included in EPC scheme.

Table 2: Contribution in GDP and Share of Energy Consumption per yearⁱ

Economic Sector	% Share in GDP	% Share in Energy Consumption
Industry	44.0	36.0
Transportation	13.3	35.7
Building	34.0	23.1
Residential		15.5
Commercial		7.6
Agriculture	8.7	5.2

Step 2: Selection of sub-sectors

Step 2(a): Select the category in Industry Sector

The Industrial sector comprises Mining, Manufacturing and Construction industries. The last five years' data show that the share of energy consumption of manufacturing sub-sector is about 99% of the entire industrial sector of Thailand, the rest two sub-sectors (mining and construction) contribute the balance of 1% of the energy consumption as shown in the **Table 3** below. *Thus, the manufacturing sector should be selected for the scheme.*

Table 3: Share of Energy Consumption per year among the Sub-Sectorsⁱⁱ

Final Energy Consumption of Industrial Sub-Sector	Unit	2007	2008	2009	2010	2011	Average of 5 years
Mining	%	0.55	0.50	0.46	0.48	0.51	0.47
Manufacturing	%	99	99	99	99	99	99
Construction	%	0.48	0.43	0.63	0.65	0.44	0.53

Step 2(b): Select the category in Building Sector

Data shows that, residential sector consumes about 67% of the energy of Thailand's building sector and the rest 33% is consumed by commercial buildings category (**Table 4**). However, the designated buildings are in the commercial building category and it is comparatively easier to verify the energy consumption and savings in these buildings. Commercial buildings also have better energy saving potential than residential buildings on a unit basis. *Hence, only commercial buildings should be selected for the scheme, and residential buildings may be covered in the LCC scheme.*

Table 4: Share of Energy Consumption per year among the Sub-Sectorsⁱⁱⁱ

Final Energy Consumption of Buildings Sub-Sector	Unit	2007	2008	2009	2010	2011	Average of 5 years
Residential	%	68	66	67	66	68	67
Commercial	%	32	33	33	34	34	33

Step 2 (c): Select the Category in Power Sector (Supply Side)

Supply side industries like power plants and oil refineries also consume substantial primary energy for desired output. In Thailand, the share of energy consumption per year of Thermal power plants (Coal + Oil + Gas + Lignite) is about 97% of the total energy consumed by the supply side industries. *Therefore, only Thermal Power Plants may be selected for the EPC scheme. It may be noted that no Captive Power Plants (CPPs) are included in this category because such power plants would be included in the respective manufacturing sectors.*

Step 3: Selection of Scheme Participants

Step 3 (a): Select the Industrial Sectors in Manufacturing Sector

Thailand's manufacturing sector comprises factories in Food & Beverage, Cement, Ceramic, Chemical, Paper, Fabricated Metal, Basic Metal, Textile, and Wood & Furniture etc. It would be prudent to select the participants of the scheme by considering the following indices:

- **Absolute Energy Consumption:** The sectors which contribute to the maximum share of Thailand's energy consumption are captured.
- **Energy Consumption per industry:** The sectors which have the highest absolute energy consumption per designated factory are captured, thereby selecting the bigger factories.
- **Energy Intensity:** The sectors having the highest energy consumption per unit of product output.

The above three criteria was used and a matrix developed as shown in **Table 5** below based on the historical trend analysis of energy consumption data. Various literatures and other studies

have been referred to rank sectors on the 3rd criteria. The **Table 5** shows prioritization of manufacturing sectors in the EPC scheme based on the indices discussed. *The manufacturing sectors in bold (Cement, Ceramic, Food & Beverage, Paper, Iron & Steel and Petro-Chemical) rank high in all three criteria and hence are suggested to be included in the first phase of EPC. DEDE, TGO and FTI have shown agreement on selection of these sectors during discussions and consultations.*

Table 5: Selection of Industrial Sectors^{iv}

Based on Total Average Absolute Energy Consumption (% of total industrial energy consumption)	Based on Absolute Energy Consumption per Designated Factories (ktoe/factory)	Based on Typical Energy Intensity (Energy Consumed per unit of product output)
Food & Beverage (32%)	Cement (44.72)	Iron & Steel
Cement (20%)	Petrochemical (23.1)	Cement
Ceramic (11%)	Paper (12.64)	Ceramic
Chemical (8%)	Ceramic (12.61)	Paper
Paper (7%)	Iron & Steel (8.7)	Petrochemical
Fabricated Metal (6%)	Food & Beverage (6.08)	Textile
Basic Metal (5%)	Textile (2.48)	Food & Beverage
Textile (4%)	Wood & Furniture (2.0)	Fabricated Metal
Wood & Furniture (1%)	Fabricated Metal (1.38)	Wood & Furniture

NOTE:

- Typically, basic metal comprises of Iron & Steel, Copper and Aluminium, etc. In case of Thailand, Iron & steel sector is considered under basic metal group.
- This table does not discuss Thermal Power Plants since it has been developed to select sub-sectors only from the "Manufacturing" sector. Both manufacturing and buildings represent "Demand" side sector. Power sector on the other hand represents the "Supply" side and has been selected in the 1st phase of EPC because of the total volume of energy consumption (15,500 ktoe).

Step 3 (b): Selection of participants in Building category in Commercial Building Sector

Thailand's Commercial Buildings sector comprises designated buildings in categories such as Hotels, Hospitals, Department Stores, Education Institutions, Offices, and Others. Such buildings consume electricity (with maximum share) and thermal energy. Therefore, an index like CO2 emissions per square metre and energy consumption per square metre may be simultaneously used to prioritize the commercial building categories. An analysis of selective commercial buildings in various categories for the energy Intensive & carbon Intensive applications was done by Chiang Mai University which is taken as the basis for selection of the participants in this category as shown in **Table 6** below. *Hotels, Hospitals, Department Stores, and Offices (in italics) are selected for EPC scheme because of high energy and carbon intensities.*

Table 6: Selection of Commercial Buildings^v

Building type	Number of Buildings for which data is available	Total energy consumption		Energy Intensity	Carbon intensity
		Tera Joules	toe	MJ/sq-m	tCO2/sq-m

Hotel	77	3,942.30	93,322	787.45	0.24
Hospital	81	3,447.98	81,621	515.87	0.11
Department store	180	9,543.34	2,25,910	826.74	0.14
Education	106	3,364.44	79,643	180.47	0.03
Office	264	9,514.66	2,25,231	1,958.76	0.33
Others	29	838.57	19,851	548.25	0.1

Selection of Sectors: Summary of Analysis

The combination of above criteria shows that *the manufacturing sectors in Food & Beverage, Cement, Ceramic, Paper, Iron & Steel and Petro-Chemical rank high in all three criterion and hence are suggested to be included in the EPC. Apart from this, the thermal power plants would also be included in the EPC scheme due to high energy consumption and their contribution towards GHG emission.*

Similarly, Hotels, Hospitals and Department Stores are selected for EPC scheme because of high energy and carbon intensities. DEDE and Industry Associations have shown agreement on selection of these sectors during discussions and consultations.

Rules for Selection of boundary

Definition of Specific Energy Consumption

Since Thailand is a developing country, the EPC scheme will be based on reduction in the specific energy consumption (SEC) and not the absolute energy consumption. The Specific Energy Consumption (SEC) gives the indication of efficient utilization of different sources of energy in an operational boundary to produce one unit of product. This is defined as the ratio of total energy input to plant boundary and the quantity of products produced. The SEC of a plant would be calculated based on Gate-to-Gate concept with the following formula.

$$\text{SEC} = \frac{\text{Total energy input to the plant boundary}}{\text{Quantity of the Product (in case of factory), Square feet area (in case of building)}}$$

- While calculating the total energy input to the plant, all energy sources would be converted to a single unit i.e. toe (metric ton of oil equivalent) using standard engineering conversion formula. In this calculation, the following guiding principle would be considered:
- All forms of energy (Electricity, Solid fuel, Liquid fuel, Gaseous fuel, By-products used as fuel etc.) which are actually consumed for production of output should be considered.
- Energy consumed in residential colony and for transportation of raw materials to the plant physical boundary and finished products outside of the plant physical boundary should not be accounted. However, if an industry does not have such segregated data, this may be included in both baseline and target year.
- Energy / Electricity from renewable sources will be accounted depending on where it is generated. If electricity from renewable is used then it will be treated as electricity and conversion of electricity to toe will be applied with suitable conversion factors. If

- renewable is used as fuel (for example – bagasse, biomass) then calorific value will be considered for conversion to toe.
- e) Energy from waste heat or any other waste generated inside the plant boundary will not be considered.
 - f) The 'Product' is the key parameter. The definition of product for various sectors may be clearly defined for the purpose of calculating SEC. This should be arrived at considering the typical practice of defining SEC and consistency in product output.
 - g) Any energy consumed for major construction work would not be accounted as this is not meant for producing the product. Quantity of such energy should be separated out from total energy consumption. The industry need to keep such data duly metered/recorded for the purpose of verification.

Plant Boundary

As the SEC of the designated consumers is to be estimated on a gate-to-gate basis (**Figure 14**), the system boundary needs to be selected in such a way that:

- a) It captures all energy input to the factory/building
- b) It captures the major output product of the factory
- c) The energy input data should be quantifiable and verifiable
- d) No appreciable change in system boundary envisaged
- e) No mining operation or external transportation system included
- f) Captive power plant (CPP) , if any, to be included
- g) Renewable Energy will be accounted whether used as electricity or fuel.

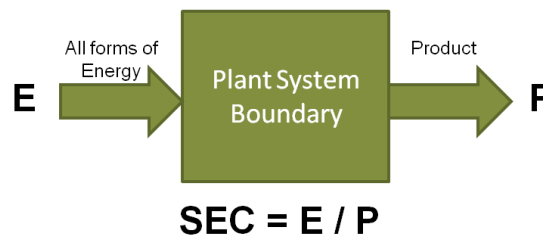


Figure 14: Plant Boundary

Once the system boundary is fixed, the same boundary will be considered for the period of the entire cycle. Any change in the boundary such as expansion of capacity, merger of two plants, division of operation, etc., has to be timely addressed by the scheme administrator.

iii. Target setting methodology

For successful implementation and sustainable operation of EPC scheme, developing a methodology for setting up of energy consumption norms in a target year with reference to a baseline year is critical. Setting up of the target for reducing the energy intensity is one of the major building blocks of EPC scheme. The potentially large variation of Specific Energy Consumption (SEC) within a sub-sector, and the inability of all designated factories to achieve a sectoral benchmark SEC, suggests that SEC improvement norms need to be set for range of factories or even individually. In general, the better the energy efficiency level (or the lower the SEC), the lower is the energy-savings potential.

It is obvious that some plants may surpass their specified SEC, just as some others will fail to reach it. Therefore to maximize energy savings across the participating designated factories and buildings most cost-effectively, these will be allowed to trade the quantum of energy savings by which they exceed their target with other DF&Bs those fail to meet its target. Based on international experience, the possible response of the industry to SEC targets can be categorized as follows:

- a) controlling the processes to meet the exact target;
- b) 'under achieving' and buying savings to take care of the balance;
- c) 'over achieving' and selling the excess savings; or

Therefore, the target setting should not only be scientifically correct, but also be a driving tool to create a market based mechanism. In order to make the EPC successful and sustainable, the target should not be too tight (impractical) or too lenient. The following steps may be adopted while setting up of a target.

Setting-Up of Baseline

In the EPC scheme, the target (which is related to Specific Energy Consumption) will have to be achieved in a particular time frame (i.e. EPC cycle of 3 years) with reference to a baseline. So defining the baseline parameters is an important step while designing EPC scheme. The main attributes of the baseline parameters for EPC are:

- a. It should be simple to understand.
- b. Establishment of baseline should not require complex data .
- c. It should be easy to calculate/estimate.
- d. It should not involve any direct measurements by gadgets at designated factories and buildings.
- e. It should be in line with international practices.

Keeping the above points and requirement of EPC in view, the following baseline parameters are suggested:

- a. **Base year:** This is an important definition in the EPC scheme. The targeted energy saving is calculated with reference to the baseline year. Ideally, the baseline year should be the year just prior to the start of the EPC cycle.
- b. **Baseline Energy Intensity:** Energy intensity or specific energy consumption (SEC) speak about the energy efficiency. This is defined as the energy consumed to produce one unit of product (in case of factories) or energy consumed per floor area (in case of building)
- c. **Baseline Production or Floor Area:** As explained above, the baseline production or floor area in case of factories and buildings respectively are to be defined in order to establish the baseline energy intensity.
- d. **Baseline Capacity Utilization (in %):** The energy intensity is a function of capacity utilization (CU). Sometimes, a lower capacity utilization of a factory may also result in higher energy intensity which is not a true reflection of energy efficiency of that factory.

The above baseline parameter ideally should not be taken by referring to data of a single year. There may be influence of many factors like operational, market demand or any other issues in the energy consumption of a factory or building which may not be captured in the data of single year. While establishing the baseline parameters for the EPC scheme, it is necessary that such

variations should be captured over longer period. It may be good to have the 3 years average of each baseline parameters.

- Base Year : 2010
- Baseline Production (P_{base}) : Avg. of 2010, 2011 & 2012
- Baseline SEC (SEC_{base}) : Avg. of 2010, 2011 & 2012
- Baseline CU (CU_{base}) : Avg. of 2010, 2011 & 2012

Barriers in establishing the baseline

- a. Getting proper and authentic information in a time bound manner is the greatest challenge in this activity. It is understood that as per existing law, all the designated factories and buildings are required to submit the desired information to the Government (i.e. DEDE). However, the existing energy data reporting format seems very exhaustive and may not also contain the desired information for EPC scheme. It is necessary to develop well-structured sector specific formats for collection of information from the designated factories and buildings. This seems to be critical activity not only for establishing baseline but also for target setting.
- b. There may be difficulty in understanding the format and furnishing of information by the factories/buildings. Development of simple guidelines and capacity building of fellow designated factories/buildings and the data verifiers will address this issue.
- c. Authenticity of the reported data is also another challenge. Independent data verifiers and their capacity building are highly required for successful implementation of the scheme. So, a baseline survey of each designated factories/buildings by independent and qualified verifiers will address this issue.

Setting-Up of Target

Setting-up of the target for reducing the energy intensity is one of the major building blocks of EPC scheme. The target may be defined in the 'percentage' form. It is the percentage reduction of SEC from Baseline SEC of Base Year to be achieved in a target year. The target could be given annually or over a period. The first phase of EPC is proposed for three years. The scheme will be launched in 2017 and the performance period will be 2017-2019. The SEC reduction target for a cycle period may be divided into yearly target. Whether annual target will be equal for all year or different (as shown in **Figure 15**) will be decided during the EPC implementation phase.

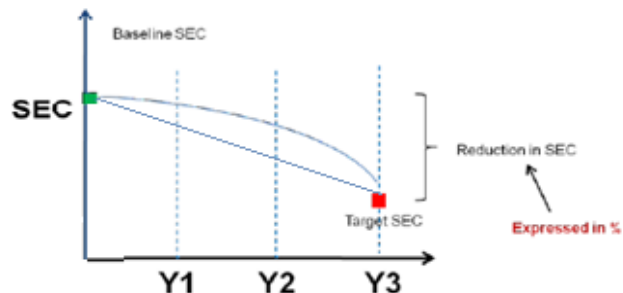


Figure 15: Illustration of Target Setting

The guiding principles of target setting should be:

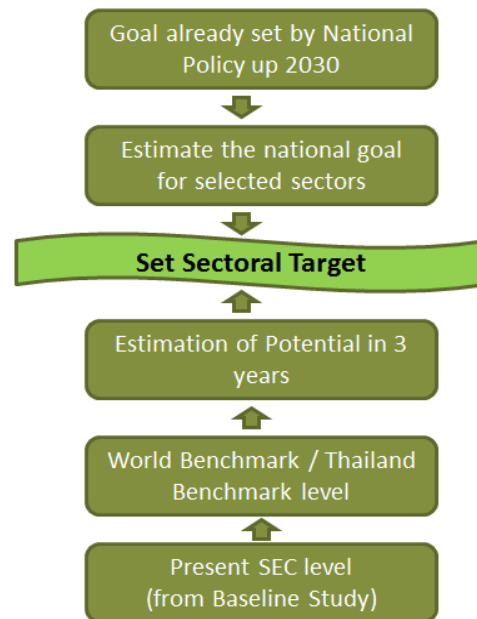
- The target must reflect the energy saving goal set by Thailand Government for 2030 (under the Energy Efficiency Development Plan 2030)

- The target setting methodology should be simple, transparent, and scientifically correct and avoid one-to-one negotiation.
- It should be practical to achieve by the target year and create market for energy performance certificates.

Allocation of the '**Sectoral target**' is the next step. It should emanate from the national goal already set by the Thai Government as per their Energy Efficiency Development Plan. It has set a target of 25% reduction in energy intensity of GDP by 2030 from a baseline of 2005. The target translates into savings of about 16,100 ktoe from entire Industrial sector and about 3,600 ktoe from entire building sector by 2030 through adoption of various policy initiatives. For existing thermal power plants, goal is to achieve savings of about 550 ktoe by 2030.

This overall targeted saving must be correlated with the potential available in each sub-sector of the manufacturing sectors and the commercial building sectors. This may be obtained from a bottom-up approach. Present situational survey, Baseline studies, comparison with world benchmark, etc. can give the typical energy saving potential available in a particular sub-sector. So, allocation of sectoral target is basically a mix of 'Top-down' and 'Bottom-up' approach.

Figure 16: Sectoral Target



Methodology to set sector level targets

The following methodology may be followed to set the sector level targets:

- The national energy saving goal for Industrial and Building sector is interpolated for 2018 to estimate the aspired savings till 2018. The aspired savings from designated factories and buildings under EEDP has been arrived at based on their share of consumption in the total mix. This becomes a reference to set energy savings target in EPC scheme. The **Table 7** below illustrates the methodology of arriving at aspired savings under EEDP by 2018.

Table 7: Estimate of savings aspired from EEDP

		2010 (published in EEDP)	2018 (estimated value based on interpolation)	2030 (approximate value based on EEDP)
Consumption in Business as usual scenario (ktoe)	Industrial	25,281	37,270	66,713
	Buildings	5,696	8,668	16,272
Consumption in EEDP scenario (ktoe)	Industrial	25,281	33,371	50,610
	Buildings	5,696	7,835	12,642
Estimated savings from EEDP (ktoe)	Industrial	-	3,899	16,103
	Buildings	-	832	3,630

Estimated savings from designated factories and buildings targeted under EPC (ktoe)	Industrial Buildings		1,365 324	
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Keeping the national energy saving goal in view and subsequently apportioned to the manufacturing and commercial building sectors, the goal for reduction of energy consumption under EEDP is estimated at 1365 ktoe for designated factories and 325 ktoe for designated buildings by 2018. These savings are based on a reference year of 2010. If we consider the first EPC cycle of 3 years (2015-2018), the prorated energy savings for 3 years is about 512 ktoe for Industry (2.14% per year) and 122 ktoe for Building (2.10% per year). For thermal power plants, a conservative estimate of 1% improvement per year has been assumed.

