การวิเคราะห์ประโยชน์ทางด้านการพัฒนาอย่างยั่งยืนของโครงการภายใต้กลไกการพัฒนาที่สะอาดในประเทศไทย

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วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาศิลปศาสตรมหาบัณฑิต
สาขาวิชาการพัฒนาระหว่างประเทศ
คณะรัฐศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย
ปีการศึกษา 2009

DOES IT DELIVER? AN ANALYSIS OF THE SUSTAINABLE DEVELOPMENT BENEFITS FROM CLEAN DEVELOPMENT MECHANISM (CDM) PROJECTS IN THAILAND

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A Thesis Submitted in Partial Fulfillment of the Requirements
for the Degree of Master of Arts Program in International Development Studies
Faculty of Political Science
Chulalongkorn University
Academic Year 2009

Thesis title:	DOES IT DELIVER? AN ANALYSIS OF THE SUSTAINABLE DEVELOPMENT BENEFITS FROM CLEAN DEVELOPMENT MECHANISM (CDM) PROJECTS IN THAILAND
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นาโอมิ จิน ชวิคเคอร์: การวิเคราะห์ประโยชน์ทางด้านการพัฒนาอย่างยั่งยืนของโครงการภายใต้กลไกการพัฒนาที่สะอาดในประเทศไทย (DOES IT DELIVER? AN ANALYSIS OF THE SUSTAINABLE DEVELOPMENT BENEFITS FROM CLEAN DEVELOPMENT MECHANISM (CDM) PROJECTS IN THAILAND) อ. ที่ปรึกษาวิทยานิพนธ์หลัก : ดร. โสภิตสุดา ทองโสภิต, อ. ที่ปรึกษาวิทยานิพนธ์ร่วม : รศ.ดร. พิษณุ เสงี่ยมพงษ์, 80 หน้า.

ในช่วงระยะเวลา 10 ปีที่ผ่านมา นานาประเทศได้มีความพยายามที่จะแก้ไขปัญหาที่เกิดจากการเปลี่ยนแปลงของสภาพภูมิอากาศ ซึ่งนำมาสู่ข้อตกลงระหว่างประเทศในการลดการปล่อยก๊าซคาร์บอนไดออกไซด์และก๊าซเรือนกระจกอื่นๆ ภายใต้พันธสัญญาที่เรียกว่า พิธีสารเกียวโต

ภายใต้พิธีสารเกียวโต ประเทศที่พัฒนาแล้วได้มีข้อตกลงร่วมกันในการลดการปล่อยก๊าซเรือนกระจกภายในปี 2555 ให้ได้ร้อยละ 5 เมื่อเทียบกับระดับการปล่อยก๊าซเรือนกระจกในปี 2533 พิธีสารเกียวโตได้กำหนดกลไกยืดหยุ่นขึ้นมา 3 กลไก รวมถึงกลไกการพัฒนาที่สะอาด (CDM) ซึ่งอนุญาตให้กลุ่มประเทศที่พัฒนาแล้ว (Annex I) ดำเนินการโครงการเพื่อให้เกิดการลดการปล่อยก๊าซเรือนกระจกในประเทศที่กำลังพัฒนา โดยมีวัตถุประสงค์คือ ประเทศที่พัฒนาแล้วสามารถซื้อคาร์บอนเครดิตในราคาที่ต่ำที่สุด อีกทั้งยังมีส่วนช่วยสนับสนุนการพัฒนาอย่างยั่งยืนในประเทศที่กำลังพัฒนา

อย่างไรก็ตาม ผลการดำเนินงานของกลไกการพัฒนาที่สะอาดอาจไม่ได้สอดคล้องกับเป้าประสงค์ที่ได้รับการกล่าวอ้าง ได้มีผู้ตั้งคำถามเกี่ยวกับผลการลดการปล่อยก๊าซเรือนกระจกเกิดขึ้นจริง และผลประโยชน์ที่เกิดขึ้นจริงจากการพัฒนาอย่างยั่งยืน ทั้งนี้ประเทศที่กำลังพัฒนาแต่ละประเทศได้ตั้งเกณฑ์การอนุมัติโครงการของตนเอง เพื่อให้สอดคล้องกับความต้องการในการพัฒนาของประเทศ สำหรับประเทศไทยมีเกณฑ์การอนุมัติที่เข้มงวดกว่าประเทศอื่นๆ ซึ่งวิทยานิพนธ์ฉบับนี้ ได้ทำการวิเคราะห์ว่าเกณฑ์การอนุมัติที่เข้มงวดดังกล่าวได้เพิ่มพูนประโยชน์ทางด้านการพัฒนาจากโครงการกลไกการพัฒนาที่สะอาดในประเทศไทยหรือไม่

จากการวิเคราะห์ข้อมูลในเอกสารประกอบโครงการ (PDD) และการสอบถามความคิดเห็นจากผู้พัฒนาโครงการภาคเอกชน ผู้เข้าร่วมฟังความคิดเห็นของโครงการในท้องถิ่น และหน่วยงานภาครัฐ พบว่า โครงการภายใต้กลไกพัฒนาที่สะอาดของประเทศไทย ได้ก่อให้เกิดผลประโยชน์ทางด้านการพัฒนาที่ยั่งยืนสู่ท้องถิ่นในระดับหนึ่ง แต่ประโยชน์ที่ได้รับจะมากหรือน้อย ขึ้นอยู่กับปัจจัยต่าง ๆ หลายปัจจัย ได้แก่ ขนาดของโครงการ การดำเนินงานทางการตลาด และข้อจำกัดทางด้านนโยบาย

สาขาวิชา การพัฒนาระหว่างประเทศ ลายมือชื่อนิสิต.....

ปีการศึกษา 2009 ลายมือชื่อ อ.ที่ปรึกษา...Sopitsuda Tongsopit.....

ลายมือชื่อ อ.ที่ปรึกษาวิทยานิพนธ์ร่วม.....

5181009524 MAJOR: INTERNATIONAL DEVELOPMENT STUDIES
KEYWORDS: Clean Development Mechanism/ sustainable development/ renewable energy/ Thailand/ Kyoto Protocol

NAOMI SWICKARD: DOES IT DELIVER? AN ANALYSIS OF THE SUSTAINABLE DEVELOPMENT BENEFITS FROM CLEAN DEVELOPMENT MECHANISM (CDM) PROJECTS IN THAILAND. [SOPITSUDA TONGSOPIT, PH.D.], 80 pp.

Over the last decade a growing consensus has emerged to address climate change, and international agreements on the regulation of emissions of carbon dioxide and other greenhouse gasses (GHGs), namely the Kyoto Protocol, have come into full effect. Under the Kyoto protocol, developed countries agreed to reduce emissions of GHGs by an average of 5% of 1990 levels by 2012. Three mechanisms were set up, including the Clean Development Mechanism (CDM), which allows Annex 1 (developed) countries to source a percentage of their emission reductions within developing countries. The goals of this were to allow countries to purchase emission reductions at the lowest possible cost while contributing to sustainable development in the host country.

However, the CDM has come under fire for not living up to its claims. Both the emission reduction claims and sustainable development benefits have been questioned. Each developing country under the CDM sets its own requirements for fulfilling sustainable development requirements that are inline with its development priorities. Thailand has relatively more strict requirements than many other countries, and this study analyzes whether these requirements have contributed to greater development benefits from CDM projects in Thailand.

Through analysis of project design documents (PDDs) and interviews with private sector project developers, local stakeholders, and public sector actors, results show that while projects have contributed somewhat to local sustainable development, these benefits are constrained by a number of factors, including their small-scale, market effects, and by policy challenges.

Field of study: International Development Studies
Academic year: 2009

Student's signature: _____

Advisor's signature: Sopitsuda Tongsopit

Co-Advisor's signature: _____

ACKNOWLEDGEMENTS

First and foremost, I would like to thank my thesis supervisor, Dr. Sopitsuda Tongsopit for her excellent advice, encouragement, and contacts. She repeatedly offered helpful suggestions that were essential to the completion of this thesis. In addition, I'd like to thank my co-supervisor and committee members, Dr. Pisanu Sangiampongsa, Asst. Prof. Soravis Jayanama, and Dr. Saranarat Kanjanavanit for their helpful advice, comments, critiques, and networking. I couldn't have done it without you all.

I would also like to express my gratitude for all of my interviewees at DEDE, TGO, Energy for Environment Foundation, INDIES, AT Biopower, CYY Biopower, and local stakeholders. Your input was essential to the findings of this thesis. Thank you for generously giving your time.

Special thanks goes out to everyone at South Pole, especially Pat, Nook, and Oh for helping with contacts, site visits, and expertise.

To all the MAIDS staff, thank you for your endless assistance and coordination. You have all been very helpful. To the MAIDS class of 2008-2009, best of luck to you all, it's been a great year.

To Kelly, thanks for putting up with the madness, offering encouragement, and telling me when to take a Buffy break.

And finally, last, but not least, thank you to Omar and Sookie for your constant presence, entertainment, moral support, and distraction. It might have been more efficient without you, but it would have been much less enjoyable.

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ABBREVIATIONS

CDM	Clean Development Mechanism
DEDE	Department of Alternative Energy Development and Efficiency
DNA	Designated National Authority
EFE	Energy for Environment Foundation
EIA	Environmental Impact Assessment
ET	Emissions Trading
GHG	Greenhouse Gas
INDIES	Institute for National and Democratic Studies
JI	Joint Implementation
LOA	Letter of Approval
MATA CDM	Multi Attributive Assessment of CDM
MAUT	Multi Attributive Utility Theory
MONRE	Ministry of Natural Resources and the Environment
ONEP	Office of Natural Resources and Environmental Policy and Planning
PDD	Project Design Document
PPCC	People's Protocol on Climate Change
SD	Sustainable Development
TGO	Thailand Greenhouse gas Management Organization
UNDP	United Nations Development Program
UNFCCC	United Nations Framework Convention on Climate Change
WWF	World Wildlife Foundation

CHAPTER I

INTRODUCTION

1.1 Background to the Question

Climate change has been a growing issue around the world in the last two decades, prodding governments, aid agencies, scientists, and multilateral institutions to action. Because those most at risk are often those in developing countries, where governments and citizens are least prepared, climate change has become not only an environmental issue, but a truly intergenerational issue of sustainable development. Over the last decade a growing consensus has emerged to address climate change, and international agreements on the regulation of emissions of carbon dioxide and other greenhouse gasses (GHGs), namely the Kyoto Protocol, have come into full effect.

The scientific basis and potential impacts of climate change have now been widely addressed by numerous studies. While uncertainty remains a major debate in measuring and predicting future impacts, there is now consensus on the fact that action must be taken to prevent “dangerous climate change” (UNDP, 2008). Climate change has changed the ballgame; what were once seen as separate issues of environmental sustainability, social equity, and development have become intertwined and inseparable in the space of global climate change; an issue that spans time, place, and responsibility.

Under the Kyoto protocol, developed countries agreed to reduce emissions of GHGs by an average of 5% of 1990 levels by 2012 (UNFCCC, 2006a). Three market mechanisms were set up, including Emissions Trading (ET), Joint Implementation (JI), and the Clean Development Mechanism (CDM). The ET and JI allow Annex 1 (developed) countries to reduce emissions by trading within and between Annex 1 countries, respectively. The CDM was set up to allow Annex 1 countries to source a percentage of their emission reductions within developing countries. The goals of this were to allow countries to purchase emission reductions at the lowest possible cost while contributing to sustainable development in the host country (UNFCCC, 2006b).

However, the CDM has come under fire for not living up to its claims. Both the emission reduction claims and sustainable development benefits have been questioned. A number of studies has analyzed the development benefits of a wide number of projects and found they do not contribute significantly to development aims (K. Olsen, 2007; K. H. Olsen & Fenhann, 2008; Sutter, 2003; Sutter & Parreño, 2007). Each developing country under the CDM sets its own requirements for fulfilling sustainable development requirements that are inline with its development priorities. Thailand has relatively more strict requirements than many other countries, and yet no study has yet been conducted that analyzes whether Thailand's requirements have led to higher sustainable development benefits than those of other countries. This study will analyze the CDM portfolio in Thailand to assess the extent of these benefits in the national context, and in comparison with the overall CDM.

1.2 Objectives

The objectives of the research are to:

1) Evaluate the current Thai CDM portfolio in order to assess how projects have or have not contributed to sustainable development,
2) Assess the strengths and weaknesses of the current sustainable development criteria for CDM projects in Thailand, and to
3) Assess the policy factors that have contributed or detracted from CDM projects' contribution to sustainable development in Thailand.

1.2.1 Research Questions

The questions this thesis will attempt to answer are;

1) How and to what extent have CDM projects in Thailand contributed to sustainable development?
2) What are the strengths and weaknesses of Thailand's sustainable development criteria for CDM projects?
3) How does the policy and overall energy development situation in Thailand effect CDM projects' contribution to sustainable development?

1.3 Hypothesis

A number of studies have assessed CDM projects in other countries around the globe. Although Thailand's requirements are somewhat stricter, it is not expected that this has had a great impact on sustainable development benefits. In addition, the policy environment in which the CDM operates in Thailand offers unique challenges to achieving real emissions reductions and development benefits. It is expected that there are a number of conflicting targets within and between the numerous agencies responsible for climate change, development, and energy policy which make it challenging to achieve the goals of the CDM within the national context.

1.4 Scope of Study

This thesis will focus on the entire registered pipeline of CDM projects in Thailand. An analysis based on the text of the PDDs will be done for all projects. Results will be qualitatively compared to the various studies which have analyzed individual projects and the global CDM pipeline. Results will also be qualitatively compared to the overall literature on the contribution of the CDM to sustainable development in other countries. While results will not be strictly comparable due to the various methodologies applied, this comparison will provide context.

In addition, the this thesis will draw out from the literature and interviews the surrounding policy context in which the CDM operates in Thailand to attempt to identify the challenges and opportunities the CDM has to contribute to sustainable development within the national context.

1.5 Purpose of Study

An analysis of the Thai CDM portfolio will contribute knowledge to the global debate over sustainable development benefits of CDM projects. As of yet, no study has analyzed the CDM pipeline in Thailand as a whole, and this study will therefore contribute to knowledge of the mechanism within Thailand and SE Asia. In addition, it could provide a baseline for the Thai government for any future analysis, especially for comparison with the post-2012 agreement. It could also contribute to a revision of the sustainable development requirements to improve benefits for local communities.

1.6 Basic Concepts

Basic concepts such as sustainable development, the Kyoto Protocol and the Clean Development Mechanism are covered in Chapter 2, Literature Review.

1.7 Keywords

Clean Development Mechanism, sustainable development, renewable energy, Thailand, Kyoto Protocol

CHAPTER II

LITERATURE REVIEW

2.1 Sustainable development and climate change

The most commonly referenced definition of sustainable development came from a report by the World Conference on Environment and Development in 1987. Referred to as the "Brundtland Report", this highly influential document produced the following often quoted statement that sustainable development is "Development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (Elliott, 2006, p. 7). The report was in large part an admission by establishment politicians and diplomats that there is a vital linkage between a healthy environment and a healthy economy, which at the time was a miraculously innovative agreement to reach (Elliott, 2006, p. 33). In general, the concept of sustainable development is presented as resting upon 3 foundational concerns: ecological, economic, and social. While sustainable development is an inherently attractive concept, and one that it is easy to build a general consensus around, there are basic inconsistencies within the theory that make it problematic in practice; sustainable development is often seen as a "motherhood and god" concept- hard to criticize, yet difficult to define.

