Institute for Global Environmental Strategies

Study of Practice Diffusion and Adoption Process under the Cities for Climate Protection program in Thailand

Final Report*

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* The views expressed in this report are those of the authors and do not represent IGES nor any of its members and affiliates.

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1 Introduction

1.1 Background

The Institute for Global Environmental Strategies (IGES) is examining the roles and potential of international intercity networks in promoting local environmental initiatives in Asia. ICLEI-Local Governments for Sustainability (ICLEI) is one of the four international intercity networks being studied.[1] ICLEI is an international association of local governments and national and regional local government organizations that have made a commitment to sustainable development. More than 880 cities, towns, counties, and local government associations worldwide comprise ICLEI's growing membership.[2] ICLEI works with its members and hundreds of other local governments through international performance-based, results-oriented campaigns and programs. One such program is the International Cities for Climate Protection Campaign (CCP). Established in 1993, the CCP Campaign works with local governments "to (1) understand how local actions and practices contribute to the emissions that cause air pollution and global warming, (2) strengthen local capacity to develop plans and implement actions to cut local emissions, and (3) promote best practices that reduce energy use in buildings and transportation, promote renewable sources of energy, and improve waste management. Local governments sign commitments to join the campaign and undertake activities that reduce greenhouse gas emissions."[3] In doing so, local governments achieve the "co-benefits" of reducing air pollution, managing municipal wastes, and cutting greenhouse gas emissions. In 1999, CCP began with five pilot cities in the Philippines. In 2001-2003, CCP activities expanded from the Philippines to cover Indonesia and Thailand. The United States Agency for International Development (USAID) funded the CCP activities in Indonesia and the Philippines, while the Canadian International Development Agency (CIDA) sponsored those in Thailand.

ICLEI's engagement through the CCP essentially consisted in assisting the cities improve local governance mechanisms and built capacity to plan and implement climate change mitigation actions mainly through the CCP milestone process. The milestone process is a strategic and performance framework for planning, implementing, and monitoring a local climate mitigation action plan and comprises five steps or *milestones*, which are:

Milestone 1- Conduct a baseline emissions inventory and forecast
Milestone 2- Adopt an emissions reduction target for the forecast year
Milestone 3- Develop a Local Action Plan
Milestone 4- Implement policies and measures
Milestone 5- Monitor and verify results

The five milestones of the CCP and the tools and methodologies behind them provide a simple, standardized means of calculating greenhouse gas emissions, of establishing targets to lower emissions, of reducing greenhouse gas emissions through local

[1] The other city networks under study are Kitakyushu Initiative Network for Cleaner Environment (KIN), Clean Air Initiative for Asian Cities (CAI-Asia), and CITYNET.
[2] ICLEI-Local Government for Sustainability website http://www.iclei.org/index.php?id=global-about-iclei, 8 July 2008.
[3] ICLEI (2007). "Global Program Circular," 25 July.

measures identified in the Local Action Plan, and of monitoring, measuring and reporting performance. A full description of each milestone is provided in Annex 1.

1.2 Objectives

Six municipalities from Thailand participated in the CCP: Chiang Mai City, Muangklang Municipality, Nonthaburi City, Phuket City, Rayong City, and Tungsong Municipality.

The study examines the following CCP projects in four of these municipalities:[4]

- Chiang Mai—Fuel-substitution for diesel-fed *songteaws*
- Rayong—Biogas from municipal solid waste (MSW)
- Muangklang—Energy switch and lamp retrofits for traffic signal
- Tungsong—Organic fertilizer and liquid detergent production from MSW

The study of the CCP project in each of the four target local governments investigates the following aspects or elements:

1. CCP project review and latest developments
2. Historical record of activities undertaken by key stakeholders with introduction of the practice
3. Policy process stages and the role of ICLEI and CCP
4. Mutual reference among city governments and the role of ICLEI and CCP
5. Political factors that played important role in adoption of the new practice
6. Impact of socioeconomic factors on new practice
7. Practice diffusion to other cities and the role of ICLEI and CCP

The study first reviews the status of the project and latest developments affecting or caused by the project. The study lists and describes the chronology of actions and events that led to the implementation of the practice or project, including formal performance evaluation if any. It also identifies the key actors or stakeholders who were responsible for the accomplishments of the project.

The study then looks at and understands the rationale and motivations for the various stages in the development of the practice in particular and of a local government environmental policy in general. It investigates the factors that led to the conception of the project idea, the framework in which it was conceived, and the decision-making process that led to its eventual implementation. It also identifies difficulties in the decision-making process, external influences, and critical factors that led to the decision to undertake the project. The role of ICLEI and CCP in the policy development or adoption of new practice is discussed.

The study also examines the interactions of the target local governments with other local government units, within and beyond the CCP, and other entities. This aspect particularly looks at the data collection and assimilation processes as well as the influence of other cities in the adoption of the practice or project. The role of ICLEI and CCP in information gathering and assimilation is also discussed.

