บทบาทหน้าที่ของหน่วยงานกลางประสานการดำเนินงานตามกลไกการพัฒนาที่สะอาดในประเทศไทย

นายณพรรษ จรรยาภรณ์พงษ์

วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาวิทยาศาสตรมหาบัณฑิต
สาขาวิชาการจัดการสิ่งแวดล้อม (สหสาขาวิชา)
บัณฑิตวิทยาลัย จุฬาลงกรณ์มหาวิทยาลัย
ปีการศึกษา 2552

THE ROLE OF DESIGNATED NATIONAL AUTHORITY IN DRIVING CLEAN DEVELOPMENT MECHANISM (CDM) IN THAILAND

Mr. Napas Charnyapornpong

A Thesis Submitted in Partial Fulfillment of the Requirements
for the Degree of Master of Science Program in Environmental Management
(Interdisciplinary Program)
Graduate School
Chulalongkorn University
Academic Year 2009

Thesis Title	THE ROLE OF DESIGNATED NATIONAL AUTHORITY IN DRIVING CLEAN DEVELOPMENT MECHANISM (CDM) IN THAILAND
By	Mr.Napas Charnyapornpong
Field of study	Environmental Management
Thesis Advisor	Chanathip Pharino, Ph.D.

Accepted by the Graduate School, Chulalongkorn University in Partial Fulfillment of the Requirements for the Master's Degree

..... Dean of the Graduate School
(Associate Professor Pornpote Piumsomboon, Ph.D.)

THESIS COMMITTEE

..... Chairman
(Assistant Professor Manaskorn Rachakornkij, Ph.D.)

..... Thesis Advisor
(Chanathip Pharino, Ph.D.)

..... Examiner
(Assistant Professor Somporn Kamolsiripichaipom, Ph.D.)

..... Examiner
(Punjaporn Weschayanwiwat, Ph.D.)

..... External Examiner
(Chaiwat Muncharoen, D.Eng.)

ณพรรษ จรรยาภรณ์พงษ์ : บทบาทหน้าที่ของหน่วยงานกลางประสานการดำเนินงานตามกลไกการพัฒนาที่สะอาดในประเทศไทย. (THE ROLE OF DESIGNATED NATIONAL AUTHORITY IN DRIVING CLEAN DEVELOPMENT MECHANISM (CDM) IN THALAND) อ. ที่ปรึกษาวิทยานิพนธ์หลัก : ดร. ชนาธิป ผาริโน, 119 หน้า.

กลไกการพัฒนากลไกสะอาด (CDM) ได้มีการดำเนินการในประเทศไทยตั้งแต่ พ.ศ. 2548 จนถึงปัจจุบันจำนวนโครงการ CDM ที่เกิดขึ้นในประเทศไทยพบว่ามีจำนวนน้อยกว่าประเทศอื่นๆ โดยเฉพาะอย่างยิ่งเมื่อเทียบกับประเทศอื่นๆในภูมิภาคเอเชียตะวันออกเฉียงใต้ ซึ่งมีโครงสร้างทางเศรษฐกิจคล้ายคลึงกับประเทศไทย หากโครงการ CDM ไม่ได้รับการพัฒนาและการสนับสนุนที่เหมาะสมให้เกิดขึ้นอย่างแพร่หลายจะทำให้ประเทศเสียโอกาสที่จะได้รับประโยชน์หลายๆ ด้านจากโครงการ CDM งานวิจัยนี้มีจุดประสงค์เพื่อศึกษาถึงปัจจัยที่มีผลต่อการดำเนินโครงการ CDM รวมถึงวิเคราะห์บทบาทของหน่วยงานกลางที่รับผิดชอบขับเคลื่อนการดำเนินงาน DNA (Designated National Authority) ในการสนับสนุนให้มีโครงการ CDM ในประเทศไทยเพิ่มมากขึ้น วิธีการศึกษาใช้การสัมภาษณ์และการจัดทำแบบสอบถามเพื่อเก็บข้อมูลจากผู้ที่เกี่ยวข้องทั้งภาครัฐบาลและองค์กรเอกชน เพื่อนำมาวิเคราะห์หาปัจจัยที่มีความสำคัญ ซึ่งอาจจะส่งผลกระทบต่อการพัฒนาโครงการ CDM อาทิเช่น ความเข้มงวดและความรวดเร็วของการอนุมัติขั้นตอนค่าใช้จ่ายในการดำเนินการ การสนับสนุนจากภาครัฐ ศักยภาพและจำนวนบุคลากรในองค์กรที่เกี่ยวข้อง ผลการศึกษาพบว่า ปัจจัยทางด้านการเงิน อาทิเช่น ความผันผวนของราคา CERs ค่าใช้จ่ายในการดำเนินการ และการขาดความสนับสนุนจากแหล่งเงินทุน เป็นปัจจัยที่มีความสำคัญมากและเป็นอุปสรรคต่อการตัดสินใจดำเนินโครงการ CDM ในประเทศไทย โดยผู้ที่เกี่ยวข้องกับโครงการ CDM เช่น นักลงทุนเจ้าของโครงการ ยังคงขาดความเข้าใจในขั้นตอนกระบวนการการดำเนินโครงการ CDM ดังนั้น บทบาทของ DNAในการส่งเสริมและสนับสนุนโครงการ CDM จะต้องมีการดำเนินการสร้างความรู้และความเข้าใจในโครงการ CDM ให้เกิดขึ้นอย่างแพร่หลาย และควรดำเนินการด้วยความต่อเนื่องและมีประสิทธิภาพมากขึ้น พร้อมกับการพัฒนาโครงการสนับสนุนทางด้านการเงินให้เป็นรูปธรรม ในอนาคต นโยบายระเบียบวาระระดับชาติด้านการลดก๊าซเรือนกระจก จะมีบทบาทสำคัญอย่างยิ่งที่จะส่งผลต่อการดำเนินโครงการ CDM ในประเทศไทย

สาขาวิชา การจัดการสิ่งแวดล้อม ลายมือชื่อนิสิต.....
ปีการศึกษา 2552 ลายมือชื่ออ.ที่ปรึกษาวิทยานิพนธ์หลัก.....

5087512820 : MAJOR ENVIRONMENTAL MANAGEMENT
KEYWORDS: CLEAN DEVELOPMENT MECHANISM / GREENHOUSE GAS / DESIGNATED NATIONAL AUTHORITY

NAPAS CHARNYAPORNPOHG : THE ROLE OF DESIGNATED NATIONAL AUTHORIY IN DRIVING CLEAN DEVELOPMENT MECHANISM (CDM) IN THAILAND. THESIS ADVISOR : CHANATHIP PHARINO, Ph.D., 119 pp.

Clean Development Mechanism (CDM) has been initiated in Thailand since 2005, but limited numbers of CDM projects have been implemented in Thailand as compared to other Southeast Asian countries. Thailand would receive significant benefits from the CDM if it was implemented widely. However, the causes hindering the project development have not been fully understood, especially the role of Designated National Authority (DNA) on CDM execution. The objectives of this research are to investigate major factors impacting CDM performance and to analyze the roles of the DNA in driving CDM projects in Thailand. The research was carried out by conducting a survey and interviewing related stakeholders to identify key factors which could have impacts on CDM project implementation and performance such as organization capacity, stringency of approval procedure, and speed and accuracy of process. The study shows that financial factor significantly hinders CDM project development in Thailand. The implementation cost, uncertainty of CERs price, and investment fund support are the major considerations to the project developers in making decision to implement CDM project. In addition, related stakeholders still lack the understanding of CDM implementation procedure. The DNA therefore needs to promote and support the CDM implementation nationwide in more effective and continuous manner, specifically a suitable financial supporting program has to be urgently developed. In essence, a national policy agenda for greenhouse gas reduction will enhance the success rate of CDM project implementation in Thailand.

Field of study Environmental management Student's signature.....

Academic year 2009 Advisor's signature.....

ACKNOWLEDGEMENTS

I would like to express my sincere gratitude to my advisor, Dr. Chanathip Pharino, for the helpful guidance in setting the research framework of the systematic thinking for the environmental application and management. Her valuable time and suggestion significantly contribute to the end results of my study

Moreover, I also wish to express my appreciation and sincere gratitude to all members of the thesis committee Dr. Manaskorn Rachakornkij (Chairman), Assistant Professor Somporn Kamolsiripichaiporn, Dr. Chaiwat Munchareon, and Dr. Punjaporn Weschayanwiwat for their constructive suggestions and comments.

In addition, I would like to thank the National Center of Excellence for Environmental and Hazardous Waste Management (NCE-EHWM) for the scholarships and partially funding for the thesis work.

I thank the South Pole Carbon Asset Management Ltd., Thailand Environment Institute, Industrial Environment Institute, and Thailand Greenhouse Gas Management Organization (Public organization) for providing time and helpful information in analytical works.

Last but not least, with my deep appreciation and gratitude, the success of this research work to my family for their warm supports and great encouragement throughout my research work.

CONTENTS

Page

CHAPTER

Page

CHAPTER

LIST OF TABLES

LIST OF FIGURES

LISTS OF ABBREVIATIONS

CDM	Clean development mechanism
CER	Certified emission reduction
CH_4	Methane
CO_2	Carbon dioxide
DENR	Department of Environment and Natural Resources, the Philippines
DNA	Designated national authority
DOE	Designated operational entities
EB	Executive board
EE	Energy efficiency
EIA	Environmental impact assessment
ET	Emission trading
GHG	Greenhouse gas
HFCs	Hydrofluorocarbon
IEE	Initial environmental evaluation
IGES	Institute for Global Environmental Strategies
IPCC	Intergovernmental Panel on Climate Change
IRR	Internal rate of return
JI	Joint implementation
LFG	Landfill gas
LoA	Letter of approval
LoE	Letter of endorsement
Max.	Maximum
MONRE	Ministry of Natural Resources and Environment
MYR	Malaysian ringgit
N_2O	Nitrous oxide
NCDMA	National Clean Development Mechanism (CDM) Authority, India
NDRC	National Development and Reform Commission of the People's Republic of China
NGO	Non-governmental organization
NOx	Oxides of nitrogen

NRE	Ministry of Natural Resources and the Environment, Malaysia
ONEP	Office of Natural Resources & Environmental Policy and Planning, Thailand
PFCs	Perfluorocarbon
PHP	Philippine pesos
PIN	Project idea note
PDD	Project design document
RE	Renewable energy
SD	Sustainable development
SF_6	Sulfur hexafluoride
SOx	Sulfur oxides
SPSS	Statistical package for the social sciences
tCO_2e	tones of carbon dioxide equivalent
TGO	Thailand Greenhouse Gas Management Organization (Public organization)
THB	Thai baht
UNFCCC	United Nations Framework Convention on Climate Change
VER	Verified emission reduction
WB	The World Bank

CHAPTER I

INTRODUCTION

1.1 Introduction

The results of human activity in energy consumption from burning fossil fuels such as oil, coal and natural gas cause the accumulation of greenhouse gases in the atmosphere. Greenhouse gases have high potentials to absorb the heat, and then it resulted in increasing average temperature of the atmosphere. This phenomenon is a part of climate change called global warming.

To find mitigation and adaptation for global warming problem, most countries joined an international treaty – UNFCCC (the United Nations Framework Convention on Climate Change). Later, in 1997, they had adapted an international agreement called Kyoto Protocol to reduce greenhouse gas (GHG) emissions for 37 industrialized countries and the European community (UNFCCC, 2008). Three mechanisms were introduced as additional means of meeting their targets of GHG reduction i.e. Emission Trading (ET), Joint Implementation (JI), and Clean Development Mechanism (CDM).

The purpose of CDM is to assist Parties included in Annex I (which are the industrialized countries that agreed to binding limitations on GHG emissions) in achieving compliance with their quantified emission limitation and reduction commitments under Article 3 of the Kyoto Protocol, and to assist non-Annex I parties (which are the developing countries that did not currently have a binding GHG emissions reduction commitment under the Kyoto Protocol) in achieving sustainable development and in contributing to GHG reduction target of the Kyoto Protocol (UNFCCC, 2006). The CDM allows carbon emission reduction projects in developing countries to earn Certified Emission Reduction (CER) credits equivalent to the amounts of carbon dioxide (CO_2) reduced which can be traded in carbon market to

help developed countries meeting their emission reduction targets under the Kyoto Protocol cost effectively.

Figure 1.1 shows the step of CDM implementation. Firstly, project developers design the CDM project. Then, the project must be approved by host country through Designated National Authority (DNA) to get the Letter of Approval and validated by Designated Operational Entity (DOE). Next, the project would be registered with the UNFCCC through Executive Board of CDM (CDM EB). After registration, the actual greenhouse gases reduction would be monitored, verified, and certified by another DOE which is different from DOE in validation step. Lastly, when all steps have been approved, CDM EB would issue the Certified Emission Reduction (CERs) which project developers can trade in carbon market.

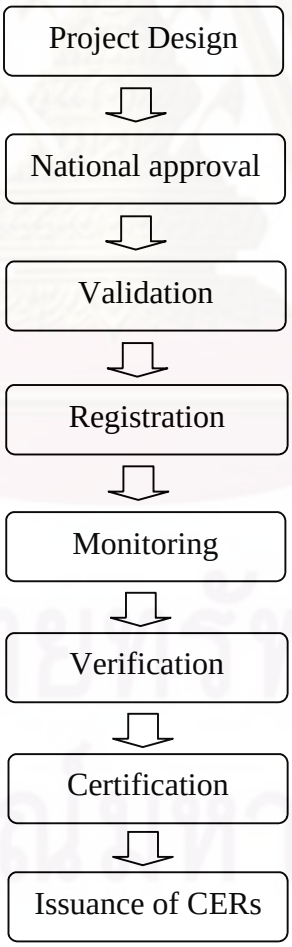

Figure 1.1: Project Cycle of CDM (TGO, 2008)

CDM project from every country must be investigated using same procedure and criteria. Nevertheless, UNFCCC gives the general criteria for the host country to use in national approval step to approve the CDM projects. Especially on the sustainable development issue, the UNFCCC gives the rights to the host country to stipulate their own criteria depending on their targets. Essentially, each country has to establish DNA which plays a vital role in approving the CDM projects before submitting to CDM EB. The success of the CDM project implementation in each country therefore relies on performance of DNA for its organization capacity, stringency of approval procedure, and speed and accuracy of process.

Thailand has ratified Kyoto Protocol in August 2002 as Non-Annex I parties, which means that Thailand has no commitment to reduce the GHG emissions but can still perform the voluntary emission reduction project. During the initial phase, CDM projects were approved by the Thai Cabinet. Thailand Greenhouse Gas Management Organization (TGO) was later established in 2007 as an implementing agency on greenhouse gas (GHG) emission reduction in Thailand and able to perform as the DNA for CDM projects. However, based on the number of registered CDM project in Thailand as shown in Figure 1.2, it appeared that Thailand has a relatively slow progress of CDM implementation as compared to other countries in Asia.

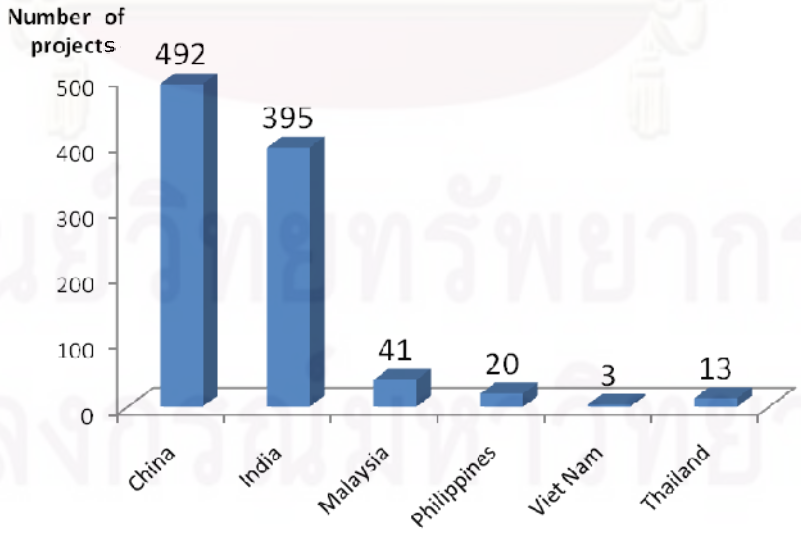

Figure 1.2: Total Registered CDM Projects from Thailand and Others (UNFCCC, 2008)

Thailand would receive significant benefits from the CDM mechanism if it was implemented widely. However, the causes hinder the project development has not been fully understood, especially, whether the role of DNA significantly effect to CDM implementation progress or not. No research study has been investigated on this issue in Thailand in comparison with other nations. This research aims to fulfill that research gap and to identify key factors controlling progresses and the way to promote the CDM implementation in Thailand.

1.2 Objectives

The main objective of this research is to understand the role and influence of Designated National Authority (DNA) in driving Clean Development Mechanism (CDM) projects and recommendation to promote CDM project implementation in Thailand. The specific objectives of this study are as follows:

1. To understand overview and performance of current CDM implementation in Thailand compared to other Southeast Asian countries.
2. To identify key factors controlling success of CDM project implementation.
3. To investigate practical solutions and develop recommendation which would help progressing CDM projects toward sustainable development in Thailand.

1.3 Hypotheses

The hypotheses of this study are as follows:

1. Different levels of stringency of CDM approval procedure between DNA of Thailand and of other neighboring countries could result in different number of registered CDM projects by CDM EB.
2. The limited of knowledge on CDM implementation procedure of the stakeholders together with the inadequate government supports could be major factors causing the slow development of CDM projects in Thailand in the past compared to other developing nations.

1.4 Scope of study

This study focuses on investigation of the key factors influencing CDM implementation including the performance of Thailand's DNA from different stakeholders' perspectives. Subsequently, the experience of CDM implementation was compared among different nations, including Vietnam, Malaysia, the Philippines, China, and India. In the comparison of CDM practice, Vietnam, Malaysia, and the Philippines were selected because of their similar economical structure with Thailand while China and India were selected because of being the world's leader of CDM project implementation. Questionnaire survey and interviews various stakeholders are used as methodology for investigation. The questionnaire was developed based on intensive literature reviews and preliminary results from interviewing with Thailand's DNA, the World Bank, and other stakeholders. The questionnaire contained different factors that respondents will provide inputs to help differentiate levels of importance of each impacting factor. The information gathered from the survey and interview was analyzed together to identify the key factors of CDM implementation and represent the practical solution that will help improving CDM approval procedure.

CHAPTER II

THEORETICAL BACKGROUND AND LITERATURE REVIEWS

2.1 Worldwide CDM

2.1.1 History

Greenhouse gas emissions from human activities resulted in increased impact in the global warming. The United Nations Environment Programme (UNEP) in conjunction with the World Meteorological Organization (WMO) then established the Intergovernmental Panel on Climate Change (IPCC) with the aim to analyze the scientific data related to the impact of climate change and to prepare measures and strategies related to climate change management.

At the beginning, there was an international convention with the purpose to find mechanism to prevent climate change and other effects that might occur to human. Then, in June 1992, 150 countries had ratified the United Nations Convention on Climate Change (UNFCCC) which intended to maintain the level of greenhouse gas in the atmosphere at the level without human intervention at Rio de Janeiro in Brazil.

As a result of signing the UNFCCC, annual convention has been held by the signing parties. At the 3rd Conference of the Parties (COP3) at Kyoto in Japan, it resulted with the Kyoto Protocol to address the global climate change problem. The concrete material under the Kyoto Protocol is shown in Appendix 1 mentioning that the parties need to collaborate to reduce GHG emissions to achieve the targets of 5 % less from the 1990 baseline level during the 5 year period (2008 – 2012), or known as first commitment period. In addition, the Kyoto Protocol also specified three mechanisms to help achieve the purpose of reducing GHG, namely Emission Trading (ET), Joint Implementation (JI), and Clean Development Mechanism (CDM).

Under the Kyoto Protocol, there were 6 types of gases classified as GHG: Carbon dioxide (CO_2), Methane (CH_4), Nitrous oxide (N_2O), Hydrofluorocarbons (HFCs), Perfluorocarbons (PCFs), and Sulphur hexafluoride (SF_6). Each GHG has different characteristic of radiative efficiency. Then, for the convenience of comparison, Global Warming Potential (GWP) of each gas is calculated with relative to the amount of carbon dioxide equivalent as shown in Table 2.1.

Table 2.1: Global Warming Potential of Greenhouse Gases

Species	Chemical formula	Global Warming Potential
Carbon dioxide	CO_2	1
Methane	CH_4	21
Nitrous oxide	N_2O	310
Hydrofluorocarbons	HFCs	140-11,700
Perfluorocarbons	PCFs	6,500-9,200
Sulfur hexafluoride	SF_6	23,900

Source: IPCC reports on Climate Change, 2007

2.1.2 Benefits of CDM

Clean development mechanism or CDM is a mechanism set up under the Kyoto Protocol to help Annex I parties achieve their commitment of reducing GHG, and to promote sustainable development of Non-Annex I parties. With voluntary cooperation between Annex I parties and Non-Annex I parties, Annex I parties will be able to convert the amount of GHG emission reduction operated from Non-Annex I parties to represent the amount of GHG emission reduction of their own and achieve the emission reduction target under Kyoto Protocol. For Non-Annex I parties, they would receive in return the support for action on sustainable development and cleaner technology including better environmental quality from emission reduction and benefits from selling CERs. Moreover, the results of GHG emissions reduction, Non-Annex I parties would receive Certified Emission Reductions (CERs) credits or known as carbon credits that can be traded with Annex I parties. The CDM project and CERs must be certified by the CDM Executive Board (CDM EB) based on the

methodology and all requirements set by UNFCCC before being sold to Annex I parties.

There are still more sustainability development benefits from CDM implementation to the host country. For example, in Thailand, the Office of Natural Resources and Environmental Policy and Planning concluded the benefits gained from implementing CDM project in 3 aspects: environmental, economic, and social , as shown in Table 2.2. For environmental aspect, Thailand can earn environmental benefits from the result of waste reduction, preservation of environment in the local area, reduction in use of non-renewable energy, and transfer of cleaner technology. For economic aspect, CDM will promote renewable energy, e.g. using local agricultural material to produce renewable energy instead of fossil fuel. The income will be distributed to farmers and the local community and eventually stimulate the domestic economy. The amount of imported energy will be reduced. The host country can get tax benefits from the trading of CERs which can be used to offset the costs of environmental protection and energy conservation. For social aspect, the quality of life will be improved from better environmental quality, and environmental friendly project which can help increase nation’s capability on negotiating at the international arena in expanding opportunities for trade and export.