The elusive definition of sustainable development in practice has often come down to the use of indicators to measure progress and operationalize the concept. Robert Kates, in a paper assessing sustainable development indicators and values, notes that indicators have become the main method of assessing development, with a wide variety of indicators developed for the global, national, local or project scale (Kates, 2005, p. 13).

There are a number of ways that climate change and sustainable development interact. First, the world must maintain "safe" levels of atmospheric greenhouse

gasses to ensure a viable planet for future generations. Second, climate change has the potential to impact the world in unequal ways; those who are most at risk from climate change are generally those who are least responsible for the emissions that have caused it (UNDP, 2008). On the other hand, it is essential that the world continue to develop, and that developing countries have the same opportunity to do so as the rich world has. At the same time, this development, should it follow the same trajectory of emissions, would contribute to much greater climate change (UNDP, 2008). Therefore it is also essential to find cleaner and more sustainable ways for development to progress.

2.2 Contribution of CDM projects to Sustainable Development

As stated in Chapter 1, sustainable development, when operationalized, is often measured by a series of indicators. In order to asses the sustainable development benefits of CDM projects in Thailand, it necessary to categorize benefits as social, environmental, or economic, in line with the three pillars of sustainable development outlined in the Brundtland Report. Sustainable development benefits from CDM projects vary widely, but in general fall into these three categories. Potential benefits include, for example:

Table 2.2 Potential benefits from CDM projects

Social	**Environmental**	**Economic**
Stakeholder participation	Air quality	Technology transfer
Capacity building	Water quality	Balance of payments and investment
Improved service availability	Land resources	Employment generation

(Nussbaumer, 2009; K. Olsen, 2007)

Since the CDM became operational, the sustainable development benefits from GHG emission reduction projects have been called into question. Christoph Sutter (2003) designed a method to evaluate the sustainable development benefits of

projects called MATA-CDM, based on Multi-Attributive Utility Assessment (MAUT) theory which allows indicators to be individually valued and then aggregated into a single score (Sutter, 2003). A study in 2007 by Sutter and Parreño evaluated sixteen registered CDM projects to asses their sustainable development benefits using the MATA-CDM and found that while 72% delivered on their GHG emission reduction claim, only 1% or less would actually contribute significantly to sustainable development (Sutter & Parreño, 2007).

The CDM requires that projects document development benefits in the Project Design Document (PDD), but the actual requirements are left to the host country to decide and there are no internationally recognized sustainable development standards (Sutter, 2003; Sutter & Parreño, 2007). This was a compromise reached during negotiation because developing countries did not want the CDM to infringe on their sovereignty in defining their own development goals (K. Olsen, 2007; Sutter & Parreño, 2007). In the end this may lead to what has been called "a race to the bottom" as countries compete to attract investment and undercut the development requirements in order to do so (Sutter, 2003; Sutter & Parreño, 2007).

Sutter and Parrreño's study (2007), among others, has lead to the question of whether the CDM can achieve both goals of emission reductions and sustainable development. A number of issues have been identified as barriers to the CDM delivering on its development claim. Most importantly, the CDM places a value on emission reductions, but not on development benefits- leading to a market preference for projects with high emission reductions (ERs) while development benefits take a back seat (Sutter, 2003; Sutter & Parreño, 2007). Second, the lack of international standards to define development means that stakeholders all define development differently, with the most powerful stakeholders setting the standards (K. Olsen, 2007).

2.3 Methods for assessing Sustainability

Each country must define its own sustainable development criteria, and these have primarily ranged from checklists to evaluate development benefits to multi-

criteria assessments like those developed by Sutter (2003), which is used by Uruguay and will be discussed in greater detail below (K. H. Olsen & Fenhann, 2008). A wide variety of methods to assess sustainable development benefits from CDM projects have been developed. Olhoff (2004) and Sutter (2003) identify four major methods which have been used both in academic studies as well as by host country Designated National Authorities (DNAs) which manage national CDM approval:

- **Guidelines,** usually developed by the DNA, which are defined generally and outline requirements in a normative way. This method does not outline specific procedures for ensuring development benefits and usually leaves outcomes to the discretion of project developers. It does not provide a method for quantitatively assessing benefits.
- **Checklists**, which are the most common method used by DNAs, predefine questions and closed answers which assess whether or not a project meets the basic requirements for contributing to sustainable development. This method is easily applied, transparent, and usually accurate, but does not allow much flexibility and does not quantify benefits in any manner.
- **Negotiated Targets** consist of negotiations with local stakeholders to implement specific projects after the implementation of the CDM project. This method does not assess the overall impact of the project, and leaves open the possibility that an unsustainable project could be approved by eliciting approval from stakeholders based on a single additional target/ project. This method does not provide a way to assess the project prior to, during, or after implementation, nor does it quantify benefits.
- **Multi-Criteria Assessments** outline a number of indicators or criteria for evaluating sustainable development, which are assigned values and can be aggregated into a single score. There is generally a minimum score required for approval. This method is flexible, quantifiable, and can weight criteria as more or less important, but is also very time consuming and requires extensive involvement of stakeholders.

(Olhoff, 2004; Sutter, 2003)

The most well-known multi-criteria methods are based on the MATA-CDM created by Sutter (2003) as the most thorough method for evaluating, quantifying, and weighting sustainable development benefits. The Multi-Attributive Assessment of CDM (MATA-CDM), based on Multi Attributive Utility Theory (MAUT), outlines a method for scoring the various aspects of sustainable development and aggregating scores in order to compare projects. The method is extremely thorough, but has been criticized for requiring too much of stakeholders in the evaluation process, and for allowing aggregate scores to gloss over any negative scores (Nussbaumer, 2009). It also does not provide a method for comparing projects to one another, as weights for indicators are negotiated amongst stakeholders and only a small number of indicators are chosen (K. H. Olsen & Fenhann, 2008).

Several labeling standards seek to address the weaknesses of the CDM and provide an add-on to the methodology that highlights development benefits and require a minimum performance. The Gold Standard was developed by the World Wildlife Foundation (WWF) and is one of the most widely known and applied standards. Nussbaumer (2009) has used an adapted version of the MATA-CDM which does not aggregate scores, but rather draws out both negative and positive aspects to compare projects qualitatively (Nussbaumer, 2009). Nussbaumer used a list of indicators within a set of three categories; social, environmental, and economic to compare Gold Standard and standard CDM projects to assess the contribution of labeling standards like the Gold Standard. The Gold Standard requires an Environmental Impact Assessment (EIA) if not already required by the host country, stakeholder participation, and assess social, economic, and environmental indicators on a scale of -2 to +2, requiring an overall positive score (Nussbaumer, 2009).

Another method of assessing development benefits was developed by Olsen and Fenhann (2008) based on text analysis of Project Design Documents (PDDs) which are publicly available for every project developed under the CDM as a part of the UNFCCC requirements for registration. The PDD is the main document that describes the project, the technology used, and how emissions will be monitored. It also includes information on environmental impacts, the stakeholder consultation, and

sustainable development benefits as identified by project participants (K. H. Olsen & Fenhann, 2008). While this method is limited to information that is provided in the PDD, it allows a wide comparison across countries and project types and is very transparent. The authors suggest that this *taxonomy* of sustainable development could be used to evaluate all projects in the CDM pipeline to provide an internationally recognized standard of assessment. While it is important for countries to continue to define their own requirements for sustainable development, this method allows a clear comparison across countries to evaluate benefits.

2.4 Alternative studies

Counter to these arguments, there exists another school of thought that suggests that climate change should be approached from a sustainable development perspective rather than attempting to include sustainable development in climate change policy. In addition, there are many critiques from civil society groups, especially, that claim the CDM has not allowed adequate participation, transparency or accountability. Others believe that the CDM, as a market mechanism, can not sufficiently meet climate change mitigation goals or sustainable development.

2.4.1 Climate change mitigation and adaptation via development

One of the primary alternative proposals is that of integrating climate change policy into development. This, however, is not necessarily counter to the CDM, as CDM policy should align with national energy and sustainable development policy and likewise climate change should be addressed in national sustainable development policy. However, due to the challenges outlined by Sutter (2003) and others that the CDM's two goals of emissions reductions and sustainable development can not necessarily be achieved at the same time, it is worth addressing the approach of climate change mitigation via development in more detail, though this lies outside the main scope of this thesis.

There are a number of studies that use this approach, including Winkler et al (2002) and Robinson et al (2006) who argue that emissions reductions scenarios

should be planned dynamically with low-emission sustainable development scenarios (Robinson, et al., 2006; Winkler, 2002). In their views, since the greatest potential growth in emissions in the future are likely to come from the further development of economies in the developing world, if this development is planned in a low-carbon way, such as promoting energy efficiency, renewable energy, and 'green cities' models as countries develop, it can achieve both economic and social development as well as emissions reductions (Robinson, et al., 2006; Winkler, 2002). This requires a much greater coordination of efforts between actors responsible for development planning and those working on climate change, energy policy, and environmental other issues. Robinson et al (2006) focus on this type of policy development in Canada, where capacity and coordination among government agencies is high. Winkler (2002), agues that development should be the priority, and advocates the sustainable development policies and measures (SD-PAM) approach. In this model poverty reduction, transport, education, health, etc., are prioritized, and more sustainable options are phased in over time, leading to a lowering emissions curve as low-carbon technologies are phased in (Winkler, 2002).

Dyer et al. (2006), advocate a strategic development-focused approach to the CDM, where the end goal is envisioned and then "back-casting" used to plan the route to the end goal. Ideally, this scenario encourages development in a way similar to the SD-PAM approach, while utilizing CDM projects to encourage investment in renewable energy and other emissions-reducing projects (Dyer, 2006).

These authors put forward alternative approaches, all of which could be used by national governments to plan both sustainable development and climate change mitigation in a way that could also utilize CDM projects, or other climate-oriented funding. The details of these proposals, however, remain outside the scope of this thesis.

2.4.2 Transparency, Public Engagement and Accountability and the People's Protocol on Climate Change

One of the main charges against the Kyoto Protocol and CDM by members of civil society is that it has not allowed sufficient levels of public engagement, nor accountability. They would ague that the CDM, as a market mechanism can not achieve its goals, and does not adequately represent people from the developing world, nor allow sufficient participation. In response to this, a group over 170 participants from across Asia gathered for the Asia Pacific Research Network's conference on natural resources (held in Bangkok) and developed the People's Protocol on Climate Change (PPCC) (IBON, 2008).

The People's Protocol on Climate Change (PPCC) argues that there must be a shift away from economic growth-led development, which has contributed to the growth in emissions, as well as exploited the resources of the South, towards people-centered development that recognizes their sovereignty over natural resources and development priorities (IBON, 2008).

2.4.3 Post-2012 and sectoral CDM options

The negotiations for the post-2012 period, potentially Kyoto II, are underway with a final agreement slated for December 2009. Most actors expect that the CDM will be renewed, albeit in a somewhat altered form, as the CDM has been successful at offering flexibility and cost-effective emission reductions. There a wide variety of options for revision and one of the main goals of a revised CDM is to improve the sustainable development benefits promoted by the mechanism. Among the many options, one which has recently dominated the discussion is that of sectoral CDM. While this remains outside the main scope of this thesis, a sectoral approach is widely argued as a solution to the challenges of promoting sustainable development in the mechanism, and is thus quite relevant. The sectoral approach is presented, in brief, below.

There are several ways that a sectoral approach might work, but the most dominant argument now is for a national baseline or benchmark. In the most simple approach, sectoral crediting would set a baseline emission factor for a national

industry, for example cement production, and any project which reduces emissions below the baseline would receive credits for the difference (Baron, 2009; Bosi, 2005; Samaniego, 2002) There is disagreement over whether baselines should be set globally or across sectors multilaterally (as Japan argues) or domestically, and many challenges remain for setting this baseline (Baron, 2009; Sawa, 2008). However, the sectoral approach may have several advantages.

A study for the OECD by Bosi and Ellis (2005) argues that a sectoral approach is based on the following rationale:

- As developing countries move towards national targets for emission reductions, the sectoral approach may offer a more simplified way to target particular industries, allowing capacity building, and a more straightforward approach, rather than trying to tackle emission reductions from the whole economy at once. This would also allow targeting high-emission industries rather than consumers, which may have an impact on welfare.
- A sectoral approach may help industries remain competitive, as high investment is often required pushing up costs for some heavy polluting industries, targeting individual firms could affect competitiveness. This is true at the global level, as well, and is the main rationale behind Japan's argument for global baselines- which would help prevent competitiveness issues between countries who have, and do not have, sectoral targets for a particular industry (Sawa, 2008).
- In many countries, industries are dominated by large multinationals that may have higher capacity to reduce emissions, and could then promote technology transfer within the industry or country.

(Bosi, 2005)

As opposed to a project-based approach, sectoral CDM may be easier to align with national sustainable development aims. This is because while the project-based approach promotes individual projects that may have co-benefits, the sectoral approach targets an entire industry, promoting sector-wide changes that could lead to an alternative development path with lower emissions (Samaniego, 2002). For

example, one of the main arguments by developing countries is that they need to balance the need for growth and development with that of concerns over climate change and emission reductions. This is the main reason developing countries do not yet have national emission reduction targets. A sectoral approach would help devise a way of developing an entire industry that is more environmentally friendly, such as more efficient cement production, or more efficient use of agricultural waste products, while also promoting investment and technology transfer in the industry. Sectoral CDM would also allow the kind of planning advocated by Winkler (2002) and Dyer (2006), as noted in section 3.4.1. This may mean that sectoral crediting would be more aligned with national sustainable development goals, though in practice it is yet to be seen how competing interests in national development planning and the industrial sectors targeted for emissions reductions would be unified.

There are a number of major challenges to a sectoral approach, however. Two of the many issues, as outlined by Bossi and Ellis (2005) and Baron (2009) that relate to sustainable development are as follows:

- Baseline and data issues: in order to set a national (or global) baseline, a huge amount of data would be required. The method and stringency of the baseline would also affect both the potential emission reductions, as well as competitiveness of the industry. It is therefore imperative that adequate data can be obtained to set a realistic and credible baseline, or 'business as usual' scenario. This is particularly challenging in developing countries where not only data, but monitoring devises to record data, may not be available and inputs, like oil prices, exchange rates, or GDP growth may be erratic or unpredictable.
- Transitioning to sector-based crediting: The transition from project to sector-based crediting will be time-consuming, data- heavy, and require significant financial and political commitments, which will be particularly challenging for developing countries. The transition period will likely be lengthy. Since only a few countries will likely have the capacity to transition early on, this may exacerbate claims that the CDM has

> discriminated against least developed countries (LDCs) by concentrating investment in a few high-capacity nations.
>
> (Baron, 2009; Bosi, 2005)

Discussions are still underway for the post-2012 period, and the decision has not yet been made for sectoral crediting, though recent discussions have trended in their direction. A full discussion of this topic is outside the scope of this thesis, however, the decision be particularly relevant for the ability of the CDM (or whatever system replaces it) to contribute to sustainable development in the host country. This makes this study particularly relevant, as lessons learned in the current period will ideally be implemented to ensure that sustainable development remains a key goal of the CDM.