[4] The order of listing of the four cities throughout the document is simply based on the schedule of field visits to the four cities, and not in any other way.

The study also determines the role of the following political factors in the adoption of the practice or implementation of the CCP project:

- Political will of the Mayor
- Pressure by citizens or NGOs to the local government
- Individuals or organizations who coordinated different stakeholders to introduce and execute the policy, both within and outside the city government
- Civil society networks
- Knowledge introduced by experts (such as researchers and consultants)
- Autonomy of the local government vis-à-vis national and provincial governments (scope of mandate, freedom of decision-making, self-reliant budget)

The study also analyzes the impact of the following socioeconomic factors in the adoption of the practice or implementation of the project:

- Population
- Urbanization rate in terms of growth of urban population and share to total population
- Regional GDP
- Revenue allocation from national government and internal revenue generation

Last but not least, the study examines the diffusion of the practices to other cities, including identification of the cities that have adopted similar practices, the process of diffusion, and the role of ICLEI and other international city networks.

1.3 Methodology

The main activities undertaken for this study were field visits in the four cities and interviews of key stakeholders of the project, starting with the mayor or local executive. Some interviews were also conducted in Bangkok to stakeholders who are located or based in Thailand's capital city. The field visits and interviews were preceded by the preparation of a standard questionnaire that was then sent to the local executives of the four cities. The field interviews were supplemented by desk research of available information on the CCP projects, related developments at the local and national levels since the implementation of the projects, and socioeconomic and political situation in the four cities.

A standard questionnaire was sent to each of the target respondents in advance of the scheduled field visits and interviews. After asking basic information about the respondent, the questionnaire is divided into six parts asking questions reflecting the various aspects mentioned earlier. The questions under each part are as follows:

<u>Background on the CCP project</u>

1. Please list and describe the chronology of events that led to the implementation of the CCP project, starting from discussion of the project idea to performance evaluation, if any? Please indicate month and year, actors, short description of the accomplishment or actions.
2. Who were the actors or stakeholders that you think have been key factors to achieving the major accomplishments or milestones of the project? Why do you think so?

Policy process stages

3. What led to the conception of project idea? In other words, how did it come about? For example, are there pressing problems or issues in the city that motivated the conception of this project idea?
4. Under what framework was the idea conceived? Is it part of the environmental, energy, or sustainable development policy of the city? Was it in response to a mandate, policy instruction, or regulation from the national government?
5. How are decisions reached in the city, for example, the decision to undertake this CCP project?
6. What were the difficulties in reaching a consensus or agreement (practicing democracy)? For example, is financing and/or technology availability an issue?
7. What were the influences of other cities, external experts or advisers, international or donor organizations, city networks, and other external factors in the decision-making process?
8. What factor or factors have been most critical to make the decision to undertake the project?

Mutual reference among city governments

9. How does your environment section or department collect or gather and collate/process information? Do you this on a daily basis?
10. If not, how frequent or often?
11. What are your sources of information? Please name all sources, whether internal (within the LGU and city) or external (outside the city, including city networks and other government agencies).
12. How many people in the environment department are involved in data collection and processing?
13. Do you share this information with other cities or other agencies?
14. What is the role of ICLEI and other city networks in information gathering and processing?
15. Is the practice or project in question copied (exactly the same), emulated (copied but partly modified), a blend of practices from other cites, or inspired (project idea borne out of existing practice) from other cities?

Political factors

16. How did the following factors play a role in the adoption of the new practice or implementation of the CCP project? Please tick the appropriate cell.

	None	Minor	Important	Very Important
Political will of the Mayor				
Pressure by citizens or NGOs to the local government				
Individuals or organizations who coordinated different stakeholders to introduce and execute the policy, both within and outside the city government				
Civil society networks				
Knowledge introduced by experts (such as researchers and consultants)				

Autonomy of the local government vis-à-vis national and provincial governments (scope of mandate, freedom of decision-making, self-reliant budget)				

Socioeconomic factors

17. How did the following socioeconomic factors play a role in the adoption of the new practice or implementation of the CCP project? Please tick the appropriate cell.

	None	Minor	Important	Very Important
Population				
Urbanization rate in terms of:				
• Growth of urban population				
• Share to total population				
Regional GDP				
Revenue				
• Allocation from national government				
• Internal revenue generation				

Practice diffusion to other cities

18. Which cities or municipalities have adopted this project or practice after learning from your own experiences?
19. How was your project or new practice disseminated to other cities?
20. What is the role of ICLEI or other city networks?