Table 2.2: Benefits from the Implementation of CDM Projects in Thailand

Aspect	Benefits
Environmental	Local level • Preservation of environment in the local area where project is being implemented. • Reduction in the amount of waste generated by using it as catalyst for energy production. • Reduction in the use of non-renewable energy. National level • Improvement in the general quality of the environment. • Transfer of CDM technology, both at national and international levels.
Economic	Local level • Projects related to renewable energy will incorporate agricultural products, such as palm, coconut, sunflower, and jatropha, as raw materials. • Farmers will be able to sell waste materials, such as sugarcane leaves, rice husks and wood chips, for use in CDM projects. • Benefits for the local labor market. National level • Projects related to renewable energy will incorporate agricultural products, such as palm, coconut, sunflower, and jatropha, as raw materials. • Farmers will be able to sell waste materials, such as sugarcane leaves, rice husks and wood chips, for use in CDM projects. • Benefits for the local labor market. • Products are generated by cleaner production processes. • Reduction of the dependence on imported energy. • Beneficial to national economy. • Tax benefits from the trading of CERs can be used to offset the costs of environmental protection and energy conservation.

Aspect	Benefits
Social	Local level • Improved quality of life from better environmental quality. • Provide options in conducting business practices that are beneficial to the environment. National level • Playing role in the management of a global issue. • Building capability in negotiation at the international arena.

Source: ONEP, 2008

2.1.3 Implementation of CDM Projects

The international guidelines about conditions required for CDM project implementation provided by the UNFCCC can be summarized as follows:

- The creation of emission reduction credits can be achieved only through voluntary action. CDM projects must be approved by certified organization, i.e. CDM EB, DOE, and the host countries.
- Creditable emissions reductions from CDM projects must be approved, validated, verified and certified as CERs through various entities. These include: a Designated National Authority (DNA), a Designated Operational Entity (DOE) and the Executive Board of the UNFCCC CDM, which is elected by COP/MOP (the Conference of the Parties and the Meeting of the Parties).
- CDM project development must be in accordance with sustainable development objectives of the host countries.
- The development of a CDM project must be additional compared to business-as-usual scenario in terms of financial, investment, technology and environment bases.
- A CDM project must be real, measurable and additional from normal operations. It must also result in long-term benefits in terms of climate change mitigation.

- All the processes involving the development of a CDM project must be transparent, efficient and accountable under independent auditing and verification.

In addition, the Kyoto Protocol specifies the network of CDM project into 15 categories as follows:

1. Energy industries (renewable/non-renewable sources)
2. Energy distribution
3. Energy demand
4. Manufacturing industries
5. Chemical industries
6. Construction
7. Transport
8. Mining/mineral production
9. Metal production
10. Fugitive emissions from fuels (solid, oil and gas)
11. Fugitive emissions from production and consumption of halocarbons and sulphur hexafluoride
12. Solvent use
13. Waste handling and disposal
14. Afforestation and reforestation
15. Agriculture

Moreover, UNFCCC also indentified types of small-scale CDM project as follows:

- Renewable energy project activities with a maximum output capacity equivalent of up to 15 megawatts (or an appropriate equivalent)
- Energy efficiency improvement project activities which reduce energy consumption, on the supply and/or demand side, by up to the equivalent of 15 gigawatt hours per year
- Other project activities that both reduce anthropogenic emissions by sources and directly emit less than 15 kilotonnes of carbon dioxide equivalent annually

A project which is registered as a CDM project must demonstrate that it can prove the actual greenhouse gases reduction. The amount of greenhouse gas emissions resulted from the project (project emission) should be less than that in the normal situation without the project (baseline emission).

The UNFCCC accordingly defines the implementation process which can be divided into 8 steps as shown in Figure 2.1 and described as follows:

1. Project Design

The project proponent must provide a design outline and prepare a Project Design Document (PDD), which should give detail information such as the project boundary, the methodology for calculating the reduction of GHG emissions, the methodology for monitoring the results, and an analysis of the environmental impacts and sustainable development.

2. National Approval

The PDD is to be submitted to Designated National Authority (DNA) to get a Letter of Approval (LoA). The project proponent must receive a LoA for the project implementation from the host country through the DNA as a confirmation that the project will be undertaken voluntarily and that the project will contribute to sustainable development in the host country.

3. Validation

The LoA and the PDD will be validated by DOE that has been appointed by the CDM EB. The DOE is responsible for review and assessment of the PDD with specific reference to prescribed requirements. There are now 5 DOE available in Thailand: Bureau Veritas Certification (Thailand) Ltd., SGS (Thailand) Ltd., TUV Rheinland Thailand Ltd., TÜV SÜD PSB (Thailand) Ltd., and TÜV NORD (Thailand) Ltd.

4. Registration

Based on the validation report, the DOE will submit the project design document and will request for project registration by the CDM Executive Board.

5. Monitoring

Once the project is registered, the project proponents can proceed with the project's implementation. Project developers need to ensure that the project performance is maintained and is periodically monitored in accordance with the validated monitoring plan for the assessment of emission reductions as compared to the baseline.

6. Verification

Based on the project monitoring, the emission reductions need to be independently verified by a DOE in comparison to the validated project design document. The purpose of this step is to verify and confirm the actual GHG reduction which is resulted from CDM project, and present that the emission reduction is actual and demonstrable.

7. Certification

The DOE is required to submit a verification report and certify the actual amount of emission reductions generated by the project for issuance of CERs by the CDM Executive Board. To avoid conflicts of interest and to ensure transparency, two different DOEs must be used to validate the PDD and certify the amount of emission reductions.

8. Issuance of CER

After the CDM EB received the certification report, it will proceed with the issuance of the CER. CER is defined as a tradable credit representing GHG emission reductions equivalent to one tonnes of CO2e (which is the concentration of CO2 that would cause the same level of radiative forcing as a given type and concentration of greenhouse gas) achieved through a CDM project. In addition, CERs expire at the end of the commitment period in which they are issued

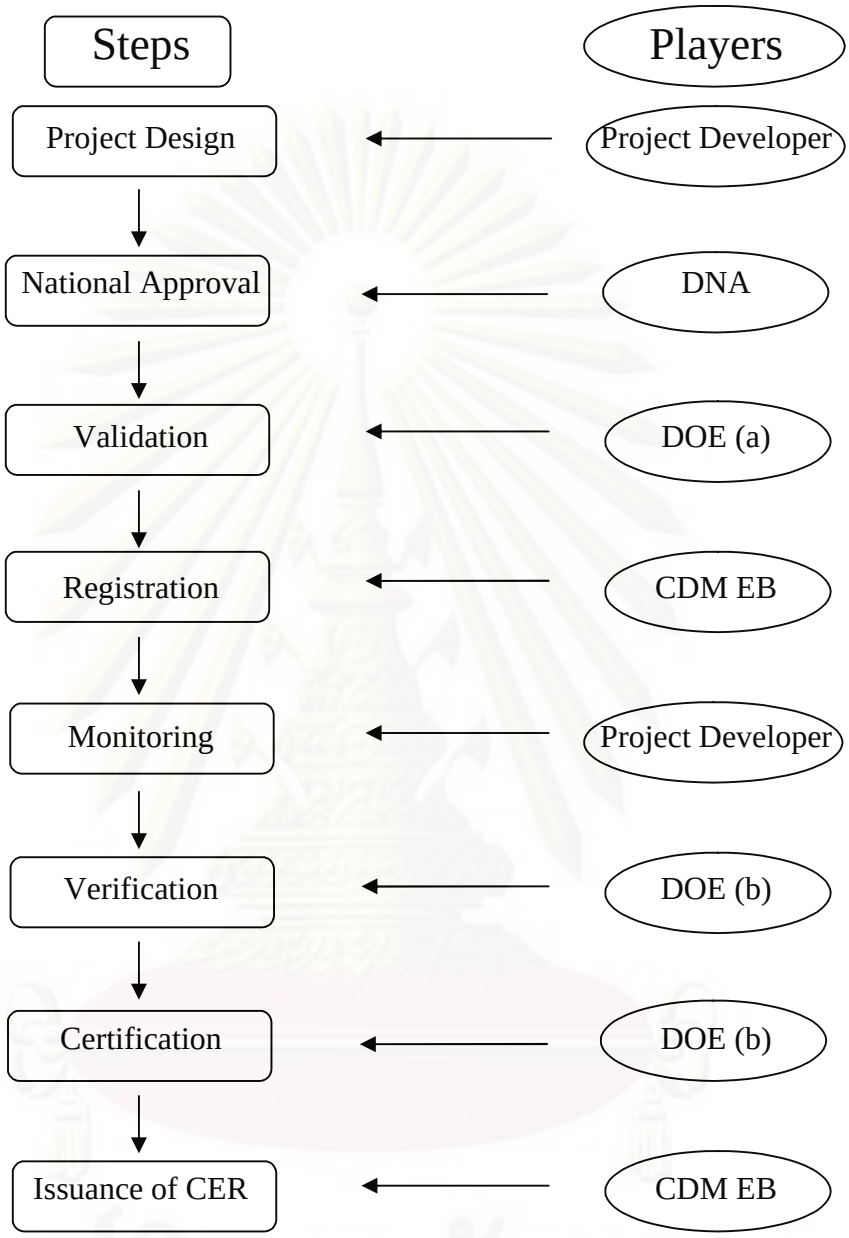

Figure 2.1: Process of CDM Projects Implementation (TGO, 2009)

Furthermore, the project developer must specify duration of selling carbon credit gained from the CDM project which is divided into 2 types. The first is 7-year period and can be extended the period of credit calculation 2 times or to a total of 21 years. The second is 10-year period and cannot be renewed or extended. Project developers must determine each project case-by-case based on project life period. Moreover, they should be aware of the possible invalidity of the original project

baseline that might occur during the next renewal period which would result in lower CER produced. The advantage of 7-year period type is that project developers could get more benefits from CERs for the whole 21 years. However, in 10-years period type, they do not have the risk of methodology change, capacity of GHG reduction decrease, rule and regulation change and etc.

2.1.4 CDM Projects Implemented

As of September 2009, there are 1,827 registered CDM projects worldwide. It can be seen that most registered CDM projects are from energy sector as summarized in Table 2.3. The highest number of registered projects (1,339 projects) is from energy industries. The second highest CDM project category is waste handling and disposal which has 392 projects. Fugitive emission from fuel is the third highest which has 130 projects. However, no projects have been registered by the sectors of energy distribution, construction, and solvent use. At the same time, there are 18 projects from Thailand registered with CDM EB. Most projects are from energy sector in electricity and heat production from biogas and biomass, and 2 projects in chemical industry, and waste handling and disposal.

As shown in Figure 2.2, out of 1,827 registered projects, China has maximum number of CDM registered projects with 634 projects, followed by India with 455 projects, Brazil with 164 projects, and Mexico with 118 projects. The projects from China and India represent almost 60 percent of total registered projects worldwide.

Table 2.3: Number of Registered Projects by Sectoral Scope

Sectoral Scope	Registered Projects* (Worldwide)	Registered Projects* (Thailand)
(01) Energy industries (renewable / non-renewable sources)	1,339	16
(02) Energy distribution	0	0
(03) Energy demand	23	0
(04) Manufacturing industries	101	0
(05) Chemical industries	59	1
(06) Construction	0	0
(07) Transport	2	0
(08) Mining/mineral production	22	0
(09) Metal production	6	0
(10) Fugitive emissions from fuels (solid, oil and gas)	130	0
(11) Fugitive emissions from production and consumption of halocarbons and sulphur hexafluoride	22	0
(12) Solvent use	0	0
(13) Waste handling and disposal	392	1
(14) Afforestation and reforestation	8	0
(15) Agriculture	122	0

* Note that a project activity can be linked to more than one sectoral scope

Source: UNFCCC and TGO on September, 2009

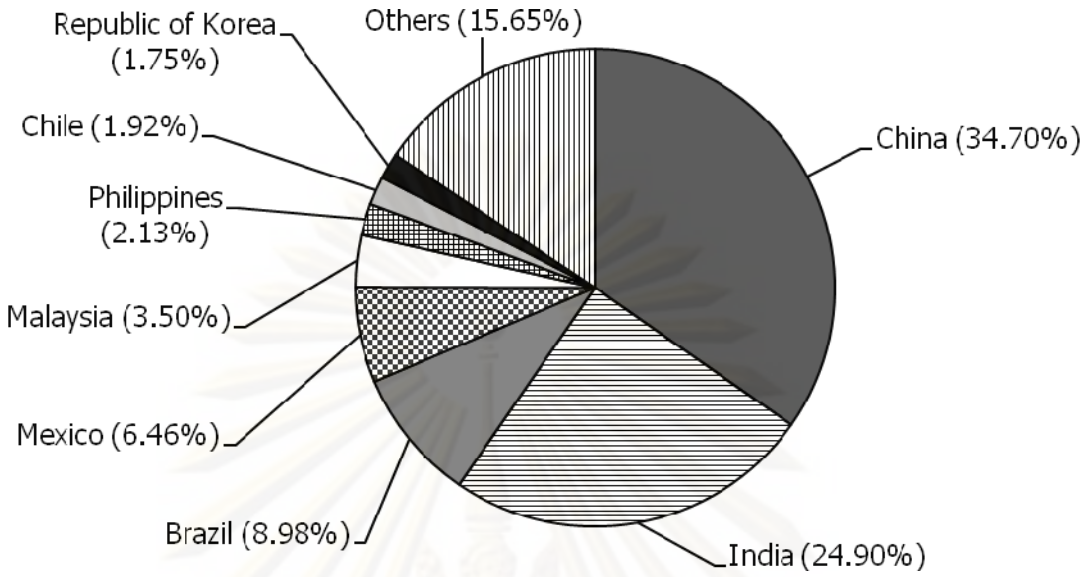

Figure 2.2: Amount of Registered Project by Host Country (UNFCCC, 2009)

From the overall projects, UNFCCC estimated that the annual average amount of CERs generated is 318.41 million, and approximately 9.4 million CERs will be generated from 72 projects under requesting for registration on 20 September 2009. Moreover, UNFCCC also estimated that the expected amount of CERs generated until the end of 2012 will be more than 1.66 billion from registered projects, 2.9 billion from projects in the pipeline, and 20 million from requesting projects.

Table 2.4: Amount of Certified Emission Reductions

Number of CDM projects	**Annual average CERs***	**Expected CERs** (until end of 2012)**
Projects in pipeline > 4200	N/A	> 2,900,000,000
1827 registered projects	318,410,942	> 1,660,000,000
72 requesting projects	9,372,722	> 20,000,000

* Assumption: All activities deliver simultaneously their expected annual average emission reductions.

** Assumption: No renewal of crediting periods.

2.2 CDM projects in Thailand

Thailand has realized the importance of global warming and climate change. Therefore, Thailand signed Kyoto Protocol on 2 February 1999 and ratified it on 28 August 2002 during the 10th Anniversary of United Nations Conference on Environment and Development or the World Summit on Sustainable Development in Johannesburg. The significance of the ratification for Thailand is that it could eventually claim the full benefits from CDM projects when the Kyoto Protocol enters into force. Thailand is listed in the Non-Annex I parties. This means that it is not obligated to reduce the amount of GHG emissions.

At the beginning (July 2003 until late 2007), Ministry of Natural Resources and Environment or MONRE, which acted as the DNA of Thailand, appointed the Office of Natural Resources and Environmental Policy and Planning or ONEP as the national focal point to coordinate the structuring on CDM operation in the country. The DNA was firstly planned to be a unit under the Office of the Minister of Natural Resources and Environment with purpose to investigate CDM projects under the fulfillment on the sustainable development criteria, environmental impact assessment, and public participation requirement. Moreover, the DNA unit would also be an information center on CDM implementation for CDM investors and other stakeholders. The MONRE implements the climate change and CDM policies to support the projects which contribute to the GHGs emission reduction. The National Office on Climate Change is the National Committee on CDM called the National CDM Advisory Board (NCAB) which is chaired by the Permanent Secretary of MONRE. The NCAB comprises two technical working groups: one for advising CDM energy and industry projects and another for forestry and agriculture projects. Lastly, the final approval of CDM projects would be made by the National Environment Board which is the Cabinet chaired by the Prime Minister.

However, there were only 14 CDM projects approved by the cabinet during the 4 year period. Then, the Cabinet has resolved on 15 May 2007 to approve the establishment of Thailand Greenhouse Gas Management Organization (TGO) as a public organization in order to unify and streamline the CDM implementation, as well

as to be a hub for collaboration between public and private international organizations.

In early 2008, TGO was established with the main purposes to help promote GHG emission reduction at both policy and procedure level, and to act as DNA for Thailand to issue the Letter of Approval which is used for registration of CDM project to CDM EB. The functions of TGO are also to review the greenhouse gases mitigation project and CDM projects, as well as being an autonomous organization to provide services on GHG inventories, information on GHG mitigation, promoting investment on GHG emission reduction, coordinating with private and relevant sectors and international partnership to mitigate GHG, and capacity development to relevant stakeholders to develop GHG emission reduction.

2.2.1 Performance of Thailand

Thailand has high potential to reduce GHG emission. Thailand has assessed the quantity of various greenhouse gases (including methane, carbon dioxide, nitrous oxide, HFCs and other gases) emitted in 1998 from different sectors, e.g. agriculture, land and forest, industry, energy, waste, and others. Carbon dioxide is the most emitted greenhouse gas which is 68% of the overall greenhouse gases emitted. The second is methane (27%). The sector that contains large quantities of greenhouse gas emissions is energy. The second largest GHG contributing sector is change of land use and deforestation. An expectation about the amount of greenhouse gas emissions during 1998-2020 under the growth rate of Gross Domestic Product at 4-5% per year would be that greenhouse gas emissions would be increased by the average of 2.9 percent per year, whereas methane emissions would be increased by the average of 1.2% per year. Besides, the most sectors that would emit the most amounts of greenhouse gases would be energy sectors (JGSEE, 2009).

Thailand focuses primarily on energy projects following the government policies on promoting the use of renewable energy. The UNFCCC has registered 17 CDM projects from Thailand. Thailand has identified projects to be considered for approval into 4 types. The details of each type can be explained as follows.

- **Energy projects,** including energy production and improvement of energy efficiency such as fuel switching project, industrial waste to energy project, improvement of cooling system performance project, and project of improving efficiency of energy use in buildings.
- **Environmental projects**, such as waste of energy conversion, and conversion of waste water to energy projects.
- **Transportation projects,** such as the improvement of efficiency in transportation and energy use project.
- **Industrial projects**, such as projects that can reduce the amount of greenhouse gases emission in the discharge process.

For other type of projects, the Board will consider for approval case-by-case.

Furthermore, there are other government and non-government agencies helping the CDM implementation in Thailand, for example, Thailand Environment Institute (TEI), The Industrial Environment Institute, Department of Alternative Energy Development and Efficiency, and Office of Natural Resources and Environmental Policy and Planning. The promotion is mostly done through knowledge dissemination via seminars or workshops.

2.2.2 Approval Procedure

Approval of CDM projects in Thailand focuses mainly whether the proposed project contributes to the sustainable development criteria. The approval processes adhere to guidelines defined by TGO and relevant authorities. The formal step for approving CDM project is shown in Figure 2.3.

- Project developer deliver project details along with other related documents to TGO to consider in order approving the project. The required documents are the following:
    - Project Designed Document (PDD)
    - Report of Environmental Impact Assessment (EIA) or Initial Environmental Evaluation (IEE)
    - Query of project status under the clean development mechanism.
    - Form of project evaluation for sustainable development criteria under CDM
- TGO will consider the completeness of project documentation and deliver all documents to related Ministry for consideration and comment on the project.
- TGO will deliver related documents along with comments from the Ministry to TGO Board to approve the project.
- TGO Board will inform the approval result to the project developer. If the reviews found that the project is contributed to the sustainable development of the country and is on a discretionary basis. It will be offered to the Permanent Secretary, Ministry of Natural Resources and Environment, or the person assigned to a position held not less than Director or equivalent to issue the Letter of Approval (LoA) for project owner for registration with Executive Board of UNFCCC.
- TGO will submit the approval result to the National Climate Change Committee.

Approved project from TGO must be determined to ensure that the project is appropriate and economically beneficial to social and environmental aspects as well as resulting in reduction of greenhouse gas discharge and promote the sustainable

development within country. For the current criteria of approving CDM projects, TGO has set guidelines for sustainable development criteria for CDM projects which include 4 sustainable development dimensions: social, environmental and natural resource, development and/or transfer of technology, and economic as detailed in Table 2.5.

Before the establishment of TGO, the Cabinet had approved 14 CDM projects which had the capacity to reduce 1,058,991 ton CO_2/year of greenhouse gas and generate 179.95 MW of electricity from January to August 2007. Afterwards, TGO was established in January 2008 and has approved (until July 2009) 72 CDM projects with approximately 4.5 million ton CO_2/year of greenhouse gas reduction and 600 MW of electricity generation. In addition, the trend of approved CDM projects from Thailand is more likely to be small-scaled projects. These evidences show that the performance of Thailand in approving CDM projects has been improved significantly after the TGO establishment (Appendix D).