CHAPTER III

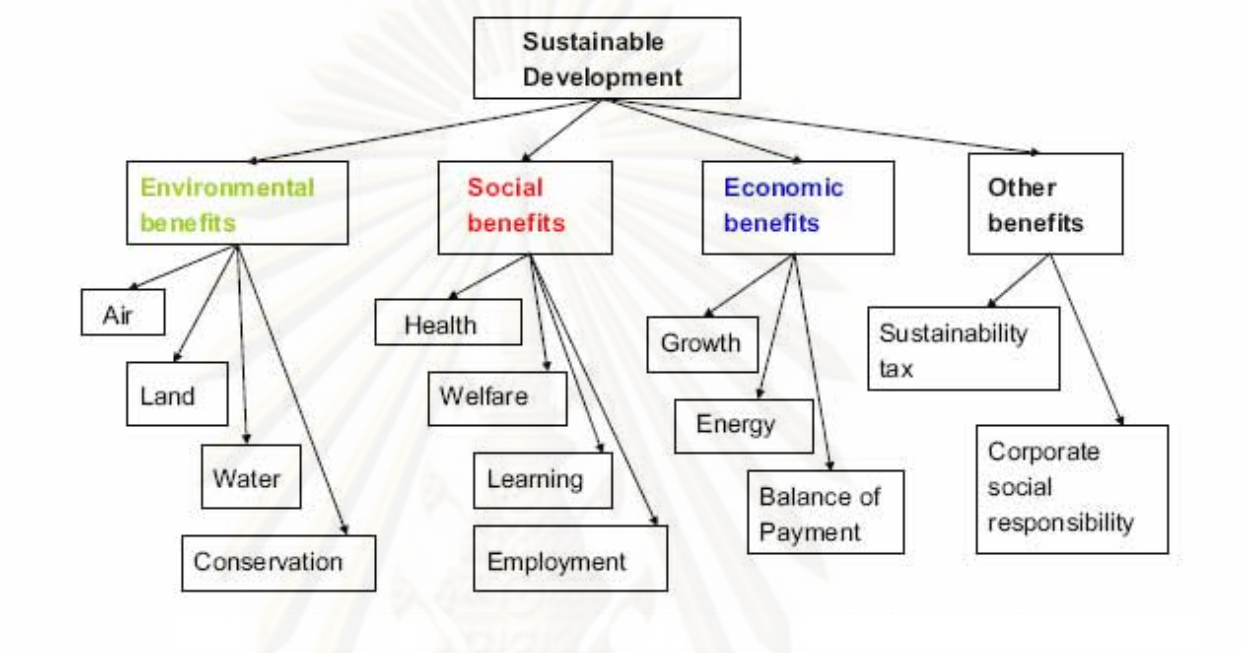
RESEARCH METHODS

3.1 Research Methods

This study uses a combination of methods. First, a thorough literature review, including published work, white and grey literature, and news reports, has been conducted of how sustainable development is measured within the Clean Development Mechanism, the requirements for sustainable development and the policy context for the CDM within Thailand. The aim of this literature review is to assess the evolution of means for assessing sustainable development of CDM projects, as well as how sustainable development might be better achieved within the context of climate change. In addition it aims to give a broad overview of the context within which the CDM operates in Thailand in order to highlight challenges and opportunities for maximizing development benefits from the CDM.

Second, a literature review of the entire pipeline of registered CDM projects in Thailand (currently 17 projects) has been conducted and qualitatively analyzed to assess the sustainable development benefits listed in the Project Design Document (PDD) for each project to outline the benefits that are expected. While this method looks at PDDs, meaning benefits are potential benefits, not measurable outcomes; it allows an assessment of transparently available documents that are easily comparable to other countries and project types. The text of each PDD has been assessed and benefits categorized according to an adapted version of the framework outlined by Olsen and Fenhann (2008), shown in Figure 3.1:

Figure 3.1 Conceptual Framework of Sustainable Development Benefits of CDM Projects



(Olsen & Fenhann, 2008)

Benefits listed in the PDD text were tracked in an Excel file, categorized, and counted to assess whether different project types deliver a wider variety of or a greater number of benefits. This has been done by recording the text reference for each type of benefit in an excel file (see Annex 1 for the full table of results). The following table shows the benefit categories and an example of the type of benefits which fall within the category, as well as the changes made to the framework:

Table 3.1 Potential Development Benefits by Category

Environmental	**Air**	Improving air quality by reducing air pollutants, suspended particulate matter, non-methane volatile organic compounds, dust, or fly ash
	Land	Avoid soil pollution including avoided waste disposal and improvement of the soil through the production and use of e.g. compost, manure, nutrient and other fertilizers

	Water	Improved water quality through e.g. wastewater management, water savings, safe and reliable water distribution, purification/ sterilization and cleaning of water
	Conservation	Protection and management of resources (such as minerals, plants, animals and biodiversity but excluding waste) and landscapes (such as forests and river basins)
Social	**Health**	Reduction of health risks such as diseases and accidents or improvement of health conditions through activities such as construction of a hospital, running a health care centre, preservation of food, reducing health damaging air pollutants and indoor smoke
	Welfare	Improvement of local living and working conditions including safety, community or rural upliftment, reduced traffic congestion, poverty alleviation and income redistribution through e.g. increased municipal tax revenues, or reduced odour emissions.
	Participation*	Mechanisms to increase public participation above and beyond those required by the CDM, including additional surveys, committees, or venues for redress.
	Learning	Facilitation of education, dissemination of information, research and increased awareness related to e.g. waste management, renewable energy resources and climate change through construction of a school, running of educational programmes, site visits and tours, and capacity building programs.
	Employment	Creation of new jobs and employment opportunities including income generation
Economic	**Growth**	Support for economic development and stability through initiation of e.g. new industrial activities, investments, establishment and maintenance of infrastructure, enhancing productivity, reduction of costs, setting an example for other industries and creation of business opportunities.

	Energy	Improved access, availability and quality of electricity and heating services such as coverage and reliability.
	Balance of Payments	Reduction in the use of foreign exchange through a reduction of imported fossil fuels in order to increase national economic independence, where adequate justification is given.
Other	**SD tax**	Collection of a sustainability tax for support of sustainable development activities
	CSR	Support for ongoing corporate social responsibility activities that are indirect or derived benefits of the CDM project activity

Adapted from (Olsen & Fenhann, 2008)

* added to framework

Results were then converted to a yes or no response to each of the following potential benefit categories as is shown above in Table 3.1. Results were then compared between the various projects and project types. This was done by counting the total number of benefits from each project and comparing them across projects, project types, and project size.

This method is limited by several factors: first it does not prioritize or weight any particular benefit over others. In reality, some benefits are much more significant than others. However, the weighting of these factors was not seen possible, as doing so would have been arbitrary and chosen by the researcher rather than local or national stakeholders. Second, benefits are counted as per those referenced in the PDD. This limits the benefits to projected benefits- those expected by the project rather than those actually produced. In addition, some PDD writers are more explicit than others; where some project developers may sight “employment of local people for construction and operation” others are more specific, i.e. “employment of 14 laborers for construction and 5 permanent staff”.

In terms of sustainable development, permanent, skilled, and local staff are much more significant and sustainable than temporary laborers for construction. Unfortunately it has not been possible to quantify or discern the extent of the benefit due to these irregularities between projects. Therefore, all scores have been converted to a 'yes/no' response for each type of potential benefit. In the end, this is seen as a fairly limited method, but it is possible to use it as a proxy to estimate the total benefit from a project, though not the extent of this benefit.

Results from the PDDs were then cross-checked with interviews with a wide variety of stakeholders, as is outlined in the next section. While this thesis does not apply the full methodology used by Olsen and Fenhann, the framework they developed is based on text analysis of 744 PDDs from the world wide CDM pipeline, and is therefore a good starting point for analysis.

While it would more accurate to assess the outputs of individual projects, the lack of an international definition for sustainable development, different priorities at the local, national, and global levels, and the time involved for in depth analysis at the project level prohibits this type of assessment within the timeframe of this thesis. In addition, since the CDM has only been fully operational for a limited time and projects are at different phases of development, it is not yet possible to fully evaluate project outputs or outcomes.

Finally, semi-structured interviews were held with a selection of representatives from the public and private sector including representatives from the Thailand Greenhouse Gas Management Organization (TGO), and the Department of Alternative Energy Development and Efficiency (DEDE), as well as several local and regional NGOs, including Palangthai, Energy for Environment Foundation (EFE), and the Institute for National and Democratic Studies (INDIES), which is a member of the People's Protocol on Climate Change (PPCC) to identify benefits or impacts which may

not be addressed in the projects' PDDs, and the challenges and opportunities for the mechanism's contribution to sustainable development in Thailand and the region. Interviews were also held with project participants of two CDM projects which were selected from the registered projects; CYY Biopower and AT Biopower. Two different project types, locations, and developers were chosen to give a broader view. Information was cross-checked across the various stakeholders in an attempt to avoid bias. In the case of CYY Biopower, interviews were held with the project owner, employees, and local stakeholders. In the case of AT Biopower, the project owner was interviewed. In addition, interviews attempted to identify any unintentional consequences that have arisen from the implementation of the CDM. Results from PDD analysis and interviews were cross checked for CYY Biopower to assess whether the benefits outlined in the PDDs were really occurring on the ground, and if stakeholders view the benefits as significant.

These various methods were then integrated to analyze how the Thai CDM portfolio contributes to sustainable development and how various stakeholders in Thailand view the CDM, policy, and post-2012 options for revision of the CDM.

CHAPTER IV

RESULTS

4.1 CDM in Thailand

Thailand signed the Kyoto Protocol in 1999 and ratified it in 2002. The Designated National Authority (DNA), which is the government organization charged with managing the national implementation and approval of CDM projects, was established in 2003 under the Ministry of Natural Resources and Environment (MONRE), was moved to the Office of Natural Resources and Environmental Policy and Planning (ONEP) in 2005. CDM policy from 2006 to 2007 was uncertain due to political unrest, and the current Thai Greenhouse Gas Management Organization (TGO) was finally created in 2007 to become the official DNA (ONEP, 2005; Onodera, 2009).

As of March, 2009, there were 17 projects from Thailand registered with the UNFCCC, another 53 which have received a Letter of Approval (LOA) from TGO, and another 115 which are currently being validated (a requirement before TGO will issue the LOA, and a part of the UNFCCC approval process) (Onodera, 2009; TGO, 2009). The registered projects are primarily biomass electricity generation or combined heat and electricity generation projects, accounting for 8 of the 17 registered so far. The rest are primarily biogas electricity generation projects from animal waste, wastewater treatment, and one from municipal waste (Onodera, 2009; TGO, 2009).

As per the requirements of the Clean Development Mechanism, Thailand has developed a framework for assessing sustainable development. It has developed a combined method which consists of a checklist which is scored between -3 and +3 on indicators which are grouped into four categories; Natural resources and environment indicators, Social indicators, Development and/or technology transfer indicators, and

Economic indicators (Onodera, 2009). While there are a number of indicators in each category, and these can range from negative to positive, the overall score of each category must be positive in order for the project to be approved (Onodera, 2009). All positive scores must be backed up with evidence. Table 4.1.1 shows the criteria that TGO uses to asses sustainable development requirements:

Table 4.1.1 Thailand's sustainable development criteria

A Natural Resources and Environment

Criteria	Indicators
Air pollution	
Greenhouse gas emission	Emission of CO_2 compared with baseline emission
Air pollution	Emission of other air pollutants (i.e. NOx CO Dioxin) compared with baseline emission
Other types of pollution	
Noise Pollution	Level of noise pollution (compared with Thai official standards)
Odour	Level of odour pollution
Wastewater	Loading of wastewater (Thai official standards / +3 for "zero discharge")
Waste management	Waste management per input material
Soil contamination	Soil contamination (Thai official standards/+1 for "soil rehabilitation")
Underground water contamination	n/a for case 1; -1 for contamination for case 2
Hazardous waste	Volume of hazardous waste (Thai official standards)
Natural resources	
Water needs and water use efficiency	Water needs and efficient usen
Soil / coastal erosion	River bank or coastal erosion (n/a for case 1; =2 for erosion outside)
Green area	Increasing green area in the project
Ecosystem diversity	Impact on ecosystem diversity
Species diversity	Biodiversity indicates
Invasive alien species introduction	Use of genetically modified species

B Economic

Criteria	Indicators
Stakeholders income	
Labour income	Labour income per year
Raw material supplier income	Raw material supplier income (i.e. farmers, merchants, can sell their products)
Energy	
Renewable energy utilisation	Renewable energy usage (ton of oil equivalent)
Energy efficiency	Percentage of energy efficiency
Local content	Proportion of local content

C Social

Criteria	Indicators
Social	
Public participation	Level of public participation (i.e. informing, hearing, committee)
Support for local community development activities	Support social activities, education, public health, religious and traditional activities, natural and cultural heritage, infrastructures and other facilities (i.e. 1-5% of the project's met income from = +1)
Public health	Arrangement for public health and occupational health

D Technology

Criteria	Indicators
Technology	
Technology development	Develop / Import technology
End-of-project-life plan	Provide a plan for end of project life
Labour skill training	Number of skilled workers

(Onodera, 2009)

These criteria are actually much stricter than many countries. Olsen and Fenhann (2008) outlined the requirements for several countries. Table 4.1.2 below compares six country requirements, including Thailand.

Table 4.1.2 Comparison of sustainable development requirements and approval process

	India	China	Brazil	Mexico	South Africa	Thailand
SD Criteria	Checklist for: * Social * Economic * and Technological 'well-being'	Discrimination by project type: * Priority areas: EE, RE, CH4 * Gas-based approach: 2% tax on CERs from priority areas, 30-60% for other gasses/ types	Checklist for congruence with existing SD policies	Checklist for congruence with existing SD policies	Checklist for: * Social * Economic * and Environmental development	Multi-criteria assessment of: * Natural Resources and Environment * Economic * Social * Technology
Other Eligibility	None	* At least 51% Chinese ownership of enterprise * CER sales belong to Chinese gov and project developers * Revenue sharing by other entities forbidden	* Submission of validation report in Portuguese before LOA is given * Documentation for stakeholder consultation * Commitment to report on CERs produced	* Documentation of the legal and physical existence of the requesting Party * Commitment to report on the CERs produced annually	None	* All SD benefits must be backed up with evidence * Site visit by DNA to confirm SD benefits

Approval Process	DNA is single window clearance for LoA	DNA + expert review + national CDM board for LoA	DNA is single window clearance for LoA	DNA incl. consultation with ministries + audit for LoA	DNA + public consultation for 30 days + advisory committee for LoA	DNA + technical working group + national CDM board for LoA

(K. H. Olsen & Fenhann, 2008; Onodera, 2009)

As can be seen in the above table, most countries use checklist approaches to evaluate sustainable development benefits and to approve projects. Thailand, however, uses a multi- criteria assessment approach similar to that of the Gold Standard, and also requires documentation to back up any benefits that are claimed.

It is unclear if this method has contributed to greater sustainable development benefits, and this study assesses the entire registered pipeline of projects in Thailand to evaluate the extent to which CDM projects in Thailand have contributed to sustainable development.