Although the questionnaires had been sent in advance of the field visits, the written responses to the questions were received only after the interviews. The written responses to these questions were combined with the results of the interviews and information from secondary sources to develop the case studies for the respective cities. It must be said that the completed questionnaires should have been the most reliable source of answers to the above-mentioned research questions. However, the language barrier had prevented the authors from communicating precisely the meaning of these questions. Moreover, there was no opportunity to get back to the cities to ask them explain their responses to the questions, especially when it should have been quite important to do so.

Indeed, one important lesson arising from this study is to conduct the field interviews with a local energy-environment expert who has both the technical knowledge and facility with the local language. It would have been ideal also if the questionnaires were answered and returned before the field visits, to take advantage of the field visits and interviews to clarify the responses to the questions and to ensure all questions were answered.

Notwithstanding these limitations, the study can still share important findings.

2 Key Findings

2.1 Local administration in Thailand

Considered as a key finding of the study is a clearer understanding of the distinct structure of local administration in Thailand. For instance, Thailand's use and definitions of the terms "city" and "municipality" are different from our understanding of these terms as they are used and defined in other Southeast Asian countries, and in fact in other countries.[5] Indeed, each country may have its own definition of these terms, particularly with respect to "city".[6] From the perspectives of the study, the structure and type of local administration impacts on the decision-making or policy processes at the local government level.

Administratively, Thailand local governments are normally divided into provinces (changwat), districts (amphoe), sub-districts (tambon), and villages (muban or sometime mooban), which are really territorial or geographical subdivisions regardless of the size of population within each territory. The heads of each of these local government units are appointed by the executive branch of the national government as salaried government administrative officers (as against locally elected public officials). Their main responsibility is to deliver social and other government services to the people in each these territories, which are still considered local government units.

Besides these territorial subdivisions, Thailand also established "municipalities" (thesaban) that are areas comprising some sub-districts within a district or a province. Municipalities are of three kinds depending on their population or income:

- A city (*thesaban nakhon*) has at least 50,000 population and population density of 3,000 persons per sq km
- A town (*thesaban muang*) has at least 10,000 population and population density of 3,000 persons per sq km
- A township or sub-district municipality (*thesaban tambon*) has at least 5,000 population, population density of 1,500 persons per sq km, a gross income of at least 1 million baht, and the consensus of the people in the area (to be recognized as such).

The heads of municipalities (whether a city, town, or township) are elected public officials and also called mayor like in many other countries.

The exceptions to these usual definitions or local government categories are Bangkok and Pattaya, which are considered special local government units. Bangkok is both a province and a city, and the head is an elected governor. Bangkok is divided into districts (khet) and sub-districts (kwaeng or khwang). Pattaya City is an autonomous local government unit independent of Chonburi Province where it is located, when normally a city or municipality is under the jurisdiction of a provincial government. Pattaya City is headed by an elected mayor.

[5] For example in the Philippines, cities and municipalities are equivalent levels of local government units after provincial governments, except that cities have higher income status than municipalities. In South Africa, a city is a smaller jurisdiction under a municipality.
[6] Vietnam, for example, a "city" status is given to some provinces.

Including Bangkok and Pattaya, there are 25 cities (or city municipalities) in Thailand. And most of these cities are named after the province overseeing them, like Rayong City, ranked 24th in terms of population, and Chiang Mai City, ranked as the 5th largest city. Table 1 below compares some cities in Thailand:

Table 1: Some cities in Thailand

Cities	Province	Region \4	Population (as of April 2007)
Bangkok \1	**Bangkok**	**Central**	**5,705,061**
Nonthaburi \3	**Nonthaburi**	**Central**	**266,844**
Pakret	Nonthaburi	Central	167,887
Hatyai	Songkhla	Southern	157,363
Chiang Mai	**Chiang Mai**	**Northern**	**148,828**
Nakhon Ratchasima	Nakhon Ratchasima	Northeastern	147,879
Udon Thani	Udon Thani	Northern	142,577
Khon Kaen	Khon Kaen	Northern	120,023
Pattaya \2	Chonburi	Eastern	101,378
Phitsanulok	Phitsanulok	Northern	79,351
Phuket	**Phuket**	**Southern**	**74,957**
Chiang Rai	Chiang Rai	Northern	69,660
Lampang	Lampang	Northern	59,971
Samut Prakan \3	Samut Prakan	Central	56,736
Samut Sakhon \3	Samut Sakhon	Central	56,333
Rayong	**Rayong**	**Eastern**	**55,766**
Phra Nakhon Sri Ayutthaya	Phra Nakhon Sri Ayutthaya	Central	54,907

\1 Bangkok is both a city and a province.
\2 Pattaya is located in Chonburi but is independent from the provincial government.
\3 These cities and their respective provinces are part of the Metropolitan Bangkok or Bangkok Metropolitan Area, which also includes the provinces of Pathumthani and Nakhom Pathom.
\4 Thailand is economically and geographically divided into six regions: Central, Northern, Southern, Eastern, Western, and Northeastern regions.
The cities in bold fonts were CCP participants or ICLEI member.
Source: Department of Provincial Administration, Ministry of Interior as quoted in http://en.wikipedia.org/wiki/list-of-cities-in-Thailand-by-population

Tungsong had a population of 27,609 and population density of more than 3,000 persons per sq km as of 2004, and is thus listed as one the 117 towns (thesaban muang). Muangklang had a population of close to 20,000 but a population density of less than 1,500 as of 2004 and is thus considered among the 1,024 townships (thesaban tambon).