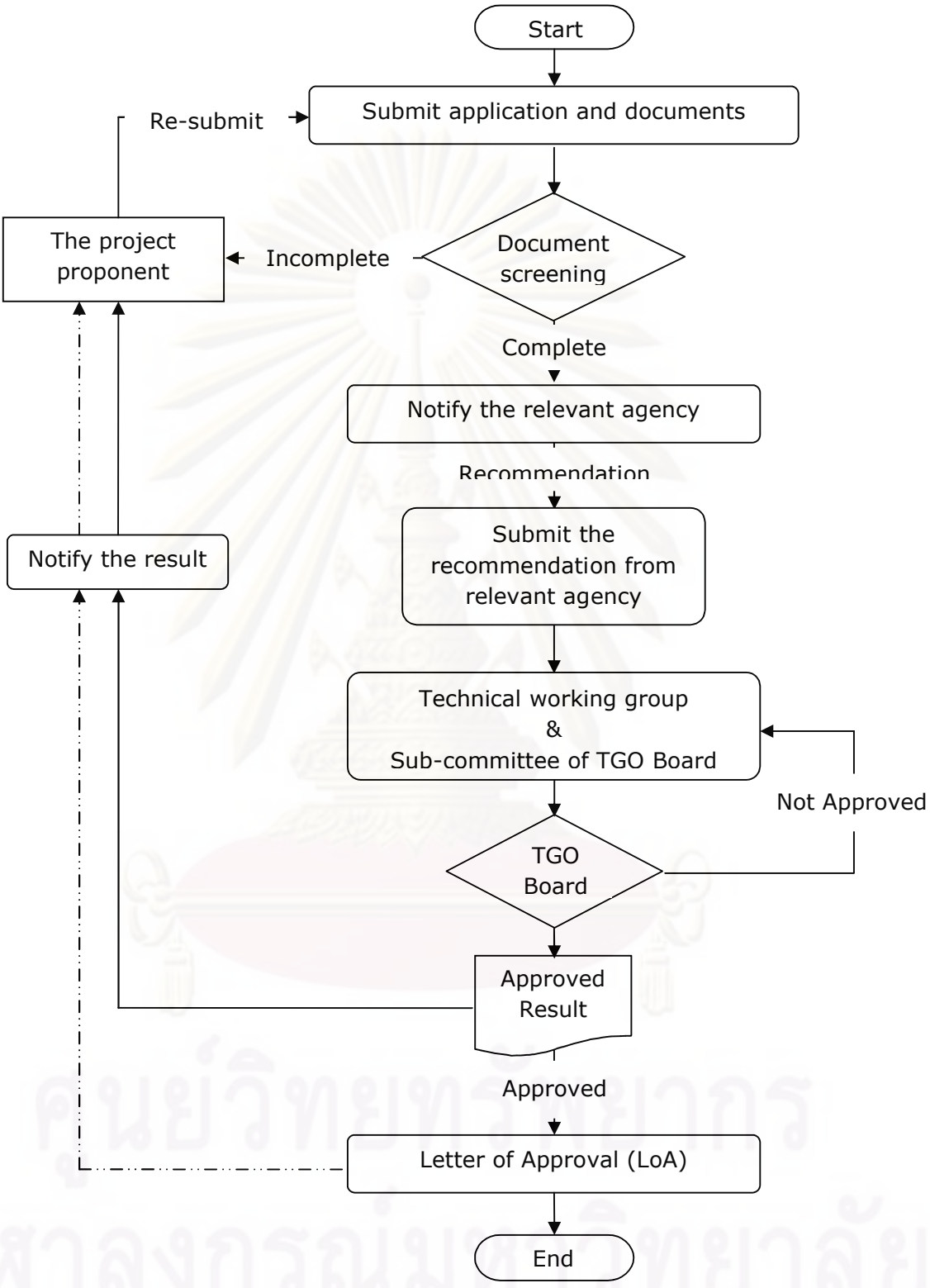

Figure 2.3: The Consideration and Approval Procedure of CDM Project in Thailand (TGO, March 2009)

Table 2.5: Sustainable Development Criteria for CDM Projects in Thailand

Sustainable Development Criteria	Aspect of SD	Indicators for CDM Projects in Thailand
1. Natural Resources and Environment Indicators	1.1 Environment	• Reduction of greenhouse gases emission as specified by the Kyoto Protocol • Reduction of air pollutant emission in compliance with air quality standards, i.e. NOx, HC, PM10, SO2, CO, O3, VOC, Dioxin • Noise pollution (in compliance with government standards) • Odor pollution (in compliance with government standards) • BOD loading in wastewater (in compliance with government standards) • Waste management • Soil pollution (in compliance with government standards) • Groundwater contamination • Reduction of hazardous waste
	1.2 Natural Resource	• Water demand and efficiency of water usage • Soil, coastal and river bank erosion • Increase green areas under the project's initiative (in accordance with provincial green areas statistics) • Ecosystem diversity • Species diversity • Use/import of GMO and/or alien species to the project site

Sustainable Development Criteria	Aspect of SD	Indicators for CDM Projects in Thailand
2. Social indicators		• People's participation (assessed by the level of participation being organized) • Activities promoting social development, culture, and 'sufficiency economy' philosophy • Workers health and surrounding community health
3. Development and/or technology transfer indicators		• Technological development • Post Project Implementation Plan or Post Crediting Period Plan as outlined by the project • Capacity-building
4. Economic indicators	4.1 Increasing income of stakeholders	• Increasing income of the workers • Increasing income of other stakeholders, for example, increasing income of farmers through selling raw materials to the project
	4.2 Energy	• Use of alternative energy • Energy efficiency • Increase in using local content

Source: TGO, March 2009

2.3 Related Study

According to Jung (2005), Thailand is ranked a very attractive country at the same level as China, India, Indonesia, and Argentina for CDM projects that are related to projects that result in accumulation of carbon dioxide or afforestation and reforestation projects. The determining factor comprises the cost of greenhouse gas emission reduction of host country, institutional CDM capacity, and general

investment climate. In contrast, the carbon market research by Point Carbon (2008) ranked Thailand the last of 16 countries based on climate institutions, investment climate, and project potential status. The evidences mentioned above suggested conflicts that may happen in CDM implementation process which could affect the evaluation of CDM performance.

The factors affecting CDM implementation have already been examined in many studies. Adhikari et al. (2007) interviewed 28 stakeholders, e.g. educational institutions, ministries, international organizations, and investors, and reported the barriers of sustainable energy technologies under CDM in Thailand, covering high investment cost of the technologies, regulatory regime, and administrative bureaucracy. Moreover, the CDM approval criteria are quite close to gold standard requirements stated by Gold Standard Foundation (non-profit organization) which have more stringent indicators.

Jessie (2004) made various interviews in Thailand between February and March 2003, and listed the barriers of implementing CDM projects in Thailand which consist of (1) lack of premium financial incentives for climate-friendly projects, (2) rigidity in project financing for climate-sound projects, (3) high initial investment requirements, (4) low local capacity to appreciate the potential of CDM, which may result in ineffectiveness or sub-optimal results of project implementation, (5) inadequate information could also result in faulty appraisal of project risks, (6) lack of well-identified mitigation options and information on technologies suitable for industry, (7) limited access to relevant information on the CDM, (8) underdeveloped raw material (input) markets, (9) various types of problems related to stakeholder participation in project scrutiny, and (10) persistent problems in inter-agency coordination.

Ellis and Kamel (2007) studied on overcoming barrier to CDM projects and concluded the national actions that may help increase in CDM project development as follows: (1) ensuring that laws are stable and enforced, (2) providing an appropriate tax/incentive framework for investments, (3) developing (or maintaining) an efficient institutional framework, (4) mainstreaming investment guarantee products, (5)

reducing participation/ownership restrictions on foreigners, (6) establishing a simple, timely and transparent CDM project approval process, (7) developing a clear policy on CDM-relevant issues, and (8) building CDM stakeholders capacity.

Weiss et al. (2008) showed that the incentives needed for a shift towards a more sustainable power grid in Thailand is about 20% financial support for the renewable energy projects, if CERs price of 15€ is assumed. Olsen and Fenhann (2008) investigated sustainable development benefits and processes for approval of CDM projects in 7 countries – India, China, Brazil, Mexico, South Africa, Morocco, and Armenia. Small-scale projects on average contribute a slightly higher sustainable development benefits than large-scale projects and have a high socio-economic profile. In contrast, large-scale projects contribute more benefits on air quality, water, health and others.

The CDM implementation problems and suggestions have been raised by many researchers. However, Olsen and Fenhann (2008) did not study in Thailand. The study from Weiss et al. (2008) and Adhikari et al. (2007) focused only on energy sector. Ellis and Kamel (2007) studied by looking at the process and identify problems that could be found, not from stakeholder study. Although, the study from Jessie (2004) showed many barriers of CDM implementation in Thailand, but the investigation was done before TGO establishment. Since then, some barriers have been changed, relieved, or resolved. Consequently, this research study aims to fulfill the lack of other study by understanding the current barriers of CDM implementation from stakeholders (after TGO establishment) and to find more appropriate solutions from their perspectives and experiences to increase the success rate of any type of CDM project implementation in Thailand.

CHAPTER III

METHODOLOGY

3.1 Experimental Framework

There are three parts of the study. First, to compare the CDM implementation experiences and DNA structure with other countries, the study was mainly done by extensive literature reviews. Second, to identify major factors controlling CDM implementation within the country, the methodology is done by conduction surveys. Third, to find solutions to improve current CDM implementation in the future, the recommendations were mainly analyzed and concluded from the question surveys and interviewing relevant experts and stakeholders. As shown in the schematic diagram in figure 3.1.

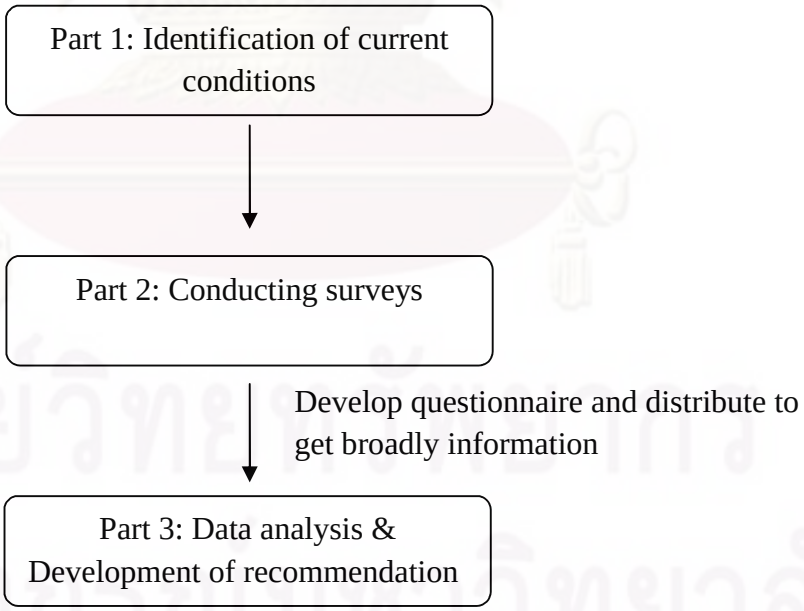

Figure 3.1: Experimental Framework

3.2 Experimental Procedure

This study chose the survey methodology to collect the opinions of the stakeholders on implementing CDM projects in Thailand. The methodology was designed and adapted from the study by Adhikari et al. (2007) and Van der Gaast et al. (2008).

3.2.1 Identification of Current Conditions and Key Factors

To understand the CDM implementation and CDM approval procedure in Thailand, the background information was studied through the literature review and interview with stakeholders as follows:

- Thailand Greenhouse Gas Management Organization (Public Organization) (TGO), which is Designated National Authorities of Thailand. Deputy Executive Director was interviewed to explore the current policies and practices, the key factors of CDM implementation in Thailand, and vision on the future.
- NGOs and others: World Bank, Designated Operational Entities (DOE), Consultant, and Project Developers were interviewed to find their opinions on CDM implementation in Thailand.

To compare with the experience on the DNA of neighboring country, the topics including approval period, approval criteria, approval fee, type of CDM project, and status of CDM project were collected from the information provided on the UNFCCC website, DNA official websites of each country, UNEP Risoe CDM/JI Pipeline analysis and database, and the previou study of Olsen and Fenhann (2008).

3.2.2 Conducting Surveys

There are 2 steps in survey study (1) preparation and information gathering in order to design the questionnaires to reflect closest to the real situation as much as possible. Step two is to conduct the surveys. The study was decided to gather information from CDM seminars organized by government and related parties which would contain of various groups of stakeholders.

3.2.2.1 Development of Questionnaire

Development of questionnaire was based on inputs and issues raised from the experts and from intensive literature reviews. The type of questionnaire was close-ended question. The questionnaire was divided into 4 sections as follows: awareness on CDM implementation, prioritization of various factors affecting the CDM implementation, performance of Thailand's DNA (which is TGO), and solutions, inputs, and suggestions from stakeholders' point of view.

I. For the section of awareness on CDM implementation, there were 2 purposes of this section. First was to understand the background information of stakeholders by asking for the role, CDM type and size interested, and study period of CDM project. Second was to explore the awareness of stakeholders on CDM implementation by measuring from the understanding of stakeholders on project implementation, terms of LoA issue, and recognition of TGO, and TGO's objective which is very important and necessary organization relevant for implementing CDM project in the primary step.

II. The section of prioritizing of various factors effecting to the CDM implementation needed to identify the key factor which is obstacle and controlling factor of implementing CDM project in Thailand. Then, the relevant factors e.g. approval fee, government support, investment fund's support, and others which was mentioned in the study from Jessie (2002), Adhikari et al. (2007), and interview results from the first step was filled in the questionnaire for the respondent can rated the priority of each factor. All factor consisted of:

- Implementation cost; refers to document preparation cost, registration fee, monitoring cost, and consult cost, and not including the approval fee.
- Government support; including financial support and providing useful information.
- Uncertainty of CERs price; CERs price is depending on demand and supply. If there is high demand from the market, the CERs price will be

increased. In the meantime, if there is high amount of CERs, the CERs price will be decreased as well.

- Implementation period; refers to the time period starting from making PDD to issuance of CERs.
- Investment fund support; refers to the support from other investment fund e.g. bank or financial institutions.
- Technology cost; refers to cost of technological adjustment, modification and/or change.
- Carbon markets reach; refers to the convenience to find buyers.
- Turnover rate period; refers to the time period starting from making PDD to selling of CERs.
- Technology transfer; refers to ease of access to appropriate technology.
- Approval fee; refers to the fees paid to the DNA for approving the project and issuance of the Letter of Approval which is 75,000 Baht for small-scale project (<15,000 tons CO2e/year of emission reduction) and 10 Baht/ tons CO2e but not more than 900,000 Baht for large-scale project (>15,000 tons CO2e/year of emission reduction).
- Sustainable development criteria; the criteria used in issuance of the Letter of Approval by DNA.
- Approval period; refers to the time used by DNA in approving the project and issuance of the Letter of Approval (LoA).
- Relevant regulation

III. Subsequently, the third section aimed to measure the performance of TGO which acts as Thailand DNA. The objectives of TGO mentioned in chapter 2 were brought to ask for the effectiveness of achieving each objective as mentioned below,

- The performance of LoA issue: Efficiency on LoA issue, Staff adequacy, Staff knowledge, Useful guidance
- The performance of capacity building: Expert staff available, Ease of contact for information

- The performance of promotion on CDM: Promotion of CDM project, Investment support, Satisfaction of approval fee
- The performance of public relation: Published data via printing media Published data via website, The thoroughness of public relation

In prioritizing of various factors effecting to the CDM implementation and the performance of Thailand's DNA part, respondents are requested to evaluate effecting factors and satisfaction of TGO performance using score system from 1 to 5 without decimal which mean very low, low, medium, high, and very high important, respectively. Nevertheless, the respondents who had never contacted to TGO could skip the section of the performance of Thailand's DNA to achieve meaningful and relevant responses.

IV. The last section planed to explore the suitable solution and suitable approval fee for increasing the success rate of CDM project. As commented from interview results in first step about the high approval fee along with comparison with neighboring country, the topic of approval fee was brought to the questionnaire and allowed the respondent to vote for the most suitable approval fee from perspective. Besides, this topic also separated the small-scaled project and large-scaled project from one another by the amount of GHG reduction which was the same principle as TGO used. The small-scale project means project that emit less than 15 kilotons of carbon dioxide equivalent annually, and the large-scale project means that emit more than 15 kilotons of carbon dioxide equivalent annually.

For the suitable solution, each solution was brought from interview results from primary step and the previous study (Jessie (2002), Adhikari et al. (2007), and Ellis and Kamel (2007)) as listed below.

- Obtain financial support program from government; will be the incentive to encourage stakeholders particularly project owner on implementing CDM project
- Provide within country DOE to reduce implementation cost; will help reducing implementation cost from the step of verification and

certification which DOE must monitor for the correctness of information requested by EB and the project developer must take care of this cost.

- Encourage Bundling and Programmatic CDM project; most of potential project in Thailand are Small and Medium Enterprises (SME) which are not worth to implement as CDM project because of high implementation cost. Bundling and Programmatic approach which allow assembly of SME project to implement as one CDM project will help increase the numbers of CDM projects in Thailand respectively. The different is that assembly of project in bundling CDM project must be done at the earliest stage and cannot be added, but programmatic CDM can.
- Facilitate carbon market reach; will guarantee the income from implementing CDM project.
- Support on technology transfer; clean technology is needed to implement CDM project. The technology selecting will affect to the methodology used, the evaluation of project risk, and technology cost.
- Increase more capacity building programs; CDM implementation has complicate and multiple step of procedure. It is also associated with many stakeholders. If stakeholders lack of basic knowledge, it will result to project delays and lose opportunities to receive more CERs.
- Accelerate LoA issue process; will accelerate overall CDM implementation process including profitability return.
- Stimulate more flexible SD criteria; stringent SD criteria need longer period of verifying and achieving. Then, more flexible SD criteria will help shorten the approval process.
- Provide learning experiences from approved or registered project; experience from success projects will encourage anyone who interested in investing into CDM projects. Moreover, it will help understanding and solving of obstacle and problem which stakeholders might find in the process of CDM implementation.
- Provide private investment fund for CDM project; will help support implementation cost, not push the burden of costs to fall only on project developer

The respondent could select multiple solutions which they think that would help encourage and support them to implement more CDM projects. Moreover, the questionnaire also provided respondent the opportunity to comment other useful suggestions that were not presented in the options**.** The summary of details of questionnaires is summarized in Table 3.1.

The questionnaire was verified by the veteran including university professor and academic for checking appropriation, accuracy, and validity of the content. The internal consistency reliability of the questionnaires was measured by calculating the coefficient alpha using Cronbach‘s alpha coefficient (Cronbach, 1951).

$$\alpha = \left(\frac{N \cdot \bar{c}}{\bar{v} + (N-1) \cdot \bar{c}}\right)$$

Where;

α	=	Cronbach‘s alpha
N	=	number of questions
$\bar{c}$	=	the average of all covariance among the questions
$\bar{v}$	=	the average variance

Cronbach’s Alpha can take values between 0 to 1 ($0 \leq \alpha \leq 1$), and the higher values would mean the higher or better reliability. The test of questionnaire used in this study results that in the second part (which is factors affecting to the CDM implementation) scored 0.8409 and the third part (which is the performance of TGO) scored 0.9085 which means that the reliability of this questionnaire is good.

Table 3.1: Details of the Questionnaire

Topics	Questions / Factors
I. Awareness on CDM implementation	• What is your role on CDM? • How long have you studied on CDM project? • What types of CDM are you interested? • What sizes of CDM are you interested? • What is your level on understanding of CDM implementation? • Did you realize how to get the Letter of approval? • Do you recognize about Thailand greenhouse gas management organization (public organization) or TGO? • Did you realize the objective of TGO? • Have you ever made a contact with TGO?
II. Factors effecting to the CDM implementation	• Government support • Relevant regulation • Technology transfer • Approval criteria • Registration time • Approval time • Turnover rate period • Carbon market reach • Investment fund support • Implementation cost (exclude approval fee) • Cost of technological change • Approval fee

Topics	Questions / Factors
III. Performance of Thailand's DNA	• Staff adequacy • Staffs knowledge • Useful guidance of CDM implementation • Expert staff available • Promotion of CDM project • Investment support • Satisfaction of approval fee • Efficiency on issue of the letter of approval • Ease of contact for information • Published data via printing media • Published data via website • Provide CDM information to public
IV. Solutions, inputs and suggestions	• What is the suitable approval fee for both small-scaled and large-scaled CDM project in your opinion? • What options do you think that will help improving and increasing CDM implementation in Thailand?

3.2.2.2 Stakeholders Study

It is difficult to estimate the exact total of population who is interested in CDM implementation because CDM is involved by multiple sectors (Infinite population). Then, in this case, the sampling size in this study can be quantified by the equation from Cochran (1953) which is designed for calculating the suitable sampling size in survey without knowing the actual total of population.

$$n = \frac{P(1-P)Z^2}{d^2}$$

Where; n = sampling size

P = estimated proportion of an attribute that is presented in the population

Z = critical value

d = allowable error

The estimated proportion of stakeholder used in this study is 0.25. The critical value at 95% confidence level is 1.96; and the allowable error is 5%. Consequently, the suitable sampling size calculated is 288. However, the survey must be done within a similar period to prevent bias from changing in action. Consequently, with the limitation of time and manpower in investigation, this study could survey only 226 stakeholders.

The selection of the sample used purposive sampling. The sample group was selected from the participants who interested in CDM projects and joined in workshops regarding to CDM. Moreover, the researcher tried to make a detailed selection by self-introduction to explain the topic and objective of this questionnaire and then ask for the relevance on CDM project with the preliminary questions before distributing the questionnaires. Then, each respondent would take 5 to 10 minutes for completing survey.

The data and survey was conducted three times from three CDM workshops/seminars held in similar period. There were 456 questionnaires released in this case study. 226 return questionnaires which mean it had 49.56% return questionnaires. There are 3 occasion surveys during CDM seminars. Figure 3.2 showed some pictures during the workshop/seminar events, and the details of each seminar are described as follows:

1 *IGES Capacity Building Workshop for Clean Development Mechanism (CDM),* 5-6 February 2009, Chiang rai, Thailand

Thailand Environmental Institute (TEI), Institute for Global Environmental Strategies (IGES), and Thailand Greenhouse Gas Management Organization (TGO) (Public Organization) jointly organized this workshop. The purpose of this workshop is to distribute fundamental knowledge of CDM to the interested local project developer in the northern part of Thailand. Seminar also received funding from Thai government. There were 60 participants in this seminar which mostly were project owners.

2 *Opportunity of Industrial Sector on CDM projects*, 10-12 February 2009, Bangkok, Thailand

The workshop was organized by the Federation of Thai Industries in cooperation with the Ministry of Industry, Ministry of Energy, Ministry of Natural Resources and Environment, TGO, and TEI under the support of the New Energy and Industrial Technology Development Organization (NEDO). The workshop intended to provide operators and enthusiasts to understand the policies and requirements of implementing CDM project and to promote the cooperation of agencies both public and private sector. There were approximately 650 participants that mostly were project owner sectors.

3 *Seminar on Future Carbon Finance in Thailand: CDM Projects, Post – Kyoto Protocol*, 16 March 2009, Bangkok, Thailand

This seminar was organized from Team Thailand, Royal Thai Embassy Tokyo with the purpose to promote the investment of CDM project in Thailand and arrange the meeting between investors and project owners. Seminar also received funding from Thai government. There were about 180 participants in this seminar. The most sectors were bank and asset management along with Security Company, Stock Exchange of Thailand (SET), and Stock Exchange Commission. The others were from project owner, research institute, education, and NGO.