- b. It has been observed that typical energy efficiency projects in industrial sectors and building sectors have pay-back periods of up to 4 years. In India, National Energy Conservation Awards which are participated by about 500 industries every year, have reported implementation of various energy saving options with substantial energy savings being realized by these units. These options typically show a payback period of less than 4 years^{vi}. Similarly, the energy audits conducted by different agencies have recommended options having payback period of not more than 4 years. The energy saving options are typically related to Operation & Maintenance (O&M) practices, Retrofit options, and fine tuning of process parameters in thermal and electrical utilities like boilers, furnaces, pumps, air compressors, fans & blowers, electrical systems, cooling towers, etc. These options generally do not focus on any major or entire change in the process technology which may have higher payback periods. So, for the EPC scheme a cycle time of '3years' looks appropriate in view of preparedness for the scheme and pay-back periods of energy saving projects. It may be noted that in PAT scheme of India, the cycle time has been kept as 3 years keeping the above logic in view.
- c. So, the minimum target for reduction of energy intensity under the EPC scheme may be fixed equivalent to the savings aspired from EEDP from the Base Year (2012). This seems to be a reasonable target for the first cycle of EPC. It may be noted that India has also set a target of about 5.6% in three years in the 1st cycle of PAT scheme which have been well accepted by the participating industries.

With the above guiding principle, an illustration of the energy saving in the target year is shown in table below.

Table 8: A Scenario for setting EPC target exactly based on National goal^{vii}

Economic Sector	Estimated Average National Goal/yr	First Cycle of EPC (yrs)	Minimum Target in first EPC cycle (%) from the Base Year
Factories	2.14 %	3	6.41%
Building	2.10 %	3	6.30%
<u>Sector</u>	<u>Potential Improvement (%)*</u>	<u>Target of EPC if based on National Goal (%)</u>	

Cement	10-14	6.4
Ceramic	10-18	6.4
Iron & Steel	10-15	6.4
Petro-Chemical	08-10	6.4
Paper	10-14	6.4
Food & Beverage	10-20	6.4
Commercial Building	10-20	6.3
Thermal Power Plant	10-12	3.0
Average		5.96

** Source: International Energy Agency, Centre for Science & Environment, Energy Audit reports of National Productivity Council of India, For Thailand, energy audits and assessments will have to be conducted during the implementation phase to establish the actual available savings potential.*

- d. As the scheme is voluntary, it might be prudent to give a target slightly higher than the national goal. This will create competition among the participants to take part in the scheme. So, it is suggested that there could be an additional target on and above 5.96% which may be decided from saving potential available in each sector. The following guideline may be used for fixing the target for each sector:

$$\text{EPC Target} = \text{National Target} + 20\% \text{ of } (\text{Lower Boundary of the Potential Range} - \text{National Target})$$

Example: For Cement Sector the potential saving is 10-14%

National target = 6.41% i.e. 2.14% per year for 3 years

EPC target = 6.41% + 0.2 * (10% - 6.41 %) = 7.13%

Based on the approach, an adjusted target has been calculated as shown in the **Table 9** below (only for illustration):

Table 9: A scenario for setting EPC target derived from National Goal

Adjusted Target (%)					
Sector	(National Goal + 20% (Lower Boundary of Potential Improvement - National Goal))	No. of Probable DF&Bs	Annual Energy Consumption (ktoe)	Saving as per National Goal (ktoe)	Saving as per adjusted target if 100% participation (ktoe)
Cement	7.13	39	1744	112	124
Ceramic	7.12	23	290	19	21
Iron & Steel	7.12	97	844	54	60
Petro-Chemical	6.72	10	231	15	16
Paper	7.12	125	1,580	101	112
Food & Beverage	7.12	232	3,291	211	234
Commercial Building	7.0	1,580	1,930	122	136

Thermal Power Plant	4.40	86	15,500	465	682
Average SEC Reduction	6.7	2,192	25,410	1,098	1,385
Saving above National Target				0	288

It can be seen that with 100% participation, the expected saving by the end of demonstration cycle of the EPC scheme is about 1,385 ktoe and may result in an extra saving of about 288 ktoe over the targeted national saving by that period.

Setting-Up of Target for Designated Factories and Buildings

Once the sectoral target is fixed, the next step is to set-up targets for individual designated factories and buildings (**Figure 17**). It is obvious that there will be large variation in specific energy consumption of facilities due to various diversity factors like input raw material, process technology, vintage, product type and quality, capacity etc. Such diversity renders each unit as unique. It is thus, may not be feasible to define a single target unless there is a significant homogeneity amongst units in a sector. This implies that the energy efficiency improvement targets would have to be almost '*factory Specific*'. However, the same may not be applicable to commercial buildings where there is great degree of homogeneity.

Each industrial sub sector will be divided into a few groups / clusters based on similarity in characteristics (such as process technology, input raw material, product output, installed capacity, etc). "Minimum number of groups" should be the criteria while deciding the grouping.

The sub-sector level targets would again be disaggregated among the cluster/group level target (in ktoe) by apportioning the sub sector target based on energy consumption of clusters. That means, for example, if a group in a sub-sector shares 35% of total energy consumption of the sub-sector, the target for energy saving of that group could be 35% of the total target allocated for the sub-sector.

Once the grouping is done and group-level target is allocated, the next step is to establish the target for individual factories/buildings. The following relative SEC concept is adopted as the following methodology:

Lowest percentage target would be given to the best performing factory/building where as others will be assigned as per a 'relative increment' based on the concept of relative SEC. Therefore, if the best performing factory has X % target to reduce the SEC, the other plants would be having (Plant SEC/Best SEC) times of X %. The X can be numerically calculated keeping in view of total energy saving in the target year. However, the idea is to arrive at a % value (of target) where the group-level or sub-sector level target would be achieved.

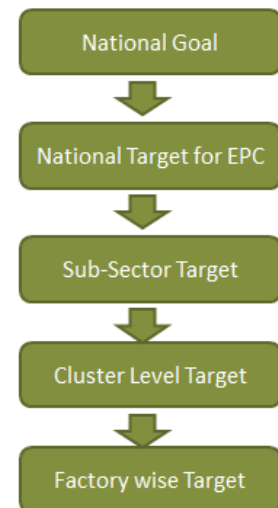
The absolute energy saving at the end of 3 years would be estimated as:

$$\text{Energy Saving} = P (\text{SEC}_{\text{base year}} - \text{SEC}_{\text{target year}})$$

Where P = Production Quantity in target year

This concept is simple and practicable and hence recommended. The major highlights of relative SEC concept are that:

Figure 17: Setting Target for DF&B



- Every designated factory/building will be having separate targets
- Lower target for best performers and higher for worst performers
- Every designated factory/building will have to perform better than its own baseline level rather than following a benchmark value (which may not be practicable)

iv. Allocation of Allowances

Unit of the Allowance

Under the EPC scheme, energy savings target to individual DF&Bs will be given in terms of percentage SEC reduction from the baseline SEC. The allowances will be based on the overachievement or underachievement in meeting SEC targets and hence it is more appropriate to denominate energy savings in the form of tonnes of oil equivalent (toe) rather than tonnes of carbon dioxide equivalent (CO₂). The other advantages of adopting toe as the unit of allowance are summarized below:

- National energy savings goal as per EEDP is in terms of energy intensity or toe reduction. 16,100 ktoe from entire industrial sector and 3,600 ktoe from entire building sector is aimed to be saved by 2030. Hence, it will be easier to directly correlate the contribution of EPC scheme with EEDP goal if energy savings are denominated in toe.
- Energy savings in toe can be easily converted into equivalent CO₂ reduction by applying appropriate conversion factors such as fuel emission factors or grid factors used for CDM projects. Converting CO₂ to toe would be very complicated.

Energy consumption allowance based on SEC improvement target

In order to build up the market readiness for Thailand with a view toward to future emission trading scheme, it decided that the allowance system is applied rather than an ex-post certification scheme. Based on discussion with DEDE, TGO, and Industry Association, the approach based on allowance has been finalized.

In this approach, program administrator will fix energy consumption allowance for each participant which will be based on annualized SEC improvement target. The SEC target will be based on the baseline estimation methodology and the target setting methodology as discussed in the previous sections. The permissible energy allowance will be given annually. At the end of year, participants will have to surrender allowance depending on the actual performance. If actual energy consumption is less than the permissible allowance, participant will have surplus of allowance that can be sold to the sink fund.

Example of calculation of allowances

An example has been provided in **Table 10**, **Table 11** and **Table 12** to explain the calculation of EPC for a hypothetical participant in three different scenarios.

Table 10: Situation at the launch of scheme (say in 2016)

Baseline SEC = 10 ktoe/unit of product
Baseline Production = 10,000 units
Target for SEC Reduction = 4% reduction in SEC
Target SEC = 9.6 ktoe/unit of product

Table 11: Situation at the end of 1st cycle or year (in 2017 or 2019)

Production in target year = 12,000 units
Total permissible allowance based on Target SEC = $9.6 \times 12,000 = 115,200$
Total actual energy consumption in Case A = 114,000 ktoe
Total actual energy consumption in Case B = 115,200 ktoe
Total actual energy consumption in Case C = 116,000 ktoe

Table 12: Illustration of different scenarios emerging at the end of year/cycle

Case A	Actual consumption = 114,000	Over achievement of 1200 allowance	Sell allowance and/or bank it, Surrender allowance to scheme administrator
Case B	Actual consumption = 115,200	Meeting the target	Surrender allowance to scheme administrator
Case C	Actual consumption = 116,000	Under Achievement of 800 allowance EPC	Buy allowance and/or contribute to LCC fund, Surrender allowance to scheme administrator

Other attributes of the EPC trading scheme mentioned in

Table 13 will be quantified and finalized after conducting in-depth study during the implementation phase.

Table 13: Other Attributes of EPC scheme

Scheme attributes	Advantages & Disadvantages	Decision
Banking of allowance	Advantage: May lead to early implementation of medium and high cost options; allows flexibility to participants to sell allowances; price assurance in case of oversupply. Disadvantage: Banking may lead to foul play and manipulation of allowance prices.	Banking of allowance is not allowed
Borrowing / carry forward of shortfall	Advantage: Since energy savings are dependent on external factors also, borrowing or carry forward of targets will provide flexibility to manage the price volatility Disadvantage: Borrowing may result in delayed implementation.	Borrowing is not allowed
Floor price of allowance	Advantage: Setting floor price of allowance will send minimum price guarantee to participants and may lead to increased participation Disadvantage: Windfall gain to abatement options that are cheaper than the set floor price	Floor price will be calculated during the implementation phase based on the achievable potential, targets set, and energy price. This is also the price at which government may decide to buy back the surplus allowances.

Scheme attributes	Advantages & Disadvantages	Decision
Ex Ante issuance	<p>Advantage: Ex ante issuance of allowance can inject investor's confidence into the scheme. It can also help in getting finance for EE projects. But a price has to be signaled either through auctioning or government buy-out.</p> <p>Disadvantage: May result in flow of junk allowances unless supported by strong M&V mechanism. The scheme design may become complicated because of the allowance allocation methodology, price discovery mechanism, etc.</p>	<p>Partial allocation of allowance in advance (say 50%) may be done and the remainder can be done ex-post. Selling of allowances will be allowed to participants who have consumed less energy than the permissible level.</p>
Penalty	<p>Advantage: It will be more binding to the participants and may result in conscious action by the participants.</p> <p>Disadvantage: Provision of penalty may deter participation since voluntary. Target setting process may also become cumbersome as industry will push for comfortable targets</p>	<p>No penalty to promote more participants to join the scheme for building market readiness capacity</p>
New entrants during the cycle	<p>Advantage: Not all eligible designated factories and buildings are expected to sign up in the first year. Having this provision will increase participation in the scheme.</p> <p>Disadvantage: Managing the scheme might be difficult.</p>	<p>New entrants is not allowed</p>

V. System for Domestic MRV and Compliance

International experience indicates that it is extremely important to establish practical and cost effective monitoring guidelines at the beginning of an energy-efficiency or target-setting program. Clear and transparent monitoring guidelines should be outlined that give participants an overview of^{fviii}:

- What needs to be monitored and reported,
- When it should be monitored and reported,
- How it should be monitored and reported, and
- Who should monitor and to whom it should be reported.

Enough detail should be provided at the beginning of the scheme about how the savings will be documented and what level of accuracy is desired. Ideally, monitoring also includes verification by an independent third party that will validate the submitted information and oversee the monitoring procedures. It is important to clearly define the monitoring process, outline the format and requirements of monitoring reports, and provide clear definitions regarding energy use and energy saving measures.

Major attributes of MRV system

The broad principles of an effective MRV system are^{ix} shown in figure below.

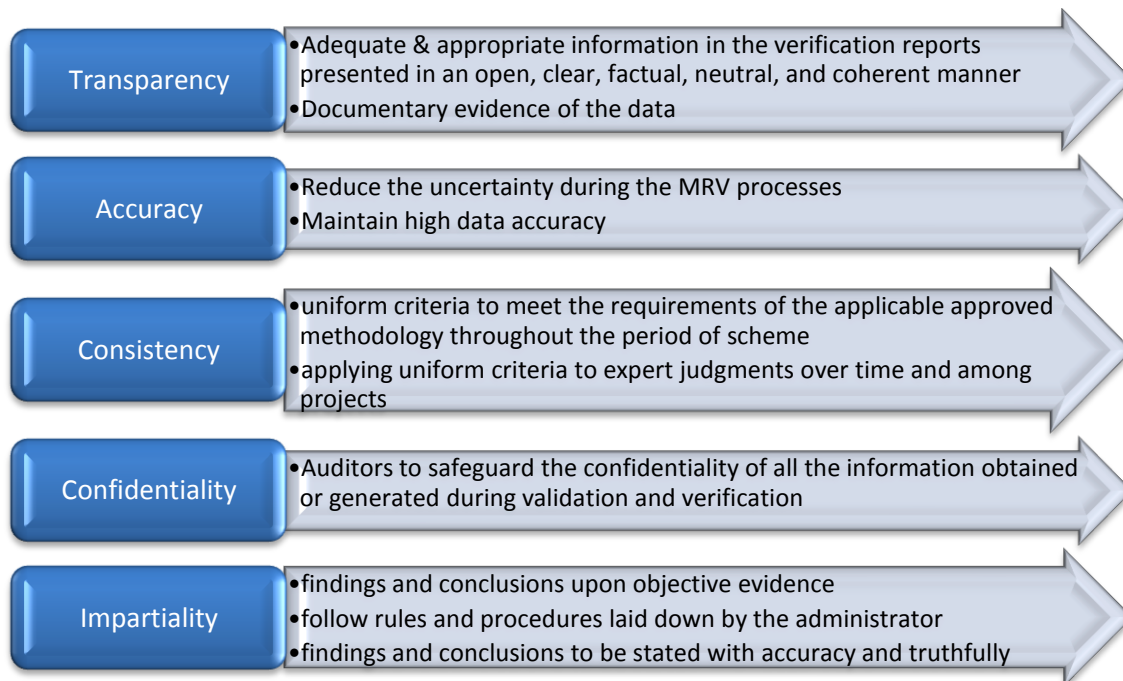


Figure 18: Broad Principles of MRV system

Based on key lessons learnt from the international schemes of China, UK, and India, following M&V Framework has been proposed for M&V in the EPC conceptualization study at different implementation stages:

- **Baseline Estimation:** Verification of Baseline Energy Data collected during the baseline estimation exercise. The verification guidelines will be a part of the EPC scheme rules.

Verifiers empanelled with the scheme administrator will conduct this exercise and will verify the production, energy consumption, capacity utilization data, etc.

- **Target Setting:** For setting the energy performance targets for eligible DF&Bs, energy audits will be conducted to estimate the energy savings potential, cluster classification and assessment of investment required.
- **Verification of Data Submitted by DF&Bs:** Annual verification of savings will be done by the accredited verifiers. This activity will include verifying and assessing the energy savings achieved, specific energy consumption reduction achieved, measures adopted for energy conservation. The verified report will state achievement or shortfall.

The **Table 14** summarizes the above observations and findings:

Table 14: M&V Framework at Different Implementation Stages

Activity	By Whom	When	How
Verification of Baseline Energy Data	Independent Verifiers	Before Target Setting	100% verification at DF&Bs
Verification of Savings Report furnished by DF&Bs	Independent Accredited Verifiers	Yearly or at the end of end of cycle	100% of the participating DF&Bs
Physical verification implemented savings measures on- site	Independent Accredited Verifiers	End of cycle	Random on-site verification through measurements if necessary

In order to place transparent, independent and credible monitoring and verification system for energy consumption and production based on the rules and guidelines of EPC scheme, a broad framework consisting of following constituents is recommended:

1. Format for preparation, maintenance and submission of energy data reports by the scheme participants to be designed or the current formats will be simplified.
2. Defined time lines for timely submission of data reports
3. An online system to be developed for data submission by the scheme participants
4. Third party verifiers and energy auditors to be empanelled by the scheme administrator to verify and audit the submitted data.
5. Methodology for normalization of energy consumption to be developed to determine the energy savings achievement.
6. Rules to be developed to conduct the onsite auditing and verification exercises.
7. The process of check-verification to be defined as well in case there is any inconsistency or error or complaint against the verification report.
8. A central repository or registry of Energy Performance Certificates to be maintained to monitor and verify the energy savings achievement from the EPC scheme.

An illustrative set of activities as shown in **Table 15** that may be conducted by different stakeholders during the course of implementation of MRV framework:

Table 15: Activities by different stakeholders under MRV framework

Activities	Stakeholder Responsible	Frequency of submission
Preparation and Maintenance of Quarterly Data Report	Empaneled DF&B	Every Quarter
Preparation and Maintenance of Yearly Data Reports	Empaneled DF&B	Once in a year
Submission of Performance Assessment Document	Empaneled DF&B	Once in a year/ cycle
Accreditation of Verifiers and Auditors	Scheme Administrator	Once in a cycle
Verification of Data Reports	Accredited Verifier	Once in a year/cycle
Submission of Verification document	Accredited Verifier	Once in a year /cycle

Possible challenges in the MRV system

Since the scheme is planned to be launched in 2017 and baseline estimation and target setting activities is required to be done by 2015-2016, it is important to have adequate verifiers in the country to take up this work. It is also important for these verifiers to adopt a common procedure/methodology for conducting verification for transparency, impartiality and consistency. The underlying challenges in M&V could be:

1. Different industrial sectors have different energy consumption patterns and normalization factors. To identify these normalization factors and develop a methodology form normalization of energy consumption and savings achievement is a challenging activity.
2. Lack of trained professionals to conduct the independent verification and energy auditing and management.
3. Limited number of Personnel Responsible for Energy (PRE) management in the designated factories/ buildings is going to be challenge. Capacity building of PRE to timely submit the energy data reports and performance documents and take up energy conservation activities in DF&B's boundary will be imminent to make MRV system work effectively.
4. To create awareness about the procedures and requirements of EPC scheme, the requirements to prepare and maintain periodic data reports will be a challenging activity. Trained energy management professionals will be required to undertake these activities for the eligible DF&Bs.
5. Implementation of standard practices to monitor and verify the energy consumption and savings for a large number of DF&Bs in different sectors and sub-sectors will pose a challenge.
6. In case of the annualized targets for the participating DF&Bs, there will be an abundance of data each year to be managed and analyzed by the scheme administrator. The capacity of administrator will be required to be built.
7. The change of boundary after the launch of the EPC scheme may affect the calculation of normalized energy consumption and savings.
8. Since this scheme is being launched in voluntary phase, ensuring compliance to the scheme's rules and guidelines by the DF&Bs is going to be a tremendous task. For this

purpose the level of flexibility given to the verifiers in understanding and conduct verification of DF&B's energy data will need to be determined.

vi. Fostering Stability

To manage all the data related to allowances, an official database preferably a web based is required. This is referred as a Registry which will contain information on allocations, transfers, surrender and cancellations of allowances. Development of registry would involve following sequential steps:

1. Identification of an entity which will act as Registry. TGO is proposed to act as Registry;
2. Conceptual architecture of functioning of EPC registry (schematic, information flow between account holders, technical requirements for software web application of Registry);
3. Rules for operation of the registry such as rules for uploading of information, etc;
4. Pricing methodologies for buying back the surplus of allowances by sink fund and their rules;
5. Development of Software web application for Registry

vii. Regulatory Framework and Institutional Arrangement

This chapter briefly describes the regulatory framework required for implementing EPC scheme. Thailand already has the necessary legal and regulatory framework (Energy Conservation Act and Energy Efficiency Development Plan) supporting some of the activities envisaged under EPC scheme. However, the existing regulations may not be sufficient to support the entire activities, and hence in order to implement the remaining activities, some regulatory gaps are required to be addressed **Table 16**.