However, for simplicity, municipality and city will be used interchangeably in this report to refer to any of the four municipalities in Thailand. Table 2 compares some socioeconomic indicators of the four cities.

Table 2: Basic socioeconomic indicators of the four cities

	Chiang Mai	Rayong	Muangklang	Tungsong
Land area (sq km)	40.216	16.95	14.5	7.17

Population (2004)	170,348	57,442	18,843	27,609
Location	751 km north of Bangkok	179 km east of Bangkok	229 km east of Bangkok	747 km south of Bangkok

Source: ICLEI (2004), "SEA-CCP Case Outlines," October.

2.2 Policy process and the role of ICLEI and CCP

Table 3 summarizes the immediate and long-term **motivations** of the four cities in participating in the CCP campaign and undertaking the recommended CCP project. The study specifically asked the cities if the projects had been a solution to a pressing environmental problem. Indeed, for Chiang Mai, Rayong, and Tungsong, the immediate motivation was to solve a pressing environmental problem. For Rayong and Tungsong, the projects were conceived as a solution to address the environmental and health impacts of mounting garbage, although the magnitude of the problem was expectedly larger in Rayong than in Tungsong.[7] In Chiang Mai, the project was perceived as a solution to the increasing air pollution from the transport sector, as well as a response to the high oil prices.

Table 3: Motivations for undertaking the CCP project

	Chiang Mai	Rayong	Muangklang	Tungsong
Immediate motivation—solution to pressing environment problem?	Yes; will address air pollution problem and provide clean energy supply and address high oil prices	Yes; will address air pollution and waste problem	No, except to increase environmental awareness and fulfill social responsibility	Yes, environmental and health impacts of garbage
Long-term motivation—policy framework and vision	Master Plan for Improving Air Quality; Vision to be a model LGU; National Strategic Action Plan of the National Energy Policy Committee—national biodiesel strategy	Environment Master Plan; 15% CO2 reduction target; community-based management of natural resources and environment	Environment and climate change program; contribution to climate change mitigation	Environmental policy

The least populated among the four cities but nearly as large as Rayong and twice as large as Tungsong, Muangklang's immediate motivation in participating in the CCP was not related to a pressing environmental problem. Muangklang response to this question was to increase environmental awareness and fulfill social responsibility.

[7] The chosen solutions by the respective cities also demonstrate the scale of the problem.

Despite the diverse immediate motivations for participating in the CCP campaign, the four cities actively undertook the CCP projects because they were within the context of their environment programs and long-term environment master plans that were usually in response to some national mandates or programs. In the case of Rayong City, the biogas project using municipal solid wastes was part of the city's 10 year Environmental Master Plan (2000-2010) of which the ultimate goal is "to create an environmentally sound society by establishing an effective tool coherent with the municipality's capacity and local culture to control, prevent, and eliminate the sources of pollution while setting out a strategy to upgrade the quality of the urban environment." In this regard, the city has set a target of 15% reduction in CO2 emissions. The project was also undertaken in the context of the national strategy on bottom-up participation or community-based management of natural resource and environment problems that had been laid down since the Ninth National Economic and Social Development Plan (NESDP, 2002-2006).[8]

The biodiesel from used cooking oil project in Chiang Mai was deemed consistent with the vision of Chiang Mai to be a model city or local government as well as its 10-year Master Plan for Improving Air Quality 2000-2010. The project was also part of the national biodiesel strategy enshrined in the 2005-2011 Strategic Plan of the National Energy Policy Committee, which is an interagency body discussing and implementing energy strategies. In fact, the biodiesel project of Chiang Mai was the first demonstration project for biodiesel production at the community level and the first of its kind in Asia.[9] It aimed to contribute towards the national biodiesel strategy of making the B10 (10% biodiesel blend) mandatory nationwide by 2012. The financial support that Chiang Mai had received in implementing the project was part of the USD32.5 million that the national government has committed to increase biodiesel production to 8.5 million liters per day by 2012.

The renewable energy project and energy efficiency project in Muangklang and solid waste management project in Tungsong were part of the respective environment and climate change programs of the two municipalities, which were apparently in response to a national campaign to reduce CO2 emissions and "stop global warming."

The poster shown in Figure 1The **decision** to undertake the project was taken up by the respective cities' municipal council. In the case of Chiang Mai, the decision was assisted by a recommendation from the Advisory Council for Air Pollution, which was a multi-sectoral body that advise the local government on related issues.