(a)

(b)

Figure 3.2: Workshop Participation of Case Study: (a) Opportunity of Industrial Sector on CDM Projects, 10-12 February 2009, Bangkok, Thailand; (b) Seminar on Future Carbon Finance in Thailand: CDM Projects, Post – Kyoto Protocol, 16 March 2009, Bangkok, Thailand

3.2.3 Data Analysis and Development of Recommendation

3.2.3.1 Data Analysis

The results given from all respondents were analyzed mainly in terms of the statistic calculation with statistic program, SPSS (Statistical Package for the Social Sciences). The score was calculated by mean, percentage, and standard deviation. Then, the percentage and means value of each factor were compared and arranged to find the key factor that is obstacle for implementing CDM project. Lastly, the most required options which will encourage stakeholders to implement CDM project would be carried out.

3.2.3.2 Development of Recommendation

The experience of neighboring country, the stakeholders' perspective on both obstacle and solution needed, and the interview with the relevant public and private sectors from the study were used to offer guidance on appropriate management especially to the DNA to enhance the ability of the implementing CDM project to increase the success rate of CDM project in the future.

CHAPTER IV

RESULTS AND DISCUSSIONS

4.1 CDM Experience Comparison with Neighboring Countries

All of CDM projects from every country need to follow the procedure defined by the UNFCCC and to be approved in the final stage by the CDM-EB. However, in the host country approval step, the UNFCCC gives the broad rule on sustainable development criteria for host country to approve the CDM project and issue the Letter of Approval (LoA). UNFCCC has allowed the host country to set the details of sustainable development criteria to meet the host country's aim on the sustainable development aspect. Moreover, UNFCCC requires that the host country must stipulate the Designated National Authority (DNA) as an organization to approve the CDM project. Therefore, in this research, the role of Thailand's DNA in driving CDM project was investigated.

Table 4.1 showed that China is the leader in term of the registered projects with 599 projects and 182,206 kCERs (about 300 kCERs/project). India had 448 projects with 36,346 kCERs (about 80 kCERs/project). Malaysia had 58 projects and 3,629 kCERs (about 60 kCERs/project). The Philippines had 39 projects and 1,431 kCERs (about 40 kCERs/project). Vietnam had 7 projects and 908 kCERs (about 130 kCERs/project). Thailand had 18 projects and 1,441 kCERs (about 80 kCERs/project). It can be seen that most of the CDM projects from China and Vietnam are large projects, while those of India, Philippines Malaysia, and Thailand are smaller. Even though Thailand has fewer projects than the Philippines, the amounts of CERs produced are at the same level. However, China, India, Vietnam, and Thailand still have CDM projects waiting for registration several times more than their current registered project. Meanwhile, projects waiting for registration from Malaysia and the Philippines are in the same level as registered projects.

According to Table 4.2, the most popular types of CDM projects, with more than 100 projects, in pipelines (counted after going through the validation step) from China were from renewable energy: hydro and wind and energy efficiency own generation. While India showed more distribution on types of project for biomass energy, wind energy, energy efficiency industry, and hydro projects. On the other hand, Malaysia, Philippines, and Thailand showed more implementation (more than 10 projects) on methane avoidance and biomass energy while Vietnam showed more implementation on hydro and methane avoidance type of projects. From data analysis, China and India show no specific trends, variable in type of project on renewable energy whereas Malaysia, Thailand, and the Philippines remain more concentrated on methane avoidance and biomass energy projects. Vietnam also implements more on hydro projects which have not received much attention in other countries. It can be seen that the type of CDM project of interest in Thailand concentrated in the narrow group of biomass energy and methane avoidance projects. However, it does not mean that Thai stakeholders are not interested in other type of CDM projects. The hindrance problem could occur because project developers in other sectors do not realize that their project could be implemented as CDM projects or they might need some time to study the opportunity to implement a CDM project. Then, more discussions with project developers in many sectors which have potential to implement as CDM project might be necessary to increase the diversity of CDM implementation in Thailand.

Table 4.1: Host Countries of CDM Projects by Status (as of 1 August 2009)

	At validation			Requesting registration			Registered		
	Number	**kCERs**	**2012 kCERs**	**Number**	**kCERs**	**2012 kCERs**	**Number**	**kCERs**	**2012 kCERs**
China	1,081	154,054	575,138	124	20,723	74,505	599	182,206	891,641
India	699	61,610	187,198	21	1,847	7,491	448	36,346	232,705
Malaysia	61	3,508	13,874	9	1,128	3,937	58	3,629	18,808
The Philippines	37	1,179	4,808	1	4	17	39	1,431	6,389
Vietnam	62	4,241	13,654	6	299	1,086	7	908	7,628
Thailand	80	4,347	17,092	4	226	764	18	1,441	8,720

* Rejected projects not included

Soure: UNEP Risoe Centre, 2009

Table 4.2: Types and Numbers of CDM Projects in the Pipelines (as of 1 August 2009)

	Afforestation	Agriculture	Biomass energy	Cement	CO_2 capture	Coal bed/mine methane	Energy distribution	EE households	EE industry	EE own generation	EE service	EE supply side	Fossil fuel switch	Fugitive	Geothermal	HFCs	Hydro	Landfill gas	Methane avoidance	N_2O	PFCs and SF6	Reforestation	Solar	Tidal	Transport	Wind	Total
China	1	0	77	7	0	67	5	0	6	278	0	8	29	1	0	11	822	54	30	29	2	5	5	0	1	371	**1809**
India	1	0	303	26	0	0	1	14	146	133	14	20	38	4	0	8	126	23	40	6	1	12	5	0	8	345	**1274**
Malaysia	0	0	41	0	0	0	0	0	4	0	0	1	0	0	0	0	3	8	79	0	0	0	0	0	0	0	**136**
Philippines	1	0	13	0	0	0	0	0	0	2	0	0	0	0	2	0	3	6	52	1	0	1	0	0	0	1	**82**
Vietnam	0	0	4	0	0	0	0	0	1	2	0	0	0	1	0	0	52	3	12	0	0	1	0	0	0	1	**77**
Thailand	0	0	20	0	0	0	0	0	1	8	0	0	0	0	0	0	0	7	65	1	0	0	1	0	0	1	**104**

Soure: UNEP Risoe Centre, 2009

Table 4.3 shows that for approval time, which refers to the time that DNA used for issuance of the Letter of Approval (LoA), Thailand set the maximum times at 180 days, same as Malaysia but more than India and China at 60 days, and the Philippines at 20-25 working days. However, approving CDM project may not use the maximum period allowed, but shorter approval time will further enhance acceleration of overall CDM process.

Another significant difference is the approval fee that results in LoA issuance. Thailand charges minimum approval fee of 75,000 Thai Baht (THB) and a maximum of 900,000 THB, where Malaysia and the Philippines only charge a maximum of 60,000 THB (3,500-6,500 MYR at 9.76 MYR/THB) and 8,000 THB (5,600-10,600 PHP at 0.74 PHP/THB), respectively. It is recognized that the tentative investment cost of CDM project is already high (approximately 3 to 8 million THB). The higher approval fee will create a disincentive for investment for small-scale project which produces less CERs.

Moreover, there is significantly different taxation on traded CERs in each country. India exempts tax on CER traded during 2008 to 2010 to encourage CDM implementation within the country. Malaysia does the same action on tax exemption, but without ending period. Vietnam charges 1.5% and 2% tax for CO_2 and CH_4 projects respectively, and more than 20% tax for other GHG projects. China charges 2% tax for renewable energy project, 30% tax for N_2O projects, and 65% tax for hydrofluorocarbons and perfluorocarbons projects. Thailand still has no specific taxation on CER trading. In general, tax exemption would encourage stakeholders to implement more CDM projects. However, China still has high number of CDM implementation even if it charges 2% to 65% tax. Thailand should take the opportunity to learn the experience of taxation from other countries to balance the benefits from CDM implementation and benefits from using tax to promote CDM activities in other sectors within the country.

Thailand and India shows similarity in the structure of DNA which is a public organization while in other countries DNA is a ministry or government organization. Although there is no obligation that DNA has to be a public organization, the overall

function of public organization should generally have higher flexibility and better performance. However, as mentioned in chapter 2 that TGO is a newly established organization which branched off from the Office of Natural Resources & Environmental Policy and Planning (ONEP) and has operated only for one year. It requires some time to build staff capacity to promote CDM activity within the country. After the establishment of TGO, the performance of CDM in Thailand has increased significantly compared to before the TGO establishment.

The results show that most countries included in the study have similar sustainable development criteria which are consisted of 3 major parts: social, economic and environmental. In addition, India and Thailand have technological aspect, while China does not seem to have clear SD criteria. At the sub-indicators level of SD criteria, Thailand listed 26 sub-indicators compared to 13 from the Malaysia, 12 from the Philippines, 17 from Vietnam, and 9 from India as shown in Table 4.3. It can be seen that Thailand sets more sub-indicators in order to ensure quality projects.

The analysis of sub-indicators, as shown in Table 4.4, shows some similarities among the five countries. For the environmental aspect, most country has similar sub-indicators, based on the national environmental standards. Most sub-indicators, e.g. air pollution, and wastewater pollution, are obtained from the actions that must be done by law, according to national protocols. There are also sub-indicators that are difficult to measure or would require long term study to get accurate information in each country. Examples are species diversity, % change in forest cover, and local environmental benefits. For Thailand, 3 sub-indicators (species diversity, ecosystem diversity, and green area) are of this nature, while other countries concern only on species diversity.

For the social aspect, the number of sub-indicators from each country is not much different. Essentially, it is not easy to obtain data for these sub-indicators. For example, the project has to provide measures to alleviate poverty and remove the social disparities. The protocols to demonstrate the result from CDM implementation

need to be provided and public participation process would need proper procedure and time to conduct.

For the economic aspect, Vietnam and Thailand have many sub-indicators including the benefits at local and national level. Thailand also focuses on the use of alternative energy and energy efficiency that are additions to requirements of other countries. On the other hand, India, Malaysia and the Philippines have only one sub-indicator which is additional investment, local content used, and local income, respectively.

For the development and technology transfer aspect, this is not classified by Thailand and India while it is included as sub-indicators in economic aspect by Malaysia, Vietnam, and the Philippines. Thailand and the Philippines have another sub-indicator on capacity building to local stakeholders. It is noted that Thailand is the only country to set the sub-indicator on post-project implementation plan. These two latter indicators would need additional effort and time to demonstrate the results.

Based on the higher number of SD sub-indicators of Thailand, the criteria may be deemed to be more stringent than other counties. In fact, these sub-indicators reflect a thorough consideration throughout the project life. The add-on environmental indicators on pollution issue (noise, odor, soil, groundwater and hazardous waste) are of great concerns in national pollution prevention scheme. These are criteria generally required in the environmental impact assessment study. Biodiversity and green areas are suitable indicators that help realize the country strategy in driving conservation of ecosystem and beneficial outcome for the indigenous communities. In particular, the post project complementation plan would guarantee a CDM project of quality contributing to sustainable development right to the end of the project implementation. In sum, as reflected by the SD criteria, Thailand focuses its sustainable development strategy deeply on the whole ecosystem and well being of the people, from the start until the end of the project. This should not be considered an obstacle of CDM implementation in Thailand but essentially an advantage on the competitiveness for good and sound CDM projects.

The distribution of CDM project type from Thailand showed interests within limited area of application and similar focus to Malaysia and Philippines but different from China and India. Although the recent number of CDM projects in Thailand is still lagging behind neighboring countries except for Vietnam, Thailand has moved ahead with the new establishment and management coordination with well-set criteria of consideration. There are both similarity and difference between Thailand and other countries which are the results of different characteristic and operations of each country. In the following section, these factors are examined with expansion based on perspectives of stakeholders in Thailand to find the key factors influencing CDM implementation and to investigate practice to help accelerate CDM implementation in Thailand.

Table 4.3: Processes for Approval of CDM Projects

	India	China	Malaysia	Philippines	Vietnam	Thailand
SD criteria	Checklist for: • Social • Economic • Environmental • Technological 'well-being' 9 sub-indicators	N.A.	Checklist for: • Economic • Environmental • Social 13 sub-indicators	Checklist for: • Economic • Environmental • Social 12 sub-indicators	Checklist for: • Economic • Environmental • Social and institutional 17 sub-indicators	Checklist for: • Natural Resources and Environment Indicators • Social indicators • Development and/or technology transfer indicators • Economic indicators 26 sub-indicators
Approval Time	Max. 60 days	Max. 60 days	Max. 180 days	Small-scale projects Max. 20 working days Large-scale project Max. 25 working days	N.A.	Max. 180 days
Fee	N.A.	N.A.	• For project idea note 1,000 MYR • For project design document Large 5,000 MYR Small 2,500 MYR 1 MYR = 9.76 THB	600 PHP + Small 5,000 PHP Large 10,000 PHP 1 PHP = 0.74 THB	N.A.	• < 15,000 tCO2e = 75,000 THB • >15,000 tCO2e = 10 THB/tCO_2e but not more than 900,000 THB
DNA	NCDMA: National Clean Development Mechanism (CDM) Authority	NDRC: National Development and Reform Commission of the People's Republic of China	NRE: Ministry of Natural Resources and the Environment	DENR: Department of Environment and Natural Resources	MONRE: Ministry of Natural Resources and Environment	TGO: Thailand Greenhouse Gas Management Organization (Public organization)

N.A. = not available in this study

Table 4.3: Processes for Approval of CDM Projects (cont.)

	India	China	Malaysia	Philippine	Vietnam	Thailand
General corporate income tax	30% of gross income	33% of gross income	26% of gross income	32% of gross income	25% of gross income	30% of gross income
Corporate income tax from trading CERs	Tax exemption between 2008 to 2010	Discrimination by project type: • 2% tax for renewable energy • 30% tax for N_2O • 65% tax for HFCs and PFC	Tax exemption	N.A.	Discrimination by GHG type: • 1.5% tax for CO_2 • 2% tax for CH_4 • more than 20% tax for other GHG	N.A.

N.A. = not available in this study

Table 4.4: Sustainable Development Criteria

SD criteria	India	Malaysia	Philippines	Vietnam	Thailand
1. Environmental aspects					
Easy (clear & measurable)					
• GHG emission	-	√	-	√	√
• Air pollution	√	√	√	√	√
• Noise pollution	-	-	-	-	√
• Odor pollution	-	√	-	-	√
• Wastewater pollution	√	√	√	√	√
• Waste management	√	-	√	√	√
• Soil pollution	-	√	-	-	√
• Groundwater contamination	-	√	-	-	√
• Hazardous waste	-	√	√	-	√
• Water needs and water use efficiency	-	-	-	-	√
• Use/import of GMO and/or alien species to the project site	-	-	-	-	√
• Soil/ coastal erosion	-	√	√	√	√
Difficult*					
• Species diversity	√	√	√	√	√
• Green area	-	-	-	-	√
• Ecosystem diversity	-	-	-	-	√
• % change in forest cover	-	-	-	√	-
• Impact of the project activity on resource sustainability and resource degradation	√	-	-	-	-
• Impact on areas on or around the location which are protected under international, national or local legislation	-	√	-	-	-
• Provide local environmental benefits	-	-	√	-	-

*Difficult means hard to measure and/or take a long time to get accurately information

Table 4.4: Sustainable Development Criteria (cont.)

SD criteria	India	Malaysia	Philippines	Vietnam	Thailand
2. Social aspects					
Easy (clear & measurable)					
• Creation of rural employment	√	√	√	√	-
Difficult*					
• Support for local community development activities	-	√	-	-	√
• Public participation	-	-	√	-	√
• Public health	√	√	-	-	√
• Readiness of public sector	-	-	-	√	-
• Readiness of private sector	-	-	-	√	-
• Remove social disparities	√	-	-	-	-
• Provide measures to alleviate poverty	-	√	√	√	-
• Provide vulnerable groups access to local service	-	-	√	-	-
• Living condition	√	-	-	√	-
3. Economic aspects					
Easy (clear & measurable)					
• Labor income	-	-	-	√	√
• Use of alternative energy	-	-	-	-	√
• CER revenues	-	-	-	√	-
• Local content	-	√	-	√	√
• Additional investment	√	-	-	-	-
• Local income	-	-	√	√	√
Difficult*					
• Energy efficiency	-	-	-	-	√
• Provide proper safety nets and compensatory measures for affected stakeholders	-	-	-	√	-
• National income	-	-	-	√	-

*Difficult means hard to measure and/or take a long time to get accurately information

Table 4.4: Sustainable Development Criteria (cont.)

SD criteria	India	Malaysia	Philippines	Vietnam	Thailand
4. Development and technology transfer aspects					
Easy (clear & measurable)					
• Technological development	√	√	√	√	√
Difficult*					
• Capacity building	-	-	√	-	√
• Post project implementation plan or post crediting period plan as outlined by the project	-	-	-	-	√

*Difficult means hard to measure and/or take a long time to get accurately information

4.2 Barriers of CDM Implementation in Thailand

4.2.1 The Experimental Samples

There were 456 questionnaires distributed during the research study. Two hundred and twenty six questionnaires (226) were returned. The percent response is 49.56% of total questionnaires. The respondents were classified based on their occupation which consisted of 29 persons from project owners, 55 persons from project managers, 36 persons from consultants, 16 persons from investors, 31 persons from government sectors, and 59 persons from NGOs and others.

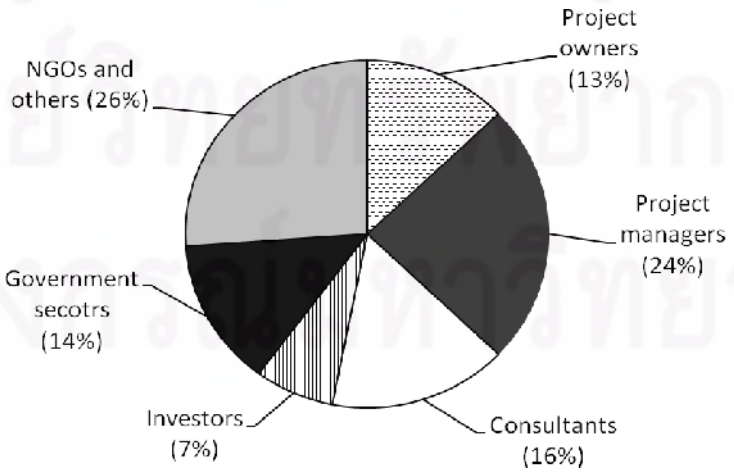

Figure 4.1: Percentage Distribution of Respondents

From the investigation result as shown in Figure 4.2, there are 46% of respondents interested in small-scale projects, 16% interested in large-scale projects, and 38% interested in both small-scale and large-scale projects. The most type of CDM project interested was energy efficiency project and followed by biogas, biomass, and renewable energy project (see Figure 4.3). Besides, there were other type of project interested included fossil fuel switching, landfill gas (LFG), and reforestation and afforestation project. Moreover, for project owners and project managers which are the primary sectors of CDM decision-making for implementation, this group contained of 37% of the respondents and showed the same type of CDM project interested as other stakeholders as shown in Figure 4.4.

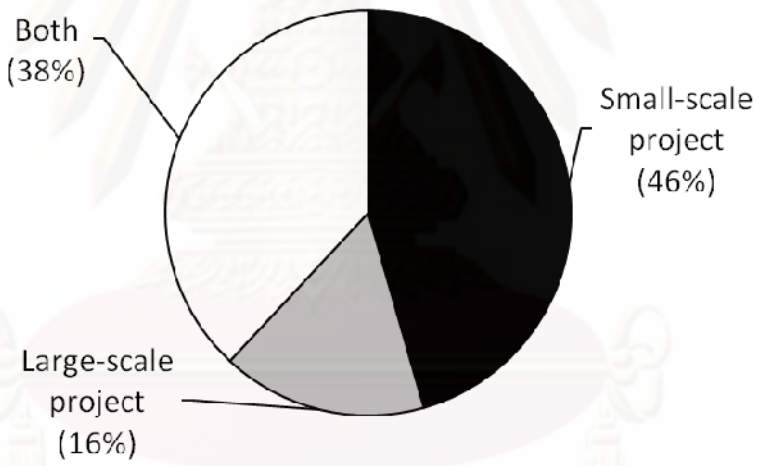

Figure 4.2: Size of Project of Interest to Respondents

Based on the survey results, it showed that the most CDM projects interested in Thailand are small-scale projects and concentrate to energy sector. The other type of CDM project can be hardly found. Lesson-learned from previously implemented projects are useful for future potential investors. Then, there were many successful energy-type CDM projects as examples in Thailand. The methodology used then was recommended to other relevant stakeholders. Moreover, the energy-type projects directly produced carbon dioxide which is easy to see association with CDM. In

addition, most project owners did not know or have enough knowledge to explore other potential or look into other type of projects that can potentially be implemented as CDM. Majority of investors still believe that the CDM project must mainly be related to energy projects.