Table 16: Regulatory Framework required for EPC Scheme

Scheme Component	Activities under the scheme	Regulatory framework in place
Scheme Design	Conceptualization of scheme	EEDP entails: <ul style="list-style-type: none"> • Enforce mandatory submission of energy consumption information • Encourage local administration organizations and the business sector to undertake activities related to low carbon society and economy development
	Eligibility / Selection of participants	ENCON Act entails: <ul style="list-style-type: none"> • Designated Factories and Buildings defined in the Act EEDP entails: <ul style="list-style-type: none"> • Enforce the ENCON Act, as amended up to B.E. 2550 (2007) • Amend the 2007 ENCON Act (e.g. expansion of the scope to cover small-scale buildings/factories and business facilities other than buildings/factories)

Scheme Component	Activities under the scheme	Regulatory framework in place
	Setting of targets	EEDP entails: <ul style="list-style-type: none"> • Long term aspiration goal for energy intensity reduction • Enforce the specific energy consumption (SEC) standards for the production process • Develop the SEC database and benchmark both domestic and overseas SEC
Scheme Launch	Enrolment of participants	EEDP entails: <ul style="list-style-type: none"> • Engage in voluntary energy-saving agreements with commercial/industrial clusters and business associations • Launch PR on energy efficiency measures and technology
	Rules of scheme, financing, trading, etc.	EEDP entails: <ul style="list-style-type: none"> • Enforcement of the Energy Conservation Promotion Act, [as amended up to] B.E. 2550 (2007), so that the energy management system through energy consumption reporting and verification imposed on designated buildings and factories would materialize • Provide subsidies for energy saving achieved, which can be verified as per the project proposals approved under the DSM Bidding scheme for large-scale businesses • Provide subsidies for energy saving achieved and/or peak load cut that can be verified for retail consumers and small businesses/industries under the Standard Offer Program (SOP) scheme • Undertake tax restructuring to encourage energy conservation and GHG reduction
	Institutional arrangement of the scheme	EEDP entails: <ul style="list-style-type: none"> • Enhance institutional capability of agencies/organizations responsible for the planning, supervision and promotion of the implementation of energy efficiency measures
Scheme Implementation	Monitoring & Verification of energy savings	EEDP entails: <ul style="list-style-type: none"> • Develop experts to serve consultancy agencies/companies and ESCO • Build up professionals to serve business operation facilities • Development of professionals in the energy conservation field to be persons responsible for energy management and operation, verification and monitoring, etc.
	Trading of Allowance	Nothing specific in place. Rule of EPC scheme needs to capture this.
	Dispute Resolution	Nothing specific in place. Rule of EPC scheme needs to capture this.

Institutional arrangements

The Market Based Mechanisms generally rely on two critical factors for success:

- a) A strong market design which has the entire blueprint of the market process along with detailing of market signals that may influence behavior of the stakeholders and
- b) A robust institutional structure that supports its development, with roles and responsibilities of various institutions being completely identified. Efficient institutional structures play a very efficient role in administration of the scheme. A step by step flowchart of the whole process of the implementation of EPC scheme is given in figure below.

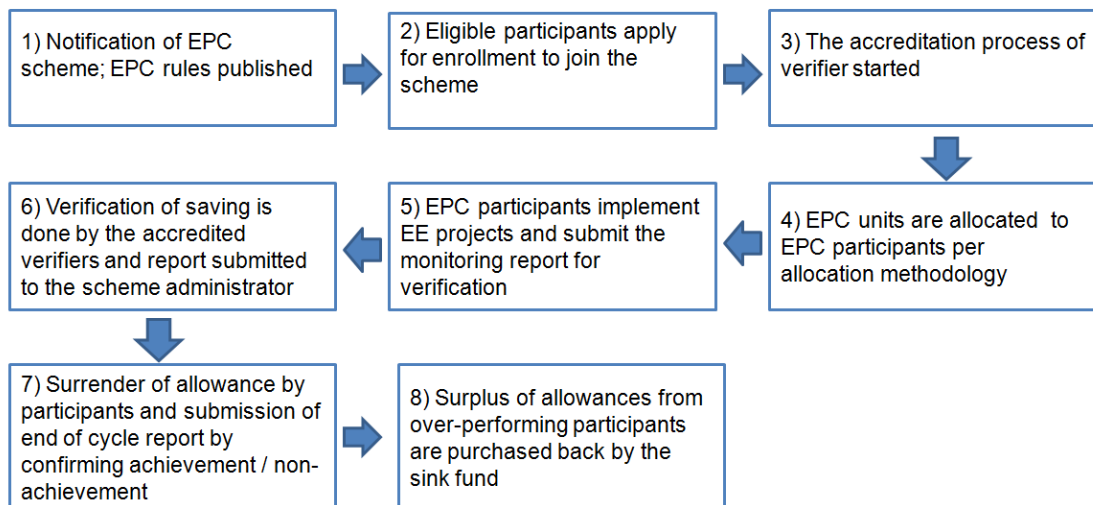


Figure 19: EPC step by step flow chart

The proposed institutional design is based on the study of international policy-mandated market-based mechanisms. In addition to lessons derived from these international mechanisms, the existing policy and regulatory framework around energy efficiency in Thailand was also taken into consideration while proposing the institutional design. Roles and responsibilities of each of the stakeholders have been discussed later in the section. In addition, entities that can possibly assume these responsibilities in the institutional framework were also discussed with DEDE and are presented in the **Figure 20**.

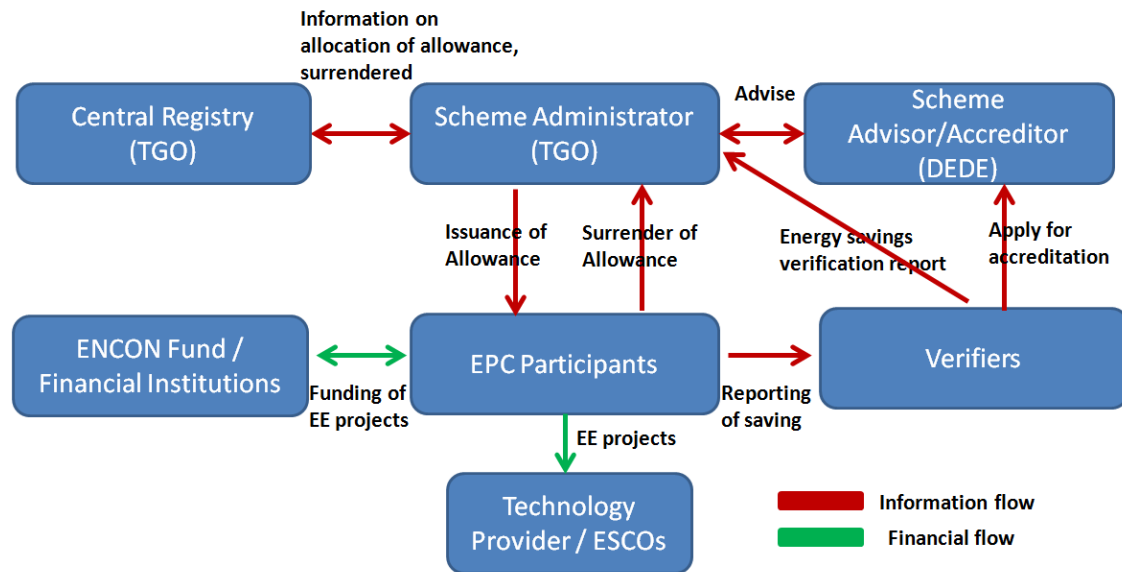


Figure 20: Institutional Structure

The roles for various entities in the proposed institutional structure are:

Department of Alternative Energy Development and Energy Efficiency (DEDE) under the Ministry of Energy will be to advise EPC scheme, to allocate budget for the activities to be undertaken provide regulatory provisions as per the Energy Conservation Act. This will be particularly essential to collect historical energy consumption data from probable designated industries and buildings and coordinate scheme progress and evaluates the implementation outcome. DEDE may undertake the accreditation /empanelment of Verifiers.

Thailand Greenhouse Gas Management Organization (TGO) as Scheme Administrator will need to analysis to estimate baseline energy consumption, set the energy efficiency targets, publish protocols and procedures for implementation of the EPC scheme, and allocation of allowances. TGO also seems suitable to act as a registry of the scheme.

The **Verifiers** would be independent entities having energy efficiency experts and engineers, responsible for carrying out monitoring, verification, and reporting of energy efficiency projects undertaken by EPC participants. There is an Energy Auditor Management system currently in place wherein DEDE has empanelled auditors which can certify the mandatory energy consumption record submission by designated factories. Previously there were RC registrars appointed by DEDE for information gathering and verification submitted by designated factories. Such existing bodies will have to be further trained and their numbers will have to be increased to meet the requirements under the scheme.

The **EPC participants** (out of eligible industries and buildings) would have the responsibilities to fulfill the energy savings targets and reporting requirements. For this purpose, they either can undertake energy efficiency initiatives. PRE (person responsible for energy) may be appointed as the nodal person for sharing of data and submission of reports to the scheme administrator. EPC participant will have to appoint an empanelled verifier for conducting verification of savings as per the developed rules.

Department of Industrial Works (DIW), Ministry of Industry, has been operating the “Energy Savings for Small and Medium-Sized Enterprises (SMEs)” program in the past and their role in EPC will be to attract participation from the eligible factories, facilitate data collection from the designated factories, and play an active role in the scheme design and launch.

Technology providers, Consulting firms, ESCOs, Financial Institutions, Financiers would have their own roles to play as the entire mechanism attains greater depth and liquidity in due course of time, wherein these entities would help the market to stabilize and sustain in the longer run. The proposed institutional design is simple, robust and optimally utilizes the existing institutional capacity. However, the critical issue with respect to implementation is development of institutional capacity of TGO, DEDE, Verifiers, and EPC participants etc., to deliver assigned responsibilities.

viii. Use of Offset and/or Linking Consideration

In order to establish a simple and independent system, it has been decided that the demonstration EPC scheme will not allow the use of offset and not consider to link with other energy efficiency trading or emission trading scheme.

ix. Incentives for EPC participants

Since the participation in EPC scheme is voluntary, it is a challenge to promote DF&Bs to join in the scheme in the demonstration phase. Hence special attention will be given to assess and describe the incentives that would encourage all companies to participate and reward early movers in EPC scheme.

To participate in the EPC scheme, the investment cost and transaction costs occur. Such transaction costs may include pre-audit of energy uses, cost of document preparation, cost of measuring devices, cost of verification by third party, etc. The financial tools are required to compensate such additional costs as well as to attract the participation of EPC scheme. From the review of international experiences and consultation with experts from Ministry of Energy, the options for incentivizing participation of EPC scheme are:

1. Grants for compensation of the transaction cost,
2. Investment & performance subsidy for early movers, and
3. Tax rebates for initial investment cost for early movers.
4. Free positive publicity on participating in the EPC

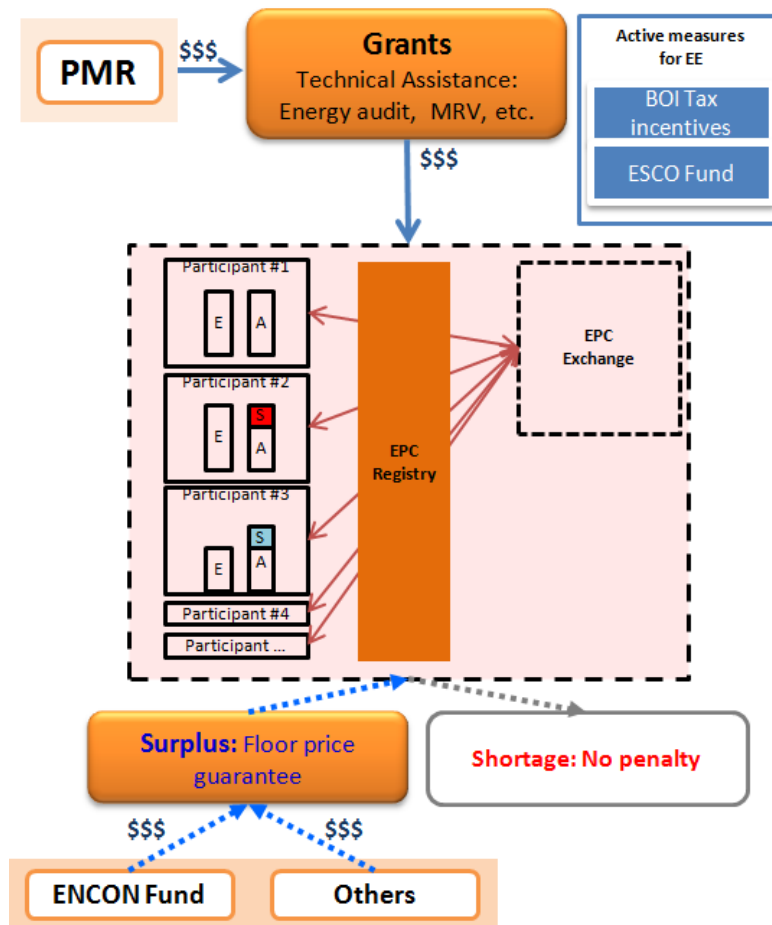
Advantages and disadvantages of these options are illustrated in the table below.

Table 17 Advantages and disadvantages of options for incentive

Option for incentive	Advantages	Disadvantages
1. Grants for compensation of the transaction cost	<ul style="list-style-type: none"> The budget required for this option is small compared to the investment subsidy. Easy to design: Fixed rate can be set up for different size of projects. 	<ul style="list-style-type: none"> Fair level of attractiveness to DF&Bs to commit their energy saving targets. Aggressive targets may not be set.

Option for incentive	Advantages	Disadvantages
	<ul style="list-style-type: none"> Easy to establish: The budget is so small that only support from PMR is sufficient. 	<ul style="list-style-type: none"> Participation may be limited to DF&Bs with high awareness of climate change. Other businesses with high potential in energy savings may not participate.
2. Investment & performance subsidy (is it possible to differentiate for early movers?) and price guarantees by the government	<ul style="list-style-type: none"> High level of attractiveness to DF&Bs to commit their energy saving targets. Businesses with high potential in energy savings may participate. Price guarantees considerably reduce the risks for EPC participants 	<ul style="list-style-type: none"> Large amount of budget is required. Large efforts are required for fund raising. Options are national budget, ENCON Fund, etc. Participation may be limited to businesses with least abatement cost. Careful design is needed. Price guarantees pose a financial risk to the government
3. Tax rebates for initial investment cost	<ul style="list-style-type: none"> The budget required for this option is small compared to the investment subsidy. Easy to design: Fixed rate can be set up for different size of projects. More attractive if the carbon tax is implemented and the exemption applies as in the case of Swiss ETS. 	<ul style="list-style-type: none"> Large efforts and long process are required for setting up the program since the cabinet resolution is needed. Fair level of attractiveness to DF&Bs to commit their energy saving targets. Aggressive targets may not be set. Participation may be limited to DF&Bs with high awareness of climate change. Other businesses with high potential in energy savings may not participate.
4. Free positive publicity on participating in the EPC	<ul style="list-style-type: none"> Free positive publicity can support the company's positive image and cause public recognition 	<ul style="list-style-type: none"> Low level of attractiveness to DF&Bs to commit their energy saving targets. – Effective when combined with financial incentives

Based on an initial study and a discussion with relevant stakeholders, it is proposed that an incentive option that contains both of providing grants for covering the transaction cost and of providing a floor price guarantee to all surpluses of EPC units could be accepted by potential EPC participants to voluntarily join the scheme. The design of the incentive option for EPC participants is presented below.



From the figure of incentive above, it shows that the EPC participants will receive two main incentives when participating in the EPC scheme.

¹⁰ ESCO Venture Capital Fund (ESCO Fund) is one of the policy instruments aiming to invest jointly with private sectors (i.e. ESCOs, project developers) in energy efficiency and renewable energy projects.

Chapter 2.2 EPC

3. Proposed Activities, Objectives, Budgets

- i. 2014-2016: EPC Preparation Phase
- ii. 2017-2019: EPC Demonstration Phase
- iii. Target setting methodology
- iv. Fostering Stability
- v. System for MRV and Compliance

The proposed activities, objectives and budgets are presented in two phases from the preparation of the EPC (2014-2016) to the operation of the EPC (2017-2019)

i. 2014-2016: EPC Preparation Phase

Objective: This phase would focus on the detail assessment of the various preparedness levels, identify and bridge the gaps, develop methodology and procedures, establish MRV system and develop detail operational guidelines of EPC scheme, convince all stakeholders regarding the scheme.

Data

As explained earlier, Thailand has already identified DF&Bs in industrial and building sectors. So, for EPC scheme the existing list of DF&Bs as maintained by DEDE can be utilized. *No further exercise is required to identify the participating factories and buildings.* Therefore, the EPC scheme is expected to focus about 1241 number of DF&Bs (about 21% of total DF&Bs) whose annual energy consumption is about 21,586 ktoe (about 32% of total energy consumption of the country).

As per existing law, all the designated factories and buildings are required to submit the desired information to the Government (i.e. DEDE). However, the existing energy data reporting format is mainly focusing on energy management system and may not also contain the desired information as required for EPC scheme. At present, about 80% of the DF&Bs have submitted their annual energy reports to DEDE. It is necessary to develop well-structured sector specific formats for collection of information from the designated factories and buildings. This will be a critical activity not only for establishing baseline but also for target setting.