Figure 1 was very visible in all the site visits to the four cities. It declares and promotes a national campaign "towards a low carbon economy" at the grassroots, or community and household levels that is in response to a global campaign with the

[8] Environmental issues in the national development processes were initially incorporated in the Fourth Plan. Impacts of economic growth and development on the environment received more attention in the Fifth and Seventh Plan, but "solving the problem was believed to be the government's responsibility and little has been mentioned (about) people participation" until the Ninth Plan (UNESCAP, 2003. "Integrating environmental considerations in to national development plan and its implementation: Waste management project in Rayong Municipality," URL:http://www.unescap.org/DRPAD/VC/conference/bg_th_45_iec.htm downloaded 2 August 2008.)

[9] Gonsalves (2006).

same slogan. It is a recent campaign (launched by UNEP on the World Environment Day in 2008), but its adoption by the four cities demonstrates their total and positive response to national environment programs.

The **decision** to undertake the project was taken up by the respective cities' municipal council. In the case of Chiang Mai, the decision was assisted by a recommendation from the Advisory Council for Air Pollution, which was a multi-sectoral body that advise the local government on related issues.[10]

Figure 1: The poster to depict the national campaign to "stop global warming"

All four cities declared that issues are consulted with the people through stakeholder consultations before decisions are finally taken. In the case of Muangklang, the local government uses a radio station, owned and operated by the municipal government and located at the municipal hall, to communicate its decision on issues. In fact, the mayor claimed that all municipal council meetings are broadcasted live through this radio station so that there is full transparency and even discussions on the issues are immediately, or *instantly*, relayed to the people.

Figure 2: The radio station in Muangklang, 104 FM

[10] In fact, similar advisory councils have been established to help local administration in Chiang Mai address other sectoral issues. It is not clear whether similar bodies operate in other cities in Thailand or in the other three cities in the study.

The eventual implementation of the project did not happen without any **challenges**. Rayong biogas power plant was a huge investment that financing had been obviously an obstacle. Because the project had been perceived as an innovative solution to the solid waste management problem, it earned grant equity from Thailand's Ministry of Energy through the Energy Policy and Planning Office and co-financing of the procurement of equipment from the EC-ASEAN Cogen Programme. While financing was a big and important issue (and eventually rather easily overcome), the project's biggest hurdle was public participation, particularly in the segregation of organic and inorganic wastes at the household level, which generates most of the municipal solid wastes. Notwithstanding, with assistance from a national NGO, Rayong had been able to raise households participation in waste segregation to 40%, which was of course very high by developing country standards and has made the city a model in this regard.

In the case of Chiang Mai, the challenges during project implementation were technical. One was the problem of having an appropriate waste water treatment system. The other was adequate supply of the feedstock or used cooking oil to produce the biodiesel. The increased demand also raised the prices of the used cooking oil.

In Muangklang, the challenges were institutional and related to increasing awareness and changing attitudes of the people. This could have been the same case in Tungsong, at least in the beginning, as its solid waste management program needs a lot of community participation. Indeed, these are the same challenges that continued to be faced by Rayong and Chiang Mai. Although Rayong has been touted as a model in people participation in solid waste management, the city has not met its target of the supply of organic wastes to serve as feedstock in the power plant so that it can operate

at full capacity. The plant had been designed assuming that organic wastes generated in the city could be collected, or 100% of households would participate in segregating organic from inorganic or recyclable wastes.[11] In Chiang Mai, after the demonstration project, other drivers of *song teaws*, the public passenger vehicle targeted by the project, remained hesitant to use biodiesel from used cooking oil. They are afraid of low quality or sub-standard biodiesel that they prefer the biodiesel sold by the oil companies.

In Tungsong, it had been difficult at the start to get the cooperation of the local people and residents. The local government leadership had to earn the trust of the local people. The local government also had to overcome the limited number of staff assigned to the project.

It is also clear from the foregoing that the central or **national government** played an important role in the four cities' local environmental initiatives. The Energy Policy and Planning Office (EPPO) of the Ministry of Energy provided funds from the National Energy Conservation Fund (ENCON Fund)[12] to Rayong's biogas power plant and to the small-scale biogas plants found in Muangklang and Tungsong, as part of these three cities solid waste management programs. The Department of Alternative Energy Development and Efficiency (DEDE) actually initiated and funded, again through the ENCON Fund, the biodiesel demonstration project in Chiang Mai. As will be shown later in the case studies, other national government agencies had been involved in the biodiesel project in Chiang Mai.