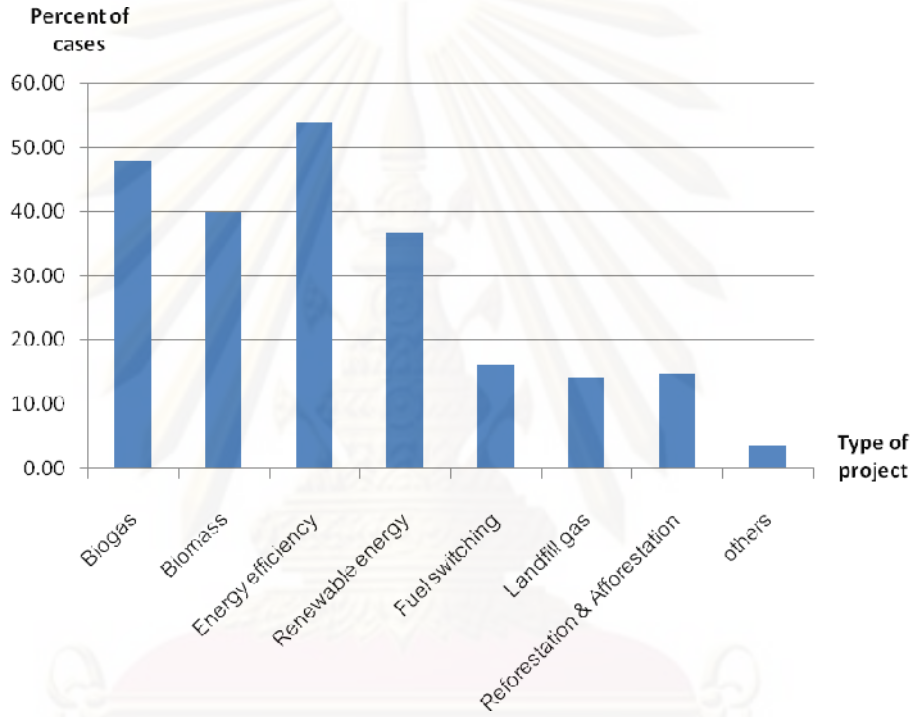

Figure 4.3: Type of CDM Project of Interest to All Respondents

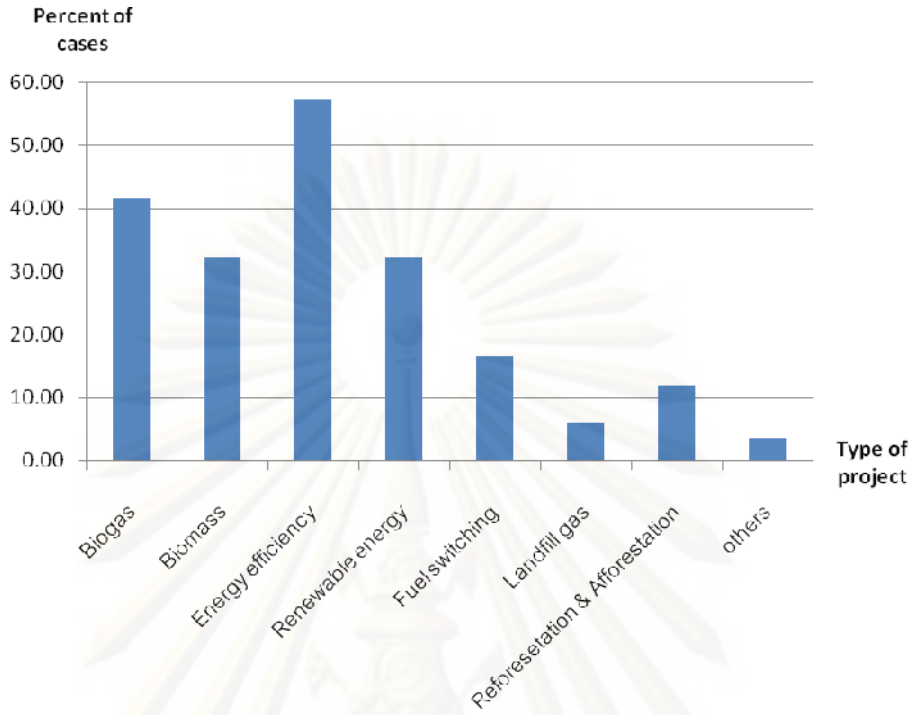

Figure 4.4: Type of CDM Project of Interest to Project Owners and Project Managers

4.2.2 CDM Recognition from Stakeholders

Although CDM had been introduced in Thailand since 2005, the results showed that more than 80% of respondents still lack knowledge on CDM implementation (see Figure 4.5). Almost 80% of stakeholders are still in the process of trying to understand procedure and to get more information on how to implement the CDM projects as shown in Figure 4.6. Furthermore, Figure 4.7 indicated that only 14% of stakeholders recognized the full requirement for issuance of LoA. As a result, it is shown that there are many stakeholders who are interesting on CDM implementation, however the understanding of procedure and current situations CDM implementation from the stakeholders are still at low level and could be the main cause of the limited numbers of implemented CDM projects in Thailand. The interview with the TGO's staff confirmed that TGO also recognized this existing problem and has created more CDM workshops throughout the past two years. The information has been disseminated throughout the country with the cooperation from many local governmental sectors, private sectors and non-government authorities.

However, the provide education on CDM through workshops and/or seminars is still necessary.

Nevertheless, these results might not be well represented all stakeholders in Thailand even though this study mainly aimed to find the solutions to increase CDM implementation in Thailand. From the preliminary survey, the focus groups that participate in the questionnaire of the study were mostly inexperienced or moderate level of expertise in CDM implementation.

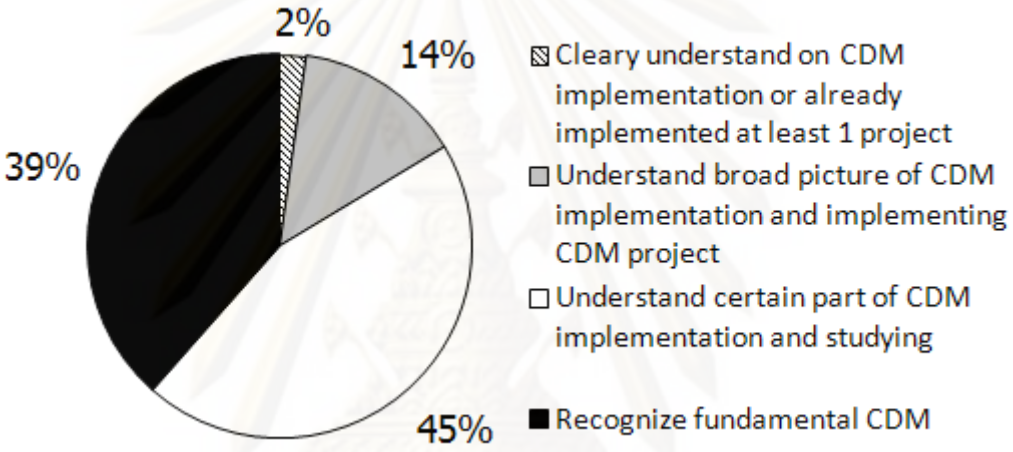

Figure 4.5: Understanding of CDM Implementation

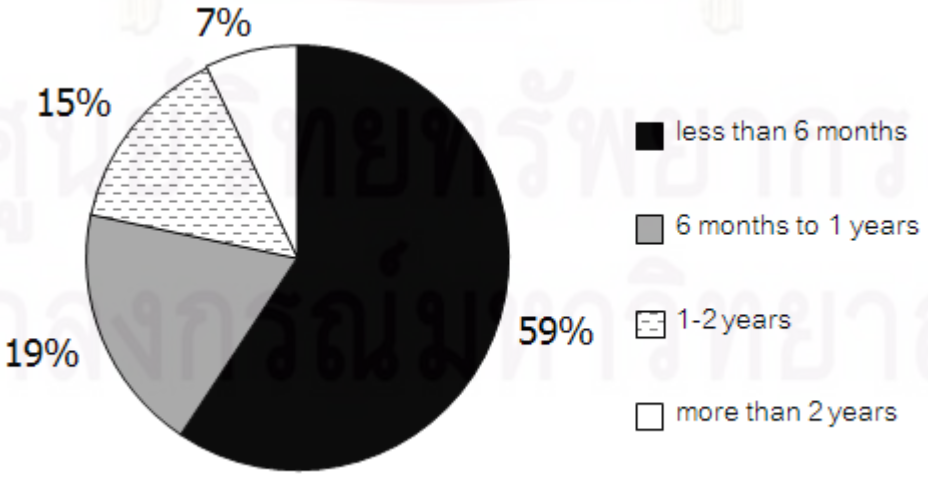

Figure 4.6: Time Period of CDM Recognition

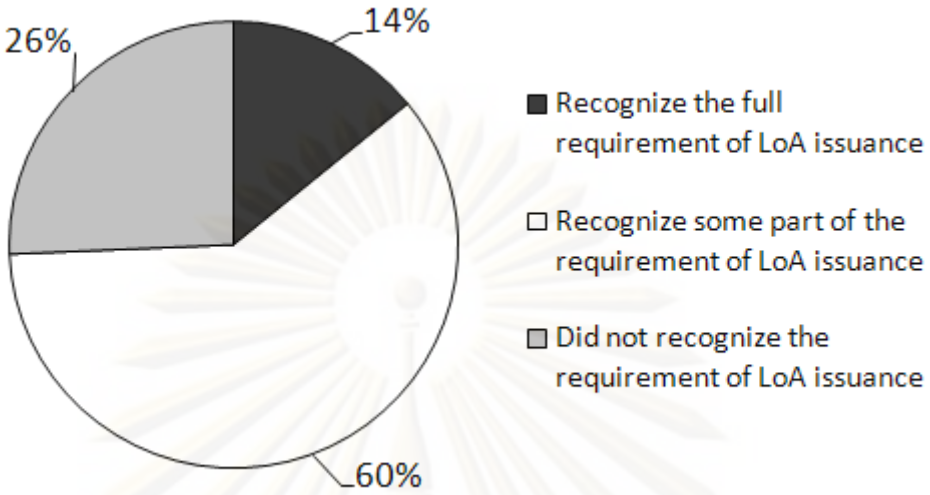

Figure 4.7: Recognition on Requirement of LoA Issuance

4.2.3 Key Factors Controlling CDM Implementation

This study divided the survey results into 2 groups based on the experience on CDM of people who answered the questionnaire. The first group consisted of 177 stakeholders who have less than one year experience on CDM or *inexperienced stakeholders*, and the second group consisted of 43 stakeholders who have more than one year experience on CDM or *experienced stakeholders*. The opinions from both inexperienced stakeholders and experienced stakeholders would help us understand the key factors controlling CDM implementation in Thailand from different perspectives.

The results shown in Table 4.5 indicated that implementation cost was scored 4.14 from 5 as the major obstacle development of CDM project in Thailand by inexperienced stakeholders. Based on the questionnaires and interviews, the high cost of CDM implementation (e.g. consultant charge, registration fee, validation cost etc.) was the number one barrier in stakeholders' decision on CDM implementation which all costs related to CDM approval procedure are approximately 3-8 million THB (87,000-230,000 $) depending on project size and type of potential reduction activities. One main reason of high implementing cost is because of the complication in project design document (PDD) and lengthy period of CDM procedure made the

project developers spending significant amount of time and investment cost in advance. The government support was the second barrier factor with scored 4.06. Most of inexperienced stakeholders wished government sector to support them to encourage them through the tax measures and other financial measure which would guarantee for the investment return benefit of implementing CDM project. Uncertainty of CERs price which would affect to uncertainty return income was ranked the third with the score of 3.97. CERs price had been reached 20 Euro/CERs in July 2008, however it has been dropped to 10-12 Euro/CERs in July 2009. CERs price is based on market demand and economic conditions. Then, the economic crisis since late 2008 is the main factor of CERs price decreased.

Table 4.5: Stakeholders' Perspective on Barrier of CDM Implementation

Factors	Respondents with less than 1 year experience	Factors	Respondents with more than 1 year experience
Implementation cost	4.14	Implementation period	3.80
Government support	4.06	Implementation cost	3.80
Uncertainty of CERs price	3.97	Government support	3.76
Technology cost	3.81	Uncertainty of CERs price	3.73
Investment fund support	3.78	Turn overrate period	3.67
Implementation period	3.78	Investment fund support	3.67

The analytical results from experienced stakeholders were similar to the previous results of inexperienced stakeholders as shown in Table 4.5. Anyway, this group also showed more concerned on implementation period along with implementation cost at scored 3.80 from 5. With the complication of methodology and requirement, CDM project must be monitored and approved by many stakeholders to reach those requirements. Then, these high documentation requirements prolong implementation period which is not beneficial especially for project developers.

In summary, from stakeholders' perspective, financial factors are still the major barrier of CDM implementation in Thailand, however tax exemption for a certain period e.g. early development, providing low interest loan, and deferring debt-free period might alleviate the burden of costs and increase CDM implementation in Thailand.

4.2.4 The Performance of Thailand's DNA

Thailand Greenhouse Gas Management Organization (Public Organization) or TGO was established early in the year 2008 to act as Thailand's DNA and issue the Letter of Approval for CDM project. Project consideration to issue the Letter of Approval (LoA) will take from 1 to 6 months based on the completeness of the information provided in the report of Environmental Impact Assessment (EIA) or Initial Environmental Evaluation (IEE). When the project is approved by the TGO board, the LoA will be issued within an average 2 weeks. Before TGO establishment, 14 projects had been approved by NCAB from 2003-2007, however 72 project have been approved by TGO from January 2008 to September 2009 (Appendix D). Moreover, TGO also created many capacity building programs on CDM implementation to local stakeholders. TGO has organized 11 workshops from January 2009 to September 2009 and another 3 workshops organized by the cooperation with Initial Graphics Exchange Specification (IGES). Furthermore, TGO also provide expert staffs as requested to educate stakeholders who are interested in other workshops. Besides, TGO has supported 3 major GHG reduction projects apart from CDM: Carbon Footprint, Carbon Reduction Label, and Cool Mode project. Carbon Footprint project intended to provide consumer about the information of life-cycle GHG emission on each product, and to increase capacity of Thai product to compete in world markets. Carbon Reduction Label project intended to provide consumer about the information of GHG emission reduction on each product. The last project (Cool Mode project) has a purpose to support the development of clothing that can reduce greenhouse gas emission to increase choices for consumers who support GHG emission reduction, and promote the production and marketing of textile products which can reduce global warming in Thailand. These investigations showed that TGO

has promoted GHG emission reduction in Thailand continuously, and the numbers of CDM project approved were significantly increased after TGO establishment.

Table 4.6: Recognition of TGO by Respondents

Questions	Yes		No	
	Count	%	Count	%
Do you recognize about TGO?	166	73.78	59	26.22
Did you realize the objective of TGO?	140	62.22	85	37.78
Have you ever made a contact with TGO?	41	18.22	184	81.78

However, the performance of TGO was study in this research. Tables 4.6 showed the questionnaire results on recognition of TGO. The results showed that most of respondents (74%) recognized TGO and over 60% knew the main objective of TGO. The satisfaction of TGO performance from stakeholders' perspective was summarized in 4.7. Although there were only 41 respondents from 226 respondents who had ever contacted TGO, it is obvious that the scores of TGO performance from this case study were rate in medium as shown in Table 4.5. The highest score was from "staff knowledge" with scored 3.49 from 5 followed by "expert staff available" with scored 3.18 and "useful guidance" with scored 3.15 which have the mean scores over 3. On the other hand, the last 3 rating topics were "efficiency on issue of the letter of approval" with scored 2.59, "published data via printing media" with scored 2.44, and "provide CDM information to public" with scored 2.44.

Table 4.7: Satisfaction of TGO Performance (from 41 respondents)

Factor	Mean
Staff knowledge	3.49
Expert staff available	3.18
Useful guidance of CDM implementation	3.15
Published data via website	3.00
Promotion of CDM project	2.90
Ease of contact for information	2.88
Staff adequacy	2.82
Investment support	2.71
Rate of approval fee	2.68
Efficiency on issuance of the letter of approval	2.59
Published data via printing media	2.44
Provide CDM information to public	2.41

Even at the highest rank on “staff knowledge” score at 3.5/5.0, it showed that the TGO succeeded in informative of CDM implementation. In addition, though Table 4.6 showed that most stakeholders in this study described that they do recognize about TGO and realize the objective of TGO, Table 4.7 showed the different results that the performance of information publicity to the community should be improved. The observation was taken from questionnaires released in the workshop/seminar which had a section for TGO to introduce itself. However, most respondents agreed that there still have many relevant stakeholders in many sectors who had a potential to implement CDM project, but they did not recognize about CDM. Therefore, capacity building program is very necessary, and should be done continually and thoroughly to reach more local stakeholders.

4.3 Solution for Implementing CDM Projects in Thailand

4.3.1 Stakeholder Needs

Practical management solutions were investigated in this case study as well. The 10 potential solutions which are gathered from various studies and from many experts on CDM implementation in Thailand were presented to the stakeholders via questionnaire as follows:

Solutions 1: Obtain financial support program from government
Solutions 2: Provide within country DOE to reduce implementation cost
Solutions 3: Encourage Bundling and Programmatic CDM project
Solutions 4: Access to carbon market
Solutions 5: Increase more capacity building programs
Solutions 6: Support on technology transfer
Solutions 7: Accelerate LoA issuance process
Solutions 8: Stimulate more flexible SD criteria
Solutions 9: Provide learning experience from approved or registered project
Solutions 10: Provide private investment fund for CDM project

Figure 4.8 summarized the needed solution from stakeholders' perspectives in Thailand. Approximately 88% of 177 stakeholders which had less than 1 year experience requested for financial support programs from government sector. Tax discount and low interest loans should be promoted to encourage project owners for implementing CDM project. About 73% of this group also agreed with establishing within country DOE to help decrease the implementation cost, and about 63% needed the learning experience from approved or registered projects.

The results from 49 stakeholders which had more than 1 year experience or already implemented at least 1 project agreed with previous results from inexperienced stakeholders that financial support program from government was the most important solution with scored 71%. However, the solution that had been rated as the second was "provide access to carbon market" with scored 63% which would help guarantee that their investment and CERs produced would not be wasted and

made some benefits return. About 49% of this group also requested for support on technology transfer. The purpose of CDM made project developer to use better or cleaner technology which has high cost. Then, transfer of knowledge on technology or development of within country technology would increase more options for project developers, and they could buy technology at a lower cost as well. In addition, there are about 11% of respondents that provided further suggestion that might help increase CDM implementation in Thailand as follows: Government should provide professional organizations that act as consultant for CDM project to help decrease implementation cost. Information provided especially methodology of CDM implementation should be translated into Thai language to facilitate local stakeholders. CDM courses should be held in educational institutions especially at university level.

The results of needed solution showed consistency with the analysis of key factor that the financial factor especially implementation cost was significantly important factor that affect project implementation decisions. All of stakeholders wish to see more financial support program from government along with capacity building to encourage them for implementing CDM projects. However, these solution needed should be amended to operate simultaneously to promote the CDM implementation effectively.

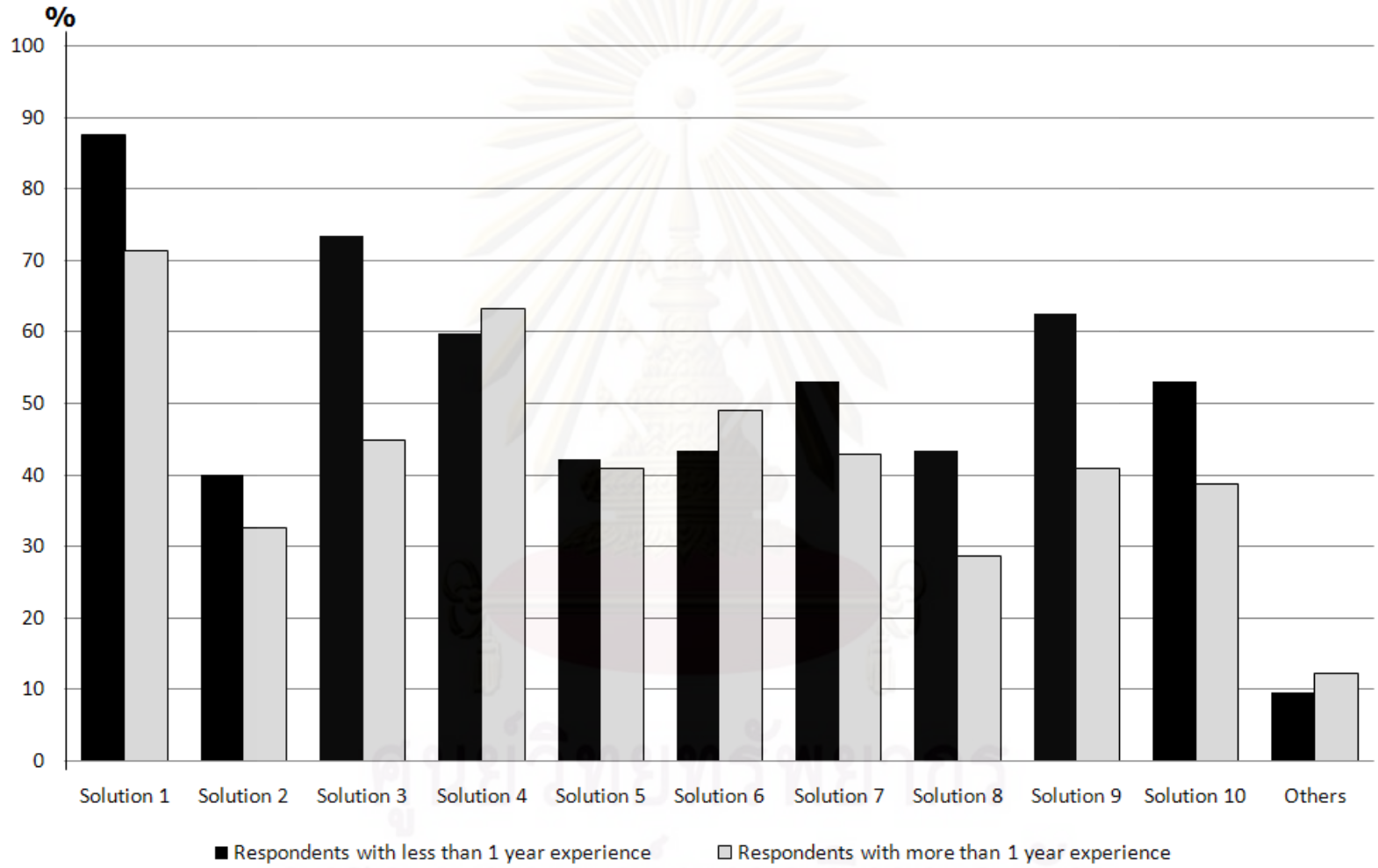

Figure 4.8: Practice Management Solutions

Due to the difference of approval fee mentioned in Table 4.3, this study also investigated for the most preferable approval fee from stakeholders' perspective. For approval fee of small-scale CDM project which is normally 75,000 THB and large-scale CDM project which is normally 10 THB/tCO2e but not more than 900,000 THB, the results revealed that approximate 50% of stakeholders in Thailand thought that the approval fee for small-scale project should be lower to the level of 10,000 – 50,000 THB as shown in Figure 4.9. In the same way, same amount of stakeholders agreed that for large-scale CDM project the approval fee should decrease to the level of 100,000 – 500,000 THB as shown in Figure 4.10. Moreover, there are about 12% of respondents had different opinions. The first was that preferable approval fee should be based on the amount of emission reduction for both small-scale and large-scale CDM project, and another opinion was that there should not charge any fee for issuance of the LoA. Stakeholders are willing to pay the approval fee because they agreed that the country should get benefits from CDM implementation. However, the key factor study showed that stakeholders focused more on other financial factor especially implementation cost which is significantly higher than approval fee. Consequently, the reduction of approval fee would alleviate the burden of overall CDM costs and might encourage CDM implementation.