There is a need to know the energy usage pattern and bandwidth of specific energy consumption among the factories or buildings across the sector. The reasons for large bandwidth in SEC should also be established. This will give an idea of possible potential improvement possibilities in different sub-sectors. No such data or information are available in Thailand as of now. A research study may be taken up for this purpose as such information are crucial for baseline and target setting. India had carried out similar exercise before setting the target for participants in PAT scheme.

The data on the list of existing Persons Responsible for Energy (PRE) in DF&Bs and energy auditors are available with DEDE. There is a need to review the list and see for any upgrade.

Proposed Activities:

1. Assessment Study on present data on list of DF&Bs, annual energy consumption of each DF&B, list of PREs and energy auditors etc, data capture and storage system
2. Review of present data format in the context of EPC requirement and look into the modifications required
3. Research study on Sector-specific energy usage pattern and potential improvement for energy efficiency
4. Development of sector-specific technology compendium

MRV System

As per existing law, the DF&Bs are required to report to DEDE regarding their energy management system. The duly-filled in data are signed by PREs appointed by DF&Bs. The submitted data are supposed to be verified by DEDE through certified energy auditors, but due to administrative constraint such verifications are not practiced.

There may be difficulty in understanding the format and furnishing of information by the factories/buildings. Development of simple guidelines and capacity building of fellow designated factories/buildings will address this issue. An assessment of skill set among PREs and energy auditors will also be very helpful in designing the capacity building program.

The data reporting system, at present, is a manual one. The DF&Bs do submit their annual report to DEDE. Establishment of an e-portal will help in increasing the efficiency and data reporting system.

Three years data (2010, 2011 and 2012) will be obtained from different DF&Bs in the identified sub-sectors. 100% data verification will be done by independent verifiers and monitored by DEDE. The existing certified energy auditors will be trained to do these verification activities. An assessment study will be taken up to know the demand-supply gap of such certified energy auditors. DEDE will also initiate action to develop sufficient number of energy auditors, if required. A verification protocol/ guideline will also be developed to facilitate the energy auditors in verification process of baseline data.

Proposed Activities:

1. Assessment Study on present MRV system, demand-supply gap of certified energy auditors and their skill level to do the verification.
2. Create suitable number of certified energy auditors, develop & maintain a list of available independent verifiers.
3. Develop an e-portal to facilitate the submission of annual energy report by DF&Bs to DEDE.
4. Obtain 3 years data (as required for EPC) as per the format from all DF&Bs
5. 100% verification of all reported data by independent verifiers.
6. Develop guidelines for PREs on how to fill-up the data format and for certified energy auditors on how to verify the data
7. Capacity building of PREs and Verifiers

Target Setting

As explained earlier, there would be separate target for separate factories and buildings due to difference in energy usage pattern affected by various diversities. So, the aim in EPC scheme would be to assign lesser target to a good performing DF&B as compared to poorly performing DF&B. The successful approach of PAT scheme of India will be applied here.

Every DF&B will have to improve the energy intensity from their baseline value. The gate-to-gate concept of estimating the baseline SEC will be used. The advantage of gate-to-gate concept is that it would capture all form of energy input to a factory boundary and product going out of the factory boundary which can be easily verified without any complex measurements.

The top-down and bottom-up approach will be used to set the target for each DF&Bs which will take care of the national target, potential available for improvement and present level of performance. The learning of PAT scheme of India will be very handy here. Although, no focus is made in the quantification of energy saving due to EPC scheme in demonstration phase, the methodology of the target setting will be tried as a model.

The methodology of baseline estimation and target setting will be duly discussed with various stakeholders through a consultation process. The methodology will be fine tuned based on the feedback and suggestions from all concerned.

As the number of DF&Bs are relatively higher and may increase in future, it is necessary that such analysis be carried out by using IT. Suitable application software will be developed to analyse the data for establishing the baseline and target setting.

There is a need to document the approach, criteria, methodology and operational features of EPC scheme for better understanding of all stakeholders. An EPC design and operational document will be prepared for this purpose before the scheme is moved to demonstration phase.

Proposed Activities:

1. Consultation process of finalizing the methodology of baseline and target setting of DF&Bs
2. Analysis of Data for baseline estimation and target setting through suitable application software.
3. Develop EPC design and operational document

Other Proposed Activities in the EPC preparation phase

Apart from the above activities on Data, MRV and Target setting front, the following activities are also proposed:

1. During the demonstration phase, technical support will be provided to DF&Bs who participate in the demonstration phase. It is expected that about 20% of the probable DF&Bs will participate in the scheme in the demonstration phase. DEDE will get the energy audit conducted in these participating units to identify the saving potential which would facilitate the DF&B to implement. So, *guidebooks on energy audit in plant utilities will be developed to standardize the energy auditing methodology by energy auditors*. DEDE may seek technical support from other countries of the region like India in this regard.

2. One of the critical issues is how (when and at what amount) to allocate energy consumption allowances to each DF&B who participates in the EPC. Therefore, it is proposed to *study the allocation methods from other ETS and to provide a proposal of allocation methodology in EPC.*
3. As described, one of the incentives for EPC participants who can perform better than the target is to provide a buy-back guarantee of the surplus of allowances by the sink fund (ENCON fund). Therefore, it is necessary to study and determine the proper price level.

Activities and proposed budget:

Section	Activity	Time Required (months)	Estimated budget requirement (Million USD)	Year of funding required
EPC Preparation Phase			2.36	2014-16
Data	1. Assessment Study on present data (list of DF&Bs, annual energy consumption of each DF&B, list of PREs and energy auditors etc, data capture and storage system)	2	0.04	2014
MRV	2. Assessment Study on present MRV system, demand-supply gap of certified energy auditors and their skill level to do the verification.	2	0.04	2014
Preparedness	3. Assessment Study on provisions of present Law and amendments required for EPC scheme	4	0.03	2014
Data	4. Review of present data format in the context of EPC requirement and look into the modifications required	3	0.04	2014
Data	5. Research study on Sector-specific energy usage pattern and potential improvement for energy efficiency	12	0.20	2014-15
MRV	6. Develop an e-portal to facilitate the submission of annual energy report by DF&Bs to DEDE.	6	0.20	2014
MRV	7. Create suitable number of certified energy auditors, develop & maintain a list of available independent verifiers.	24	0.20	2015-16
MRV	8. Develop guidelines for PREs on how to fill-up the data format and for certified energy auditors on how to verify the data	2	0.01	2015
MRV	9. Obtain 3 years data (as required for EPC) as per the format from all DF&Bs	12	-	2014
MRV	10. 100% verification of all reported data by independent verifiers.	6	0.40	2015
Data	11. Development of sector-specific technology compendium	6	0.10	2016

Section	Activity	Time Required (months)	Estimated budget requirement (Million USD)	Year of funding required
MRV	12. Capacity building of PREs and Verifiers	6	0.10	2015-16
Target Setting	13. Consultation process of finalizing the methodology of baseline and target setting of DF&Bs	6	0.10	2015-16
Target Setting	14. Analysis of Data for baseline estimation and target setting through suitable application software.	12	0.20	2016
Target Setting	15. Develop EPC design and operational document	4	0.02	2016
Preparedness	16. Development of a guidebook on energy auditing	12	0.10	2015
Preparedness	17. Development of system for EPC registry	12	0.40	2014-16
Preparedness	18. Training officials and staff for EPC registry	1	0.03	2016
Allocation methodology	19. A study of the allocation methods from other ETS and a proposal of allocation methodology in EPC	12	0.10	2015
Incentive	20. A study to determine the price level to buy back the surplus of allowances	6	0.05	2014

ii. 2017-2019: EPC Demonstration Phase

Objective: This phase would focus on launching the scheme on a demonstration basis where the design framework of the EPC scheme will be tested. The learning and gaps (if any) will be the key take away of the demonstration scheme to take necessary corrective action for launching a mandatory ETS system in the future.

1. The demonstration phase will be launched after the preparatory phase is over. The scheme administrator will take necessary steps to ensure participation of at least 20% of the probable DF&Bs in the scheme. The consultations with industry associations and other stakeholders during the preparation phase will be leveraged to attract participation in the scheme. Scheme administrator will also initiate intensive media campaign to attract participation of the scheme.
2. The DF&B willing to participate in the demonstration phase will be required to have an agreement with the scheme administrator. An agreement or memorandum of understanding will be developed by scheme administrator in this regard.
3. The scheme administrator will facilitate the participating unit in getting the energy audit conducted by energy auditors. So, energy audit by certified professionals will be conducted in all the DF&B willing to participate (at least 20% of the total probable DF&Bs here). The technology compendium earlier prepared during preparation phase will also be provided to the participating DF&B free of cost. Financial incentive may also be provided to the participating units, if feasible.

4. The participating DF&B will submit the report to the scheme administrator on achievement made by it against the target assigned. The DF&Bs will submit the same by a standardized format called EPC Assessment Document. So, an EPC assessment document will be developed by scheme administrator indicating what and how to be reported upon.
5. There will be verification of EPC Assessment document by the scheme administrator through the independent verifiers. A verification protocol or guideline will be developed for this purpose to facilitate the independent verifiers. Adequate number of capacity building programs of independent verifiers will be taken up during the demonstration phase before they do final verification.
6. Post verification and due review by scheme administrator. The surplus of allowances will be absorbed by a sink fund created by ENCON Fund.
7. An assessment study on the success or failure of the demonstration will be taken up to see the possibility of improvement. The success of the demonstration study will be well documented and propagated to all DF&Bs and other stakeholders which may be a convincing case for participation in the future.

Proposed Activities:

1. Outreach and media campaign to invite participation in the demonstration phase
2. Develop format for MoU and EPC Assessment Document
3. Develop sector-specific verification protocol
4. Energy audit of all DF&Bs willing to participate in the demonstration phase
5. Capacity building program of independent verifiers
6. Creation of a sink fund to buy back the EPC generated by over-performers
7. Assessment study on the success or failure of the demonstration
8. Outreach and media campaign to propagate the success of the demonstration phase

Activities and proposed budget:

Section	Activity	Time Required (months)	Estimated budget requirement (Million USD)	Year of funding required
EPC Demonstration Phase			1.69	2017-19
Communication	1. Outreach and media campaign to invite participation in the demonstration phase	6	0.10	2017
MRV	2. Develop sector-specific verification protocol	12	0.20	2017
MRV	3. Energy audit of all DF&Bs willing to participate in the demonstration phase	12	1.20	2017-18
Readiness	4. Capacity building program of independent verifiers	6	0.05	2018
Readiness	5. Assessment study on the success or failure of the demonstration	3	0.04	2019
Communication	6. Outreach and media campaign to propagate the success of the demonstration phase	3	0.10	2019

Chapter 2.3 Low Carbon City Program (LCC)

1. Assessment and Rationale for establishing the LCC program
2. Design of the Low Carbon City Program program
3. Proposed Activities, Objectives and Budgets

The LCC program aims to support achieving the national goal to shift towards a low carbon society by implementing greenhouse gas emission reduction activities in municipalities and communities. “Low Carbon City” refers to a province, city, municipality, or community that pursues a systematic process to achieve GHG emission reductions. The projects under the LCC Program, developed by municipalities and communities, will apply the Thailand Voluntary Emission Reduction Program (T-VER) for certifying and issuing carbon credits, TVER credits, generated under the LCC program (LCC-TVER). The LCC-TVER credits can be used for offsetting carbon footprints in voluntary market, and once the domestic emission trading scheme in Thailand established, the LCC-TVER credits will be eligible for compliance purpose in the scheme. The municipalities and local communities who participate in the program will get benefit from selling carbon credit converted from GHG emission reductions which can be translated into community revenue.

The implementation of Low Carbon City (LCC) program will be carried out, with the municipalities, being the local authorities, acting as a driving entity in developing renewable energy projects, supporting energy efficiency as well as managing community waste and public transport system and promoting green spaces, in their areas, under the supportive measures provided by the government, i.e. feed-in-tariff, soft loan, investment subsidy, ESCO venture capital fund.

Chapter 2.3 LCC Program

1. Assessment and Rationale for establishing the LCC program

- i. Background
- ii. Existing relevant policies and political tools
- iii. The outline and rationale of the LCC
- iv. LCC expanded to cover all municipalities

i. Background

As mentioned earlier, Thailand has no specific policy on climate change only; however, it has integrated climate change issues into the NESDP, which is the core plan of Thailand's public policies. According to the 11th NESDP, the country is fostering a low-carbon society and green growth. The plan has addressed climate change as one of the significant changes that Thailand will encounter during the implementation of this Plan. One of its development guidelines is to shift the development paradigm and redirect the country to a low-carbon and environmentally friendly economy.

Thailand's successful economic development has led to an increasingly urban population. Its urban population in 2010 accounted 34% and it currently has an annual urbanization rate of 1.8% (2010-2015); which makes it comparable to other countries in Southeast Asia (CIA, 2013).

Up until now, urbanization has been dominated by the Bangkok Metropolitan Region, which has around 14 million people (around 20% of the country's total). By the early 80s Bangkok was 50 times larger than Thailand's second city. As it can be observed in the map and in the graph below, urbanization has now shifted to peripheral provinces, especially in the South and in the North East of the country (UNFPA, 2011).

As in other emerging economies, urban population in Thailand (34% in 2010) is growing steadily and will be over 50% by 2050, based on the development poles of provinces. Thailand's population is expected to grow up to 2020 and to start to decline thereafter, but urban systems will become an increasing source of GHG emissions in Thailand.

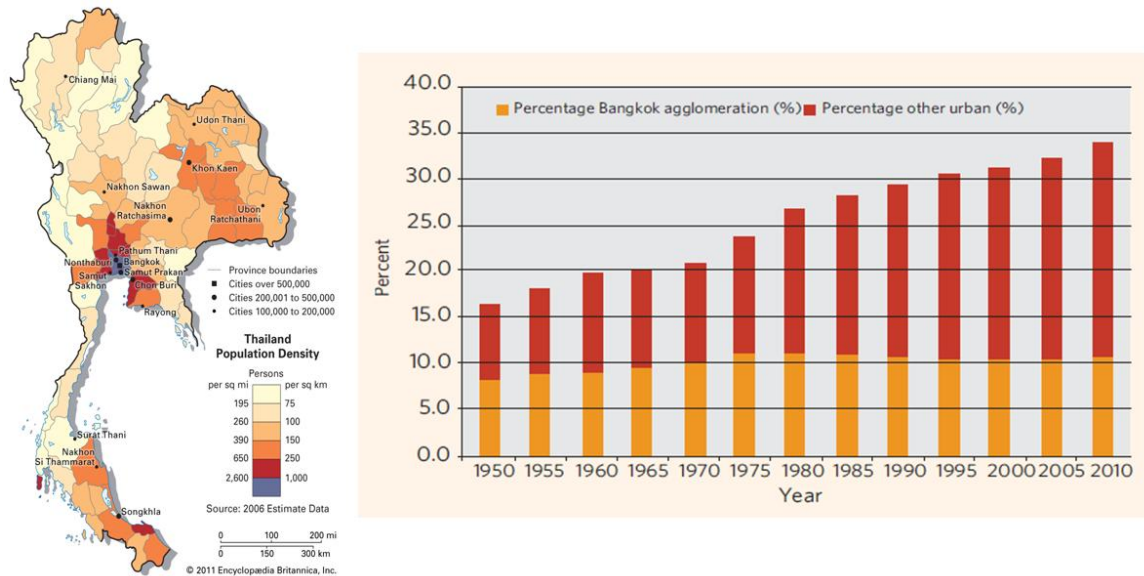


Figure 22: Thailand's Population Density and Urbanization Rate

Source: Encyclopedia Britannica (2011) and UNFPA (2011).

To redirect the country to a low-carbon society, **local authorities are the units of administration that can be targeted as a first line of action to help Thailand simultaneously address resource conservation and progress towards low carbon societies.** They provide a wide range of products and services, and this presents manifold opportunities for low carbon initiatives. Cities have to be considered, not only as energy consumers and GHG emitters, but also energy producers and suppliers. Cities have potential to become actors and catalyzers for adopting energy efficiency measures, generating electricity through local renewable energy sources, providing public transportation services and non-motorized facilities, managing urban waste, and increasing green areas. Municipal authorities can prioritize expenditures on social security nets, local/regional infrastructure and other types of development, with a view to securing long-term growth while stimulating consumption and reducing impact on local socio-economic conditions in close collaboration with central government. However, they have limited capacity to implement GHG mitigation actions.

ii. Existing relevant policies and political tools

Two key policies in the energy sector which have significant impacts on GHG mitigation are the 20-year Energy Efficiency Development Plan (EEDP) and the 10-year Alternative Energy Development Plan (AEDP).

The Ministry of Energy's 20-year Energy Efficiency Development Plan (EEDP) 2011-2030 aims to promote the reduction of energy intensity by 25% in 2030 compared with that in 2010 (23.5% of final energy consumption in 2030 or saving of 38,200 ktoe per year). The highest savings will be contributed by the industry sector (42%), followed by transportation (40%), large commercial building (9%), and small commercial and residential building (9%). The Ministry of Energy's 10-year Alternative Energy Development Plan (AEDP) 2012-2021 aims to increase renewable energy (RE) share from various renewable sources for power generation and fuel consumption to 25% of final energy consumption in 2021. Given their strategic importance, energy efficiency, renewable energy and low-carbon cities are identified as priority sectors to target efforts to build market readiness.

To strengthen the country's energy security and to support development of low carbon society, the Ministry of Energy has established the 10-year Alternative Energy Development Plan (AEDP 2012 – 2021) which has targeted to increase the share of renewable energy in the final energy demand to 25% by 2021. The plan is established to commit to the development of Low Carbon Society to be respond to the Green Growth and Low-carbon Development as part of its strategy for balanced and inclusive growth of The 11th National Economic and Social Development Plan (NESDP).

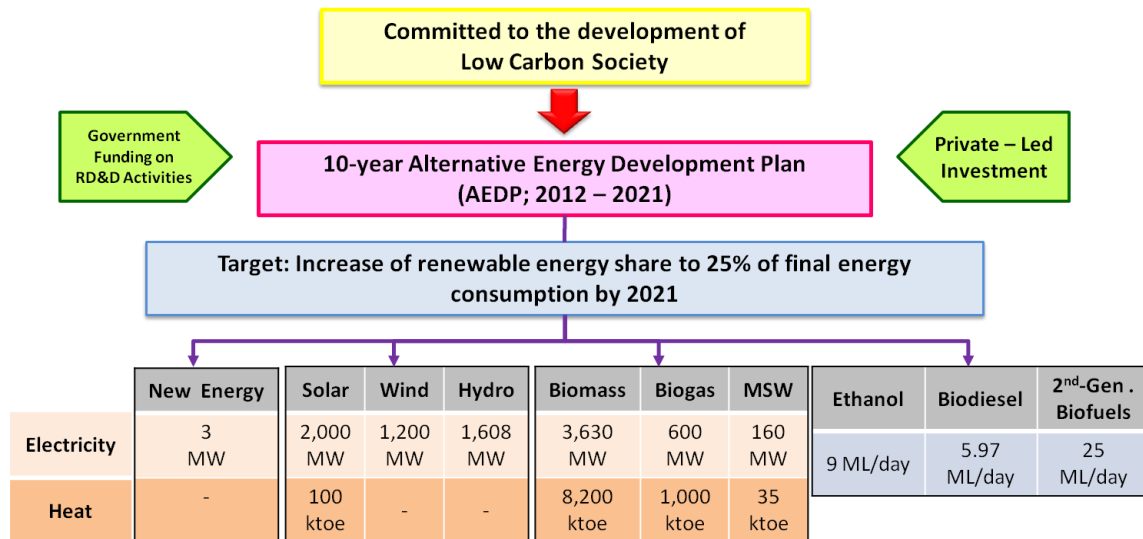


Figure 23: Target of the 10-year Alternative Energy Development Plan (AEDP), DEDE 2011

The long-term target of energy generation in terms of heat and electricity has been set for each kind of renewable energy, i.e. biomass, biogas, municipal solid waste, wind, solar and small-hydropower, as well as the target to increase the use of biofuel, particularly ethanol and biodiesel, as alternative energy for transport.