To be sure, Rayong, Chiang Mai, Muangklang, and Tungsong had been very proactive in the environmental front when they were invited by **ICLEI** to participate in the CCP program that ran in parallel in the four cities in 2002-2005. Rayong, for example, had already discussed with a local NGO and the then National Energy Policy Office the prospect for a biogas power plant from municipal solid waste and the corresponding solid waste management practices that should be integrated with the power plant project when ICLEI ask it to develop the project in the framework of a local climate action plan. Chiang Mai, Muangklang, and Tungsong had participated in exchanges with US cities in 2002 on urban sustainability as part of the Liveable Cities project of the US Asia Environment Program (AEP) Urban Program in collaboration with Kenan Institute Asia when during the same year ICLEI, together with a local coordinator, the Thailand Environment Institute, launched the CCP campaign in Thailand.

Notwithstanding, ICLEI through the **CCP program** was instrumental in increasing climate change awareness in the four cities and assisted them in devising a local climate action plan, along with CO2 emissions reduction targets, baseline inventory, local measures, and monitoring procedures, through the milestone process. Each project presented in the case studies was just one of the climate mitigation measures identified under the CCP program and was developed by ICLEI to illustrate how local actions can bring about climate mitigation and its co-benefits. The other climate

[11] This is based on discussion with some experts who in this sense say that the power plant capacity may have been over designed, thus the difficulty of operating at full capacity.
[12] The ENCON Fund is managed by the Ministry of Energy and finances energy efficiency and renewable energy projects.

mitigation projects identified for each city through their participation in the CCP program are shown in Table 4.

Table 4: Local climate actions in the four Thai cities from their participation in ICLEI's CCP program

Cities	Local measures	Estimated annual CO2e reduction (tonnes)
Chiang Mai	Energy conservation campaign (turning off lights for 5 minutes per day)	20
	Waste recycling in communities	15,967
	Purchasing 26 mini-buses to encourage mass transport	3,031
	Urban forestry	427
	Fuel-switching for 1000 song teaws	267
	Total	**19,712**
Rayong	Local renewables (waste-to-energy and fertilizer)	2,330
	Energy efficiency	23
	Waste diversion (through recovery, recycling, and converting waste to fertilizer)	12,171
	Urban greening	41
	Total	**14,565**
Muangklang	Energy efficiency in buildings	22
	Inspection and maintenance of 56 vehicles	16
	Energy efficiency for streetlights	65
	Saving energy by constructing high tank for water storage	135
	Paper recycling at the municipal office	4
	Total	**241**
Tungsong	Reduction in electricity use in the Municipal office	179
	Retrofitting of traffic lights with LEDs	15
	Reduction of operating hours of bulbs in public parks	13
	Retrofitting of incandescent bulbs to CFLs in the market and communities	21
	Reduction of fuel consumption of government fleets	130
	Waste recycling project (garbage bank in communities)	210
	Paper recycling for office consumption	12
	Waste segregation in the library	4
	City greening	840
	Encouraging people to conserve energy by using e-book	-
	Liquid fertilizer production	29
	Total	**1,453**

ICLEI partnered with the Thailand Environment Institute (TEI) as local coordinator of the CCP program. TEI, through its Thai energy and environment experts, actually provided the capacity building activities in behalf of ICLEI and assisted the cities in completing the CCP milestones. Prior to the CCP, TEI had worked with the four cities particularly as link to other international environment and urban sustainability programs.

2.3 Mutual reference among city governments and the role of ICLEI and CCP

ICLEI through the CCP program also provided methods and tools to participating cities to enhance or improve their capacity to collect and analyze data. Indeed, the CCP's milestone process is data intensive—it actually starts and ends requiring good data. The first milestone—conduct of baseline emissions inventory and forecast—requires basic data on energy consumption, waste generation, and population projections to calculate greenhouse gas emissions for a base year and for a forecast year. On top of such basic information, the computer software used by ICLEI to calculate baseline emissions inventory and forecast would sure require specific data to run. The fifth milestone—monitoring and verifying results—needs the collection of data from an ongoing project to calculate indicators that measure performance, most notable among these indicators is the actual emission reductions realized by the project.

To collect data for the CCP project, Rayong designed and used a questionnaire sent to concerned agencies and offices. Chiang Mai, on the other hand, delegated this meticulous task of data collection to the Energy Management and Conservation Center of Chiang Mai University. Muangklang has used the ISO14001 process to run its energy and environment programs.

It is not surprising, therefore, if Chiang Mai reported only a maximum of two staff involved in data collection. Meanwhile, Rayong employs 10 permanent and two temporary staff and Muangklang six permanent staff in data collection. Muangklang certification for ISO14001 allows it collect data regularly, while Rayong and Chiang Mai apparently collect data occasionally or on project basis. Tungsong collects data daily and weekly and a summary or conclusion report is prepared once a month for the person responsible. It employs 25 persons in its environment department and 2 persons for gathering information.