4.2 Potential for CDM projects in Thailand

Thailand has extensive potential for CDM projects, especially in the areas of renewable energy and energy efficiency. A study by Adhikari, et al (2008) surveyed a wide variety of stakeholders- from government officials to NGOs, technology developers, investors and universities- on the most important needs and priorities in the energy sector and other sectors relevant for potential CDM projects in Thailand. The study found that stakeholders rate biomass and biogas electricity and heat generation projects to be of the greatest need and potential. This is in line with the Thai government's priorities of diversifying energy supply, promoting renewable energy, and reducing greenhouse gas emissions (Adhikari, 2008). Second to biomass and biogas were improvements in energy efficiency in industrial and agricultural sectors. Of less importance and having less

potential in Thailand were, among others, solar photovoltaic and geothermal, and wind due to high cost and low wind availability, respectively (Adhikari, 2008).

These projects also correspond to the CDM project types with the greatest potential for sustainable development benefits, especially in the case of biomass and biogas electricity (and or heat) generation projects (Adhikari, 2008; Cosbey, 2006; K. Olsen, 2007; K. H. Olsen & Fenhann, 2008; Sutter, 2003; Sutter & Parreño, 2007). Adhikari outlines a number of potential sustainable development benefits from these project types, as follows:

Table 4.2.1 Development benefits from sustainable energy technologies with high potential in Thailand

	Sustainability benefits	Technologies				
		Biogas generator	Biomass generator	Energy efficiency	CHP	Steam boiler upgrading
1	Energy supply diversification	✓	✓			
2	Replicability potential	✓	✓	✓	✓	✓
3	Lower dependency on imported fuels	✓	✓		✓	
4	Energy supply and transmission reliability			✓		
5	Energy price stability					
6	Contribution to the country's economic development	✓	✓	✓	✓	✓
7	Employment	✓	✓			
8	Local clean air				✓	✓
9	Global CO_2 reduction	✓	✓	✓	✓	
10	Resource saving			✓	✓	✓
11	Solid waste management	✓	✓			
12	Socio-economic welfare especially poverty alleviation	✓	✓			
13	Health	✓	✓	✓		
14	Education	✓	✓			

(Adhikari, 2008)

Thailand has great potential for the production and use of renewable energy. Although agriculture now only accounts for 11% of GDP, due to rapid economic growth and export diversification, agriculture still employs 56% of the labour force and rice production alone accounts for 55% of arable land use (IRRI, 2008). Waste products from agriculture account for the largest renewable energy potential in Thailand, including bagasse (leftover sugar cane stalks), rice husk, palm oil waste (including empty fruit bunches (EFB)), and wood residues (Prasertsan, 2006).

Another source with great potential is wastewater biogas. Biogas is produced from methane emissions from anaerobic digestion of organic content in wastewater. Thailand has extensive potential for biogas from effluent from pig farms, as well as from agricultural processing such as tapioca starch effluent and palm oil mill effluent (POME) (Prasertsan, 2006). Biomass power has been used extensively in Thailand for a number of years, but has been primarily thermal energy from burning biomass residues without conversion to electricity (Srisovanna, 2004). Total installed cogeneration (mechanical and thermal energy) was over 700 MW in 2004 (Srisovanna, 2004).

Another more up-and-coming source of alternative energy in Thailand is biofuel, primarily palm oil and ethanol (Pichalai, 2006). The Energy Policy and Planning Office (EPPO) aims to replace the current gasoline 91 with gasohol 91 (a higher blend of ethanol with a ratio of 1:9 ethanol: gasoline) and aims to blend 10% biodiesel into all diesel nationwide by 2012 to reduce dependence on imported fossil-fuels (Pichalai, 2006).

4.3 Renewable energy Policy and challenges for CDM projects in Thailand

Although there is very high potential for renewable energy and energy efficiency projects in Thailand, there are also a number of policy factors that remain as constraints to the industry and to CDM development.

Energy policy has long been dominated by a centralized grid-connected and large-scale system in Thailand. Despite this, a number of factors have contributed to the growing commitment within the Thai government to renewable energy. Foremost among these has been concern over energy security, although greenhouse gas emissions have begun to emerge as a major concern as well (Pichalai, 2006; Wattana, 2008).

On February 28, 2008, the Thai Energy Minister at the time, Poonpirom Liptapanlop announced a new 15-year renewable energy plan as a part of it's plan to make Thailand a hub for green energy in SE Asia (Lane, 2008). The plan will provide tax breaks and other incentives for renewable energy, including ethanol, biodiesel, wind, solar, and biomass power. However, due to a number of factors including political instability, the plan was not approved by the Thai Cabinet until January 28, 2009 (Chandler, 2009).

The 'Fifteen-Year Alternative Energy Development Plan' aims to "increase the proportion of renewable energy in total energy consumption up to 20% by 2022" (DEDE, 2009) with the following objectives:

1- To increase the proportion of renewable energy usage in Thailand to reduce oil import
2- To enhance energy security and supply
3- To promote integrated green energy usage in communities
4- To promote the domestic renewable energy industry
5- To promote R&D in renewable energy and increase energy efficiency

(DEDE, 2009)

The main mechanisms of the policy consist of the promotion of renewable energy through tax breaks and increased feed-in tariffs for Small Power Producers (SPPs) using renewable energy. The feed-in tariffs are priced to make otherwise more expensive generation from alternative fuels competitive at the market price for electricity (Wattana, 2008).

The plan is divided into three stages:

1- The short term (2008-2011), where the focus will be on the promotion of mature indigenous renewables with high potential, including biomass, biogas, and biodiesel through financial incentives;

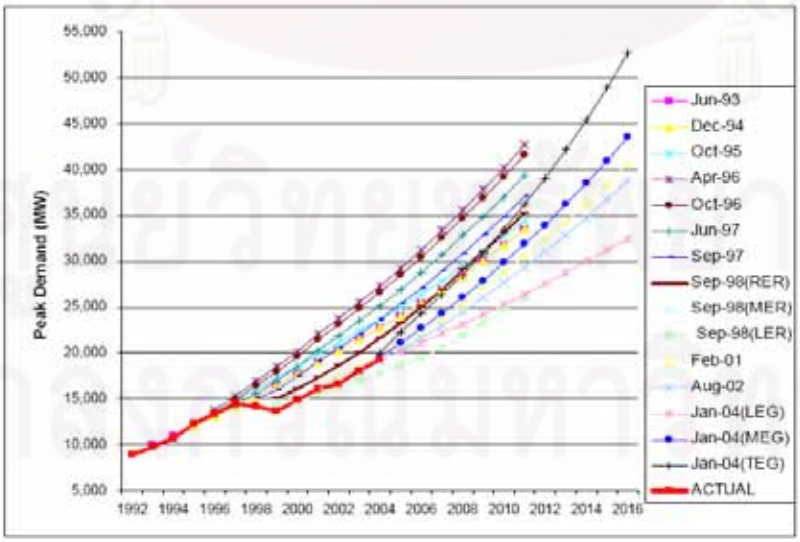
2- In the medium term (2012- 2016) focus will shift to promote innovation and R&D in new fuels with a goal to make them market competitive, including '2nd generation biofuels'. In addition, energy efficiency and 'green city' models will be promoted both to the industry and the public; and,
3- From 2017- 2022 (Long term) upcoming fuels, potentially including hydrogen, will be promoted, and 'green city' programs expanded, with the overall goal of making Thailand the green energy hub of SE Asia.

(DEDE, 2009)

The policy builds on a previous renewable energy development plan from 2003 which sought to increase the share of renewable energy generation from 0.5% in 2002 to 8% by 2011 (Prasertsan, 2006).

Thailand's great economic growth over the last several decades has greatly increased demand for energy. However, EGAT and the Ministry of Energy have a long history of overestimating demand. Figure 4.3.1 below shows historical load forecasts in comparison to actual growth in energy demand.

Figure 4.3.1 Thailand load forecast vs. actual demand growth



(DuPont, 2005)

As can be seen above Ministry of Energy and EGAT demand growth figures have historically well above actual growth. Due to the historical structure of the energy market, it has continued to be in EGAT's interest to overestimate demand growth and build new power plants in order to increase profit (DuPont, 2005). In addition, greater demand growth projections have allowed EGAT to consistently argue that the potential of renewable energy is not sufficient to meet the need for growth. A study by Danish Energy Management (2005) shows that not only are renewable energy (RE) and energy efficiency (EE) measures enough to meet demand, but when lifecycle costs, including damage to the environment and social cost are included, RE and EE are also significantly cheaper (DuPont, 2005). Figure 4.3.2 shows the cost of power from Nam Theun 2 Dam, a hotly contested project by Thai civil society, verses the cost of various types of demand side management (DSM), EE, and RE.

Table 4.3.2 Cost of NT2 vs. DSM, EE, and RE

Resource Type	Achievable Amount of Resource in 2011		Average Commercial Cost of Supplied Energy
	Energy (GWh/yr)	Peak (MW)	(THB/kWh)
NT2 at plant	NA	995	
NT2 delivered to EGAT customers in Thailand	**5,636**	**920**	**2.3**
DSM/Energy Efficiency	11,181	2,207	0.92
Firm Renewable Energy	1,943	274	1.54
Subtotal for DSM/EE and Firm RE	**13,124**	**2,481**	**< 1.88**
Amount of DSM/EE included in the August 2002 demand forecast	6,314	982	NA
Amount of DSM/EE and Firm RE not included in August 2002 demand forecast and PDP, respectively.	**6,810**	**1,499**	**< 1.88**
Additional NON-Firm Renewable Energy that is commerciall viable and practically achievable	3,310	1,195	2.13

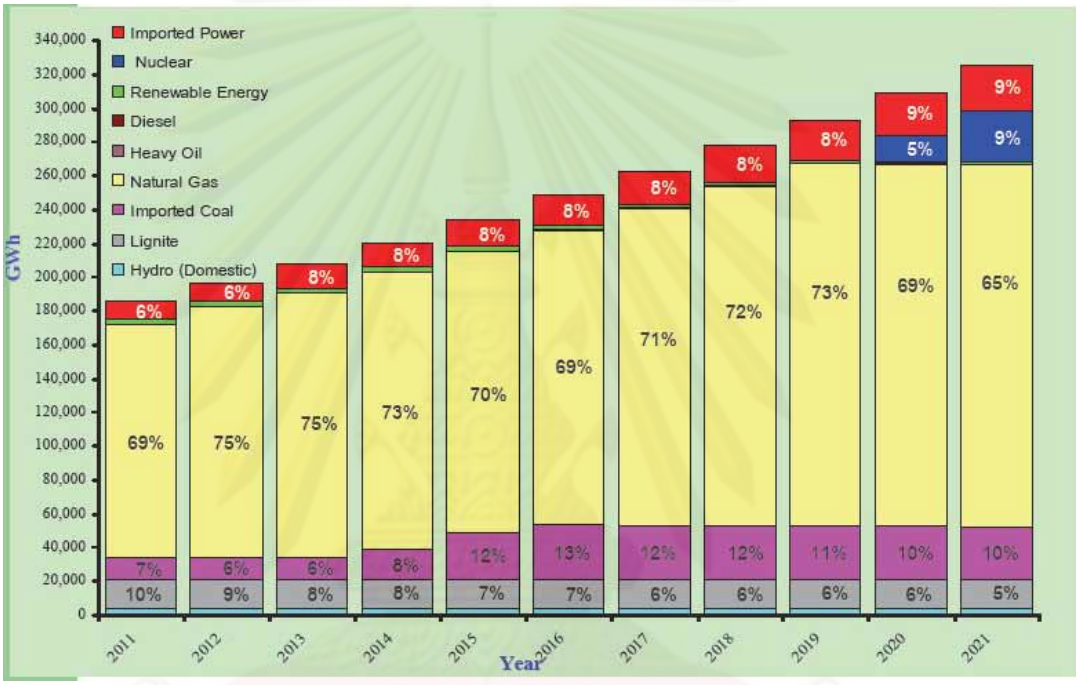
(DuPont, 2005)

There is also great discrepancy between the Power Development Plan, approved in 2007, and the Thai Renewable Energy Policy. A lack of coordination among ministries and political upheaval are partly responsible (DuPont, 2005; Sukkumnoed,

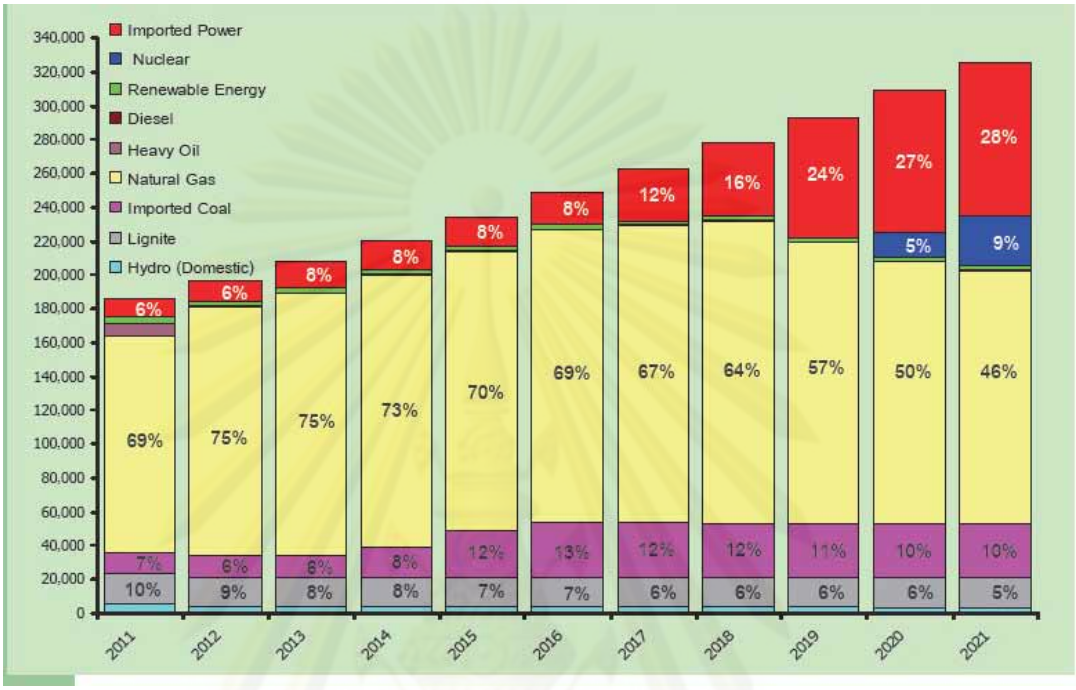
2006) . The figures in 4.3.3 below show the two PDP plans from the Thai government; the recommended plan and the 'alternative plan', both based on "least-cost options".

Figure 4.3.3 Power Development Plan 2007

Recommended Plan (A)



Alternative Plan (B)



(Chonglertvanichkul**,** 2007)

What is striking about the PDP 2007 is the estimate for renewable energy- both the recommended and alternative plans include less than 2% of renewable energy at any point in time. While the new 15 year RE plan was not developed until 2008, at the time of the PDP 2007, the RE plan from 2003, with a goal of 8% RE by 2011 was already in place. This shows a systematic lack of coordination and/or intentional ignorance between agencies responsible for the overall energy planning and those responsible for renewable energy.

There is also no provision in the policy to take into account the differences between various types of renewable energy. As mentioned above, there is great potential for small scale renewable energy to bring benefits to local communities, but there are downsides to some of the technologies, as well. Biofuels, in particular, have been hotly debated and accused of increasing monocropping, having an adverse impact on biodiversity, and competing for agricultural land, and therefore raising food prices and

threatening food security in the region (Rajagopal, 2007). Without proper policy in place to regulate the biofuels industry, the promotion of biofuels may end up causing any number of negative impacts from environmental destruction to social conflict, or lowering food security for the poor.