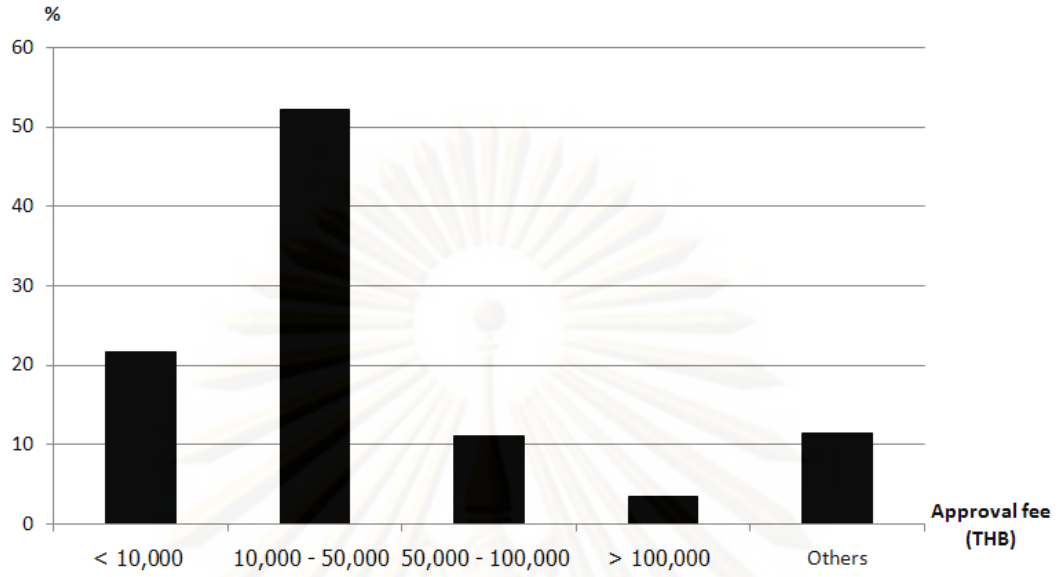

Figure 4.9: Preferable Approval Fee for Small-Scale Project

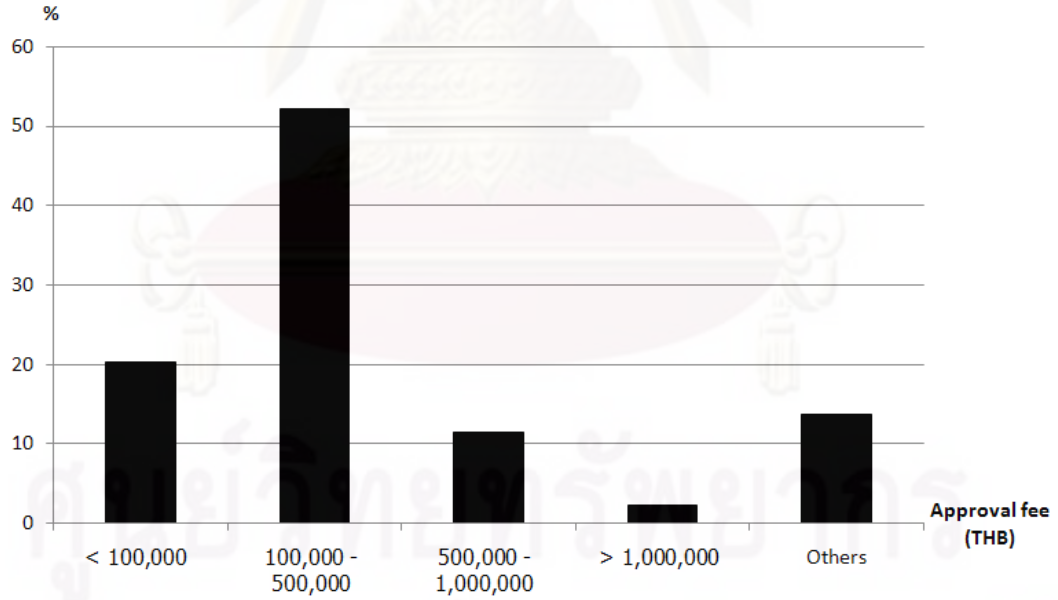

Figure 4.10: Preferable Approval Fee for Large-Scale Project

4.3.2 Opinions from Key Stakeholders' Interview

This study also interviewed a number of relevant stakeholders from both public and private sectors to verify the survey results. This study could able to interview 5 groups of stakeholder as follows.

4.3.2.1 Project Developers

Project development senior officer from Phu Khieo Bio-Energy Co., Ltd. mentioned on 2 October 2009 about CDM project implementation before TGO establishment that the projects were firstly suggested by the World Bank under prototype carbon fund program since year 2000. They decided to implement CDM project because it would help improve company image and had no disadvantage. However, CDM implementation at that time found many obstacles. The methodology was revised frequently; therefore it was necessary to rewrite the project design document many times by themselves. Furthermore, because CDM was not yet known even by the government, the request of LoA from government was very difficult and took long time which resulting the World Bank to quit from supporting project. However, they commented that these issues have been resolved after TGO establishment. TGO has organized many capacity building along with has approved many projects in the past year. Currently, the high implementation cost was the major barrier of CDM implementation in Thailand. Nevertheless, clarity in taxation from trading CERs and tax exemption might be the key to increase CDM implementation in Thailand. Besides, programmatic approach (which allows assembly of small-scale project to implement as one CDM project and allow other similar small-scale project to be added later) would certainly help increase the numbers of CDM projects in Thailand.

For the CDM project that was implemented after establishing of TGO, financial manager from GRT Ecosystem Co., Ltd. was interviewed on 29 September 2009. He said that his company recognized CDM from other project developer in the same business area. After a thorough study, they revealed that CDM implementation

would make additional earning gains from the primary income which was electricity selling, then in collaboration with international finance institution they decided to start implement as CDM project 3 years ago. However, they operated in main of electricity production and let their partner company to implement the CDM. He also agreed that Thailand has many potential and material for supporting CDM implementation. But, he described that there had many barriers of CDM implementation. Firstly, CDM implementation still relied on foreign companies because stakeholders in Thailand still lack of knowledge on CDM implementation, and it make the higher cost of CDM implementation. Moreover, there were few regulation and laws related to CDM, and government agencies still lack of CDM knowledge. Consequently, they made delay of contact for requesting information or relevant documents. Nevertheless, if the government sector gave more priority on CDM implementation and solving these problems, CDM implementation would certainly be increased.

4.3.2.2 Consultants

Consultant who was advising two landfill gas projects at the central of Thailand was interviewed on 28 September 2009. She mentioned that although the CDM project would benefits in many areas, but they are intangible and long-term benefits. Then, it should be studied carefully. She also gave a comment that problem with the fulfillment of the SD criteria's requirements was the obstacle in CDM implementation. However, she expected that TGO should emphasize more on this issue and build documentation checklist for requesting the LoA. Moreover, another barrier was related to DOE were foreign companies which result to high implementation cost. Therefore, government sector should promote the formation of within country DOE to mitigate burden costs of project developers.

4.3.2.3 Investment Bank

Kasikorn bank, as a premier Thai bank in CDM market, committed to support CDM projects varied from match-maker, consultant to debt financing arrangement. The first vice president from multi-corporate business department commented on 24 March 2009 that Kasikorn bank has approved more than 3 billion THB to CDM energy project in various registration levels while the movement of other local bank on CDM project was not obviously seen. Most first group that implemented CDM are large-scale project, however there are more interests from small-scale projects. He thought that SME groups should be concerned more for implementing CDM project in Thailand. The barrier of implementing CDM project in Thailand was knowledge dissemination to local project developer. Further, stakeholders in Thailand still had less awareness on environment aspects. Therefore, the bank has organized CDM campaign with specific loans plan for renewable energy power plants and joined with TGO to provide information on criteria for determining the loan through CDM workshops. Nevertheless, he mentioned that TGO should concern more knowledge dissemination and co-operate with other government sector to create more incentive program and clarity in taxation of CDM project. In term of sustainable development criteria, TGO can play major role to improve the situation by simplifying approval process. Clear CDM procedure will help project developers to follow and accelerate the procedure of CDM implementation.

4.3.2.4 The World Bank

The carbon finance analyst from the World Bank gave comments on 18 March 2009 that the World Bank mostly conducts the part of development of new CDM project methodology in many countries including Thailand, and also cooperates with TGO by sending expert staff to educate interested stakeholders. The efficiency of implementing CDM in Thailand has been increased after TGO establishment. The CDM projects from Thailand seemed to be better from international perspective. Nevertheless, she suggested that the first and very important priority of Thailand to drive CDM implementation was to issue the CDM regulation especially the category

tax of CERs; for example, in China, stakeholders must pay 30% tax for N_2O CDM project and 65% tax for HFCs and PFC CDM projects. At present without specific CDM regulation, the trading of CERs from Thailand would be charged for 30% of gross income. Tax exemption would certainly increase CDM implementation, but host country would lose the opportunity to bring that tax to develop the country. If CERs tax must be collected, then the clear CDM regulation would help stakeholders to evaluate the exact implementation cost and investment risk. Furthermore, TGO should make a CDM instruction to facilitate project developer. Lastly, different SD criteria from Thailand compared to other neighboring nation could be both advantages and disadvantages and should do more study carefully.

4.3.2.5 TGO

The senior technical assistant from TGO commented on 23 February 2009 that the start of CDM implementation in Thailand was slow. Thailand had 57 approved projects which involved 13 registered projects and 2 projects that were issued for CERs as of February 2009. 25 projects were in pipeline and more than 90 projects had sent letter of intent to TGO. However, the number of TGO staffs was not enough and affected some efficiency in issuance of the Letter of Approval (LoA). For the obstacles mentioned by other stakeholders, he said that the stringency SD criteria were the result of TGO's policy to release high quality CDM project and should not be the obstacles. He also said that the late approval process was caused by incomplete documentation from stakeholders as expected. There were many absence of required information for approving project. Moreover, the high approval fee was because TGO also included yearly monitoring charge. Nevertheless, TGO did not ignore these comments and solved the problems by directly contact both consultants and project developers to inform about requested information. Furthermore, TGO had plans to develop dissemination program through local government, CDM manual and internal carbon market to facilitate stakeholders, to promote more CDM implementation in Thailand.

The results and interviews suggest some agreements and some disagreements. TGO commented that the approval fee is in an appropriate rate, however the questionnaire showed disagreement and requested for lower fee. Verification of SD criteria to issue the LoA was mentioned as the barrier from consultant, but the World Bank agreed with TGO that SD criteria would create high quality project and positive impact for Thailand in the future. Moreover, all of information required by TGO to approve the CDM project and issue the LoA is regularly information that project developers must already demonstrate to prove the capacity and possibility of the projects in implementing as CDM projects, therefore project developers and consultants could send additional clarification document to TGO using a short time period. Furthermore, if TGO could show that the payment of approval fee was returned to stakeholders e.g. speed up the process of LoA issuance, and fund for the green project, then it would be beneficial for both TGO and project developers.

Moreover, both results from interviews and questionnaire survey showed similarly agreement that financial factor was the major obstacle. More financial support from government sector is preferred. Furthermore, more knowledge distribution program is very necessary to reach not only local project developer but also business and banking sector which will help increase loan for CDM project and induce CDM implementation.

Finally, all of interviewed stakeholders agreed that CDM implementation in Thailand after TGO establishment seen from many capacity building programs and many project approved. However, the results of economic crisis and low CERs price might slow down CDM implementation. However, Thailand would get more benefits on CDM particularly environmental aspect. Thailand still has more opportunity on CDM projects. There are many sectors that could and should implement CDM e.g. transportation, waste to energy, energy efficiency. Supporting by the questionnaire result, the small-scale projects would be the future of CDM projects in Thailand. Then, bundling and programmatic CDM should be studied urgently under the leadership and extensive supports of government sectors. The uncertainty of CDM condition after 2012 which will be released by the 15th Conference of the Parties

(COP 15) on December 2009 at Copenhagen would not affect CDM projects in Thailand because they believe that the results of UNFCCC convention on December 2009 would continue CDM implementation. Consequently, the benefits of CDM itself would be benefit for Thailand as well.

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

With the intention to understand the role and influence of DNA in driving CDM projects in Thailand, this study investigated the implementation progress of CDM project in Thailand and the performance of DNA through comparing with experiences in neighboring countries. A survey was also directly carried out with stakeholders in Thailand to find the key factors controlling success of CDM and to develop solutions to promote CDM implementation.

Based on the investigation, TGO has 4 major roles as Thailand Designated Operational Authority.

1. Screening CDM projects under sustainable development criteria for issuance of the Letter of Approval (LoA).
2. Promoting CDM projects through providing consultation to project developers, coordinating the activities between different stakeholders, e.g. technology providers, banker, and investors.
3. Building personnel capacity on CDM knowledge to relevant stakeholders and public.
4. Providing information on current status of CDM projects, Certified Emission Reductions and GHG information.

After TGO was established, the performance on approval CDM projects is significantly improved both in quality and quantity due to the independence and flexibility in implementation. The preparedness of providing necessary information to stakeholders in term of staff knowledge, experts available, and useful guidance of CDM implementation received praises by most stakeholders. Although TGO has provided many workshops/seminars to educate local stakeholders in the past year,

capacity building programs should be done continually and thoroughly along with the publication of CDM information through printing media, and other media to reach more local stakeholders.

The CDM implementation itself is complex and involves many relevant parties. Each implementation step has different obstacles and constraints. The entire process takes long period and high investments. For the project design, stakeholders in Thailand still lack awareness and knowledge on CDM project. So, it is difficult for project developer to complete PDD which contained many data, e.g. the methodology for calculating the GHG emissions, the methodology for monitoring, and analysis of the environmental impacts and sustainable development. As a result, they need to hire consultants to deal with this problem which increases cost of CDM implementation. At validation step, the difference of DNA operational rule and structure from each country lead to different performance and SD criteria which directly affect the speed or number of project approval. Meanwhile, the number of DOE to review project document in validation and verification steps (each step requires different DOE) are still limited and mostly are foreign companies. At monitoring step, project developer must take the risk that the amounts of GHG emission from actual monitoring, i.e. received CERs, might be different from the estimate projected by calculations. Lastly, project developer must take the risk of selling CERs because there is no central market in Thailand. Project developers themselves have to look for the buyers. Overall transaction costs for CDM project is therefore high. The stakeholders accordingly need high capital investment and must be well prepared in order to succeed in implementing CDM project.

The study on the comparison with neighboring countries showed that the CDM implementation procedures from chosen countries compared to Thailand have some similarity and are different in certain aspects. China charges for tax by project type which varies from 2-65% on CERs, but India provides tax exemption for CERs traded during 2008-2010. Although, both countries have different taxation schemes, they have many more number and variation of CDM projects compared to that in Thailand. Malaysia also provides tax exemption for CERs trading without limiting period, and has highest CDM projects in Southeast Asia. Malaysia and the Philippines

charge for approval fee, similarly to Thailand but at much cheaper rate. DNA from Thailand and India are public organizations while DNA from the remaining countries are governmental organization. Malaysia, the Philippines and Thailand have the same project types of interest. India, China, and the Philippines have shorter maximum approval time in the issuance of the Letter of Approval, compared to Malaysia and Thailand. Thailand set more indicators of SD criteria than other countries, however the details of sub-indicator are not greatly different. However, these comparisons do not indicate which country has the best CDM implementation procedure, because each country has different operation and characteristic. On the other hand, they show that CDM implementation in Thailand is in the same standard with the counties compared in the study. Moreover, there are some issues i.e. DNA's type that are similar to the counties that succeed in CDM implementation. Nevertheless, Thailand could study some different issues, i.e. approval fee and taxation to find more appropriate procedure that might help increase CDM implementation in Thailand.

Based on the stakeholders' interviews, the experienced stakeholders and inexperienced stakeholders have similar views that the financial factors covering high implementation cost, lack of financial support from government, and uncertainty of CERs price, are major obstacles for CDM implementation in Thailand. Moreover, experienced stakeholder indicated that long implementation period of CDM project is a major barrier of CDM implementation.

Recommendations to solve the existing obstacles are suggested on this study. Firstly, the government should consider financial support programs, such as tax deduction and low interest loan. This is the most needed solution that can increase implementation on CDM project. Provision of local DOE will help reduce the implementation cost. Moreover, the government agencies especially the local authorities should give more priorities and provide assistance to materialize the programmatic and bundle CDM that allows assembly of small-scale projects to be implemented as one CDM project. This helps reducing the overall implementation cost and could be the future of CDM project implementation in Thailand. In addition, there are many other sectors, e.g. energy efficiency and transportation that have potentials for CDM projects. Increased facilitation of carbon market access will

guarantee the income from implementing CDM project. Finally, stakeholder would expect to see reduction of approval fee, to the level of 10,000–50,000 THB in small-scale project and 100,000–500,000 THB in large-scale project to reduce overall CDM implementation cost. It is recommended that the approval fee should be collected after the project was approved by CDM EB to relieve financial burden of the project developers. In the case that the project is not approved by CDM EB, a reduced fee is requested, to the level that cover the operation cost of TGO.

There are many high potential CDM projects to be implemented in Thailand. A large number of stakeholders are interested and examining their potentials to implement CDM projects. TGO, as DNA of Thailand, plays a major role for driving clean development mechanism in Thailand. After TGO establishment, CDM implementation in Thailand has been increased significantly. However, there are some suggestions that TGO should give more attention to facilitate CDM implementation in Thailand as follows:

1. Cooperate with other government agencies to provide legislation regarding to CDM especially taxation of trading CERs
2. Assist in the establishment of domestic Designated Operational Entity (DOE) to help reduce the expense of CDM implementation
3. Be more descriptive on specific requirement of sustainable development criteria or provide a check list of information needed for project approval and the issuance of Letter of Approval (LoA)
4. Promote CDM knowledge continually and thoroughly to all sectors, including governmental agencies, investors, and other potential stakeholders

5.2 Future Work

There are several subjects that should be studied in more details to completely understand CDM implementation and to encourage the stakeholders to develop more CDM projects in Thailand, as follows:

1. Suitable approval fees and flexible payment plans including CER price floor, internal CER market, and other financial support programs to decrease the financial risk for stakeholders.
2. Development of domestic methodology and technology to decrease the technology cost.
3. Potential and methodology for developing bundling and programmatic CDM for small-scale CDM project in Thailand.
4. Methodology for implementing potential CDM projects in Thailand, particularly the reforestation and afforestation.
5. Suitable scheme or policy for supporting CDM project after Kyoto Protocol (post 2012).
6. Estimation/Assessment of potential credits generation from entire sector to help develop policy direction to promote the high potential sectoral CDM.

REFERENCES

Adhikari, S., Mithulananthan, N., Dutta, A., and Mathias, A. T. Potential of sustainable energy technologies under CDM in Thailand: Opportunities and barriers. Renewable Energy 33 (2007): 2122-2133.

CDM Malaysia, Malaysia CDM Information Handbook, Malaysia Energy Centre, 2005.

CDM Malaysia, National CDM Criteria Proposal for Further Interpretation, Malaysia Energy Centre, 2005.

Chaiwat M. Deputy Executive Director of TGO. Interview, 21 July 2008.

Chanwit U. Senior technical assistant. Interview, 23 February 2009.

Climate Change Officer. Interview, 28 September 2009.

Cochran, W. G. Sampling Techniques. John Wiley and Sons Inc. New York, 1953.

Cronbach, L. J. Coefficient alpha and the internal structure of tests. Psychometrika 16 (1951): 297-334.

Department of Environment and Natural Resources (DENR), Submission of Application Document. DENR Administrative order No. 2005-17, Philippines: 2005.

Ellis, J., and Kamel, S. Overcoming barriers to clean development mechanism projects, UNEP Risoe Centre, 2007.

Fenhann, J. CDM pipeline [Computer file]. UNEP Risoe Centre, 2009. Available from: http://cdmpipeline.org/publications/CDMStatesAndProvinces.xls [2009, August 11]

Fenhann, J. CDM project pipeline overview [Computer file]. UNEP Risoe Centre, 2008. Available from: http://cdmpipeline.org/publications/CDMpipeline.xls [2008, July 15]

Forster, P., Ramaswamy, V., Artaxo, P., Berntsen, T., Betts, R., Fahey, D.W., Haywood, J., Lean, J., Lowe, D.C., Myhre, G., Nganga, J., Prinn, R., Raga, G., Schulz, M., and Van Dorland, R., Changes in Atmospheric Constituents and in Radiative Forcing. Climate Change, 2007.

Ingo P. Managing Partner of South Pole Carbon Asset Management Ltd. Interview, 1 July 2008.

Jesdapipat, S. Thailand Case Study: Report from the UNIDO project UC/RAS/01/107: Capacity Mobilization to Enable Industrial Projects under the Clean Development Mechanism. UNIDO, 2002.

Jessie, L. T. CDM in Thailand: Status and Policy Issues. Foundation for International Human Resource Development (CEERD-FIHRD), 2004.

JGSEE, Studies on Clean Development Mechanism [Online]. Available from: http://www.jgsee.kmutt.ac.th/greenhouse/research/research5.php [2008, June 21]

Jung, M. Host country attractiveness for CDM non-sink projects. Energy Policy 34 (2006): 2173-2184.

Nopadej K. First vice president from multi-corporate business department of Kasikorn bank. Interview, 24 March 2009.

Olsen, K. H. The clean development mechanism's contribution to sustainable development: a review of the literature. Climate Change 84 (2007): 59-73.

Olsen, K. H., and Fenhann, J. Sustainable development benefits of clean development mechanism projects: A new methodology for sustainability assessment based on text analysis of the project design documents submitted for validation. Energy Policy 36 (2008): 2773-2784.

ONEP, Implementation of CDM project [Online], 2008. Available from: www.onep.go.th/cdm/cdm_work.html [2008, July 10].

Point Carbon, CDM rating in June 2008 [Online], 2008. Available from: www.pointcarbon.com/research/carbonmarketresearch/cdmhostcountyrating/cdm/ [2008, July 9]

Pongtip P. Carbon finance analyst of World Bank. Interveiw, 18 March 2009.