Rayong also reported that it had collected data from other divisions of the municipality, the Rayong branch of Provincial Electricity Authority (PEA) for electricity data, and had conducted road surveys to collect transport data as part of its participation in the CCP project. Rayong and Muangklang also mentioned that TEI itself was an important source of information insofar as the climate mitigation measures were concerned. Chiang Mai, on the other hand, relied on the Chiang Mai University's Energy Management and Conservation Center. Tungsong collected data from TEI, DEDE, and from the Institute of Packaging Management for Environment, under the Ministry of Industry of Thailand.

The cities were all sharing information with other cities in Thailand and other cities worldwide, especially those participating in the CCP through regional and

international workshops and conferences. ICLEI, therefore, facilitated this sharing of information. In fact, ICLEI also published in its website many information about the projects under discussion, refecting the results of the cities' participation in the CCP. The respective websites of the four cities were also a rich source of information and a media for sharing information (both knowledge and experiences) with other cities.[13] Except for Chiang Mai, the websites are only available in Thai so only other Thai cities can benefit fully from their experiences in energy and environment projects.

The sharing of information with other cities inspired Rayong to conceptualize the biogas project. Muangklang claimed that its projects were a blend of other cities' experiences, gathered by the mayor no less in his participation in international and national meetings of cities, organized both by ICLEI and other city networks. Chiang Mai's community-scale biodiesel project, meanwhile, was acclaimed as the first of its kind in Thailand and Asia. Muangklang claimed that Tungsong adopted its environmental practices. In fact, there are a number of similarities in the solid waste management and other environment programs of Muangklang and Tungsong, reflecting the close relationship between the two cities. This close relationship goes back even before their participation in the CCP program, as indicated earlier.

2.4 Political factors for adoption of new practices

The authors acknowledge significant variation between their initial assessments of the importance of the political factors shown in Table 5 after the field visits and the cities' own assessments as reflected in their answers in the questionnaire. However, the unanimous agreements as far as the importance of the political will of the mayor is concerned stand out. Indeed, a very important, if not the most important, factor in the adoption of new practices at the local level is the political will and commitment of the city's highest leadership.[14]

In fact, this commitment and strong political will go back to the former mayors of the four cities, with the mayors of Chiang Mai, Rayong, and Muangklang actually starting the CCP projects. The current mayor of Rayong City acknowledged that the former mayor set the environmental policy of the city and prepared the grounds for the development of this project. The present mayor was happy to assume the implementation of the project during his watch, claimed to be the first of its kind at least in Southeast Asia. In addition, he is starting a new project to recycle plastics back to petroleum, also the first in Thailand and Southeast Asia.[15]

The new mayor of Chiang Mai, elected only in 2008, is not only adopting the practice started by the former mayor but expanding it. The city is now planning to produce first generation biodiesel from palm oil and use it for the city's fleet of vehicles, of which 90% are already using biodiesel.

[13] The study, however, has had limited resources in translating all the available information in Thai to English.
[14] This was also proven by the author in another work with other cities in Southeast Asia. See Todoc, Jessie (2008). "Integrating Energy in Urban Planning in the Philippines and Vietnam," in Peter Droege, ed. *Urban Energy Transition: From Fossil Fuels to Renewable Power*, Elsevier, Oxford, pp. 507-531.
[15] A similar project is already operating in India using Polish technology, the same technology that will be used in Rayong.

The mayor of Muangklang was deputy mayor when Muangklang participated in the CCP program. But it seems he was the one representing the city in many of the CCP activities.

In the case of Tungsong, the current mayor started the CCP project but he acknowledged that the environment programs in the city are a continuation of the programs of the former mayor.

All these only indicate a tradition of environment-friendly governance in the four cities.

Table 5: Impact of political factors in the adoption of new environment practices in the four cities

	Chiang Mai	Rayong	Muangklang	Tungsong
Political will of the Mayor	3 (3)	3 (3)	3 (3)	3 (3)
Pressure by citizens or NGOs to the local government	0 (0)	3 (1)	1 (0)	0 (2)
Individuals or organizations who coordinated different stakeholders to introduce and execute the policy, both within and outside the city government	0 (3)	2 (3)	0 (0)	2 (3)
Civil society networks	0 (0)	2 (2)	1 (0)	2 (0)
Knowledge introduced by experts (such as researchers and consultants)	1 (3)	2 (3)	2 (3)	3 (3)
Autonomy of the local government vis-à-vis national and provincial governments (scope of mandate, freedom of decision-making, self-reliant budget)	2 (3)	3 (3)	1 (3)	3 (3)

Notes:
0-Not important; 1-Of minor importance; 2-Important; 3-Very Important
Numbers in parenthesis were the authors' initial assessment prior to the return of the questionnaire.

The mayor of Muangklang was the brain and muscle of the energy and environment programs of the municipality as he took direct hand in the conception, design, and implementation of the projects. In fact, he had been actively attending international meetings of cities since he was deputy or vice-mayor to get inspiration for energy and environment projects that can be implemented in his city.