Although the progress of AEDP is largely on track with substantial private investments in renewable energy projects, there is a greater role for local municipalities to play in renewable energy development especially waste-to-energy projects (for solid waste and wastewater), smaller-scale or community-level renewable energy projects, fuel-switching in public vehicles, and etc. On the other hand, while there is a keen interest to promote low-carbon city nation-wide with efforts by various agencies including NESDB, TGO, and the Ministry of Energy to develop national policy and guidelines on low-carbon city, establish local inventory, and pilot low-carbon city projects in selected municipalities, the low-carbon city policy is still in an early stage of development. Key challenges which prevent local authorities to implement low-carbon city initiatives include limited technical capacity of local authorities to plan, design and implement low-carbon projects, as well as limited financial capacity to raise fund or secure budget to finance capital investment, and operation and maintenance of these projects.

To scale-up low-carbon city development (there are over 1,100 municipalities nation-wide), it is commonly agreed that efforts to build up local capacity to identify and develop sound GHG mitigation reduction plan and projects in their judicial area will be critical to enable local municipalities to become major players in mitigation efforts in the long-run. Market-based instruments are expected to help incentivize local municipalities and communities to implement mitigation actions by filling in local capacity gap and financial gap in project financing and

thereby support the 11th NESDP plan in achieving sustainable development and low carbon society goals as well as support AEDP by promoting small and micro renewable energy projects under Green City as part of the AEDP.

In sum, there is a strong rationale for the country to consider adopting market-based instruments to implement cost-effective emission reductions nation-wide in the long-run. Thus, it will be vital to prepare the market players in both private and public sectors to build technical knowledge, lay down institutional and legal infrastructure, and gain broad-based public acceptance before launching full-fledged mandatory schemes in the future. In the short-term, these market readiness efforts will help incubate and develop voluntary domestic markets. Under the targeted scope of PMR activities, the market-based instruments are expected to help fill in existing policy and implementation gaps in the current national priorities of EE, RE and low-carbon city and accelerate the implementation of these three national priorities.

iii. The outline and rationale of the LCC

In this context, TGO has conducted a comprehensive consultation process along the Thai local authorities. Remarkably, it has been identified 32 municipalities (*Thesaban* in Thai) that have showed interest in participating to the LCC program as the details in the following table.

Num.	Municipality	Level	Province	Region	Population*	Remark
1	Pak Kret	Nakhon	Nonthaburi	Central	180,727	The Mayor is the President of NMT
2	Nakorn Pathom	Nakhon	Nakhon Pathom		79,148	NMT's Regional Coordinating Center on Urban and Environmental Management
3	Nonthaburi	Nakhon	Nonthaburi		257,745	
4	Samut Prakan	Nakhon	Samut Prakan		51,691	
5	Samut Sakhon	Nakhon	Samut Sakhon		55,069	
6	Om Noi	Nakhon	Samut Sakhon		52,097	
7	Phra Nakhon Si Ayutthaya	Nakhon	Phra Nakhon Si Ayutthaya		53,290	
8	Rangsit	Nakhon	Pathum Thani		78,826	
9	Phetchaburi	Mueang	Phetchaburi		23,811	
10	Amphawa	Tambon	Samut Songkhram		5,337	
11	Laem Chabang	Nakhon	Chon Buri	Eastern	73,520	
12	Rayong	Nakhon	Rayong		60,437	
13	Phanut	Mueang	Chon Buri		11,267	The Mayor is the

Num.	Municipality	Level	Province	Region	Population*	Remark
	Nikhom					President of Subcommittee on Environment, City Planning and Civil Engineering, NMT
14	Mueang Klang	Tambon	Rayong		17,491	NMT's Regional Coordinating Center on Urban and Environmental Management
15	Chiang Rai	Nakhon	Chiang Rai	Northern	69,888	NMT's Regional Coordinating Center on Urban and Environmental Management
16	Chiang Mai	Nakhon	Chiang Mai		135,757	
17	Lampang	Nakhon	Lam Pang		55,852	
18	Nan	Mueang	Nan		21,249	
19	Rong Kwang	Tambon	Phrae		12,902	
20	Khon Kaen	Nakhon	Khon Kaen	North Eastern	110,686	NMT's Regional Coordinating Center on Urban and Environmental Management
21	Udon Thani	Nakhon	Udon Thani		135,179	
22	Nakhon Ratchasima	Nakhon	Nakhon Ratchasima		137,579	
23	Sikhio	Mueang	Nakhon Ratchasima		18,259	
24	Si Saket	Mueang	Si Saket		40,168	
25	Fang Daeng	Tambon	Nong Bua Lamphu		11,932	
26	SongKhla	Nakhon	Song Khla	Southern	68,725	NMT's Regional Coordinating Center on Urban and Environmental Management
27	Phuket	Nakhon	Phuket		75,536	
28	Hat Yai	Nakhon	Song Khla		157,917	
29	Surat Thani	Nakhon	Surat Thani		126,131	
30	Koh Samui	Nakhon	Surat Thani		62,357	
31	Thung Song	Mueang	Nakhon Si Thammarat		29,695	
32	Prik	Tambon	Song Khla		6,304	

Specifically, these 32 municipalities represent more than 2,200,000 inhabitants in Thailand. In addition, this selection of municipalities covers different size of population such as: cities (*Thesaban Nakhon*), towns (*Thesaban Muaeng*) and sub-districts (*Thesaban Tambon*) and regions in the country (Central, Eastern, Northern, North Eastern, Southern). In this regard, the 32 municipalities are divided in: 21 *Thesaban Nakhon*, 6 *Thesaban Muaeng* and 5 *Thesaban Tambon*. The table below shows type of local authority in Thailand.

Table 18 type of local authority in Thailand

Type of Local Authority	Number	Population
Provincial Administrative Organizations (PAO)	76	300,000-1,700,000
Special Municipalities [Urban Population]	2	
Bangkok Municipal Administration (BMA)	1	10,376,753 (2011)
City of Phattaya	1	104,318 (2007)
Municipalities (<i>Thesaban</i>) [Urban Population]	2283	
Cities (<i>Thesaban Nakhon</i>)	30	50,000-300,000
Towns (<i>Thesaban Muaeng</i>)	172	10,000-150,000
Sub-district (<i>Thesaban Tambon</i>)	2081	7,000-100,000
Tambon Administrative Organizations (TAO) [Rural P.]	5492	200-40,000
Total	7853	

Source: Department of Local Administration (As of July 2013)

In this regard, Thailand is setting up different policy instruments to achieve the “Low Carbon City” paradigm (and ultimately the “Low Carbon Society” paradigm), avoiding locking in to unsustainable municipal infrastructures.

LCC policies can contribute to large GHG mitigation potentials. Up until now, however, the contribution of international MBIs like the CDM to low-carbon urban development has been very modest in municipalities and communities, due to the limitations of traditional carbon market instruments to achieve GHG emission reductions in urban environments, including

additionality, principal-agent problem, data availability, transaction costs, etc. (WB, 2010; UNEP, 2012).

Emerging cities can design and implement a wider range of MBIs to achieve climate change mitigation, including, inter alia, carbon taxes, cap and trade systems and other crediting instruments. In addition, they can use other policies such as command and control regulations, technology support policies and information and policy approaches (IEA, 2011).

Achieving GHG emissions through a crediting instrument like the LCC program has clear advantages relative to more traditional command and control regulations, such as technology or performance standards. By placing a general price on avoiding pollution, the LCC program gives a general incentive for climate change mitigation, providing a wide-range signal to abate GHG emissions. Several studies have demonstrated that this approach can lead to significant gains in effectiveness related to technology mandates. Instead of favoring low carbon activities with different policy instruments (i.e. one-off subsidies to LED street lighting, FIT to renewable energies, concessional loans to MSW management facilities, etc.), a crediting instrument like the LCC program will ensure that GHG abatement is rewarded equally and impartially, regardless of the technology, sector or geographical location where it takes place (IEA, 2011).

MBIs like the LCC program can provide an either fixed or floating price signal for GHG emission reductions. A fixed carbon price eliminates the uncertainty of the private investor, but does not ensure that the desired/demanded level of GHG mitigation is achieved. On the contrary, a floating carbon price aligns carbon supply and demand, but does not guarantee a minimum financial return to low carbon investments. This is why hybrid approaches with price caps and floors are becoming increasingly popular, and may become a functional design option for Thailand's future LCC program.

Interaction of the LCC program with other policy instruments

The implementation of LCC program can support the mitigation objectives as already defined within the country's main regulatory framework. For example, the 11th NESDP has set up mitigation of GHG emissions as a key target in the country's development to achieve a low-carbon economy.

The LCC program will be implemented under energy policy and measures such as following strategies introduced in the AEDP (10-year Alternative Energy Development Plan 2012-2021), obtaining existing financial incentive for supporting renewable energy development from the ENCON Fund through investment subsidy, soft loan, and both equity investment and equipment leasing measures under ESCO Fund, to support an investment in RE and EE projects. Meanwhile, the implementation of LCC program can support the goal of AEDP since municipalities and communities will be facilitated to ensure that they are able to develop RE projects, and with their own experiences, they will have better understanding on RE so that RE development becomes more widely accepted.

Moreover, the municipalities and communities will also gain co-benefits from conducting GHG mitigation activities such as improving air quality and public health.

iv. LCC expanded to cover all municipalities

The development of LCC program can be divided into two phases; LCC preparation phase (2014-2016) and LCC operating phase (2017-onward)

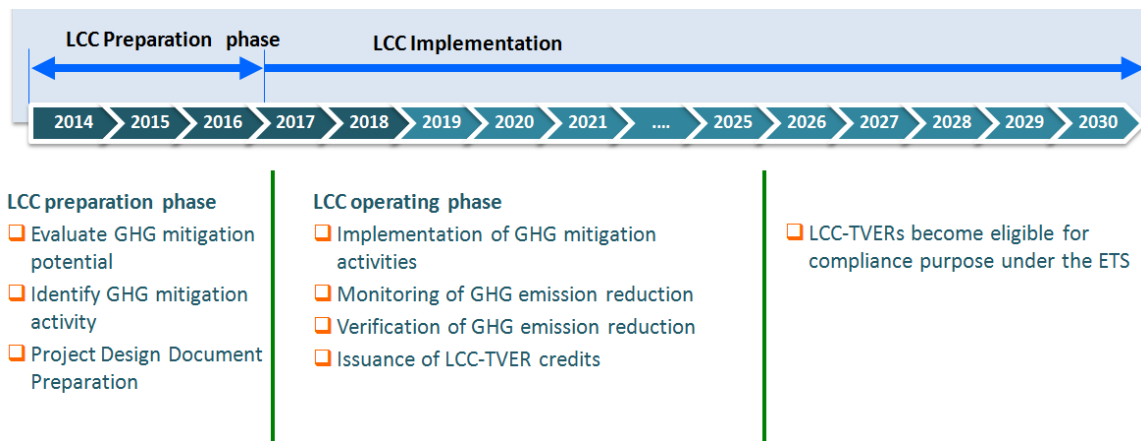


Figure 24: A plan to expand LCC to cover all municipalities

2014-2016: LCC preparation phase

During this phase, the Local GHG Abatement Plan and the Project Design Document will be developed.

The steps required to develop Local GHG Abatement Plan will include: (1) evaluation of the GHG emission potential, (2) identification of GHG emission activities and (3) assessment of the GHG abatement cost to implement the mitigation actions.

The Local GHG Abatement Plan would include relevant and detailed information per each potential mitigation activity such as: investment cost, payback time without LCC support, net present value, cost-efficiency (USD/tCO₂e), internal rate of return, lifetime of the project, GHG emission reductions expected and co-benefits (pollution avoided, local green jobs created, etc.). The Local GHG Abatement plan will consist in a MAC assessment for the Thai municipalities will provide average figures per low carbon technology, and will thereby identify those “no-regret”, negative-cost technologies which do not need support from the LCC program other than administrative support, and those which have high carbon abatement costs and do need to receive additional carbon finance from the LCC Fund.

Then, the GHG mitigation activities over a given mitigation cost threshold will be presented in the Project Design Document of each municipality and local community. The PDD presents the each of the GHG emission reduction activities that the municipality and local community want to implement. The PDD also presents the level of required carbon finance for the project in order to compensate the expected shortfall in the financing of proposed GHG emission reduction activities, after taking into account the contributions reasonably to be covered from Municipalities’ core budgets, tax-rebates, subsidies etc. and taking into account a reasonable payback time, which is different for each type and scale of technology.

2017- onward: LCC operating phase

During this phase, the objective is to implement and operate the GHG emission reduction activities that have been identified in the preparation phase and present in the PDD. The monitoring, reporting and verification of GHG emission will be performed according to TVER standard. Finally, the LCC-TVERs will be issued.

The LCC is planned to expand to cover all municipalities and generate eligible credits for compliance purpose under the ETS by 2026.

Chapter 2.3 LCC program

2. Design of Low Carbon City Program (LCC)

- i. Conceptual framework of the LCC program
- ii. LCC program cycle
- iii. Scope and coverage
- iv. Quantification of Emission Reductions and the MRV system
- v. Potential Emission Reductions generated from LCC program
- vi. Regulatory and institutional Framework

The design of the LCC program has been completed.

Please note that all proposed activities, objectives and budget **for preparing and operating the LCC** are presented in the following section.

i. Conceptual framework of the LCC program

The LCC program's objective is to promote sustainable development as well as environmental and social co-benefits through GHG emissions reduction actions in Thai's local municipalities and communities. The LCC program aims to support achieving the national goals in terms of energy efficiency (EEDP) and the share of renewable energy (AEDP) shifting towards a low carbon society.

In order to do so, the LCC program aims to be a crediting mechanism to achieve GHG reductions in municipalities and communities through a crediting mechanism, Thailand Voluntary Emission Reduction (T-VER), based on project bottom-up approaches. This means that LCC program does not have to develop the new baseline methodologies nor MRV system. It can apply the existing design from T-VER program as a basis for generating and certifying carbon credits.

In addition to the existing financial incentives (e.g. feed-in-tariff, investment subsidy, soft loan, etc), the LCC participants will be provided with incentives from an existing domestic crediting mechanism, T-VER. The carbon credits generated under the LCC program with T-VER standard is therefore "LCC-TVERs" which represents one ton of CO₂e from GHG emission reduction activities. The LCC-TVERs can be sold to LCC fund (see Chapter 2.3: LCC Fund for more details) which is a one-stop service for buyer and seller of LCC-TVERs. The LCC fund will therefore be the main element to ensure the functionality of the LCC program (see figure below).

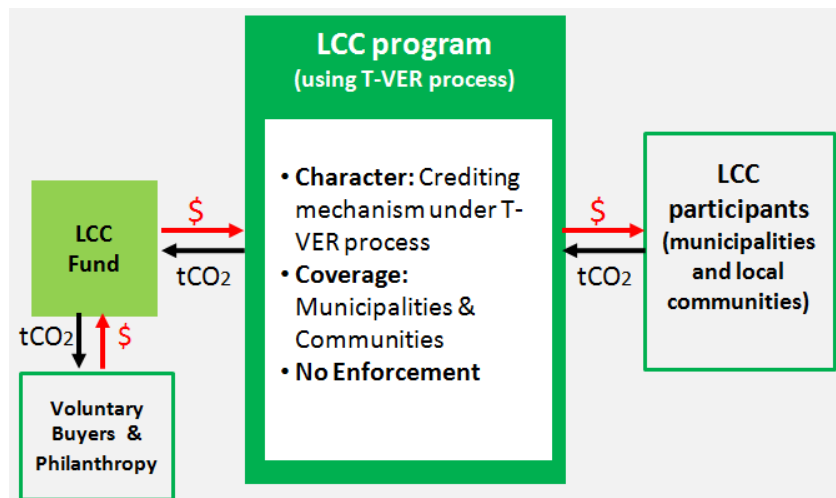


Figure 25: The relationship between LCC and LCC Fund

The municipalities will also be supported in terms of technical assistance and capacity building to conduct GHG inventories, identification of GHG emission reduction actions and GHG mitigation potential assessment, as well as implement the MRV procedures through the T-VER scheme.

ii. LCC program cycle

The LCC program cycle can be divided into 8 steps as follows:

1. Evaluation of GHG mitigation potential
2. Identification of GHG mitigation activity
3. Evaluation of GHG emission reduction activities
4. Project Design Document Preparation
5. Implementation of GHG emission reduction activities
6. Monitoring of GHG emission reduction
7. Verification of GHG emission reduction
8. Issuance of LCC-VERs

As the first steps, the LCC program will entail evaluating the GHG mitigation potential, and identifying the GHG mitigation activity in each of the 32 municipalities and communities under the LCC program (steps 1, 2 and 3). These activities will be carried out by the participating municipalities and communities, following the procedural framework and guidelines established by TGO under T-VER. These activities are knowledge-intensive and will require technical assistance from consultants. The outputs of the design phase will be a Local GHG Abatement Plan setting out establishing each city's mitigation roadmap.

After that the PDD will be developed to present the GHG emission reduction activities that the municipality and community plan to implement (step 4).

During the implementation phase of the LCC program, municipalities and communities will implement GHG mitigation activities defined in the PDD, and will monitor GHG emission reductions. Monitoring and reporting of achieved GHG emission reductions will be verified by a

third party. Based on the Verification Report, TGO will issue LCC-TVERs to participating municipalities and communities (steps 5, 6, 7 and 8).

iii. Scope and coverage

Eligible Participants

The LCC program will target the Thai municipalities (local public authorities) and local communities (residential sector and CSOs). Specifically, the LCC program will be a voluntary program open to any Thai municipality and local community (1,162 *Thesaban*), except Special Municipalities (BMA and the City of Pattaya), PAOs (Thailand's 77 geographical units into which Thailand is divided) or its 6,616 TAOs (*Tambon*). The eligibility criterion for municipalities is based on general and specific aspects .

The LCC program will target very different municipal realities, ranging from small and medium sized cities (*Thesaban Nakhon*) like Chiang Mai City, Nonthaburi City, Rayong City, Phuket City, etc.; towns (*Thesaban Muang*) like Muang Klang or Tungsong or even smaller districts (*Thesaban Tambon*).