According to Prasertsan and Sajjakulnukit (2005) bioenergy systems have faced a number of technical barriers, including a lack of standards for biofuels systems and equipment (Prasertsan, 2006). With the 2008 policy's heavy focus on promoting biofuels and becoming a regional hub, this lack of comprehensive standards is a major risk factor. Other barriers identified by Presertsan and Sajjakulnukit that have been issues since the 2003 policy was enacted are:

- Institutional and policy factors: Overlapping responsibility between the numerous agencies responsible for various parts of the energy policy, including often overlapping responsibility, has prevented a clear and comprehensive implementation of policy;
- Lack of information and public support: Because many renewable energy technologies are very new and untested in Thailand, the initial transaction cost is high in comparison to more established technologies, and financing is difficult to acquire. There is a systemic lack of information at all levels, from policy makers, to financiers, and especially amongst the public who are skeptical of power plants and of new technologies and may oppose projects based on inaccurate information.

(Prasertsan, 2006)

In addition, several studies have identified a number of barriers to responsible energy policy in terms of governance and stakeholder issues. In 2006, the World Resources Institute (WRI) funded a study by a number of Thai NGOs including Health Systems Research Institute, Palang Thai, and Thailand Environmental Institute as part of a larger study called the Electricity Governance Initiative (Sukkumnoed, 2006; WRI,

2008). They assessed electricity governance in the policy process, regulatory process, and environmental and social aspects. In terms of the policy process, the study found that the privatization of EGAT blocked any involvement from the parliament and had very weak mechanisms for accountability and redress by stakeholders (Sukkumnoed, 2006). There were a number of studies done outlining alternatives to the privatization of EGAT, but no report was released to public, and the process did not include sufficient means for participation, especially for minority groups, even in terms of what the Thai constitution requires by law (Sukkumnoed, 2006).

The policy process also scored very low in terms of transparency and capacity within the government. The study found that access to information was limited by a number of factors:

- Websites displaying information are numerous and no government site contains all of the relevant policy on energy, timeliness of information was poor, and there was no comprehensive information available on plans for restructuring during the process;
- Media coverage has been poor with little analysis of options, most coverage has been biased or partisan, and the potential impacts, benefits, or risks of privatization or of power plant development have not been covered.

(Sukkumnoed, 2006)

Additional barriers outlined by Adhikari (2008) for renewable energy systems that have high potential and demand in Thailand, and are particularly relevant as CDM projects are shown below:

Table 4.3.4 Policy barriers to implementation of renewable energy projects with high potential in Thailand

	Implementation barriers	Technologies				
		Biomass generator	Biogas generator	Energy efficiency	CHP	Steam boiler upgrading
1	Limited present affordability	✓	✓	✓	✓	✓
2	Existing domestic legal/institutional framework	✓	✓			
3	Availability of cheaper but less sustainable alternative technologies	✓	✓		✓	
4	Investment climate, financial misuse/limited transparency, lack of investment	✓	✓	✓		✓
5	Lack of knowledge to operate and manage new technologies	✓	✓	✓	✓	✓
6	Limited availability of spare parts and maintenance expertise	✓	✓	✓	✓	✓
7	Negative impact on community social structures	✓	✓			
8	Lack of effective publicity for investors and the public			✓		✓
9	Lack of energy subsidies	✓	✓	✓	✓	✓

(Adhikari, 2008)

The table shows four major barriers common to all types of renewable energy projects: limited affordability, a lack of knowledge to operate and maintain new technologies, limited availability of spare parts and maintenance expertise and a lack of energy subsidies. Interestingly, the first three are all addressed by the CDM, which helps to both fund projects, as well as disseminate knowledge and skills for the design, management, operation, and maintenance of the new systems. The fourth, a lack of subsidies, is changing in Thailand, with a number of feed-in tarrifs in place and a number of other subsidies as part of the new 15 year renewable energy plan. Other barriers, such as the existing legal framework, the existence of less sustainable, but cheaper technologies, investment and transparency issues are more difficult to overcome and remain barriers.

All of these policy challenges are particularly relevant to CDM projects for two reasons: first, if renewable energy generation capacity is matched by traditional energy, as is implied by the PDP 2007, there are significant implications for the additionality of CDM projects and their emissions reductions. The CDM is prefaced on the fact that a project is additional if it reduces emissions against an imagined ‘business as usual’ scenario. However, if these renewable energy projects are matched by growth of

traditional fossil-fuel based electricity generation plants, it remains questionable if there has been any actual reduction in emissions.

The same could be said for sustainable development benefits; if a project is developed that increases access to clean energy, provides skilled jobs, and acts as a model to the industry, but the industry does not actually change, or is matched by traditional development or energy production, has there been a net development benefit? The question is impossible to answer and is one of the arguments for a sectoral approach in the CDM which would apply to whole industries rather than on a project by project basis. This, however, remains a contested approach as will be shown in the next chapter through interviews with project participants in Thailand.

4.4 PDD analysis

As outlined in Chapter 3 Research Methods, once each project was coded for sustainable development benefits by tracking text, answers were converted to Yes/No for each potential development benefit. The following chart, table 4.4.1, shows the results of PDD analysis:

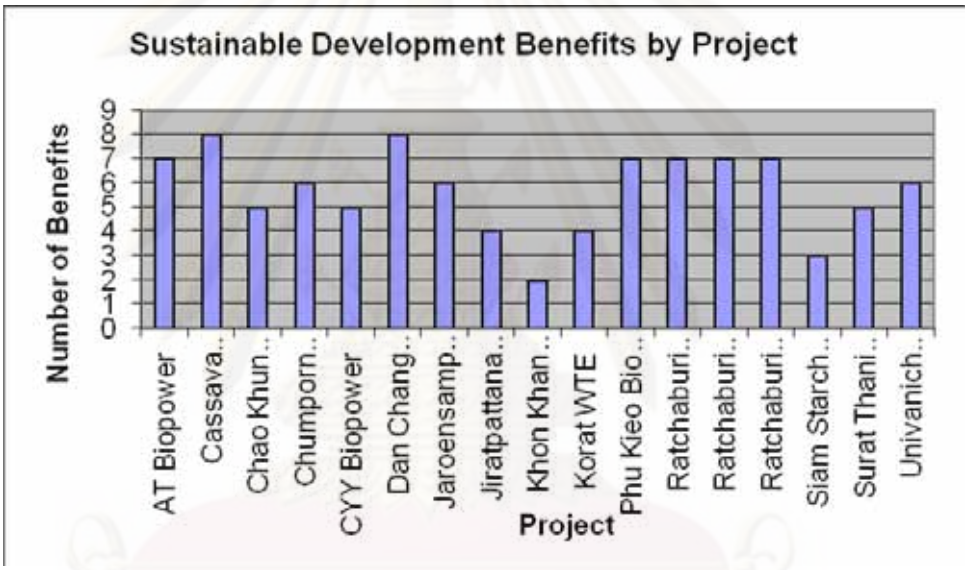
Table 4.4.1 Sustainable Development Benefits outlined in project PDDs

SD Benefits	Project Name	AT	C WTE Kalasin	Chao Khun	Chumporn	CYY	Dan Chang	Jaroensampong	Jiratpattana	Khon Khan	Korat WTE	Phu Kieo	Ratchaburi NB	Ratchaburi SPM	Ratchaburi V	Siam Starch	Surat Thani	Univanich L
Environmental	Air	Y	N	N	N	N	Y	Y	N	N	N	Y	N	N	N	N	N	N
	Land	N	N	N	N	N	Y	N	N	N	N	Y	Y	Y	Y	N	N	Y
	Water	N	Y	Y	Y	Y	N	Y	Y	N	N	N	Y	Y	Y	Y	Y	Y
	Conservation	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Social	Health	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
	Welfare	N	Y	Y	Y	Y	N	Y	N	N	N	N	Y	Y	Y	Y	Y	N
	Participation	Y	Y	N	N	N	Y	N	N	N	N	Y	Y	Y	Y	N	N	N
	Learning	Y	Y	Y	Y	Y	Y	Y	N	N	N	Y	N	N	N	N	N	Y
	Employment	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N	N	N	Y	Y
Economic	Growth	Y	Y	Y	Y	N	Y	N	Y	N	Y	Y	Y	Y	Y	N	Y	N
	Energy	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	Balance of Payments	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Other	SD tax	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
	CSR	Y	Y	N	N	N	Y	N	N	N	Y	N	Y	Y	Y	N	N	Y

Once scores were converted to Yes/ No, the total number of benefits per project type were added and compared by project, project type, type of benefit and project size. As previously noted, these are *potential* benefits, outlined by project developers in the PDD, and are thus a proxy measurement for the total possible contribution to sustainable development. While this serves as a measure of comparison between projects, it is not a measure of how much a project contributes in one area, nor does the overall score represent any absolute value.

Table 4.4.2 below shows the total number of benefits per project[1].

Figure 4.4.2 Total number of benefits by project



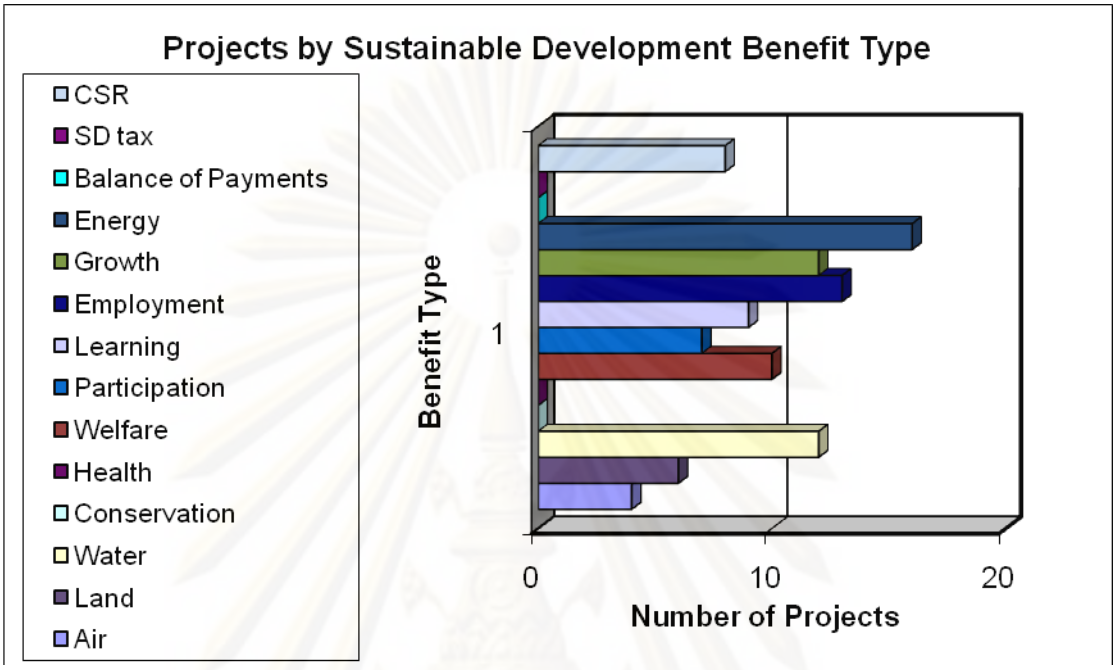
Two projects were found to have the highest number of benefits, Dan Chang Bioenergy, and Cassava Waste to Energy (WTE), with 8 total 'yes' answers. This was followed by a number of projects with benefits in 6- 7 categories.

4.5 Projects by sustainable development category

Projects were then compared for sustainable development categories. Table 4.5.1 shows the number of projects in each benefit category.

[1] Full results, including the text and page referenced, are included in Appendix 1.

Figure 4.5.1 Number of projects with each development benefit category



The most common benefit from CDM projects in Thailand was energy; this includes greater access to, availability of, or improved quality of renewable energy sources, with 16 of the 17 projects positively benefiting this category. This is largely due to the fact that all projects registered so far in Thailand produce renewable energy of some kind, with the exception being Chao Khun Agro Biomass, which uses biomass for heat, but not electricity production. The upcoming pipeline of projects in Thailand with an LOA and undergoing validation include many new project types for Thailand including; composting, NO_2 reduction, and energy efficiency (TGO, 2009). Though the dominant project types will remain electricity and or heat production from biogas or biomass, as the new project types become registered the distribution of development benefits will change, and the percent of projects that deliver energy benefits will likely decrease somewhat.

The next most common benefits were employment and growth. These results match a number of studies of CDM sustainable development benefits, with employment being one of the most common benefits of most CDM projects. In the Thai sample of registered projects, the benefits to water were very high, again due to the project types included, mainly wastewater treatment with biogas capture. Such projects have very high benefits for local water resources as they improve the management of wastewater, prevent spillage, and in the event of overflow, have much lower levels of pollutants due to the improved wastewater treatment systems. Many of these projects also recycle the treated wastewater or give it to local farmers, meaning they use less local groundwater.

Several categories had no projects with said benefit. These were SD Tax, balance of payments, health and conservation. SD tax was zero due to Thailand's policy of not imposing a separate tax on CDM projects to fund development, as some countries do.

Balance of payments, which represents a reduction in the use of foreign exchange through the importation of fossil fuel, or technology, was excluded from this study due to the lack of clear justifications in the PDD. While many projects claimed to positively benefit the balance of payments, the justifications were often missing, incomplete, or illogical. Due to the inability to assess whether projects actually contribute to the balance of payments, it was excluded from the study.

As for health benefits, a number of projects claimed to have benefits, mainly relating to a reduction in odour from wastewater treatment plants. This benefit, however, has been included as 'welfare' as odour-reduction itself has not been proven to contribute to better health, though it certainly affects the welfare of the people. Conservation benefits were not seen by any projects in Thailand. This may change as more project types are developed, as it is uncommon for the current types to contribute to conservation, unless done as an additional CSR project (which would have been categorized as CSR).

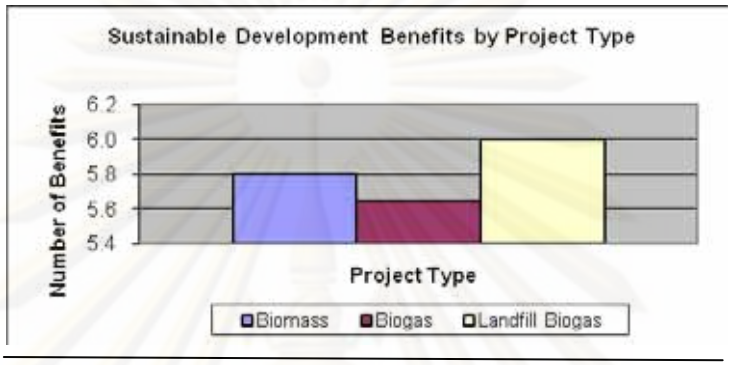
Other important benefits with a significant number of projects representing were learning, participation, and welfare. Nine projects offered additional training for staff in the operation and maintenance of new technology, increasing their skills, and contributing to technology transfer, as well as training in the CDM, environmental impacts, or other relevant topics. Participation was only scored positive if the project developers did more than was required by the CDM to ensure adequate public participation, such as additional surveys, stakeholder meetings, or community committees. Seven projects contributed significantly to participation. Welfare was positively impacted by ten projects, again primarily due to the reduction in odour from wastewater treatment projects.