Pornpen J. Project Development Senior Officer from Phu Khieo Bio-Energy Co., Ltd. Interview, 2 October 2009.

Punjaporn W. Senior Researcher / Project Manager of Thailand Environmental Institute. Interview, 6 December 2008.

Sakda S. Financial Manager from GRT Ecosystem Co., Ltd. Interview, 29 September 2009.

Saleenmul H., Applying Sustainable Development Criteria to CDM Projects: PCF Experience, World Bank Carbon Finance Unit, 2008.

TGO, Concept of CDM [Online], 2008. Available from: http://www.tgo.or.th/index.php?option=com_content&task=view&id=21&Itemid=26 [2008, December 17]

TGO, Sustainable Development Criteria [Online], 2008. Available from: www.tgo.or.th/english/index.php?option=com_content&task=view&id=15&Itemid=1 [2008, July 15].

UNFCCC, Essential Background [Online], 2008. Available from: http://unfccc.int/essential_background/items/2877.php [2008, July 27].

UNFCCC, Registered Project Activities by Host Party [Online], 2008. Available from: http://cdm.unfccc.int/Statistics/Registration/NumOfRegisteredProjByHostPartiesPieChart.htm [2009, March 17]

UNFCCC, Report of the conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol on its first session, held at Montreal from 28 November to 10 December 2005, UNFCCC, 2005.

Van der Gaast, W., Begg, K., and Flamos, A. Promoting sustainable energy technology transfers to developing countries through the CDM. Applied Energy 86 (2009): 230-236.

Weiss, P., Lefèvre, T., and Möst, D. Modelling the impacts of CDM incentives for the Thai electricity sector. Energy Policy 36 (2008): 1134-1147.

APPENDICES

Appendix A

Appendix A: Background information

Table A-1 Sustainable development criteria of Malaysia

Sustainable development dimensions	Aspects of SD	Indicators
Environment	Air quality	• Impact of project on GHG emissions • Impact of project on local air quality (e.g. emissions of SOx, NOx and particulates) • Impact from pollutants or any hazardous or toxic substances to air
	Water quality	• Impact of project on surface waters, underground waters, coastal waters or the sea
	Biodiversity	• Impact of the project on local biodiversity
	Soil condition	• Impact of the project on soil condition
	Land-use change	• Impact on areas on or around, which are important or sensitive for reasons of their ecology e.g. wetlands, watercourse • Impact on areas on or around the location which are protected under international, national or local legislation
Economic	Competitiveness	• Impact on technology improvement (uses cleaner, more efficient and environment-friendly technology) • Impact on efficient utilization of resources
	Employment	• Impact on the number and quality of jobs created for the local community
Social	Local Community	• Impact on quality of life of local community e.g. health, poverty alleviation • Impact of project on preservation of local heritage/culture

Table A-2 Sustainable development criteria of the Philippines

Sustainable development dimensions	Indicators
Social	• Provides measures to alleviate poverty • Provides education and training which build the capacities of local stakeholders • Provide vulnerable groups access to local services • Promotes local participation in the project
Economic	• Generates sustainable employment of local community • Provides livelihood and other economic opportunities in the community • Provides proper safety nets and compensatory measures for the affected minority • Uses cleaner, more efficient and environment-friendly technology
Environmental	• Complies with environmental policies and standards • Provides local environmental benefits • Promotes sustainable use of natural resources • Protects and conserves local biodiversity

Table A-3 Sustainable development criteria of India

Sustainable development dimensions	Indicators
Social well being	• Alleviation of poverty by generating additional employment • Removal of social disparities • Contribution to provision of basic amenities to people leading to improvement in quality of life of people
Economic well being	• Bring in additional investment consistent with the needs of the people
Environmental well being	• Impact of the project activity on resource sustainability and resource degradation • Bio-diversity friendliness • Impact on human health • Reduction of levels of pollution
Technological well being	• Lead to transfer of environmentally safe and sound technologies with a priority to RE sector or EE projects that are comparable to best practices in order to assist in upgrading of technological base

Table A-4 Sustainable development criteria of Vietnam

Sustainable development dimensions	Aspects of SD	Indicators
Economic sustainability	National income generation	• Growth of national income • CER revenues
	Economic externality	• Technology transfer • Import Substitution
Environment sustainability	Greenhouse effect	• GHG emission reduction
	Non GHG air pollution	• Non GHG air pollution emission • Non GHG water pollution
	Waste	• Waste generation rate
	Ecosystem	• % change in forest cover • Soil erosion • Likely effect on biodiversity
Social and institutional sustainability	Poverty eradication	• Creation of rural employment • Reduction in number of poor households
	Quality of life	• People income • Improving of living conditions
	Readiness of implementing agencies	• Public sector • Private sector

Appendix B

Appendix B: The questionnaire used in this study

Figure B-1 Draft of questionnaire

แบบสอบถามนี้เป็นส่วนหนึ่งของการทำวิทยานิพนธ์ระดับปริญญาโท
ของนายณพรรษ จรรยาภรณ์พงษ์
หลักสูตรสหสาขาวิชาการจัดการสิ่งแวดล้อม คณะบัณฑิตวิทยาลัย จุฬาลงกรณ์มหาวิทยาลัย
จึงใคร่ขอความร่วมมือจากท่านในการตอบแบบสอบถาม
และขอแสดงความขอบคุณอย่างสูงมา ณ โอกาสนี้

หากท่านมีคำแนะนำหรือข้อสงสัยเกี่ยวกับแบบสอบถามนี้ สามารถติดต่อได้ที่ napas.cha@gmail.com

ศูนย์ความเป็นเลิศแห่งชาติด้านการจัดการสิ่งแวดล้อมและของเสียอันตราย
โทร. 0-2218-8132-3, 08-9631-6183
โทรสาร 0-2255-4967
ไปรษณีย์อิเล็กทรอนิกส์ NCE-EHWM@chula.ac.th

แบบสอบถาม

โครงการกลไกการพัฒนาที่สะอาด (CDM) ทำอย่างไรให้ประสบความสำเร็จ

I. ข้อมูลเบื้องต้นเกี่ยวกับท่าน

1. ท่านมีหน้าที่รับผิดชอบใดที่เกี่ยวข้องกับโครงการกลไกการพัฒนาที่สะอาด

❑ เจ้าของโครงการ ❑ ผู้ให้คำปรึกษาโครงการ ❑ ผู้รับผิดชอบโครงการ
❑ ผู้ออกทุนสนับสนุน ❑ องค์กรรัฐ _____ ❑ อื่นๆ โปรดระบุ _____

2. ท่านได้ศึกษาโครงการที่เกี่ยวข้องกับโครงการกลไกการพัฒนาที่สะอาดเป็นเวลา

❑ น้อยกว่า 6 เดือน ❑ 6 เดือนถึง1 ปี ❑ 1-2 ปี ❑ มากกว่า 2 ปี

3. ท่านสนใจดำเนินโครงการกลไกการพัฒนาที่สะอาดประเภทใดบ้าง (เลือกได้มากกว่า 1 ข้อ)

❑ Biogas ❑ Biomass ❑ Energy efficiency
❑ Renewable energy ❑ Fuel switching ❑ Landfill Gas
❑ Reforestation & Afforestation ❑ อื่นๆ โปรดระบุ _____

4. ท่านสนใจดำเนินโครงการกลไกการพัฒนาที่สะอาดในระดับใด

❑ โครงการขนาดเล็ก < 15,000 tons CO_2e /year
❑ โครงการขนาดใหญ่ > 15,000 tons CO_2e /year
❑ ทั้งโครงการขนาดใหญ่และขนาดเล็ก

5. ท่านมีความเข้าใจในการดำเนินโครงการกลไกการพัฒนาที่สะอาดในประเทศไทยในระดับใด

❑ เข้าใจถึงระเบียบปฏิบัติทุกขั้นตอน โดยละเอียดหรือเคยดำเนิน โครงการแล้วอย่างน้อย 1 โครงการ
❑ กำลังมีส่วนในการดำเนิน โครงการและเข้าใจระเบียบปฏิบัติในภาพรวม ไม่ลงลึกถึงรายละเอียด
❑ รู้จักโครงการ CDM และขั้นตอนการดำเนิน โครงการบางส่วน และกำลังศึกษาหาข้อมูลเพิ่มเติม
❑ รู้จักโครงการ CDM แต่ยังไม่ทราบรายละเอียดการดำเนินการ

6. ท่านทราบถึงข้อกำหนดของการออกหนังสือให้คำรับรองของโครงการกลไกการพัฒนาที่สะอาดของประเทศไทยหรือไม่

❑ ทราบ และเข้าใจชัดเจนถึงรายละเอียดขั้นตอนการปฏิบัติ
❑ ทราบว่าต้องมีหนังสือให้คำรับรอง แต่ไม่ทราบขั้นตอนการดำเนินการ
❑ ไม่ทราบ

7. ท่านรู้จักองค์การบริหารจัดการก๊าซเรือนกระจก (องค์กรมหาชน) หรือ TGO หรือไม่

❑ ทราบ ❑ ไม่ทราบ

8. ท่านทราบหรือไม่ว่า TGO มีหน้าที่และความสำคัญอย่างไรเกี่ยวกับโครงการ CDM

❑ ทราบ ❑ ไม่ทราบ

9. ท่านเคยติดต่อหรือทำงานร่วมกับ TGO หรือไม่

❑ เคย ❑ ไม่เคย

II. ปัจจัยที่ส่งผลกระทบต่อการตัดสินใจดำเนินโครงการกลไกการพัฒนาที่สะอาด

ท่านคิดว่าปัจจัยต่อไปนี้เป็น อุปสรรค ที่ส่งผลต่อการตัดสินใจในการดำเนินโครงการ CDM อย่างไรบ้าง (จากน้อยที่สุดถึงมากที่สุด)

- การสนับสนุนจากภาครัฐฯ เช่น การขาดแคลนแหล่งให้ความรู้และข้อมูล หรือ ขาดการสนับสนุนด้านเทคโนโลยีในกรณีที่ต้องร่างระเบียบวิธีการคำนวณ (methodology) ใหม่

น้อยที่สุด ○ ○ ○ ○ ○ มากที่สุด

- ข้อกฎหมายที่เกี่ยวข้อง เช่น ข้อกฎหมายด้านสิ่งแวดล้อม เช่น มาตรฐานการปล่อยมลพิษ

น้อยที่สุด ○ ○ ○ ○ ○ มากที่สุด

- การถ่ายทอดเทคโนโลยีจากต่างประเทศ

น้อยที่สุด ○ ○ ○ ○ ○ มากที่สุด

- ข้อกำหนดของการได้รับหนังสือให้คำ รับรอง (Letter of Approval) มีประเด็นการพิจารณาโครงการ CDM ทั้งหมด 4 ด้านคือ ด้านทรัพยากรธรรมชาติและสิ่งแวดล้อม ด้านสังคม ด้านการพัฒนาและ/หรือการถ่ายทอดเทคโนโลยี และด้านเศรษฐกิจ

น้อยที่สุด ○ ○ ○ ○ ○ มากที่สุด

- ระยะเวลาที่ใช้ในการยื่นขอดำเนินโครงการ CDM ทั้งสิ้น 1-2 ปี

น้อยที่สุด ○ ○ ○ ○ ○ มากที่สุด

- ระยะเวลาในการได้รับหนังสือรับรองโครงการ 1-6 เดือน

น้อยที่สุด ○ ○ ○ ○ ○ มากที่สุด

- ระยะเวลาในการได้รับผลตอบแทน เมื่อมีผู้ซื้อเครดิต 1-2 ปี

น้อยที่สุด ○ ○ ○ ○ ○ มากที่สุด

- ความสะดวกในการติดต่อผู้ซื้อเครดิตจากต่างประเทศ

น้อยที่สุด ○ ○ ○ ○ ○ มากที่สุด

- การสนับสนุนจากแหล่งเงินทุน เช่น เงินกู้ยืมเพื่อลงทุนเกี่ยวกับโครงการด้านสิ่งแวดล้อม

น้อยที่สุด ○ ○ ○ ○ ○ มากที่สุด

- ค่าใช้จ่ายในดำเนินโครงการ (ยกเว้นค่าธรรมเนียมหนังสือรับรองโครงการ) อาทิเช่น ค่าใช้จ่ายในการดำเนินกระบวนการขอขึ้นทะเบียนโครงการประมาณ 3,000,000 – 8,000,000 บาท

น้อยที่สุด ○ ○ ○ ○ ○ มากที่สุด

- ค่าใช้จ่ายในการปรับเปลี่ยน/ดัดแปลง เครื่องจักรที่ใช้

น้อยที่สุด ○ ○ ○ ○ ○ มากที่สุด

- ความไม่แน่นอนของผลตอบแทน (ราคา CERs) เนื่องจากความผันผวนของราคา CERs ตามกลไกตลาด

น้อยที่สุด ○ ○ ○ ○ ○ มากที่สุด

- ค่าธรรมเนียมหนังสือรับรองโครงการ โครงการขนาดเล็ก 75,000 บาท (< 15,000 tons CO2e /year), โครงการขนาดใหญ่ 10 บาทต่อตันคาร์บอน แต่ไม่เกิน 900,000 บาท (> 15,000 tons CO2e /year)

น้อยที่สุด ○ ○ ○ ○ ○ มากที่สุด

III. การสนับสนุนการดำเนินโครงการของหน่วยงานกลางประสานการดำเนินงาน

องค์การบริหารจัดการก๊าซเรือนกระจก (องค์กรมหาชน) หรือ TGO ในฐานะของ Designated National Authorities (DNA) ในประเทศไทยที่ทำหน้าที่ให้คำปรึกษาข้อมูลและออกหนังสือรับรองโครงการกลไกการพัฒนาที่สะอาด CDM มีลักษณะการทำงานเป็นอย่างไรในความคิดเห็นของท่าน ?

**** หากท่านไม่เคยร่วมงานกับองค์การบริหารก๊าซเรือนกระจก (องค์การมหาชน) สามารถข้ามหัวข้อที่ III ไปยังหัวข้อที่ IV****

- ความเพียงพอของจำนวนบุคลากร

ควรปรับปรุงอย่างยิ่ง ○ ○ ○ ○ ○ ดีมาก

- บุคลากรที่ให้บริการมีความรู้และทักษะในการดำเนินโครงการ

ควรปรับปรุงอย่างยิ่ง ○ ○ ○ ○ ○ ดีมาก

- สามารถให้คำแนะนำ/ชี้แจงโครงการที่เป็นประโยชน์ เพื่อนำกลับไปแก้ไข

ควรปรับปรุงอย่างยิ่ง ○ ○ ○ ○ ○ ดีมาก

- มีผู้เชี่ยวชาญหรือพนักงานอาวุโสเพื่อให้คำปรึกษาเมื่อเกิดปัญหา

ควรปรับปรุงอย่างยิ่ง ○ ○ ○ ○ ○ ดีมาก

- การส่งเสริมให้เกิดโครงการ เช่น มีการจัดศูนย์ข้อมูลให้ความรู้แก่ผู้สนใจในการดำเนินโครงการ การเป็นศูนย์กลางความร่วมมือระหว่างภาครัฐ ภาคเอกชน และองค์การระหว่างประเทศ

ควรปรับปรุงอย่างยิ่ง ○ ○ ○ ○ ○ ดีมาก

- การประสานงานให้ความช่วยเหลือด้านการลงทุน

ควรปรับปรุงอย่างยิ่ง ○ ○ ○ ○ ○ ดีมาก

- ความเหมาะสมของค่าธรรมเนียมในการออกหนังสือรับรองโครงการ โครงการขนาดเล็ก 75,000 บาท (< 15,000 tons CO_2e /year), โครงการขนาดใหญ่ 10 บาทต่อตันคาร์บอน แต่ไม่เกิน 900,000 บาท (> 15,000 tons CO_2e /year)

ควรปรับปรุงอย่างยิ่ง ○ ○ ○ ○ ○ ดีมาก

• ความรวดเร็วในการออกหนังสือรับรองโครงการ

ควรปรับปรุงอย่างยิ่ง ○ ○ ○ ○ ○ ดีมาก

• ความสะดวกในการติดต่อขอข้อมูล

ควรปรับปรุงอย่างยิ่ง ○ ○ ○ ○ ○ ดีมาก

• การเผยแพร่ข้อมูลข่าวสารทางสื่อสิ่งพิมพ์

ควรปรับปรุงอย่างยิ่ง ○ ○ ○ ○ ○ ดีมาก

• การเผยแพร่ข้อมูลข่าวสารทางเวปไซด์

ควรปรับปรุงอย่างยิ่ง ○ ○ ○ ○ ○ ดีมาก

• ความทั่วถึงของการประชาสัมพันธ์ข่าวเกี่ยวกับโครงการ CDM

ควรปรับปรุงอย่างยิ่ง ○ ○ ○ ○ ○ ดีมาก

IV. ข้อเสนอแนะเพื่อส่งเสริมการดำเนินโครงการให้ดียิ่งขึ้น

1. ท่านคิดว่าค่าธรรมเนียมที่เหมาะสมในการออกหนังสือรับรองโครงการควรจะเป็นเท่าใด

โครงการขนาดเล็ก

❑ < 10,000 บาท ❑ 10,000 -50,000 บาท ❑ 50,000 - 100,000 บาท

❑ > 100,000 บาท ❑ อื่นๆ โปรดระบุ _____

โครงการขนาดใหญ่

❑ < 100,000 บาท ❑ 100,000 -500,000 บาท ❑ 500,000 – 1,000,000 บาท

❑ > 1,000,000 บาท ❑ อื่นๆ โปรดระบุ _____

2. ท่านคิดว่าทางเลือกใดต่อไปนี้จะช่วยผลักดันและพัฒนาให้มีการดำเนินโครงการกลไกการพัฒนาที่สะอาดเพิ่มมากขึ้นในประเทศไทย (เลือกได้มากกว่า 1 ข้อ)

- ❑ มีโครงการสนับสนุนทางด้านการเงินจากภาครัฐฯเพิ่มขึ้น เช่น ส่วนลดทางภาษี เงินกู้ดอกเบี้ยต่ำ
- ❑ หามาตรการเพื่อระดมทุนหรือให้แหล่งเงินทุนสนับสนุนโครงการเพื่อสิ่งแวดล้อมมากขึ้น
- ❑ ผลักดันให้มีหน่วยงานที่เป็น DOE ในประเทศเพื่อลดค่าใช้จ่ายและลดระยะเวลาที่ใช้ในขั้นตอน Validation และ Verification
- ❑ มีการส่งเสริมให้มีการดำเนิน โครงการ CDM ในรูปแบบ Bundle Pattern สำหรับการรวมกลุ่มดำเนินการ โครงการขนาดเล็กพร้อมกัน และ Programmatic CDM สำหรับโครงการที่มีรูปแบบการดำเนินกิจกรรมคล้ายคลึงกันซึ่งสามารถเพิ่มเติมได้ในภายหลัง
- ❑ ปรับปรุงให้ข้อกำหนดในการออกหนังสือรับรองมีความยืดหยุ่นมากขึ้น
- ❑ เร่งรัดให้การออกหนังสือรับรองรวดเร็วขึ้น
- ❑ จัดให้มีกิจกรรมสัมมนาเพื่อให้ความรู้แก่ผู้ประกอบการเพิ่มมากขึ้น
- ❑ จัดให้มีกิจกรรมศึกษางานนอกสถานที่ หรือการเยี่ยมชมโครงการที่ได้รับการอนุมัติแล้ว
- ❑ สนับสนุนให้การเข้าถึงตลาดคาร์บอนเป็นไปได้ง่ายขึ้น
- ❑ มีโครงการสนับสนุนทางด้านเทคโนโลยีจากภาคเอกชนทั้งในและต่างประเทศเพิ่มขึ้น
- ❑ อื่นๆ โปรดระบุ _____

_____

_____

_____

** หากมีคำแนะนำอื่นๆที่ท่านคิดว่าจะทำให้เกิดการดำเนินโครงการ CDM ได้อย่างมีประสิทธิภาพเพิ่มขึ้นเห็นผลได้ดีและเร็วยิ่งขึ้น กรุณาให้คำแนะนำตรงนี้เพื่อจะได้เสนอคำแนะนำต่อผู้ที่เกี่ยวข้องให้ดำเนินการปรับปรุงต่อไป

Appendix C

Appendix C: Experimental Data

Table C-1: Result of question "What is your role on CDM?"

Groups	Frequency	Percent	Cumulative Percent
Project owners	29	12.83	12.83
Project managers	55	24.34	37.17
Consultants	36	15.93	53.10
Investor	16	7.08	60.18
Government sectors	31	13.72	73.90
NGOs and others	59	26.11	100
Total	226	100	

Table C-2: Result of question "How long have you studied on CDM project?"

Answers	Frequency	Percent	Cumulative Percent
less than 6 months	134	59.29	59.29
6 months to 1 years	43	19.03	78.32
1-2 years	33	14.60	92.92
more than 2 years	16	7.08	100
Total	226	100	

Table C-3: Result of question "What types of CDM are you interested?" from all respondents

Type of CDM interested	Count	% by N (N=226)
Biogas	108	47.79
Biomass	90	39.82
EE	122	53.98
Renewable energy	83	36.73
Fuel switching	36	15.93
LFG	32	14.16
Reforestation & Afforestation	33	14.60
others	8	3.54
Total	512	

Table C-4: Result of question "What types of CDM are you interested?" from Project owner & Project manager

Type of CDM interested	Count	% by N (N=84)
Biogas	35	41.67
Biomass	27	32.14
EE	48	57.14
Renewable energy	27	32.14
Fuel switching	14	16.67
LFG	5	5.95
Reforestation & Afforestation	10	11.90
others	3	3.57
Total	169	

Table C-5: Result of question "What sizes of CDM are you interested?"

Size of CDM interested	Frequency	Percent	Cumulative Percent
Small-scaled project	103	45.58	45.58
Large-scaled project	37	16.37	61.95
Both	86	38.05	100
Total	226	100.00	

Table C-6: Result of question "What is your level on understanding of CDM implementation?"