GHG covered by the LCC program

The LCC program will focus on the GHG covered by the Kyoto Protocol: carbon dioxide (CO₂), methane (CH₄) and nitrous oxide (N₂O). GHG emissions and reductions under the LCC will take into the account the Global Warming Potential (GWP) of each gas and report under a common unit: tons of carbon dioxide equivalent or tCO₂e (e.g. CO₂ (1), CH₄ (25) and N₂O (298)).

Sectors covered by the LCC program

The LCC program will focus on project activities with GHG mitigation potential, as defined by the IPCC (IPCC, 2007). As mentioned, only the municipalities (local public authorities) and the local communities will be eligible to implement the activities covered. That means the commercial and industrial sectors are excluded from the LCC program.

More specifically, the LCC program's scope will include GHG mitigation activities in the 7 areas covered by the T-VER as shown in the table below:

Table 19 Types of eligible projects under the T-VER

Types of Project	Potential list
Energy Efficiency	Efficiency improvement on electricity consumption and/or generation
	Efficiency improvement on heat consumption and/or generation
Alternative Energy	GHG emission reduction from utilization of Bio-diesel
	GHG emission reduction from utilization of Ethanol
Renewable Energy	Electricity generation from renewable resources
	Heat generation from renewable resources
Solid Waste Management	Emission reduction through landfill management
	Emission reduction through fertilize organic waste
	Waste to energy (RDF)
Transportation Management	Fuel switching in vehicle

Types of Project	Potential list
	Emission reduction through non-motorized transportation
	Fuel switching in transportation system
	Energy saving vehicle
Forestry and Green Area	Carbon capture through public parks and urban forest
	Vertical gardening
	Forest conservation (A/R, REDD+)
	Agro-forestry
Agriculture	Good practice on using fertilizers in agricultural areas
	Low carbon rice from management of agricultural practice
Others	Any type of project/activities approved by TGO

However, it is important to note that Energy DSM activities in commercial buildings will not be covered by the LCC program, because such large facilities will be covered by the EPC scheme, and because small-medium activities may be covered by another domestic market mechanism, like the T-VER. In addition, most of the GHG mitigation activities in the transport sector are excluded from the LCC program due to its complex carbon metrics in terms of baseline setting, and also because Thailand's long term energy policy (ICF, 2013) plans to cover it in the future under mandatory labeling and standards.

Regarding the eligible project activities, the LCC program has developed provisions to **avoid double counting** with international standards like the CDM or voluntary carbon market standards like the VCS or the GS. Existing domestic initiatives such as T-VER have different purposes and target different sectors, and therefore are compatible with the LCC program. By avoiding double counting with international standards, the LCC program will gain international recognition, as well as access to international sources of finance.

Eligibility criteria for project activities

Eligibility criteria for project activities will include:

- Scope/boundary: project activities located within the municipality geographical boundaries.
- Baseline and monitoring: projects will apply methodologies under the T-VER.
- Time: project activities starting after a given date.
- Lawfulness: baseline cannot be illegal and project line must comply with environmental and legal requirements.
- Double counting: project activity cannot benefit from another carbon standard.
- Additionality: project activity must comply with the additionality criteria set up by the T-VER.

Avoidance of double counting

The avoidance of double counting refers to international standards like the CDM or voluntary carbon market standards like the VCS or the GS. The LCC program will follow the T-VER standard that will contribute to develop a domestic voluntary carbon market.

The LCC program will avoid double counting with regard to international standards by:

- Requesting a written declaration from project developers that the project activity does not gain credits under another standard.

- Requesting UTM coordinates, whenever technically feasible (e.g. in small-scale and micro-scale project activities, but certainly not all individual activities under programmatic approaches). TGO has demonstrated to have reliable GIS software to support the localization of the projects.
- Designing a third party verification process which specifically addresses and controls the issue of double-counting.

Additionality

The additionality criteria for the project under the LCC program can be shown below.

Table 20 Additionality criteria under the T-VER program

Project Size	Definition	Additionality Criteria
Microscale Project	<ul style="list-style-type: none"> • The renewable electricity generation project, which has installed capacity no more than 5 MW. • The energy efficiency project, which aim to achieve energy savings no more than 20 gigawatt hours per year. • The T-VER project, which aim to achieve emission reductions no more than 20,000 tCO₂e per year. 	A project under this category is automatically additional by default
Small Scale Project	<ul style="list-style-type: none"> • The renewable electricity generation project, which has installed capacity no more than 15 MW • The energy efficiency project, which aim to achieve energy savings no more than 60 gigawatt hours per year • The T-VER project, which aim to achieve emission reductions no more than 60,000 tCO₂e per year. 	A project under this category is automatically additional by default
Large Scale Project	<ul style="list-style-type: none"> • The renewable electricity generation project, which has installed capacity more than 15 MW. • The energy efficiency project, which aim to achieve energy savings more than 60 gigawatt hours per year. • The T-VER project, which aim to achieve emission reductions more than 60,000 tCO₂e per year. 	A project with a payback period of more than 3 years is additional.

iv. Quantification of Emission Reductions and the MRV system

Quantification of emission reductions

The participation in the LCC program will be only possible when the municipality has completed and submitted a Project Design Document (PDD) to TGO.

This document will include the description of the overall mitigation actions eligible under the LCC program (following T-VER guidelines), the baseline selection and MRV procedures. A suitable format for this PDD needs to be developed.

The LCC program will also rely on simplified MRV procedures under the T-VER able to accomplish a satisfactory degree of environmental integrity while building on readily available information.

The GHG emission reductions under the LCC program will be the net difference between the baseline and the project emissions.

Establishing the MRV system

Monitoring

Existing monitoring methods and guidelines

The LCC program, the municipalities and local communities will rely on the existing monitoring methodologies developed by the T-VER scheme to gather necessary data to calculate the GHG emission reductions achieved by Thai municipalities and communities.

Reporting

Monitoring report

Thai municipalities and local communities under the LCC program will be required to submit annual Monitoring reports to track the GHG emission reductions.

The goal of the Monitoring reports will be to ease the monitoring process and to generate standard and comparable documentation.

LCC reporting cycle

Consistent with the LCC program development, a reporting cycle will be designed to ensure integrity, fairness and effectiveness of the mechanism. The reporting cycle will be tailored to fit the national context and to simplify the whole pipeline. It will be based on the T-VER scheme based on different existing practices in project-level carbon market mechanisms (CDM, ISO 14064-2 and 14064-3). The following table presents a preliminary reporting cycle that will need to be further developed.

Verification

The Monitoring report will be verified by an authorized third party. During the MRP implementation phase a verification framework and procedures will be designed, as well as for the accreditation process.

Verification framework and process

The verification framework will need to be flexible enough to ensure reduced transaction costs in participating municipalities and communities. Therefore, the verification process will include

certain steps, like an initial desk review, an on-site visit, and procedures for resolution on key findings.

Verification procedures and documentation

A Verification Protocol will be elaborated containing all the important aspects subject to verification. In addition, the minimum contents of the Verification Report will be established. This may include a Summary Page; Objective of the Verification; Verification Team; Project Information; Review of the Monitoring Report; Review of the GHG Emission Reduction calculation; Opinion of the Verification Entity.

Accreditation process

The LCC program will need to establish an accreditation process to become an authorized entity to carry out verification services under the LCC program.

The simplest option is to extend the accreditation to parties authorized to perform similar duties.

Another option would be to organize specific accreditation processes, for example through specific trainings that would provide automatically, after a test, the accreditation to conduct the verification process.

Payment and confidentiality issues

In line with other MBIs like the CDM, the cost of the verification will be borne by the project proponents, i.e. LCC Municipalities and communities. Similarly, strict confidentiality rules will be applied for the LCC program. Only information required by the Verification Protocol will be publicly disclosed. Any other information will not be publicly available without the authorization of the project proponent.

V. Potential Emission Reductions generated from LCC program

A first indicative MAC study was conducted to estimate the LCC program's GHG mitigation potential and investment needs.

The aggregated carbon mitigation potential and costs were estimated up to 2030 in 21 large municipalities (Thesaban Nakhon), 6 medium-size cities (Thesaban Mueang) and 5 small-size cities (Thesaban Tambon), totaling 2,276,572 citizens. The mitigation measures analyzed included 4 energy DSM measures, 2 renewable energy measures, and 2 waste-to-energy measures.

According to the preliminary results, the GHG abatement potential of the LCC program would exceed 8.6 M tCO₂e, as illustrated by the figure below.

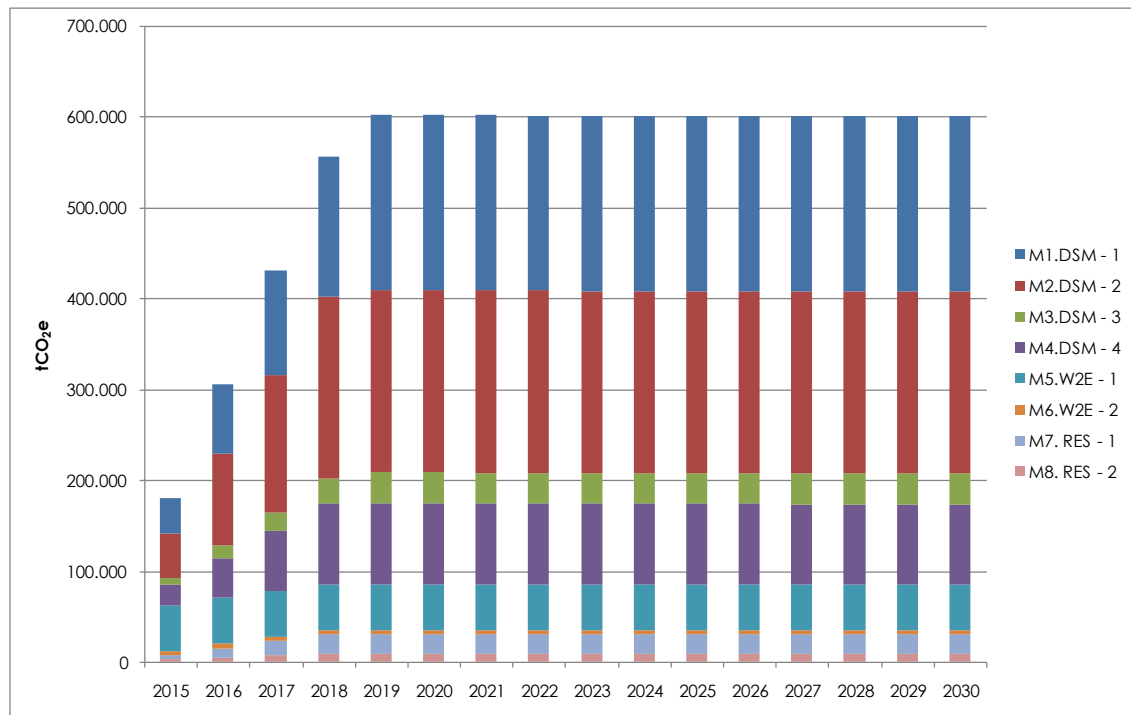


Figure 26: Annual GHG emission reduction potential up to 2030 under the LCC program

In absolute terms, the replacement of both indoor lighting (2.7 MtCO₂e), and air-conditioning (2.9 MtCO₂e) would achieve the highest GHG emission reductions to 2030.

However, in terms of per-capita GHG savings, the most effective measures are biogas generation with MSW (0.022 tCO₂e/capita), followed by the replacement of air-conditioning (0.022 tCO₂e/capita) and refrigerators (0.010 tCO₂e/capita).

As illustrated below, the study resulted in an average GHG abatement cost of -5.41 US\$ per tCO₂e abated. This result suggests that overall Thai municipalities and communities may be able to reduce GHG emissions while reducing energy costs.

In terms of cost-efficiency, finally, energy efficiency measures (i.e. switching lighting, replacement of air-conditioning and refrigerators) would have a negative marginal abatement cost, whereas renewable energy measures and waste to energy activities would achieve GHG savings at a reduced cost.

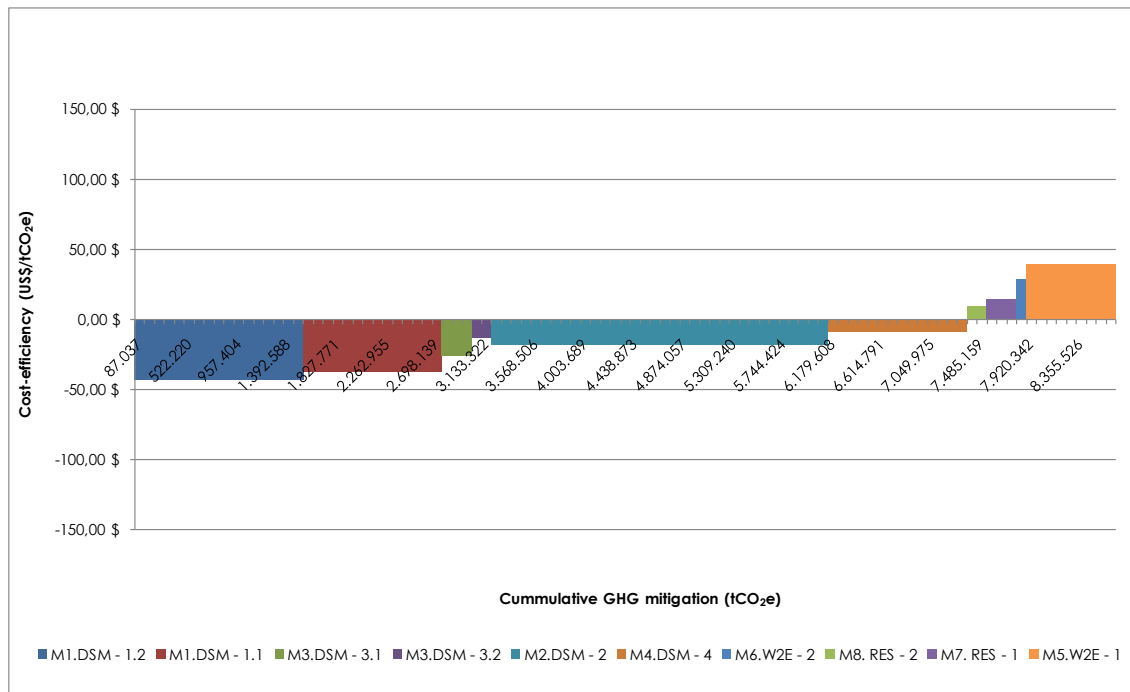


Figure 27: GHG emission reduction costs by 2030 under the LCC program

vi. Regulatory and Institutional Framework

As a first stage, it is important to define key functions which will be required during the implementation of an MBI for GHG mitigation in Thailand. In line with OECD recommendations (IEA, 2010) and ongoing experiences for cities (WBI, 2013), these functions include:

- **Policy thrust and direction**, which includes establishing the instrument's overall policy design in view of the objectives, existing policy framework and policy interrelations, mitigation potential and costs, etc. as well as encouraging pilot activities during the implementation phase.
- **Coordination and management**, which requires establishing the instrument's technical building blocks (overall functioning, scope, baseline data collection, MRV, tracking system, financial regulation), implementing and enforcing the instrument, and ensuring that the instrument serves the wider policy goals.
- **Baseline setting and quantification of emissions reductions**, which involves initial GHG data collection to develop the instrument's baseline, as well as the use of the T-VER methodologies to estimate the amount of the GHG emission reductions which will be attributed to each action comprised within the MBI.
- **Monitoring, Reporting and Verification**, which involves monitoring GHG-relevant data, reporting this information according to pre-established procedures, and having it audited by a third party.
- **Tracking System**, which involves issuing carbon credits of project activities which have generated verifiable emission reductions, and which requires the design and implementation of a registry tool aligned with the MBI and especially to its financial regulation.

Role of public or private sector bodies

Policy Thrust and Direction and Coordination and Management

Most of the functions identified serve a public interest and need to be carried out by public sector bodies. This is clearly the case on the “Policy Thrust and Direction” and “Coordination and Management” functions.

Baseline setting and quantification of emissions reductions

In MBIs for local GHG mitigation, the “Baseline setting and quantification of emissions reductions” function will be carried out predominantly by the public sector. Central authorities will be responsible for establishing baseline methodologies and data collection procedures, while participating municipalities will be responsible for collecting data. The private sector will play an important technical assistance role, both in terms of baseline setting, on behalf of central authorities (e.g. developing standardized baselines for certain sectors), and in data collection, on behalf of participating municipalities.

Monitoring, Reporting and Verification

The public sector will also be responsible for establishing the system underlying the “Monitoring, Reporting and Verification” function. Based on other experiences, the private sector can play an important role in supporting this function, as verification processes can be done by independent third parties (or based on government-defined rules and regulations). If carried out by the private sector, it is important to ensure that accredited verifiers are under supervision of the public authority in charge of all information compilation and calculation.

Tracking System

Finally, the “Tracking System” will most likely be performed by a public body. However, this function may be performed by privately developed software, and efficiently outsourced to the private sector.

Existing institutions relevant to each function

Policy Thrust and Direction.

Thailand's future MBI to mitigate GHG emissions locally, could receive policy thrust and direction by the PMR Steering Committee under TGO. The TGO has been created under the MoNRE with the specific purpose of becoming an implementing agency of GHG emission reduction in Thailand, promoting low carbon actions, investment and marketing on GHG emission reductions and setting up a GHG information center. In addition it acts as a DNA office for CDMs in Thailand, and as co-secretariat of the NCCC, it is responsible for considering the national agenda and issues tackling climate change.

In order to correctly align the MBI for local GHG mitigation with existing policies to promote LCC development in Thailand, it will be necessary to also receive political thrust and guidance from other institutions, such as the Office of Natural Resources and Environmental Policy and Planning (ONEP) of the MoNRE, and from other public bodies, such as the DEDE, in charge of reducing fuel electricity consumption; or the PEA, in charge of the local and provincial electricity distribution.

The DOLA will also play a relevant role in streamlining the MBI with Thailand's decentralization and local development policies. It also appears to be another obvious candidate to become part

of the Steering Group. Similarly, the National Municipal League of Thailand (NMT) may ease the cooperation and relationships between municipalities and communities under the LCC program.

Coordination and Management

TGO appears to be the most relevant institution to perform the coordination and management function of an MBI for local GHG mitigation under the Project Management Unit (PMU).

Baseline setting and quantification of emissions reductions and Monitoring, Reporting and Verification

In the same manner, TGO has the necessary institutional capacities to carry the baseline setting and quantification of emissions reductions, Monitoring, Reporting and Verification, as well as the tracking system function. In fact, TGO has several technical units which could perform the different functions required by the MBI under the LCC Working Group and LCC Technical Unit such as: the Strategy Office, the Carbon Business Office, the Approval and Monitoring Office, and the GHG Information Center.

Chapter 2.3 LCC program

3. Proposed Activities, Objectives and Budget

- i. 2014-2016: LCC program preparation
- ii. 2017-onward: LCC implementation/operation

Similar to the EPC, the proposed activities, objectives and budgets are presented in two phases from the preparation for LCC program (2014-2016) to the operating phase of the LCC program (2017 - onward).