4.6 Benefits by project type

Projects were then divided by project type, and the total number of benefits for each project type was averaged. Due to the limited scope of registered projects in Thailand, only three project types are represented; Biogas energy (mostly wastewater treatment from agricultural processing or swine farms with heat or electricity production), biomass energy (heat and/or electricity production), and landfill biogas (electricity production). Landfill biogas could have been grouped with the other

biogas projects, but as the technology is quite different, it was separated. Table 4.6.1 shows the average number of benefits by project type.

Figure 4.6.1 Benefits by project type

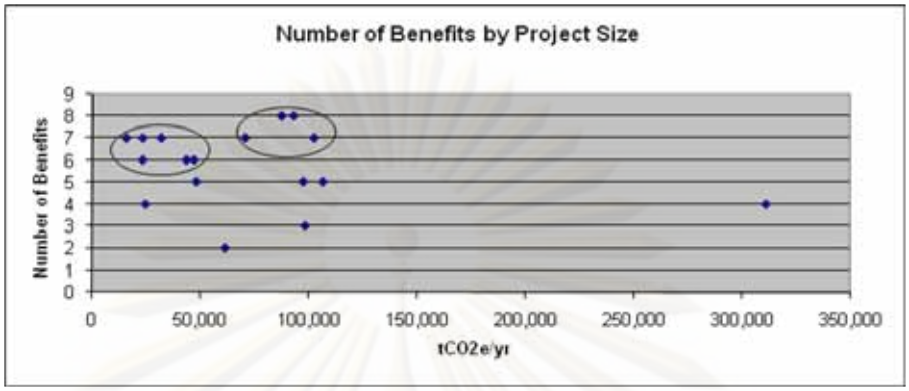


The one landfill biogas project shows the highest number of benefits. However, as there was only one project in this category, the results can not be considered statistically significant. This is followed by biomass projects, with an average of 5.8 and biogas with an average of 5.6. Due to the sample size it is difficult to say if this is significant or not, especially as many studies have shown that both biomass and biogas projects contribute more than many other project types. This analysis is unfortunately limited by the number of project types in Thailand. The study should be repeated as more projects are registered representing a greater variety of project types. Other studies, such as Olsen and Fenhann (2008) have found that project type is the most important variable in determining development benefits from projects.

4.7 Sustainable development benefits by project size

Many studies have claimed or predicted that small projects will have greater development benefits since they are small-scale and, therefore assumed to be community projects (Cosbey, 2005; Olsen & Fenhann, 2008). Olsen and Fenhann, however, found that this is not necessarily the case. Results of this study were plotted by number of benefits and project size, as is shown in table 4.7.1, below:

Figure 4.7.1 Benefits by project size



No clear correlation could be found between project size and development benefits, though there are two clusters, as is shown above. In this study it appears that medium size projects had the highest number of benefits, followed by small-scale projects. As there was only one large scale project, it is not possible to evaluate the significance of its fairly low sustainable development profile. These findings seem to be in line with the findings of Olsen and Fenhann (2008) and others who found that small-scale projects do not necessarily contribute greater benefits, though they tend to score slightly higher. It is important to note that these measures merely count 'yes' or 'no' and do not measure the degree to which projects contribute. A larger project may benefit fewer categories, but provide many more jobs, greater economic benefits, or more significant balance of payments benefits, for example.

4.8 Summary of PDD analysis

The most common benefits from CDM projects in Thailand were energy, employment and growth, followed by water benefits. Several categories were not found, including SD Tax, balance of payments, health and conservation, though some of these categories may have been represented if results were categorized differently, as is outlined in section 4.2.1. Due to the limited scope of project types in Thailand, it was not possible to decisively state which project types had the greatest benefit. However, as benefits from Thai projects were fairly high, this is in keeping with other studies that have shown biogas and biomass projects generating the greatest benefits. As project types diversify in Thailand, the overall benefit from the whole pipeline is likely lower, on average, as project types with less sustainable development potential are implemented. No correlation was found between project size and number of benefits, though small-scale and medium-scale projects did cluster at higher levels of benefits.

4.9 Case studies

In order to cross-check the development benefits found in the registered project's PDDs, two case studies were selected: CYY Biopower and AT Biopower. Interviews were conducted with project owners, and in the case of CYY, with project employees and local stakeholders. Due to the limited time of the study it was not possible to visit additional projects, though a third potential project, being developed by Energy for Environment Foundation was also discussed with the project participants, as is addressed in section 4.9.1, below.

4.9.1 CYY

CYY Biopower is a wastewater treatment project at an existing starch manufacturing plant in Nakhorn Ratchasima Province which captures methane produced by anaerobic digestion of organic matter in the wastewater and produces heat and electricity, replacing thermal oil use and electricity from the grid used by the plant. This reduces emissions by preventing the uncontrolled release of CH_4 to the atmosphere, as well as reducing the emissions from grid-supplied fossil fuel-based electricity. The project's PDD states that it contributes to sustainable development as follows:

- Environment
  - Water: The project improves the quality of wastewater and therefore protects groundwater and nearby streams from contamination in the event of overflow or spillage.
- Social
  - Welfare: The project reduces odour from the previously uncovered lagoons, by capturing odour causing gases such as CH_4 and SO_2. This has very obvious benefits for the local community who were previously subjected to putrid odour that permeated the area, but is now contained within a very small area directly surrounding the biogas reactor (and within the starch plant).
  - Learning: Training is provided to all staff who work on the biogas project in the operation and maintenance of the technology, contributing to greater skills development and capacity building, as well as helping to transfer the technology. The project serves as a model to the starch industry in a new and more efficient wastewater management system.

    - Employment: Twelve full time staff are employed by the project to operate, maintain, and manage the project, and additional employment was need for the construction of the plant.
- Economic
    - Energy: The project produces heat and electricity for the plant's own use, and also exports it to the grid, producing 2.72 MWel. This contributes to reducing the dependence on imported fossil fuel, and increases the availability of renewable energy.

In order to cross check these results a site visit was conducted to inspect the site, and interview local stakeholders, employees, and the project owner. Five stakeholders were interviewed by visiting homes within 1km from the project site.[2] According to local stakeholders, who all felt positive about the project, the greatest benefit to the local community from the project was the reduction of odour emissions (S. Sriarphai, L. Bankoontod, L. Whernkuntod, L. Sriarphai, and H. Rattnasantia (personal communication 18 July 2009)). While this may sound minor, odour was at times putrid up to five kilometers from the biogas plant and is now completely contained within a small radius (apx 100 metres) surrounding the biogas reactor. In addition, stakeholders reported no problems with water contamination since the project was implemented and believed the project had contributed significantly to local employment opportunities. When asked if they felt the project should be replicated, all five stakeholders were very enthusiastic about similar projects, and repeatedly stressed the benefit of the reduced smell. No negative impacts were reported by stakeholders. The project also provides treated wastewater free to local farmers and 3 of the 5 stakeholders interviewed wished that more was available, and this has been seen as a an additional benefit (S. Sriarphai, L. Bankoontod, L. Whernkuntod, L. Sriarphai, and H. Rattnasantia (personal communication 18 July 2009)).

Interviews were also conducted with two employees; the plant manager, Nakorn Phaisri and the lab staff supervisor, Yupin Umwan. The plant manager reported that he and 11 other people are employed by the project, as was noted in the PDD. Training has been provided to all staff by the technology provider, from the Philippines, on plant operation and maintenance. Both the plant manager and lab supervisor were previously employed at other starch factories but had no experience in operating a biogas plant, and neither had any of the other 10 employees (N. Phaisri and Y. Umwan (personal communication 17 July 2009)). The project has thus contributed to skills development, and has transferred the technology to Thailand from the Philippines. Both employees reported that odour reduction was a major benefit, not only to the community, but to the entire staff of the starch plant, as they

[2] A full list of interviewees is available in Appendix 2

previously worked very closely to the open lagoons, which produced a very strong and nauseating smell that was difficult to remove. The plant manager reported no major safety issues or other unintended consequences from the plant. In addition, the plant manager reported that there were an additional 50-60 people employed for approximately one year during the construction of the plant. While this can not be considered sustainable, due to the short duration, it brought significant additional income to the local community, if temporarily.

The project owner, Thawatchai Yuenyong, was also interviewed, and reported that his main motivation for pursuing CDM, other than reducing emissions, was to increase the cash flow of the plant. The open lagoons previously employed by the plant were fully within the regulations of the Thai government, and the conversion to covered lagoons with biogas capture and electricity production is a very expensive investment that would otherwise not be financially attractive. As noted previously, most such projects face a number of challenges, not least being the cost of implementation. The additional funding from CDM revenues will allow the project to be financially viable. The project owner also reported the main benefit as the reduction in odour, but also pointed out that the project increases the availability of renewable energy. Additionally, the plant provides treated wastewater to farmers for irrigation, and has completed additional CSR activities such as sponsoring local events, building a road to the local temple, and offers its equipment and employees to repair local water systems, when needed (T. Yuenyong (personal communication 17 July 2009)). The project owner also invites other private sector actors wishing to implement similar systems to visit the plant and shares expertise, contributing further to technology transfer.

In summary, it appears that the development benefits outlined in the PDD have indeed been delivered. However, the project is relatively small scale, and the number of people living near the plant is also small. While no negative or unexpected impacts could be uncovered, the degree to which the plant ultimately contributes to the development of the community is questionable. For those working on site or living nearby, the reduction in odour is quite significant, as are the skills and capacity development for the 12 employees. It is not possible to say whether the plant will ultimately sway other starch factories to follow a similar path to implement biogas capture and utilization, but it does serve as a successful example of best-practice technology advancement that has the potential to benefit those nearby and to contribute to a reduction in emissions and the use of fossil fuel.

4.9.2 AT Biopower

AT Biopower is a 22MW rice husk power plant in Pichit Province that uses agricultural waste (rice husk) to produce electricity which is sold to the Thai grid, displacing fossil fuel-based power that would otherwise have been produced. Rice husk used to be openly burned as waste, but is now utilized as fuel for the power plant. The project, according to the PDD, contributes to sustainable development, as follows:

- Environmental
  - Air: The project reduces the emission of SO_2 and NOx which is produced by the burning of rice husk waste in the baseline (prior to the project), improving local air quality.
- Social
  - Participation: In addition to stakeholder meetings, surveys were conducted of 20 community leaders and 150 community members with 87% in favor of the project. In addition, a "tripatriate committee" was established, bringing community members, local government and the power plant management.
  - Learning: Training is provided to employees in the operation and maintenance of the plant, contributing to greater capacity.
  - Employment: The project gave preference to local employees in hiring, with a large number of permanent employees and additional indirect employment for the collection and transportation of rice husk, as well as during the construction of the plant.
- Economic
  - Growth: There was previously little market for rice husk, but the project, and others like it have contributed to a growing market for rice husk, which was previously waste, increasing revenues for farmers, and improving agricultural efficiency.
  - Energy: The project produces 22MW of electricity which is exported to the grid, increasing the availability of renewable energy.
- Other
  - CSR: In addition to the tripatriate committee and environmental fund, the project established a community development fund of 1 million baht to contribute to the community and local environment.

In order to cross check the information in the PDD, an interview was conducted with the project owner, Natee Sithiprasasana. Due to the time limitations of the thesis and the travel schedule of the project owner, it was not possible to visit the plant, but information was cross- checked with available documentation.

The project owner reported that the greatest benefit to the community was attributable to two public participation mechanisms- a 'social contract' and the 'tripatriate committee'. The community was originally resistant to the power plant because they were unsure about the technology, believing it would end up a coal-fired plant and were also concerned that it would negatively impact the river that the plant was built very close to. In order to contribute to greater understanding and commit to using only rice husk as fuel, the plant signed a 'social contract' with the community through the Tombol administration and opened the plant for inspection and site visits by the community.

In addition, a "tripatriate committee" was established, bringing community members, local government and the power plant management together for monthly meetings which are open to any complaint from the community, and in the event of any negative impact disperse funds from an 'environmental fund'. No significant negative impacts have occurred so far, and no funds have been dispersed. However, the 'community fund', which consists of one million baht managed by the tripatriate committee, has funded a number of community projects, including an announcement system, and school equipment and facilities upgrades.

During the construction of the plant, over 300 people, mostly unskilled laborers, were employed for two years. 90 are now employed full time for the operation and maintenance of the plant, of which 70% are from the local area and training has been provided to all employees. Those managing and operating the plant have been trained by the Japanese technology provider, contributing to skills development.

The plant has faced several challenges, mainly competing uses of rice husk. The PDD attributes creating a market for rice husk, a previous waste product, as one of the economic benefits of the plant. However, the main issue the plant has faced is a growing market and rising price of rice husk, which has severely affected the financial returns of the plant. In 2002 and 2003, when the decision was made to build the plant, the cost was 410 baht per tonne, including transportation. At its peak in 2008, rice husk went for 980 baht per tonne, and now costs 800-820 baht per tonne. The main reason for the price rise is that rice husk, according to Khun Natee, competes with other renewable fuel sources such as palm shell and oil palm Empty Fruit Bunches (EFB) which are increasingly being used for fuel for heat or steam generation for industrial processes such as cement production, as well as for electricity production. While it was not possible in the time frame of the thesis to interview providers of rice husk, it is likely they have benefited from the increase in the price of rice husk.

It appears that AT Biopower has also benefited the community as was described in the PDD. The plant has been committed to public participation to a greater extent than is required by the CDM, and has also implemented several additional CSR programs, including the community and environmental funds. While construction employment is not generally considered significant or sustainable, the employment of 300 people for 2 years clearly brought additional funds to the community, and the permanent employment of 90 more is considered significant. While the price of rice husk has been a challenge for the plant, it has likely benefited the sellers and increased agricultural income in the area. Although it is not possible with this analysis to measure the full impact of the project, it appears that there has been a positive impact in terms of participation and employment, as well as greater access to renewable energy.

4.10 Challenges and Opportunities for CDM in Thailand

Interviews were held with a wide variety of stakeholders, including government entities, the private sector and NGO's, as is discussed in section 2.1, in order to identify the major challenges and opportunities to CDM development in Thailand and its contribution to sustainable development. There were several recurring themes; lack of capacity, the length of the CDM process, the challenge of meeting sustainable development criteria, and the difficulty of moving forward with a sectoral approach, which is addressed in section 4.11.

First and foremost, is the issue of capacity of local government, project developers and owners, and local communities to understand the CDM and its incredibly complex processes. The project owners of both CYY and AT Biopower, as well as Energy for Environment foundation, DEDE and TGO all identified this as a major hurdle. The Thai government has been giving a number of seminars on the CDM to assist potential developers and local governments to understand the process. However, as noted by Khun Natee, the project owner of AT Biopower, seminars alone will not build capacity. What is needed are a greater number of market participants and government officials with real experience in implementing projects. This will come with time, but until then, a lack of capacity has increased cost as outside consultants must be hired as experts. Energy for Environment Foundation, which seeking to develop a Program of Activities (PoA) project has faced an uphill battle in the development of the project and has largely stopped the project due to lack of capacity and the technical challenge of this approach, is noted below.