Answers	Frequency	Percent	Cumulative Percent
Clearly understand on CDM implementation or already implemented at least 1 project	5	2.21	2.21
Understand broad picture of CDM implementation and implementing CDM project	32	14.16	16.37
Understand certain part of CDM implementation and studying	102	45.13	61.50
Recognize fundamental CDM	87	38.50	100
Total	226	100.00	

Table C-7: Result of question "Did you realize how to get the Letter of approval?" from all respondents

Answers	Frequency	Percent	Cumulative Percent
Recognize the full requirement of LoA issue	32	13.78	13.78
Recognize some part of the requirement of LoA issue	136	60.44	74.22
Did not recognize the requirement of LoA issue	58	25.78	100.00
Total	226	100.00	

Table C-8: Result of question "Did you realize how to get the Letter of approval?" from Project owner & Project manager

Answers	Frequency	Percent	Cumulative Percent
Recognize the full requirement of LoA issue	11	13.10	13.10
Recognize some part of the requirement of LoA issue	51	60.71	73.81
Did not recognize the requirement of LoA issue	22	26.19	100.00
Total	84	100.00	

Table C-9: Result of question "Do you recognize TGO?"

Answers	Frequency	Percent	Cumulative Percent
Yes	166	73.45	73.45
No	59	26.11	99.56
Missing	1	0.44	100.00
Total	226	100.00	

Table C-10: Result of question "Did you realize the objective of TGO?"

Answers	Frequency	Percent	Cumulative Percent
Yes	140	61.95	61.59
No	85	37.61	99.56
Missing	1	0.44	100.00
Total	226	100.00	

Table C-11: Result of question "Have you ever made a contact with TGO?"

Answers	Frequency	Percent	Cumulative Percent
Yes	41	18.14	18.14
No	184	81.42	99.56
Missing	1	0.44	100.00
Total	226	100.00	

Table C-12: Result of barrier effecting CDM implementation from 177 respondents with less than 1 year experience

Factors	Mean	Std. Deviation
Implementation cost	4.14	1.01
Government support	4.06	1.02
Uncertainty of CERs price	3.97	0.96
Technology cost	3.81	0.93
Investment fund support	3.78	1.09
Implementation period	3.78	1.00
Carbon market reach	3.73	1.06
Turnover rate period	3.66	0.89
Technology transfer	3.59	1.01
SD criteria	3.55	1.01
Approval fee	3.47	1.07
Relevant regulation	3.39	1.08
Approval period	3.38	0.91

Table C-13: Result of barrier effecting CDM implementation from 49 respondents with more than 1 year experience

Factors	Mean	Std. Deviation
Implementation period	3.80	1.12
Implementation cost	3.80	1.10
Government support	3.76	1.05
Uncertainty of CERs price	3.73	1.04
Turnover rate period	3.67	1.01
Investment fund support	3.67	1.07
Carbon market reach	3.50	1.03
Approval period	3.45	1.04
Technology cost	3.41	1.02
Approval fee	3.41	0.86
Technology transfer	3.37	1.01
Relevant regulation	3.33	1.11
SD criteria	3.10	0.98

Table C-14: Result of Performance of TGO

Factors	Mean	Std. Deviation
Staff knowledge	3.49	1.03
Expert staff available	3.18	1.06
Useful guidance of CDM implementation	3.15	1.01
Published data via website	3.00	1.05
Promotion of CDM project	2.90	1.18
Ease of contact for information	2.88	1.05
Staff adequacy	2.83	1.15
Investment support	2.71	1.12
Satisfaction of approval fee	2.68	1.11
Efficiency on issue of the letter of approval	2.59	1.07
Published data via printing media	2.44	0.98

Table C-15: Suitable fee for small-scaled project from stakeholders' perspective

Type of Stakeholders	<10,000 THB	10,000 – 50,000 THB	50,000 – 100,000 THB	>100,000 THB	Others	Total
Project owners	5	19	1	0	4	29
Project managers	13	25	9	2	6	55
Consultants	8	18	4	2	4	36
Investor	3	10	2	1	0	16
Government sectors	9	16	3	0	3	31
NGOs and others	11	30	6	3	9	59
Total	49	118	25	8	26	226
%	21.68	52.21	11.06	3.54	11.50	100

Table C-16: Suitable fee for large-scaled project from stakeholders' perspective

Type of Stakeholders	<100,000 THB	100,000 – 500,000 THB	500,000 – 1,000,000 THB	>1,000,000 THB	Others	Total
Project owners	6	15	2	2	4	29
Project managers	13	29	4	1	8	55
Consultants	8	17	6	1	4	36
Investor	2	11	2	1	0	16
Government sectors	7	18	2	0	4	31
NGOs and others	10	28	10	0	11	59
Total	46	118	26	5	31	226
%	20.35	52.21	11.50	2.21	13.72	100

Table C-17: Solutions, inputs, and suggestions from 177 respondents with less than 1 year experience

Solutions	% from 177 respondents
Obtain financial support program from government	87.57
Provide private investment fund for CDM project	40.11
Provide within country DOE to reduce implementation cost	73.45
Encourage Bundling and Programmatic CDM project	59.89
Stimulate more flexible SD criteria	42.37
Accelerate LoA issuance process	43.50
Increase more capacity building programs	53.11
Provide learning experience from approved or registered project	43.50
Access to carbon market	62.71
Support on technology transfer	53.11
Others*	9.60

* Example of other suggestions:

- Government should provide professional organizations that act as consultant for CDM project to decrease implementation cost
- Approval fee should not be based on expected CERs because it can be different from exact CERs produced
- Information provide should be translated into Thai especially methodology
- SD criteria should be explained clearly
- CDM courses should be held in educational institutions especially at university level
- TGO should work proactively for example project which have potential to CDM should be facilitated and promoted

Table C-18: Solutions, inputs, and suggestions from 49 respondents with more than 1 year experience

Solutions	% from 49 respondents
Obtain financial support program from government	71.43
Provide private investment fund for CDM project	32.65
Provide within country DOE to reduce implementation cost	44.90
Encourage Bundling and Programmatic CDM project	63.27
Stimulate more flexible SD criteria	40.82
Accelerate LoA issuance process	48.98
Increase more capacity building programs	42.86
Provide learning experience from approved or registered project	28.57
Access to carbon market	40.82
Support on technology transfer	38.78
Others*	12.24

* Example of other suggestions:

- Government should provide professional organizations that act as consultant for CDM project to decrease implementation cost
- Approval fee should not be based on expected CERs because it can be different from exact CERs produced
- Information provide should be translated into Thai especially methodology
- SD criteria should be explained clearly
- CDM courses should be held in educational institutions especially at university level
- TGO should work proactively for example project which have potential to CDM should be facilitated and promoted

Appendix D

Appendix D: CDM project in Thailand

Table D-1 Approved CDM project in Thailand from Cabinet (TGO, 4 August 2009)

No.	Project Title	Project Detail	Project lifetime (Years)	GHG reduction (ton CO2/yr)	Generated Electricity (MW)
1	Dan Chang Bio-Energy Cogeneration Project	Generate electricity from bagasse and sugarcane residual	21	93,129	41
2	Phu Khieo Bio-Energy Cogeneration Project	Generate electricity from bagasse and sugarcane residual	21	102,493	41
3	Korat Waste to Energy Project, Thailand	Generate heat and electricity from tapioca mill waste water	15	312,774* 714,546**	3
4	A.T. Biopower Rice Husk Power Project	Generate electricity from rice husk	25	77,292* 100,678**	20
5	Rubber Wood Residue Power Plant in Yala, Thailand	Generate electricity from wood chip	25	60,000	20.2
6	Khon Kaen Sugar Power Plant	Generate electricity from bagasse and sugarcane residual	20	61,449	30
7	Wastewater treatment with Biogas System in a Starch Plant for Energy and Environment Conservation in Nakorn Ratchasima	Generate heat and electricity from tapioca mill waste water	20	31,454	1.8

108

No.	Project Title	Project Detail	Project lifetime (Years)	GHG reduction (ton CO2/yr)	Generated Electricity (MW)
8	Wastewater Treatment with Biogas System in a Starch Plant for Energy and Environment Conservation in Chachoengsao	Generate heat from tapioca mill waste water	20	19,369	-
9	Surat Thani Biomass Power Generation Project in Thailand	Generate electricity from empty fruit brunch of oil palm	20	173,359*	9.95
10	Natural Palm Oil Company Limited – 1 MW Electricity Generation and Biogas Plant Project	Generate heat and electricity from palm oil mill waste water	15	17,533	1
11	Northeastern Starch (1987) CO.,Ltd. -- LPG Fuel Switching Project	Generate heat and electricity from tapioca mill waste water	20	27,321	1
12	Chumporn Applied Biogas Technology for Advanced Waste Water Management, Thailand	Generate heat from palm oil mill waste water	20	23,436	-
13	Surin Electricity Company Limited	Generate electricity from bagasse and sugarcane residual	20	12,197	10
14	Jaroensompong Corporation Rachathewa Landfill Gas to Energy Project in Thailand	Generate electricity from municipal waste	20	47,185	1

* The estimated amount of GHG reduction along to PDD which submitted to TGO

** The amount of GHG reduction which issuance by CDM EB

Table D-2 Approved CDM project in Thailand from TGO (TGO, 4 August 2009)

No.	Project Title	Project Detail	Project lifetime (Years)	GHG reduction (ton CO2/yr)	Generated Electricity (MW)
1	Ratchaburi Farms Biogas Project at Nongbua Farm	Generate electricity from pig farm waste water	20	15,958	1.38
2	Ratchaburi Farms Biogas Project at Veerachai Farm	Generate electricity from pig farm waste water	20	32,092	0.950
3	Ratchaburi Farms Biogas Project at SPM Farm	Generate electricity from pig farm waste water	20	23,556	0.480
4	Jiratpattana Biogas Energy Project	Generate heat and electricity from tapioca mill waste water	20	46,758	1.4
5	Kitroongruang Biogas Energy Project	Generate heat and electricity from tapioca mill waste water	25	19,578	1.4
6	Chao Khun Agro Product Energy Project	Generate heat and electricity from tapioca mill waste water	25	55,319	1.4
7	Cassava Waste To Energy Project, Kalasin, Thailand	Generate heat from tapioca mill waste water	12	81,502	-
8	Organic Waste Composting at Vichitbhan Plantation, Chumporn Province, Thailand	Compose organic fertilizer from empty fruit brunch of oil palm and palm oil mill waste water	20	397,500	-

No.	Project Title	Project Detail	Project lifetime (Years)	GHG reduction (ton CO2/yr)	Generated Electricity (MW)
9	V.P. Farms Pig Manure Methanisation, Methane Recovery and Energy Production Project	Generate electricity from pig farm waste water	10	38,067	2.16
10	Catalytic N2O Abatement Project in the Tail Gas of the Caprolactam production plant in Thailand	Reduce N2O emission	25	168,887	-
11	Univanich Lamthap POME Biogas Project in Krabi, Thailand	Generate electricity from palm oil mill waste water	25	47,673	0.952
12	Power Prospect 9.9 MW Rice-Husk Power Plant	Generate electricity from rice husk	21	33,788	9.9
13	Biomass thermal and electricity generation project for Thai Urethane Plastic	Generate heat and electricity from biomass	10	18,150	2
14	Siam Cement (Thung Song) Waste Heat Power Generation Project Thailand (TS5 Project)	Generate electricity from waste heat	20	25,373	7.88
15	Siam Cement (Ta Luang) Waste Heat Power Generation Project Thailand (TL5&6 Project)	Generate electricity from waste heat	20	44,138	16.65
16	Siam Cement (Kaeng Khoi) Waste Heat Power Generation Project Thailand (KK6 Project)	Generate electricity from waste heat	20	29,301	9.1

No.	Project Title	Project Detail	Project lifetime (Years)	GHG reduction (ton CO2/yr)	Generated Electricity (MW)
17	Wastewater Treatment with Biogas Technology in a Tapioca processing plant at P.V.D. International Company Limited, Thailand	Generate electricity from tapioca mill waste water	20	48,481	2.8
18	Wastewater Treatment with Biogas Technology in a Tapioca processing plant at Roi Et Flour Company Limited, Thailand	Generate heat and electricity from tapioca mill waste water	20	38,920	1.4
19	CYY Biopower wastewater treatment plant including biogas reuse for thermal oil replacement and electricity generation project, Thailand	Generate heat and electricity from tapioca mill waste water	30	99,399	1.95
20	N.E. Biotech wastewater treatment and power production project	Generate heat and electricity from tapioca mill waste water	30	50,951	0.96
21	Bangna Starch wastewater treatment and biogas utilization project	Generate electricity from tapioca mill waste water	30	51,085	2.6
22	Siam Quality Starch Wastewater Treatment and Enegy Generation Project in Chaiyaphum, Thailand	Generate heat from tapioca mill waste water	12	98,839	-
23	C.P.A.T tapioca processing wastewater biogas extraction and utilization project, Nakhonratchasima Province, Kingdom of Thailand	Generate heat from tapioca mill waste water	30	149,975	-

No.	Project Title	Project Detail	Project lifetime (Years)	GHG reduction (ton CO2/yr)	Generated Electricity (MW)
24	Eiamburapa Campany Ltd. Tapioca starch wastewater biogas extraction and utilization project, Sakaeo Province, Kingdom of Thailand	Generate heat and electricity from tapioca mill waste water	30	114,262	2.2
25	Grid-connected Electricity Generation from Biomass at Advance Bio Power	Generate electricity from Eucalyptus wood chip	25	28,096	9.5
26	Grid-connected Electricity Generation from Biomass at Bua Yai Bio Power	Generate electricity from rice husk	25	23,579	7.5
27	Green to Energy Wastewater Treatmant Project in Thailand (the project)	Generate electricity from palm oil mill waste water	15	29,876	0.978
28	Biogas from Ethanol Wastewater for Electricity Generation	Generate electricity from ethanol plant waste water	14	24,578	1.063
29	TBEC Tha Chang Biogas	Generate electricity from Palm oil extract and rubber mill	25	54,497	1.4
30	Thailand AEP Livestock Waste Management Project	Generate electricity from pig farm waste water	20	57,993	1.19
31	TPI Polene Waste Heat Recovery Power Plant Project, Thailand	Generate electricity from waste heat	20	89,517	32
32	Mungcharoen Green Power-9.9 MW Rice Husk Fired Power Plant Project	Generate electricity from rice husk	21	38,033	9.9

No.	Project Title	Project Detail	Project lifetime (Years)	GHG reduction (ton CO2/yr)	Generated Electricity (MW)
33	Wastewater Treatment with Biogas System in Palm Oil Mill at Sikao, Trang, Thailand	Generate electricity from palm oil mill waste water	20	15,431	1
34	Wastewater Treatment with Biogas System in Palm Oil Mill at Saikhueng, Surat Thani, Thailand	Generate electricity from palm oil mill waste water	20	18,739	1
35	Wastewater Treatment with Biogas System in Palm Oil Mill at Sinpun, Surat Thani, Thailand	Generate electricity from palm oil mill waste water	20	18,155	1
36	Wastewater Treatment with Biogas System in Palm Oil Mill at Bangsawan, Surat Thani, Thailand	Generate electricity from palm oil mill waste water	20	18,396	1
37	Wastewater Treatment with Biogas System in Palm Oil Mill at Kanjanadij, Surat Thani, Thailand	Generate electricity from palm oil mill waste water	20	18,359	1
38	Eiamheng Tapioca Strach Industry Co.,Ltd. Tapioca strach wastewater biogas extraction and utilization project, Nakhonratchasima Provice, Kingdom of Thailand	Generate heat and electricity from tapioca mill waste water	21	394,125	1.4
39	Bionersis Project Thailand 1	Generate electricity from land filled gas	10	71,474	2
40	Green Glory Wastewater Treatment and Electricity Generation in Suratthani, Thailand	Generate electricity from palm oil mill waste water	12	17,132	500 KW X 2 Units = 1 MW

No.	Project Title	Project Detail	Project lifetime (Years)	GHG reduction (ton CO2/yr)	Generated Electricity (MW)
41	Southern Palm Wastewater Treatment and Electricity Generation in Suratthani,Thailand	Generate electricity from palm oil mill waste water	12	18,343	500 KW X 2 Units = 1 MW
42	Biomass gasification for electricity generation in Lop Buri Province by A+Power Co.,Ltd.	Generate electricity from wood chip	30	6,240	0.9 MW X 2 Units = 1.8 MW
43	Pitak Palm Wastewer Treatment and Biogas Utilization Project	Generate electricity from palm oil mill waste water	15	12,116	1.063
44	Chok Chai Starch Wastewater Treatment and Energy Generation Project in Uthai Thani, Thailand	Generate heat and electricity from tapioca mill waste water	15	60,826	0.45
45	Avoidance of methane emission from the wastewater treatment facility in K.S. Bio-Plus Co., Ltd., Thailand	Generate electricity from tapioca mill waste water	20	59,505	0.952 MW x 3 Units = 2.856 MW
46	T.H. Pellet Wastewater Treatment and Heat and Electricity Generation in Nakhon Ratchasima, Thailand	Generate heat and electricity from tapioca mill waste water	10	49,088	0.952
47	Siam Cement (Kaeng Khoi) Waste Heat Power Generation Project (KK3-5 Project)	Generate electricity from waste heat	10	64,209	25
48	Siam Cement (Thung Song) Waste Heat Power Generation Project (TS46 Project)	Generate electricity from waste heat	10	52,252	25

No.	Project Title	Project Detail	Project lifetime (Years)	GHG reduction (ton CO2/yr)	Generated Electricity (MW)
49	Siam Cement (Ta Luang) Waste Heat Power Generation Project, Khaw Wong Plant (KW Project)	Generate electricity from waste heat	10	50,033	18
50	Siam Cement (Lampang) Waste Heat Power Generation Project (LP Project)	Generate electricity from waste heat	10	26,784	12
51	UPOIC Forced Methane Organic Waste-Water Treatment Plant for energy generation in production process	Generate electricity from palm oil mill waste water	10	35,448	1.904
52	Univanich TOPI Biogas Project	Generate electricity from palm oil mill waste water	7	41,174	2.856
53	Chantaburi Starch Wastewater Treatment and Biogas Utilization Project	Generate heat and electricity from tapioca mill waste water	15	41,034	0.950 MW x 2 Units = 1.9 MW
54	Advanced wastewater management at Rajburi Ethanol Plant	Generate electricity from ethanol production waste water	15	70,557	-
55	Thachana Palm Oil Company Wastewater Treatment Project in Thailand	Generate electricity from palm oil mill waste water	15	28,052	1.063 MW x 2 Units = 2.126 MW
56	Boiler Fuel Switching to Biomass at Kamphaeng Phet Factory, Ajinomoto Thailand	Generate heat from biomass (rice husk)	30	151,502	-
57	Biogas project, Cargill Siam Borabu	Generate electricity from tapioca mill waste water	21	58,926	1.364 MW x 2 Units = 2.728 MW

No.	Project Title	Project Detail	Project lifetime (Years)	GHG reduction (ton CO2/yr)	Generated Electricity (MW)
58	Energy efficiency improvement of Mae Moh power plant through retrofitting the turbines	Increase electricity generation efficiency by installed Low Pressure Turbine (Retrofit Type)	13	29,041	300
59	Srijaroen Palm Oil Wastewater Treatment Project in Krabi Province, Thailand	Generate electricity from palm oil mill waste water	15	21,525	1.063
60	Chaiyaphum Strach Plant Wastewater Treatment and Energy Generation Project in Thailand	Generate heat and electricity from tapioca mill waste water	15	57,177	1
61	Sangpetch Tapioca Flour Wastewater Treatment and Energy Generation Project in Thailand	Generate heat and electricity from tapioca mill waste water	15	55,718	1
62	Methane recovery and utilisation project at S. S. Karnsura Co., Ltd., Ubon Ratchathani, Thailand	Generate heat from spirit waste water	20	54,112	-
63	Methane recovery and utilisation project at Athimart Co., Ltd., Buri Ram, Thailand	Generate heat from spirit waste water	20	43,363	-
64	Saraff Biogas Wastewater Treatment and Biogas Utilisation Project	Generate electricity from squeezed EFB wasted water of palm oil mill	25	25,075	1.364
65	Saraff Energy EFB to electricity project	Generate electricity from EFB	25	46,615	9.5

No.	Project Title	Project Detail	Project lifetime (Years)	GHG reduction (ton CO2/yr)	Generated Electricity (MW)
66	Lam Soon Forced Methane Extraction from Organic Waste-Water Treatment Plant for energy generation in production process	Generate electricity from palm oil mill waste water	20	21,667	0.952
67	Jaroensompong Corporation Panomsarakham Landfill Gas to Energy Project	Generate electricity from land-filled Gas	10	93,320	1.02 MW X 2 Units = 2.04 MW
68	New installation of an environmental friendly can production line at Bangkok Can Manufacturing Co.Ltd.,Thailand	Increase energy efficiency in can production line (TULC)	25	834	-
69	Decha Bio Green Rice Husk Power Generation 7.5 MW	Generate electricity from rice husk	21	29,620	7.5
70	Chiang Mai Landfill Gas to Electricity Project	Generate electricity from municipal waste	21	81,366	1.26 MW x 3 Units = 3.78 MW
71	Kamphaeng Saen East: Landfill Gas to Electricity Project	Generate electricity from municipal waste	21	280,871	1.063 MW x 9 Units = 9.567 MW
72	Bangkok Kamphaeng Saen West: Landfill Gas to Electricity Project	Generate electricity from municipal waste	21	273,424	1.063 MW x 9 Units = 9.567 MW

118

BIOGRAPHY

Name: Mr. Napas Charnyapornpong

Date of Birth: July 15, 1985

Nationality: Thai

University Education: 2002-2005 Bachelor Degree of Science in Chemistry, Faculty of Science, Chulalongkorn University, Bangkok, Thailand

Presentation:

- Napas Charnyapornpong, and Chantathip Pharino. *The Role of Designated National Authority in Driving Clean Development Mechanism (CDM) in Thailand*. The 2nd Thammasat University International Conference on Chemical, Environmental and Energy Engineering (TUChEEE), Bangkok, Thailand, March 3-4, 2009, Co-organized by Department of Chemical Engineering, Thammasat University, and Tokyo Institute of Technology, Japan.

- Napas Charnyapornpong, and Chantathip Pharino. *Factors Impacting Progresses of CDM Projects in Thailand: Stakeholders' Perspectives*. World Renewable Energy Congress 2009 – Asia (WREC 2009 – Asia) The 3rd International Conference on Sustainable Energy & Environment (SEE 2009), Bangkok, Thailand, 19-22 May, 2009, Co-organized by The Joint Graduate School of Energy and Environment (JGSEE), King Mongkut's University of Technology Thonburi (KMUTT), and United Business Media (UBM).