- **LCC preparation phase (2014-2016)**, Thai municipalities will voluntarily join the program and will receive incentives in terms of technical assistance to perform technical functions regarding the LCC planning, including the Local GHG Abatement plan and the Project Design Documents (PDDs).
- **LCC implementation phase (2017-onward)**, municipalities and local communities will implement the project activities under the LCC program to reduce GHG emission and generate LCC-TVERs. Thai municipalities and local communities will receive additional revenue by selling LCC-VERs to the LCC fund. These credits are expected to be high quality offsets aiming at improving the local urban context in terms of sustainable development. Therefore, participating municipalities and communities will benefit from the mitigation benefits and co-benefits of clean technologies.

i. 2014-2016: LCC program preparation

Objective: This phase would focus on the detail assessment of the various preparedness levels for developing the Local GHG Abatement plan and Project Design Document for selected municipalities and communities

Data

The GHG reporting is built on data related to activities that produce and increase GHG (then multiplied by GHG emission factors). Developing the Local GHG Inventories requires the use of local activity data, which is not always readily available. This is a challenge when compared to national or facility-level GHG reporting levels, where national statistics or site-specific data may be used.

Thailand's available activity data to develop Local GHG Inventories varies from activity to activity. A first assessment regarding the data available said that the quality of data is good in electricity supply and consumption, medium/poor in waste management and industry, and poor in transportation and AFOLU activities.

Up until now, data collection has been a bottleneck in all LCC projects developed in Thailand. Therefore, the guideline for developing the Local GHG Abatement plan as well as the Project Design Document shall be developed.

Proposed Activities

1. Development of the Local GHG Abatement plan and the PDD guideline

MRV system

The Monitoring, Reporting and Verification System of the LCC will be based on the MRV procedures in relation with the T-VER scheme (as explained in previous chapter).

In this regard, a number of T-VER methodologies have been developed by TGO while some are simplified from CDM methodologies. Additionally, the MRV system is developed in line with the ISO 14064-2 and 14064-3. There are 6 principles in T-VER implementation: Transparency, Relevance, Accuracy, Completeness, Consistency, and Conservativeness. These principles aim to ensure that TVER credits are reliable and creditable.

Proposed Activities

1. Development of the PDD and Monitoring report template
2. Monitoring: Monitoring Methodologies and Guidelines
3. Reporting: Development of Monitoring Report
4. Verification: Design of a verification framework
5. Verification: Design of an accreditation process

Registry

The registry of the LCC program will have two main objectives. First, it will ensure accuracy, transparency and consistency of data, as well as to allow traceability of LCC-TVERs generated by LCC actions. Second, it will provide publicly available information for all project participants, stakeholders, municipalities, and general public, in order to build up trust and confidence in the program. Since LCC program use the T-VER standard, the registry for LCC-TVERs shall be shared with the registry for TVERs.

Proposed Activities

1. The development of the registry
2. Training officials and staff for registry

Other activities related to LCC program preparation are presented in the table below.

Activities and proposed budget:

Section	Activity	Time Required (months)	Estimated budget requirement (Million USD)	Year of funding required
LCC preparation phase			3.08	2014-16
Scope	1. Selection of GHG covered by the LCC program	-	-	2014
Scope	2. Selection of project activities covered by the LCC program	-	-	2014
Scope	3. Development of the Local GHG	3	0.20	2014

Section	Activity	Time Required (months)	Estimated budget requirement (Million USD)	Year of funding required
	Abatement plan guidelines			
Scope	4. the Local GHG Abatement plan development in 32 municipalities and communities	24	0.64	2014-16
Baseline	5. Development of baseline methodologies (baseline setting)	-	0.21	2014
MRV	6. Development of the PDD and Monitoring report template	-	0.02	2014
MRV	7. Monitoring: Monitoring Methodologies and Guidelines	-	0.07	2014
MRV	8. Reporting: Development of Monitoring Report	-	0.20	2014
MRV	9. Verification: Design of a verification framework	-	0.05	2014
MRV	10. Verification: Design of an accreditation process	-	0.03	2014
MRV	11. Verification: Accreditation of verifiers	-	-	2017
MRV	12. Development of PDDs in 32 municipalities and communities	24	0.64	2014-16
MRV	13. Validation of the PDD	12	0.64	2014-16
MRV	14. Registration of the PDD	3	-	2014-16
Data	15. Development of pricing mechanism to support the implementation of the LCC program (demand side)	6	0.09	2014
Regulatory	16. Develop the guidelines/procedures for approval of projects/LCC proposals submitted in the PDDs	-	0.18	2014
Registry	17. Development of system for LCC registry (using TVER registry)	-	0.40	2014
Registry	18. Training officials and staff for LCC registry	2	0.03	2017

ii. 2017-onward: LCC implementation/operation

Objective: This phase would focus on launching and operating the LCC program

During the implementation phase of the LCC program, municipalities and communities will implement GHG mitigation activities defined in the PDD, and will monitor GHG emission reductions. Monitoring and reporting of achieved GHG emission reductions will be verified by a third party. Based on the Verification Report, TGO will issue LCC-TVERs to participating municipalities and communities.

Proposed Activities

- Monitoring the GHG emission reduction activities
- Reporting the GHG emission reduction activities
- Verifying the GHG emission reduction activities
- Issuance of LCC-TVER units

Activities and proposed budget:

Section	Activity	Time Required (months)	Estimated budget requirement (Million USD)	Year of funding required
LCC implementation phase			0.64	2017-onward
MRV	1. Verification of the PDD in 32 municipalities and communities	-	0.64	2017-onward
MRV	2. Issuance of LCC-TVER units	-	-	-

Chapter 2.4 Low Carbon City Program Fund (LCC fund)

1. Assessment and Rationale for establishing the LCC fund
2. Design of the LCC Fund
3. Proposed Activities, Objectives and Budget

The LCC Fund is a carbon fund to be established to support the development of GHG emission reduction projects under the LCC program. The LCC fund are designed to deliver carbon finance and comprehensive technical support to local municipalities and communities to enhance the quality of emission reduction projects and thereby increase market confidence in financing LCC projects. It is also expected to provide credit guarantee to financial institutions in order to bridge the debt financing gap for funding LCC projects.

Chapter 2.4 LCC Fund

1. Assessment and Rationale for establishing the LCC Fund

As described earlier in the LCC pillar, Thailand is prompting a paradigm shift within society and behavior change among its citizens towards low carbon practices. The Low Carbon City program is designed with aims to help achieve reductions in GHG emissions in local municipalities and catalyze shifting to a low carbon society. This includes transforming thinking about development at the national and local levels—such as among policymakers and other stakeholders—towards a low carbon future as described under the Green Policy in the 11th National Economic and Social Development Plan (NESDP).

The Low Carbon City Fund (LCC Fund), a carbon fund, will be established as a response to the need to understand and test the procedures for creating the domestic carbon market in Thailand. The LCC fund will demonstrate the role market instrument by supporting cost-effective emission reductions and channeling mitigation finance to LCC program. The LCC Fund will play a pioneering role in supporting LCC-TVERs, while promoting sustainable development and offering a learning-by-doing opportunity to its stakeholders.

The LCC Fund aims to support local municipality and community to shift toward a low carbon society by supporting the development of GHG emission reduction projects under the Low Carbon City Program. The main objectives of LCC fund are:

1. to become the one-stop service for buyers and sellers of LCC-TVERs generated from LCC program,
2. to deliver carbon finance and technical support to local municipality and community
3. to provide voluntarily GHG offsetting opportunities,
4. to provide confidence and credit guarantee to financial institutions (i.e. bridging debt financing for LCC projects),
5. to increase market liquidity of the LCC-TVERs

Chapter 2.4 LCC Fund

2. Design of the LCC fund

- i. LCC Fund Function and Activities
- ii. Pricing mechanism for LCC-TVERs & carbon finance
- iii. Promotion, Outreach and Business Development to promote LCC program
- iv. Sources of funding
- v. Administrative arrangement

i. LCC Fund Function and Activities

The LCC fund will identify promising GHG emission reduction projects in local municipality and community under the LCC program at an early stage and provides technical support for the targeted municipalities and communities.

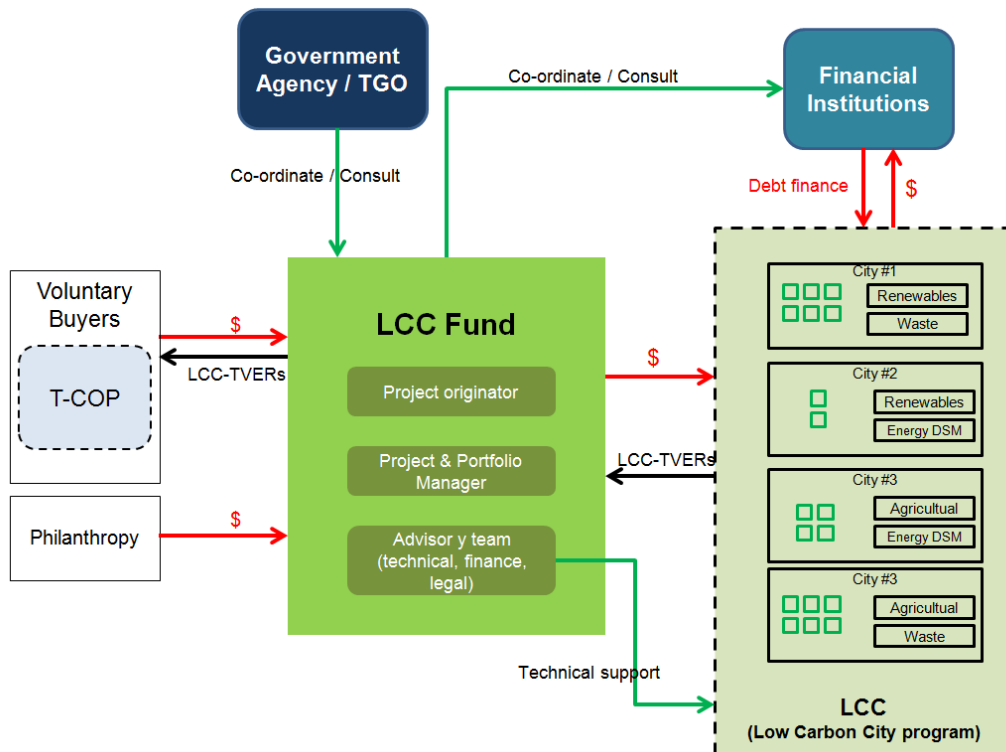


Figure 28: The LCC fund's function and activities

- In principle, TGO will coordinate and consult to the LCC Fund general aspects and main issues.
- The LCC Fund will be responsible to provide the technical support to the eligible participants acting as: project originator; project and portfolio manager; and, advisor

- team. It will also be in charge of the coordination and consultation with the financial institutions in order to manage the suitable economic incentives in any case.
- The municipalities and local communities will receive technical support from the LCC Fund and debt finance from the financial institutions to develop the eligible project activities under the LCC program. In turn, once they implement the mitigation actions and follow the MRV procedures under the T-VER, they will be able to issue LCC-TVERs to the LCC Fund and they will get payments in return. In this regard, they will provide the supply side of the LCC program.
 - The CSR investors (e.g. large Thai corporate firms) and domestic/international entities will be allowed to become buyers of the LCC-TVERs and they will create the demand side of the LCC program.

In short, the LCC Fund's core activities are:

- Providing technical support
- Project Identification & Screening:
- Supporting to create an Investment & Financing Structure
- Identifying sources of Debt Financing
- Providing carbon finance
- Organization and Co-organization of events
- Promotion, Outreach and Business Development to promote LCC program

ii. Pricing mechanism for LCC-TVERs & carbon finance

The main role of the LCC fund is to purchase LCC-TVERs generated from GHG emission reduction activities under the LCC program. The price guarantee (USD/tCO₂e) will be provided by LCC fund to municipalities and communities by securing the forward purchase & sale agreements of LCC-TVERs. The main principles to determine the price for LCC-TVERs are:

- The prices of the LCC-TVERs (according to each of the project type) will be determined ex-ante on a generic level, which is then equally applicable to all municipalities & communities that want to sell LCC-TVERs to the LCC Fund.
- The LCC-TVER price setting will be based on compensating the expected shortfall in the financing of proposed GHG emission reduction activities, after taking into account the contributions reasonably to be covered from Municipalities' core budgets, tax-rebates, subsidies etc. and taking into account a reasonable payback time, which is different for each type and scale of technology (example: 7 years for renewable energy).
- For several project types (renewable energy, waste methane recovery etc), which need carbon finance to make project more financially attractive, the expected financial shortfall will be calculated and compared to the expected GHG emission reductions during the project lifetime.
- For low-hanging fruit project types with very short payback times (e.g. <3 years) or have the negative abatement cost, the LCC-TVER price will be set to at least covering the monitoring & operational costs of participating in the LCC program.

iii. **Promotion, Outreach and Business Development to promote LCC program**

In order to secure funding for the LCC fund, the Promotion and Outreach activities will be launched. Some of the activities are:

- Researching and attracting new businesses/individual that desire to reduce their carbon footprint in partnership with the LCC fund;
- Identifying and soliciting direct donations from corporations, institutions, and event participants to reduce their impact on climate change and contributing to support the LCC program;
- Assisting potential voluntary buyers of LCC-TVERs by responding to inquiries about calculating their carbon footprint;
- Program promotion and education with a broad array of stakeholders;
- Development of website, writing blogs, releases, proposals, using social medias and promotional materials to promote LCC program and LCC fund

iv. **Sources of funding**

During the preparation phase, the required budget is mainly for human resources to prepare some work before launching the LCC fund. There are numbers of activities need to be done in this phase (e.g. a study to assess and to propose a final structure of the fund, a study of pricing methodology for providing carbon finance to LCC projects, the administrative and legal arrangement, sources of fund arrangement. The funding is expected to come from the support from PMR and the national budgets.

During the operating of the fund, more budgets are needed in order to provide carbon finance and technical support to LCC program activities. Major sources of fund are:

1. **Voluntary Buyers:**

- a. **Thailand Carbon Offsetting Program (T-COP):** The T-COP is a carbon offsetting program established in Thailand where each participant (i.e. individuals, organizations, products & services, and events) can voluntarily join. It provides a platform for a participant to offset its own carbon footprint (e.g. GHG emissions from individual/event/organizational activities, product life cycles, etc) by contributing money to retire the certified carbon credits (e.g. LCC-TVERs) under the program. The carbon offsetting is one of the fastest ways to achieve the deepest reductions for individuals and/or businesses and it also often delivers added benefits at the project site, such as employment opportunities, community development programs and training and education. The T-COP aims use the contributions from participants for supporting GHG emission reduction activities, especially for domestic projects under the T-VER program. The T-COP is therefore another demand of carbon credits generated under the LCC (LCC-TVERs). The participants in T-COP can choose to support the LCC program by purchasing LCC-TVERs to offset their own carbon footprints.

- b. **Other Voluntary Buyers:** Based on the report by Forest Trends' Ecosystem Marketplace, the demand for voluntary carbon credits grew 4% in 2012, with buyers committing more than \$523 million to offset 101 M tCO₂e. Consumer awareness of the immediate impacts and future risks of climate change is trending upward - converging with a global economic scenario that complicates the implementation of broad-based policy solutions. But where some policy makers fear to tread, many private companies are voluntarily internalizing the price of carbon in their business activities, as seen in their still-growing voluntary demand for carbon offsets in 2012. By having strong impacts and co-benefits to local community and municipalities, LCC program expects to attract Voluntary Buyers (both domestic and international) to support the LCC program by purchasing LCC-TVERs from the LCC Fund. The market-wide survey found that 2012's voluntary buyers paid a volume-weighted average price of \$5.9 per tCO₂e - slightly down from 2011's \$6.2 tCO₂e.
2. **Philanthropy:** There are several cases demonstrating the demand from Philanthropy to support municipalities and communities to develop GHG emission reduction projects. For example, ThaiOil group agreed to provide a committed capital of about 10 millions Baht for supporting renewable energy development projects in rural area during 2008-2012. This group of parties does not want anything in return from their contributions, they want to promote, support and contribute something back to society and local community.

v. Administrative arrangement

In order to establish and manage the LCC fund successfully according to its objective, various capacities have been assessed and analyzed. Four main core capacities required for managing the LCC fund are:

- Capacity to plan finance
- Capacity to access finance
- Capacity to deliver finance and implement & execute activities
- Capacity to monitor, report and verify on financial expenditures and associated results / transformative impacts

Capacity to plan finance

Planning for climate actions at the municipality and community level must be based on overarching development priorities at the municipality and community level. This requires identification of municipality and community actions based on development plans, projections of impacts, and a review of innovative solutions and practices available for reducing GHG emission. On this basis, effective and appropriate actions and priorities can be articulated, including both new actions and actions that mainstream climate change within existing development spending.

As for development finance more widely, financial planning is a fundamental step in ensuring the effective, efficient, and equitable use of carbon finance. Planning allows LCC fund to articulate its priorities and the financial resources required to meet them. Planning also includes assessments of carbon finance flows, allowing LCC fund to match its priorities with potentially available resources, and so plan how to integrate resources and sequence them over time.

Capacity to access finance

Due to a challenge at an early phase of the LCC program in which its main funding source or the demand of LCC-TVERs will not come from compliance buyers (e.g. EPC participants) but voluntary buyers, it is important for LCC fund to be able to access resources from different sources, and then blend and combine those resources in order to access a wider range of financial instruments to support the LCC program. This may include formulating projects, programmes, and sector-wide approaches that attract and catalyse further public and private financing. Accessing finance may require a range of different institutional tools and mechanisms.

Capacity to deliver finance and implement & execute activities

Delivering finance is a key component of ensuring that carbon finance contributes to effective and transformative actions in the LCC program. Delivering resources requires systems that provide financial oversight and management, as well as execution services such as procurement, contracting, or hiring. These systems must have a local supply of expertise from which to procure skills to undertake project activities. Furthermore, coordination among entities is essential to ensure that project-level activities are in line with municipalities and communities development planning.

Capacity to monitor, report and verify on financial expenditures and associated results / transformative impacts

MRV systems are needed to understand what financial resources are flowing where, for what purpose and how effectively they abate GHG emissions and promote the LCC program.

Chapter 2.4 LCC Fund

3. Proposed Activities, Objectives and Budget

- i. 2014-2016: LCC Fund preparation phase
- ii. 2017-onward: LCC Fund Operation Phase

In line with the LCC implementation plan, the implementation of LCC fund is divided into two phases:

- **LCC Fund Preparation phase (2014-2016)**, this is the phase to prepare before launching the LCC fund. There are numbers of activities need to be done in this phase (e.g. a study to assess and to propose a final structure of the fund, a study of pricing methodology for providing carbon finance to LCC projects, the administrative and legal arrangement, sources of fund arrangement and promotion, outreach and business development to promote LCC program.
- **LCC Fund Operating phase (2017-onward)**, under this phase, the municipalities and local communities will send their PDD to the LCC Fund to show their interests in getting carbon finance support. The LCC Fund will thus responsible to perform due diligence and evaluate the proposed GHG emission reduction activities. If the outcome is satisfied, the LCC fund will offer to a forward contract to purchase the LCC-TVERs generated from the proposed activities.

i. 2014-2016: LCC Fund preparation phase

Objective: This phase would focus on the detail assessment of the various preparedness levels, availability of funds, etc.