The project owners of CYY and AT Biopower independently stated that while the strict and complex rules were necessary to ensure the CDM worked realistically,

the length of the process is a major hurdle for project developers who have to find financing to construct and operate the project, often times without significant income for 1-3 years while the CDM process is completed. Only once a project is registered and issued will profit from the sale of CERs be available. This has nearly bankrupted some projects and favors large- scale already wealthy companies who are the only companies capable of operating a loss for such a long period. Representatives at DEDE and TGO agreed. Khun Sirithan, the executive director of TGO, also identified this as a major problem, and admitted that TGO has also had issues with capacity that has increased the length of time necessary for local approval of projects as well. TGO has since revised policy and set maximum amounts of time between document submission and approval in order to move projects more rapidly through the system.

Energy for Environment foundation has found that the PoA approach, meant to bundle a number of small scale projects in order to increase financial returns, has not been enough to overcome the length and complexity of the process. They have not been able to find enough investors willing to take the risk with very small scale projects (the PoA consists of a number of small (in the order of 1MW) biogas to energy projects), even when combined in a PoA.

Another additional hurdle noted by CYY, AT Biopower and TGO is the challenge of meeting sustainable development requirements. While both CYY and AT Biopower agreed that ensuring development benefits and adequate participation were essential to ensuring communities support the project, they also noted that the requirements have often been unrealistically strict. In order to count development benefits under the Thai requirements, certain criteria must be met, for example a very low emission of SO_2 and NOx in order to qualify for air quality benefits. These requirements have been well below national and international standards and project developers were finding it challenging to comply. TGO has since reduced the requirement in order to make it easier for projects to qualify.

This may have several implications. While on the one hand, requirements must be realistic, they must also maintain credibility as benefits. As many researchers have identified, there is pressure to be internationally competitive so as not to lose investment to nearby countries with lower SD requirements. Lowering the requirements may help to bring greater investment, but also risks compromising the sustainable development in favor of greater financial returns. This is essentially why those that support the People's Protocol on Climate Change argue that the CDM, as a market mechanism, can not actually achieve both emissions reductions and sustainable development, as noted below in section 4.12.

Interviews with DEDE and TGO, as well as project owners revealed that nearly all parties currently involved in CDM see it as a beneficial mechanism. Khun Areerat of DEDE pointed out that while the CDM is but a small part of the overall Thai strategy on renewable energy it has succeeded in attracting investment for renewable energy projects. However, she also identified that there is great overlap between the various agencies responsible for energy, alternative energy and CDM policy which makes communication and coordinated policy somewhat difficult. As part of the 15 year renewable energy policy, the CDM is seen as playing a small but significant role in promoting cleaner energy. No one interviewed at DEDE or TGO would comment on the conflict between the 15 year RE plan and the Power Development plan developed by EGAT, and no one could be reached at EGAT for comment.

4.11 Post-2012 and Sectoral crediting options

Section 2.4.3 outlines the thinking in the literature on post-2012 options. As the Copenhagen Conference of the Parties (CoP) meeting approaches, it appears that the CDM will favor a sectoral approach after 2012. Interviews with a variety of stakeholders in Thailand revealed a surprising consensus; nearly every person interviewed was skeptical of the sectoral approach and did not agree with the research that sectoral crediting would achieve greater sustainable development or be beneficial for developing countries. This is contrast to most published research on the subject.

The sectoral approach would require setting a national baseline or benchmark for the emissions reductions of an industry, such as cement production, or swine farms. Project owners of CYY and AT Biopower both identified this as a major hurdle. In order to set a baseline, a significant amount of data is required, which requires monitoring equipment, which is often very expensive, to be in place. In many cases, this equipment is not a part of normal operations in Thailand and therefore data collection would be a major issue. This approach would also require a significant amount of coordination between local and national government and individual industrial plants and owners, which both project owners saw as a challenge.

Interviews with TGO and DEDE also revealed that the baseline or benchmark setting would be challenging. In addition, Khun Sirithan of TGO and Khun Natee of AT Biopower stated that reaching agreement on a baseline would extremely challenging, as this implies an overall emissions cap on the industry. While there are many different ways a sectoral approach can be developed, and for countries without emissions cap projects which reduce emissions below the baseline would receive credit, but those over the baseline would not face penalty (as they would in developed

countries with emissions caps) this is seen by many as a step towards a cap for developing countries. Khun Sirithan identified this as something that he believes most developing countries will not agree to, including China and India, the main negotiators for developing countries in the Kyoto negotiations.

Overall, it appears that all relevant parties in Thailand do not see a sectoral approach as more beneficial. Energy for Environment Foundation (EforE), which believes that small scale projects have a greater potential benefit for communities also agreed. Kannikar Srithunyalucksana, energy policy analyst for EforE, stated that she hopes the 2012 agreement will include greater support for small projects. The research on the subject actually seems to support a sectoral approach precisely for this reason and many argue (as is shown in chapter 3) that the sectoral approach would benefit small scale projects. Khun Sirithan of TGO believes that even if a sectoral approach is approved, the project by project approach will also still be possible, and perhaps preferable for developing countries.

4.12 Alternative views

In order to give balance to this thesis and those in support of the CDM, an interview was also held with a representative of the Institute for National and Democratic Studies (INDIES), an NGO from the Philippines which was instrumental in the creation of the People's Protocol on Climate Change. Syamsul Ardiansyah, Director of INDIES, believes that the Kyoto Protocol has many weaknesses, including a lack of public participation. He believes this is essential, as climate change will have devastating impacts on some of the world's poorest people, they should be given a chance to weigh in on the negotiations, but were not given sufficient opportunity to do so. He is also sceptical of many of the emissions reductions delivered under the Kyoto Protocol and cites Germany as an example, which has reduced its transport emissions largely by converting to bio diesel. This bio diesel, however, has been sourced considerably from Indonesia, where bio diesel production has had severe environmental impacts, including the destruction of forests and severe air pollution from the burning of those forests to clear land for palm oil production (Knudson, 2009).

Signatories of the People's Protocol on Climate Change also believe that the CDM allows developed countries to 'dump' the real work of reducing emissions on developing countries. As a market mechanism, lacking a rights-based approach, that allows developed countries to purchase cheaper emissions reductions from developing countries, they see developed countries avoiding the real work of changing habits or reducing emissions in their own countries. Mr. Ardiansyah does believe the CDM

could contribute to sustainable development, if it were conducted based on a rights based approach that includes local communities to a greater extent having a say over their own environment. However, he does not see this as possible so long as the CDM remains a market based mechanism. He advocates the greater use of the Adaptation Fund, established as part of the Kyoto Protocol to fund adaptation activities in developing countries. This fund should be distributed in a transparent and equitable manner that prioritizes communities most at risk from climate change. He believes this to be much more equitable than the market-based CDM.

Certainly, there are several very important points made the proponents of the People's Protocol. Transparency and civil society involvement are critical to the CDM having a positive impact on local sustainable development. It is also imperative that renewable energy or alternative fuels are not accepted whole-sale, but that the true full cost socially and environmentally are considered. While it still remains up for debate whether the CDM can, as a market mechanism, contribute to both emissions reductions and sustainable development, it is important to keep this question in mind and to give full weight to the voices of local stakeholders.

CHAPTER 5

CONCLUSION

5.1 Summary of Results

Thailand has relatively more strict requirements for sustainable development benefits from CDM projects than many other countries, and this study has analyzed the CDM portfolio in Thailand to assess the extent of these benefits in the national context and whether the stricter requirements have contributed to sustainable development. The PDDs of all registered projects in Thailand were analyzed to assess the potential development benefits from CDM projects. In addition, two projects were selected for greater analysis; CYY Biopower, a wastewater treatment project that produces electricity from captured biogas, and AT Biopower, a biomass electricity generation project that produces electricity by burning rice husk agricultural waste. In addition, interviews were conducted with a wide variety of stakeholders, both to cross check these results as well as to analyze further the Thai policy surrounding the CDM and renewable energy development, and on the future of the CDM in Thailand, specifically in the post-2012 period and in terms of the proposed sectoral approach.

5.1.2 Results of PDD analysis

PDD analysis of registered projects in Thailand showed that the most common benefit from CDM projects in Thailand was energy; including greater access to, availability of, or improved quality of renewable energy sources, with 16 of the 17 projects positively benefiting this category. This is largely due to the fact that all projects registered so far in Thailand produce renewable energy of some kind, and is likely that this will change as the project types become more varied.

However, due to the structure of the Thai energy market and the lack of coordination between renewable energy plans and the Power Development Plan, while the overall amount of renewable energy available may be increasing, the percentage of electricity production in Thailand from renewable sources has not necessarily increased. In addition, most CDM projects are relatively small scale, and therefore add very little to the overall energy production capacity. While benefits are felt locally, from improved air quality, for example, the significance of these benefits remains relatively minor.

The next most common benefits were employment and growth. These results match a number of studies of CDM sustainable development benefits, with employment being one of the most common benefits of most CDM projects. Wastewater projects contributed significantly to the protection of local water resources. Several categories had no projects with said benefit. These were SD Tax, balance of payments, health and conservation. This was primarily due to Thai policy (lacking a tax on CDM projects to fund sustainable development projects) and incomplete information in the PDD to assess the balance of payments. It is difficult to quantify the extent to which benefits in these categories contribute to overall development. Again, while projects tend to bring job opportunities to low-income and/or rural areas, most projects are small scale and therefore only employ small numbers of people. In addition, the most technical jobs are usually sourced from outside local communities due to a lack of local capacity in engineering or other required skills. While many projects provided short term construction employment, and this may have benefited people in the short term, it can hardly be called sustainable.

Other important benefits from CDM projects in Thailand were learning, participation, and welfare. Nine projects offered additional training for staff in the operation and maintenance of new technology, as well as training in the CDM, environmental impacts, or other relevant topics increasing their skills, and theoretically contributing to technology transfer. Seven projects contributed significantly to

participation by increasing public participation, stakeholder meetings, or community committees. Welfare was positively impacted by ten projects, primarily due to the reduction in odour from wastewater treatment projects.

Due to the limited scope of project types in Thailand, it was not possible to decisively state which project types had the greatest benefit. However, as CDM projects in Thailand did show some positive benefits, this is in keeping with other studies that have shown biogas and biomass projects generating the greatest benefits. As project types diversify in Thailand, the overall benefit from the whole pipeline is likely lower, on average, as project types with less sustainable development potential are implemented. No correlation was found between project size and number of benefits, though small-scale and medium-scale projects did have clusters with higher levels of benefits.

5.1.3 Results case studies

It appears that the development benefits outlined in the CYY Biopower PDD have indeed been delivered, to some extent. However, the project is relatively small scale, and the number of people living near the plant is also small. While no negative or unexpected impacts could be uncovered, the degree to which the plant ultimately contributes to the development of the community is questionable. For those working on site or living nearby, the reduction in odour is quite significant, as are the skills and capacity development for the 12 employees. It is not possible to say whether the plant will ultimately sway other starch factories to follow a similar path to implement biogas capture and utilization, but it does serve as a successful example of best-practice technology advancement that has the potential to benefit those nearby and to contribute to a reduction in emissions and the use of fossil fuel.

It appears that AT Biopower has also benefited the community as was described in the PDD. The plant has been committed to public participation to a greater extent than is required by the CDM, and has also implemented several additional CSR programs, including the community and environmental funds. While construction employment is not generally considered significant or sustainable, there were clearly some additional benefits to the community, and permanent employment is considered significant. While the price of rice husk has been a challenge for the plant, it has likely benefited the sellers and increased agricultural income in the area. This could eventually have a negative impact, however, as the price of rice husk may become too expensive for the power plant, or price out alternative uses of rice husk; such as compost material. Although it was not possible with this analysis to measure the full impact of the project, it appears that there has been a positive impact in terms of participation and employment, as well as greater access to renewable energy.

5.1.4 Results of interviews

Interviews were held with a wide variety of stakeholders, including government entities, the private sector and NGO's, in order to identify the major challenges and opportunities to CDM development in Thailand and its contribution to sustainable development. There were several recurring themes; lack of capacity, the length of the CDM process, the challenge of meeting sustainable development criteria, and the difficulty of moving forward with a sectoral approach.

It seems the greatest challenges facing Thailand in terms of promoting the CDM are a lack of capacity and the length of the CDM process. The most surprising result from interviews was the opposition to sectoral crediting. It appears that the thinking in the literature and policy debate may not represent the opinions and experience of developing countries thus far within the CDM. This perhaps proves the point of those opposed to the CDM, such as the signatories of the People's Protocol on Climate Change

who have argued that the mechanism does not offer sufficient involvement of local communities.

While this thesis found that project owners value stakeholder involvement in the development of projects, there was no evidence of local stakeholder involvement at the national or international level. It seems the CDM can do quite well at involving communities in local projects, but does not necessarily allow their involvement at the policy level. This is partly a result of the national policy on CDM and a larger lack of comprehensive stakeholder involvement in energy and environmental policy as well as the CDM, as was discovered in the literature review. However, at the international level, much more could be done to involve civil society in the decisions. It is not yet clear whether the People's Protocol on Climate Change will help to raise awareness and involvement.

While results of the PDD analysis and interviews indicated a positive contribution to development, it may be that the projects developed in Thailand so far represent the 'low hanging fruit' of potential CDM projects in the country. In other words, future projects may be those with higher up front cost or lower sustainable development benefits. In addition, as noted by Olson (2007) and Sutter and Parreño (2007), since the CDM currently places a value on emissions reductions, but not sustainable development benefits, the market will preference projects with greater GHG reductions with or without development benefits. As was noted by Khun Sirithan at TGO, the trend in Thailand is to weaken, rather than strengthen, the sustainable development requirements of projects in Thailand. While the stated goal of this is to make a greater number of projects viable, it is a step in the direction of favoring GHG reductions over development benefits. As the market, and thus competition, grow there will be further pressure to attract investment which could result in what Sutter (2007) calls 'a race to the bottom' in favor of the most cost efficient projects.

5.2 Strengths and weaknesses of Thai CDM and related policy

As noted above, it is important to note that the trend in Thailand is to decrease the sustainable development requirements for CDM projects. This is a slippery slope and may further indicate that the projects registered so far represent 'low hanging fruit'. As the project pipeline becomes more diverse, with projects that offer lesser benefits, and as policy becomes less strict in order to make it easier for market participants to comply, there is a great chance that sustainable development benefits will less and less significant. In addition, while the current SD requirements do more than many other countries, it is still possible to game the system. It is only required to have a positive score in each overall category, meaning that so long as a project can identify even one weak contribution in each category, it will comply with the regulations.

It must also be taken into account that while the renewable energy projects developed so far appear to have had an impact on increasing the availability of renewable energy, they have not, in fact, necessarily increased the percentage of RE available in the Thai grid. So long as RE development continues to be matched by traditional energy development, the goal of reaching 20% renewable energy consumption by 2022 will not be reached. The overall emission reduction is also somewhat questionable when matched by traditional energy development.

In addition there remain a number of challenges at the policy level. Overlapping responsibilities of agencies responsible leaves loopholes open for exploitation. The biggest evidence of this is the lack of coordination between CDM policy, the 15 year renewable energy plan, and the overall Power Development Plan of 2007. While representatives from each agency were aware of the other policies, there no was no evidence that these policies are in any way being harmonized. The overestimation of demand growth, coupled with lack of growth in renewable energy production in the PDP

2007 is in direct contrast with the 15 year renewable energy policy, and it was not possible for any policy maker interviewed to address this. While the CDM may help to bring investment to the renewable energy sector, this will continue to be insignificant if the PDP 2007 continues to define the energy future of the country.

The second major challenge at the policy level is the lack of local stakeholder participation. As mentioned above, individual projects appear to do fairly well at engaging local stakeholders, however at the national policy level this does not appear to be the case. Since each country, under the CDM, sets its own requirements for sustainable development, this is a missed opportunity for communities to help set the agenda for how projects should benefit them, and what is required by TGO in terms of sustainable development. As is pointed out by INDIES and the People's Protocol on Climate Change, the CDM, and the approach taken by TGO to develop the sustainable development criteria do not represent a rights-based approach to development, but rather a top-down dictation of what defines "development" and what is required for CDM projects.

Finally, the overall policy on renewable energy development outlined in the 15 year renewable energy plan, if it can be assumed to apply to CDM projects as well, does not discriminate by energy type. This has huge implications for potential negative environmental and social impacts, should future CDM projects trend towards biofuels production, for example. As the percentage of ethanol and bio diesel increase, as is outlined in the plan, the demand for these fuels will increase. This could have one of two impacts; either an increase in energy imports, as biofuels are sourced from other areas in the region, such as Indonesia, or to encourage the development of biofuels in Thailand. While the full impact of biofuels remains outside the scope of thesis, as was pointed out in chapter 4, they are extremely controversial and could have very negative impacts. The CDM, nor the 15 year energy plan, should indiscriminately promote all forms of

renewable energy without also including restrictions on the type, technology, and standards.

One way of preventing these problems would be to take a similar approach to that of China, which discriminates by project type. As noted by Olsen and Fenhann (2008), and outlined in figure 4.1.2, China both discriminates by project type, and adds further incentive by using a regressive tax on projects depending on the gas reduced and project type. This tax is then used to support additional sustainable development activities beyond direct CDM projects. In addition, both CDM and non-CDM renewable energy projects in Thailand should further outline the types of acceptable fuels, standards for development and production, and at minimum full social and environmental impact assessments.

5.3 Conclusion

In conclusion, while development benefits outlined in the PDDs of Thai CDM projects appear to be significant, it is not fully possible at this point to assess the degree to which they have contributed in Thailand or in comparison to the international portfolio of registered projects. This is primarily due to the limited scope of projects registered so far in Thailand. The projects approved by the Thai government, via TGO, but not yet registered show that the future will bring a greater diversity of project types which may impact the degree to which projects contribute to sustainable development.

With that in mind, it does appear that CDM projects have had significant benefits in terms of employment, greater availability of renewable energy, and welfare, especially in terms of reduced odour from wastewater treatment plants. In addition projects have contributed to capacity development of employees and local communities, raised awareness of the CDM and climate change issues, and helped to establish best-practice and demonstration projects in a number of industries including wastewater management and electricity production, among others.

Nearly every stakeholder interviewed, from the private sector project developers to government officials believed the CDM has a role to play in Thailand to help to develop renewable energy projects, among others. This fits within the 15 year renewable energy plan and plays an important role in spurring investment the sector. However, overall, the contribution of CDM is limited and is only one of many mechanisms needed in order to hasten the transition of to a low-carbon economy while still allowing the high intensity development required to advance the Thai economy overall.

In addition, there are several policy challenges in Thailand, including overlapping responsibility of agencies involved in renewable energy and CDM, as well as a large question remaining over how renewable energy policy is intergraded into overall energy policy and planning. It is possible that a sectoral approach may make this somewhat easier as it would address the energy sector as a whole. However, great resistance remains towards a sectoral approach in the post-2012 period and a number of challenges for data collection and baseline-setting remain.

There is also concern that the CDM and renewable energy policies in Thailand do not discriminate by type of renwable energy. As has been seen in Indonesia it is imperative that proper controls are in place to ensure that biofuels, for example, do not negatively impact local environments and communities while allowing developed countries to offset their emissions cheaply. This should be more fully addressed by the requirements for CDM projects in Thailand.

Finally, it appears that CDM has a role in encouraging the development of climate and environmentally friendly development, but a number of challenges remain. It can be concluded that projects have contributed to sustainable development, to some degree, in local communities, but the approach is not the only solution. The post-2012 climate regime is encouraged to allow greater civil society participation and take the experience

of developing countries into account in order to promote greater involvement of local communities, as well as to ensure that the CDM is able to accomplish both emissions reductions and sustainable development, as is necessary to maintain the legitimacy of the mechanism.

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APPENDICES

APPENDIX A

Sustainable Development Benefits outlined in project PDDs

SD Benefits	Project Name CERs p.a.	AT Biopower 70,772	Cassava WTE Kalasin 87,586	Chao Khun Agro Biomass 48,167	Chumporn Biogas WWT 23,448
Environmental	Air	Control of burning rice husk (instead of open burning, which produces SO2 and Nox) p.17-21	N	N	N
	Land	N	N	N	N
	Water	N	Improved WWT: protection and conservation of groundwater, p.51	Improved WWT: protection of groundwater, p.2	Improved WWT: protection and conservation of groundwater, p.2, sludge and effluent w/ COD removed can be used for

					fertilizer p.3 (protects groundwater)
	Conservation	N	N	N	N
Social	**Health**	N	N	N	N
	Welfare	N	Reduction of odour causing gasses from baseline open lagoons p.2, 51	Reduction of odour causing gasses from baseline open lagoons p.2	Reduction of odour causing gasses from baseline open lagoons p.2
	Participation	surveys were conducted of 20 com leaders and 150 community members with 87% in favor of the project p.49	additional surveys conducted w/ 95% confidence (sample) 73% agreed, 24% no comment p.56	N	N
	Learning	Training will be provided to employees to promote tech. transfer p.9	Tech transfer promotion as a demonstration project for increased eff. In starch production p.3	Capacity building for staff, promotion of tech transfer p.2	Training provided to 16 staff to properly operate equipment and monitoring, and emergency situations

	Employment	Preference will be given to qualified locals to work in plant p.9, indirect employment for collection and transport of rice husk, add. ST jobs during construction	22 additional staff to operate the plant p.3	temporary construction employment, some perm employment for operation p.2	4 new jobs: 2 labour, 2 technitions for construction, operation, and maintenance p. 3
Economic	**Growth**	Creation of market for rice husk, previously not a commodity p. 50-51	increased competetiveness of starch industry p.3	increased competetiveness of starch industry p.2, locally sourced tech where pos. p.2	will serve as demonstration, potential tech transfer to improved process management in Palm Oil industry p.3, 5
	Energy	Increased access to clean energy services p.2	clean energy access	N	clean energy access
	Balance of Payments	N	N	N	N
Other	**SD tax**	N	N	N	N
	CSR	Est. community development fund (1mil baht/ annually) to fund projects in education and	Community biogas education center at plant to promote tech transfer p.3	N	N

		environment			
SD Benefits	**Project Name** **CERs p.a.**	**CYY Biopower** 97,468	**Dan Chang Bio E Cogen** 93,129	**Jaroensampong Landfill gas** 47,185	**Jiratpattana Biogas** 24,726
Environmental	**Air**	N	increased air quality due to decreased uncontrolled burning of sugar cane leaves p. 2	reduction of volatile organic compounds VOC p. 30	N
	Land	N	reduced dependance on chemical fertilizers, as remaining ash will be distrubted to local farmers to improve soil quality p.3	N	N
	Water	improved quality of wastewater p.3 and protection of groundwater p.52	N	control of leachate drainage, improving water quality p.3	improved water quality of ww, p. 45
	Conservation	N	N	N	N
Social	**Health**	N	N	N	N

	Welfare	Reduction of odour causing gasses from baseline open lagoons p.3	N	Reduction of odour causing gasses from uncontrolled emissions from landfill p.3	N
	Participation	N	Tripatriate committee to increase participation p.3, emphasis on participation; group meeting, public hearing, and survey. 11 sc meetings, 3 site visits p. 39m,	N	N
	Learning	training in the operation of the plant for staff p.3	Capacity building of staff for operation of the plant p.3, contribution to tech transfer in the insdustry p.3	Training for staff on imported tech, pot. Tech transfer to the industry p.3	N
	Employment	12 full time staff to operate the system p.3	increased local employment p.3, increased income for farmers through sale of what was previously waste (cane leaves) p.3	20 people employed for project purposes p.30	Temp employment for construction, perm emp for operation p.3

Economic	**Growth**	N	increased efficiency in the sugar cane industry by utilizing what was previously waste (cane leaves) p.3, promotion of best practice management in industry p.3	N	Increased competitiveness of cassava industry via greater efficiency p.3, use of previous waste product
	Energy	clean energy access	clean energy access	clean energy access	clean energy access, p.3
	Balance of Payments	N	N	N	N
Other	**SD tax**	N	N	N	N
	CSR	N	PO involved in community activities	N	N

SD Benefits	**Project Name** **CERs p.a.**	**Khon Khan sugar power** 61,449	**Korat WTE** 310,843	**Phu Kieo Bio E cogen** 102,493	**Ratchaburi Nong Bua** 15,958
Environmental	**Air**	N	N	reduction in air pollution from burning of previous waste material p.3	N

	Land	N	N	reduced dependance on chemical fertilizers by supplying farmers with ash to improve soil quality p.3	dried sludge and potentially liquid to be supplied to local farmers for fertilizer p.4 (also welfare- cheap fert. For farmers), p.31
	Water	N	N	N	improved ww quality will prevent contamination from leakage or overflow in the rainy season p.28
	Conservation	N	N	N	N
Social	**Health**	N	N	N	N
	Welfare	N	N	N	reduction of odour and flies from open lagoons p.4, safety measures and training for staff p. 31
	Participation	N	N	public participation thru 'tripatriate' committee, which will hear and resolve issues, should any arise from local communities p 40. SC and attitude survey conducted in 25 local communities p. 39, 70% locals agreed (7%	10% of residents in surrounding villages surveyed in addition to SC meeting (95% in favor) p. 30

				disagreed) p. 40	
	Learning	N	N	promotion of 'best practice' in sugar industry p.3, training in power plant operation to staff p.3	N
	Employment	50-60 people employed for operation, including technicial positions p. 2	temp employment for construction, perm for operation p.3	increased local employment, increased income to farmers thru purchase of previous waste material p. 3	N
Economic	**Growth**	N	Increased competitiveness of cassava industry via greater efficiency p.3, use of previous waste product	enhanced agricultural competitiveness thru use of previous waste material (bagasse and cane leaves) p. 3	enhanced efficiency in swine farms, contribution to tech transfer p. 4
	Energy	clean energy access, p.3	clean energy access, p.2	clean energy access, p.3, increased stability of local grid p. 3	clean, low cost energy access p.4
	Balance of Payments	N	N	N	N
Other	**SD tax**	N	N	N	N
	CSR	N	Funding to local NGO for eductation on sustainabiliity and renewable energy p. 3	N	sludge provided to schools to fertilize gardens for student food programme p.4

SD Benefits	Project Name CERs p.a.	Ratchaburi SPM 23,556	Ratchaburi Veerachai 32,092	Siam Starch WWT 98,372	Surat Thani biomass 106,592	Univanich Lamphang POME biogas 43,650
Environmental	Air	N	N	N	N	N
	Land	dried sludge and potentially liquid to be supplied to local farmers for fertilizer p.4 (also welfare-cheap fert. For farmers), improved waste disposal p.30	dried sludge and potentially liquid to be supplied to local farmers for fertilizer p.4 (also welfare-cheap fert. For farmers), p.31	N	N	organic fertilizer from sludge avail for Palm plantation p.5
	Water	improvement of ww quality to a level sufficient to re-use it for flushing p. 3, improved ww quality will prevent contamination from leakage or overflow in	improvement of ww quality to a level sufficient to re-use it for flushing p. 3, improved ww quality will prevent contamination from leakage or overflow in	improvement of groundwater protection, improved ww quality in case of leakage or overflow which protects from contamination p 46	protection of groundwater through 'zero wastewater discharge system' p. 44	protection of groundwater p. 4

		the rainy season p.28	the rainy season p.31			
	Conservation	N	N	N	N	N
Social	**Health**	N	N	N	N	N
	Welfare	reduction of odour and flies from open lagoons p.4, safety measures and training for staff p. 32	reduction of odour and flies from open lagoons p.4, safety measures and training for staff p. 33	reduction of odour from open lagoons p.3	reduction of odour from open lagoons p.3	N
	Participation	10% of residents in surrounding villages surveyed in addition to SC meeting (80% in favor) p. 32	10% of residents in surrounding villages surveyed in addition to SC meeting (86% in favor) p. 33	N	N	N
	Learning	N	N	N	N	Imported technology, designer will train workers in operation and maintainence, contribution to tech transfer, p. 4

	Employment	N	N	N	Employment in construction and operation p.3, 20-30 employees over lifetime of project p. 46	5 new jobs for operation, additional temp emp for construction p.4
Economic	**Growth**	enhanced efficiency in swine farms, contribution to tech transfer p. 4	enhanced efficiency in swine farms, contribution to tech transfer p. 4	N	improved competitiveness of agriculture, via use of previous waste material (EFB) p.3	N
	Energy	clean, low cost energy access p.4	clean, low cost energy access p.4	access to clean energy p4, 46	access to clean energy p.2	access to clean energy p.4
	Balance of Payments	N	N	N	N	N
Other	**SD tax**	N	N	N	N	N
	CSR	sludge provided to schools to fertilize gardens for student food programme p.4	sludge provided to schools to fertilize gardens for student food programme p.4	N	N	"active support of community activities" p. 4

APPENDIX B

INTERVIEWS

Type	Agency/ Company	Name	Title	Date	Location	City
Public sector	DEDE	Dr. Sukamon Hinchiranan	Scientist	3-Jul	DEDE	Bankgok
	DEDE	Dr. Areerat Yooltoon	Senior Scientist	3-Jul	DEDE	Bangkok
	TGO	Sirithan Pairaj-Boriboon	Executive Director	21-Jul	TGO	Bangkok
Private sector	AT Biopower	Natee Sithiprasasana	CEO, project owner	21-Jul	KPN	Bangkok
	CYY	Thawatchai Yuenyong	Project Owner	17-Jul	site visit	Amphur, Khamtalesor District, Nakhorn Ratchasima Province
	Local stakeholder	Sawit Sriarphai	Local Stakeholder	18-Jul	home visit	
	Local stakeholder	Lee Bandkuntod	Local Stakeholder	18-Jul	home visit	
	Local stakeholder	Lhong Whernkuntod	Local Stakeholder	18-Jul	home visit	
	Local stakeholder	Luan Sriarphai	Local Stakeholder	18-Jul	home visit	
	Local stakeholder	Hing Rattnasantia	Local Stakeholder	18-Jul	home visit	
	CYY	Nakorn Phaisri	Plant Manager	17-Jul	site visit	
	CYY	Yupin Umwan	Lab Supervisor	17-Jul	site visit	
NGOs	Energy for Environment Foundation	Kannikar Srithunyalucksana	Energy Policy Analyst	3-Jul	EforE	Bangkok
	Institute of National and Democratic Studies (INDIES)	Syamsul Ardiansyah	Director	15-Jul	Via email	Jakarta, Indonesia (email)

BIOGRAPHY

Naomi Swickard is from the United States and graduated with honors from Portland State University with a Bachelors degree in International Studies in 2003. Since then she has worked in Kyrgyzstan, the United States and Thailand in the fields of international development and environmental services. She currently focuses on climate change and GHG emission reduction projects worldwide with a focus on agriculture, land use, and forestry projects that seek to deliver social and environmental co-benefits in developing countries.