Proposed Activities

- a study to assess and to propose a final structure;
- a study of pricing methodology for providing carbon finance to LCC projects;
- the administrative and legal arrangement;
- promotion, outreach and business development to promote LCC program

Activities and proposed budget:

Section	Activity	Time Required (months)	Estimated budget requirement (Million USD)	Year of funding required
LCC Fund Preparation Phase			0.55	
Fund Structure	1. a study to assess and to propose a final structure of the fund	12	0.1	2014-15
Incentive	2. a study of pricing methodology for providing carbon finance to LCC projects	6	0.05	2015
Administrative arrangement	3. the administrative and legal arrangement		0.1	2015-17
Outreach	4. promotion, outreach and business development to promote LCC program	-	0.3	2015-17

ii. 2017-onward: LCC Fund Operation Phase

Objective: This phase would focus on operating the LCC fund to provide support for the development of GHG emission reduction project activities under the LCC program

Proposed Activities

- The summary of LCC fund activities, lesson learnt and feedback.

Activities and proposed budget:

Section	Activity	Time Required (months)	Estimated budget requirement (Million USD)	Year of funding required
LCC Fund Operation Phase			0.05	
MRV	1. The summary of LCC fund activities, lesson learnt and feedback.	60	0.05	2017

Chapter 3. Organization, Communication, Consultation and Engagement

1. Project Management and Organization
2. Communication, Consultation and Engagement
3. Proposed Activities, Objectives and Budget

During the draft MRP development, TGO organized the stakeholder consultation meetings with related Ministries, local municipalities, private sector as well as business association such as Federation of Thai Industries and the Thai Chamber of Commerce:

- **Discussions with DEDE, Ministry of Energy:** DEDE has already formulated the 20-year energy plan (EEDP) and the 10-Year Alternative Energy Development Plan (AEDP). It is highly believed that such a scheme would definitely augment the other existing initiatives by government to achieve the national goal by 2030. However, there may be requirement of certain regulatory and institutional mechanisms in place.
- **Discussion with Industry Associations:** As per the number of consultation with industry stakeholders, Federation of Thai Industries and the Thai Chamber of Commerce, Thai industry believes that this scheme would infuse competitiveness in achieving energy efficiency. However, they may require technical support (in identifying energy saving potential, energy efficient technology and technology providers) and financial support (in the form of soft loans, subsidies, tax benefits etc.).
- **Discussion with Ministry of Finance:** Ministry of Finance has been appraised of the proposed scheme and possible financial support that may be required to prepare and operationalize the scheme.
- **Discussion with Municipalities and National Municipal League of Thailand (NMT);** A number of meetings were arranged to discuss their interest and determination to pursue toward a low carbon society by participating in the LCC program.
- **Consultation with Indian experts on PAT Scheme:** TGO had organized workshop where Indian expert from Bureau of Energy Efficiency, India had presented the various aspects of PAT scheme. The learning and take away of successful launch of PAT scheme in India is very much helpful in conceptualizing a similar scheme in Thailand.

The start of the implementation will be marked by a decision of the full Thai Cabinet of ministers. The organization, communication, consultation, and engagement envisioned for Thailand's PMR implementation phase are illustrated as follows:

Chapter 3. Organization, Communication, Consultation and Engagement

1. Project Management and Organization

Thailand Greenhouse Gas Management Organization (TGO), acting as the national implementing agency to create, maintain and facilitate NAMA and GHG mitigation mechanism, to perform roles as a certify body, to approve, and register third-party GHG validators /verifiers, to perform roles on national GHG information and reporting, and to provide capacity development services and knowledge outreach, will be responsible for the project implementation and management of this PMR project.

A **PMR Steering Committee** will be established to provide recommendations on development of market mechanism and carbon market and to monitor the implementation of PMR. The committee will also oversee the progress of implementation of the project and evaluating project deliverables. Members of the PMR Steering Committee include officials from 14 key agencies, i.e.

1. Office of the National Economic and Social Development Board (NESDB);
2. Department Alternative Energy Development and Efficiency (DEDE), Ministry of Energy;
3. Energy Policy & Planning Office (EPPO), Ministry of Energy;
4. Department of Industrial Works (DIW), Ministry of Industry;
5. Fiscal Policy Office (FPO), Ministry of Finance;
6. Public Debt Management Office (PDMO), Ministry of Finance;
7. Office of Natural Resources and Environmental Policy and Planning (ONEP), Ministry of Natural resources and Environment;
8. Office of Transport and Traffic Policy and Planning (OTP), Ministry of Transport;
9. National Municipal League of Thailand (NMT);
10. Federation of Thai Industries (F.T.I.);
11. Thai Chamber of Commerce (TCC);
12. Electricity Generating Authority of Thailand (EGAT);
13. Provincial Electricity Authority of Thailand (PEA); and
14. Metropolitan Electricity Authority (MEA)

TGO will set up a **Project Management Unit (PMU)** and appoint a project director and a project manager to be in charge for the overall organization, management, and daily operation as well as to coordinate with other relevant stakeholders, Ministries, and agencies. The key functions of the PMU include responsibility for project management and administration and the PMU will assume the role of the Scheme administrator for both EPC scheme and LCC program and will be an advisor to the LCC Fund. To support its functions, the PMU will be divided into three units including an EPC Technical Unit, an LCC Technical Unit, and the LCC Fund supporting unit. The PMU will be supported by **EPC and LCC Working Groups**.

The **EPC Working Group** will be chaired by DEDE with the participation of key government agencies, representatives from direct stakeholders (e.g. representative from DF&Bs,

representative from Energy auditors, representative from ESCOs) as well as the expert consultants. The key role is to provide technical recommendations on the EPC scheme, e.g. scheme design, technical issues, MRV system.

The **LCC Working Group** will be chaired by TGO with the participation of key government agencies, representatives from direct stakeholders (e.g. Representatives from municipalities & communities), business associations, NGOs, universities as well as the expert consultants. The key role is to provide technical recommendations on the LCC program, e.g. scheme design, technical issues, MRV system.

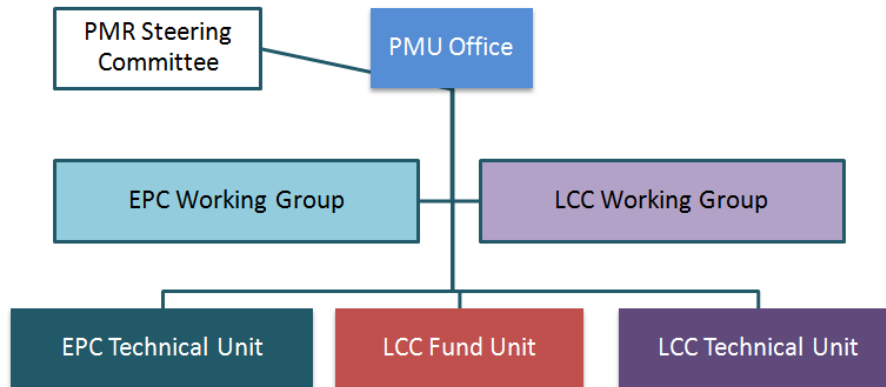


Figure 29: Organization of Thailand's PMR implementation phase

Chapter 3. Organization, Communication, Consultation and Engagement

2. Communication, Consultation and Engagement

It is essential to build the political and technical consensus on both the EPC scheme and the LCC program. This project will include specific activities to ensure proper communication, consultation and engagement with stakeholders.

The communication will start from the identification of the target audience and what to communicate. The PMU team, then, will develop materials such as brochures, booklets for communication. The communication can be provided through the media, a website, social networks, etc.

For stakeholder consultations, two methodologies will be mainly applied:

- Direct interviews with key stakeholders to get a detailed insight on their perception of the project, the main barriers, and the alternatives to overcome these barriers. Key stakeholders needed for direct interview are DEDE for the EPC scheme and 32 municipalities for the LCC program.
- Consultation workshops will be held to review the design of the EPC scheme and the LCC program as well as the type and level of incentives. The consultation workshops also aim to increase awareness and engagement among stakeholders. A series of workshops will be conducted by TGO. Key issues for consultation include: i) market design, ii) scheme/program design, iii) MRV system, iv) trading, and v) coordination with targeted DF&Bs, municipalities, and communities.

The table below illustrates the scope of each key consultation issue as well as the key stakeholders.

Table 21 Key consultation issues and stakeholders

Issues	Scope	Stakeholders	
		EPC scheme	LCC program
Market design and linkages	<ul style="list-style-type: none"> • Incentives for EPC and LCC participants • Marginal abatement costs • Pricing of EPC and LCC credits 	<ul style="list-style-type: none"> • PMR Steering Committee, • Representatives from DF&Bs, • Business associations; e.g. FIT, TCC, etc. • Representatives from municipalities and communities, • Universities, research institutes, think-tanks, NGOs, Chiang Mai University, KMUTT, Chulalongkorn University, Thammasart University, etc. • International cooperation: UNDP, GIZ, etc. • Financial institutions • CSR – oriented companies 	

Issues	Scope	Stakeholders	
		EPC scheme	LCC program
Scheme/program design	<ul style="list-style-type: none"> • Scope/coverage, boundary • Emission reduction potential for LCC program • Target setting for EPC scheme 	<ul style="list-style-type: none"> • PMR Steering Committee, • Representatives from DF&Bs, • Universities, research institutes, think-tanks, NGOs 	<ul style="list-style-type: none"> • PMR Steering Committee, • Representatives from municipalities and communities • Universities, research institutes, think-tanks, NGOs
MRV system	<ul style="list-style-type: none"> • MRV methodologies 	<ul style="list-style-type: none"> • TGO, DEDE • Representatives from DF&Bs, • Energy management auditors • Designated operational entities and third party verifiers • Universities, research institutes, think-tanks, NGOs 	<ul style="list-style-type: none"> • TGO, DEDE, ONEP • Representatives from municipalities and communities • Universities, research institutes, think-tanks, NGOs • Designated operational entities and third party verifiers • Representatives from voluntary standards: VCS, GS
Trading	<ul style="list-style-type: none"> • Registry and tracking tool • Regulation and distribution framework for the market transaction 	<ul style="list-style-type: none"> • TGO, DEDE, FPO • Representatives from DF&Bs • Universities, research institutes, think-tanks, NGOs 	<ul style="list-style-type: none"> • TGO, DEDE, ONEP, NMT, FPO • Representatives from municipalities and communities • Universities, research institutes, think-tanks, NGOs • Representatives from voluntary standards: VCS, GS
Coordination with targeted DF&Bs, municipalities, and communities	<ul style="list-style-type: none"> • Admission procedures • Rights and obligations of EPC and LCC participants 	<ul style="list-style-type: none"> • TGO, DEDE • DF&Bs 	<ul style="list-style-type: none"> • TGO, DEDE, ONEP, NMT • Municipalities and communities

Chapter 3. Organization, Communication, Consultation and Engagement

3. Proposed Activities, Objectives and Budget

Objectives

- To support the operation of PMU office, the budgets required for both administration cost and capacity building for the staff.
- To build the political and technical consensus on both the EPC scheme and the LCC program as well as to increase awareness and engagement among stakeholders, a proper communication, consultation and engagement with stakeholders are needed.

Activities, deliverables and proposed budget:

Section	Activity	Time Required (months)	Estimated budget requirement (Million USD)	Year of funding required
Organization, Communication, Consultation and Engagement			3.75	2014-18
Organization	1. Corpus Fund for Human resource required for overall administration of the scheme at PMU, issuance of EPC and LCC units, and other miscellaneous expenses	60	2.00	2014-18
Organization	2. Capacity building for staff of PMU Office	10	0.75	2014-18
Consultation & Engagement	3. Direct interview & Consultation workshops for EPC scheme	3	0.40	2014-15
Consultation & Engagement	4. Direct interview & Consultation workshops for LCC program	24	0.50	2014-16
Consultation & Engagement	5. The PMR implementation report	60	0.10	2014-18

Chapter 4. Summary of Schedule and Budget

In summary, the total budget required under the PMR program is about 12.32 Million USD, in which 6.19 Million USD is required for preparation (2014-2016) and 2.38 Million USD is required for the operational phase (2017-2019). The remaining budgets of 3.75 Million USD are proposed for arranging organization, communication, consultation and engagement activities from 2014-2019.

During the preparation (2014-2016), the total required budgets are 6.19 Million USD which come from:

- ETS 0.20 Million USD (only for preparing legal framework)
- EPC 2.36 Million USD
- LCC 3.08 Million USD
- LCC Fund 0.55 Million USD

During the operational phase (2017-2019), the total required budgets are 2.38 Million USD which come from:

- EPC 1.69 Million USD
- LCC 0.64 Million USD
- LCC Fund 0.05 Million USD

The summary of proposed activities and required budgets to be carried out during the PMR is as follows:

Section	Activity	Time Required (months)	Estimated budget requirement (Million USD)	Year of funding required
ETS preparation			0.2	
Legal Framework	1. A study to propose the legal framework for establishing the ETS in Thailand	24	0.2	2015-2016
EPC Preparation Phase			2.36	2014-2016
Data	1. Assessment Study on present data (list of DF&Bs, annual energy consumption of each DF&B, list of PREs and energy auditors etc, data capture and storage system)	2	0.04	2014
MRV	2. Assessment Study on present MRV system, demand-supply gap of certified energy auditors and their skill level to do the verification.	2	0.04	2014
Preparedness	3. Assessment Study on provisions of present Law and amendments required for EPC scheme	4	0.03	2014
Data	4. Review of present data format in the context of EPC requirement and look into the modifications required	3	0.04	2014
Data	5. Research study on Sector-specific energy usage pattern and potential improvement for energy efficiency	12	0.2	2014-2015
MRV	6. Develop an e-portal to facilitate the submission of annual energy report by DF&Bs to DEDE.	6	0.2	2014
MRV	7. Create suitable number of certified energy auditors, develop & maintain a list of available independent verifiers.	24	0.2	2015-2016
MRV	8. Develop guidelines for PREs on how to fill-up the data format and for certified energy auditors on how to verify the data	2	0.01	2015
MRV	9. Obtain 3 years data (as required for EPC) as per the format from all DF&Bs	12	-	2014
MRV	10. 100% verification of all reported data by independent verifiers.	6	0.4	2015
Data	11. Development of sector-specific technology compendium	6	0.1	2016
MRV	12. Capacity building of PREs and Verifiers	6	0.1	2015-2016

Section	Activity	Time Required (months)	Estimated budget requirement (Million USD)	Year of funding required
Target Setting	13. Consultation process of finalizing the methodology of baseline and target setting of DF&Bs	6	0.1	2015-2016
Target Setting	14. Analysis of Data for baseline estimation and target setting through suitable application software.	12	0.2	2016
Target Setting	15. Develop EPC design and operational document	4	0.02	2016
Preparedness	16. Development of a guidebook on energy auditing	12	0.1	2015
Preparedness	17. Development of system for EPC registry	12	0.4	2014-2016
Preparedness	18. Training officials and staff for EPC registry	1	0.03	2016
Allocation methodology	19. A study of the allocation methods from other ETS and a proposal of allocation methodology in EPC	12	0.1	2015
Incentive	20. A study to determine the price level to buy back the surplus of allowances	6	0.05	2014
EPC Demonstration Phase			1.69	2017-2019
Communication	1. Outreach and media campaign to invite participation in the demonstration phase	6	0.1	2017
MRV	2. Develop sector-specific verification protocol	12	0.2	2017
MRV	3. Energy audit of all DF&Bs willing to participate in the demonstration phase	12	1.2	2017-2018
Readiness	4. Capacity building program of independent verifiers	6	0.05	2018
Readiness	5. Assessment study on the success or failure of the demonstration	3	0.04	2019
Communication	6. Outreach and media campaign to propagate the success of the demonstration phase	3	0.1	2019
LCC preparation phase			3.08	2014-2016
Scope	1. Selection of GHG covered by the LCC program	-	-	2014
Scope	2. Selection of project activities covered by the LCC program	-	-	2014
Scope	3. Development of the Local GHG Abatement Potential guidelines	3	0.2	2014
Scope	4. Local GHG Abatement Potential development in 32 municipalities and communities	24	0.32	2014-2016
Baseline	5. Development of baseline methodologies (baseline setting)	-	0.21	2014

Section	Activity	Time Required (months)	Estimated budget requirement (Million USD)	Year of funding required
MRV	6. Development of the PDD and Monitoring report template	-	0.02	2014
MRV	7. Monitoring: Monitoring Methodologies and Guidelines	-	0.07	2014
MRV	8. Reporting: Development of Monitoring Report	-	0.2	2014
MRV	9. Verification: Design of a verification framework	-	0.05	2014
MRV	10. Verification: Design of an accreditation process	-	0.03	2014
MRV	11. Verification: Accreditation of verifiers	-	-	2017
MRV	12. Development of PDDs in 32 municipalities and communities	24	0.96	2014-2016
MRV	13. Validation of the PDD	12	0.32	2014-2016
MRV	14. Registration of the PDD	3	-	2014-2016
Data	15. Development of pricing mechanism to support the implementation of the LCC program (demand side)	6	0.09	2014
Regulatory	16. Develop the guidelines/procedures for approval of projects/LCC proposals submitted in the PDDs	-	0.18	2014
Registry	17. Development of system for LCC registry (using TVER registry)	-	0.4	2014
Registry	18. Training officials and staff for LCC registry	2	0.03	2017
LCC implementation phase			0.64	2017-onward
MRV	1. Verification of the PDD in 32 municipalities and communities	-	0.64	2017-onward
MRV	2. Issuance of LCC-TVER units	-	-	-
LCC Fund Preparation Phase			0.55	
Fund Structure	1. a study to assess and to propose a final structure of the fund	12	0.1	2014-2015
Incentive	2. a study of pricing methodology for providing carbon finance to LCC projects	6	0.05	2015
Administrative arrangement	3. the administrative and legal arrangement		0.1	2015-2017

Section	Activity	Time Required (months)	Estimated budget requirement (Million USD)	Year of funding required
Outreach	4. promotion, outreach and business development to promote LCC program	-	0.3	2015-2017
LCC Fund Operation Phase			0.05	
MRV	1. The summary of LCC fund activities, lesson learnt and feedback.	60	0.05	2017
Organization, Communication, Consultation and Engagement			3.75	2014-2018
Organization	1. Corpus Fund for Human resource required for overall administration of the scheme at PMU, issuance of EPC and LCC units, and other miscellaneous expenses	60	2	2014-2018
Organization	2. Capacity building for staff of PMU Office	10	0.75	2014-2018
Consultation & Engagement	3. Direct interview & Consultation workshops for EPC scheme	3	0.4	2014-2015
Consultation & Engagement	4. Direct interview & Consultation workshops for LCC program	24	0.5	2014-2016
Consultation & Engagement	5. The PMR implementation report	60	0.1	2014-2018
Total required budget			12.32	