In contrast (with the mayor of Muangklang), the mayor of Tungsong relied on individuals and organization within the local administration to promote and execute the environment policy of the city. The Chief Librarian and the entire Library staff in general were responsible for increasing public awareness and disseminating the environment programs of the municipality. On the other hand, the head and some staff of the Sanitary Office were responsible for organizing the community's participation and the technical aspects of the projects. The Sanitary Office had been responsible in organizing and coordinating a network of community leaders to manage the household and community scale production of compost and detergents from organic

wastes. These individuals in our opinion had become champions in their own way, like the mayor but perhaps even in a more passionate way, to push for the successful implementation of their environment projects. Thus, in the case of Tungsong, these individuals and their respective organizations had been important in coordinating the different stakeholders in the municipality.

The same opinion was shared by Rayong, which relied on DEE in mobilizing community participation, particularly in the segregation and collection of the wastes from households. We think, however, this was a very important factor in the successful implementation of the local environmental initiatives.

Except Rayong, the cities did not consider civil society networks an important political factor. We think, however, that the community leaders in Tungsong form a civil society network that had been very important in exacting public participation in the city's environment projects. In the end, we also had to revise our assessments of Chiang Mai and Muangklang in this regard, given the broad and proper definition of civil society networks. Communities themselves, in each of the cities, formed a civil society network that did play an important role in all the local environment initiatives. In Chiang Mai, the communities were directly responsible for generating the used cooking oil and producing the biodiesel. In Rayong, the households in communities were responsible for collecting and segregating organic wastes that serve as feedstock to the biogas plant. In Muangklang, the communities participated in both the collection and segregation of organic wastes before they were "processed" to produced compost, liquid fertilizer, or biogas.

Figure 3: The head and technical staff of the Sanitary Office and the community leaders of Tungsong

Rayong acknowledged similar important roles from both external and internal organizations. A national NGO, the Development of Environment and Energy Foundation (DEE), had assisted the city in motivating the citizen on waste recycling activities. It had closely monitored and quantified participation of households in waste segregation, as this was an important factor in the technical operation of the biogas plant, which needs adequate supply of organic wastes as feedstock. Rayong City had also organized Ad-hoc Teams for Environment to build and strengthen community networks to preserve environmental quality in their respective communities. These groups initiated many activities to promote and persuade the people to participate in segregating and collecting wastes.

All cities acknowledged the important to very important role of technical knowledge introduced by external experts. In Rayong, this role also came from DEE. Chiang Mai relied on the Energy Management and Conservation Center of the Chiang Mai University for technical support, but apparently only in terms of data gathering. The technical expertise was really provided by DEDP, which probably explains their lower rating of this factor than those by the other three cities. Muangklang and Tungsong, meanwhile, were technically assisted by TEI.

The autonomy of the respective cities or local governments was a very important political factor in the adoption of new practice. This opinion was shared by Rayong and Tungsong, to a large extent by Chiang Mai, and to some extent by Muangklang, as indicated by their respective ratings of this political factor. In Thailand, the autonomy of local government units is enshrined in "The Act of Determining Plan and Process of Decentralization B.E. 1999." The Act has decentralized powers and functions to municipalities, including in terms of targets and budget, for managing problems in their communities, including environmental issues. Nevertheless, big projects such as the biogas plant in Rayong need endorsement from provincial governments, even before local funds are committed to the project.

2.5 Socio-economic factors for adoption of new practices

Total population should directly impact the magnitude of the environmental problem (that is, increasing volume of wastes, increasing traffic and attendant air pollution). However, as indicated in Table 6, the cities played down the impact of population *per se* in their adoption of new policies. The only exception is Tungsong, which recognized the impact of its growing total and for that matter urban population in the adoption of new environmental practices. But for Rayong and Chiang Mai, what had been more important was the share of urban population, and for Rayong and Tungsong, the growth of urban population was even a very important factor. Understandably, it is urbanization that contributes to increasing volume of municipal solid wastes and increasing traffic and its attendant air pollution. Thus, new practices must be found to minimize the wastes that go to the landfill or dumpsite and provide clean fuels for transport and reduce air pollution.

Table 6: Impact of socioeconomic factors in the adoption of new practices

	Chiang Mai	Rayong	Muangklang	Tungsong
Population	0 (2)	- (3)	1 (2)	3 (3)
Urbanization rate in terms of:				

• Growth of urban population	0 (2)	3 (3)	1 (3)	3 (2)
• Share to total population	2 (1)	2 (0)	1 (1)	3 (1)
Regional GDP	0 (2)	2 (2)	0 (1)	2 (1)
Revenue				
• Allocation from national government	3 (3)	3 (3)	0 (3)	2 (3)
• Internal revenue generation	3 (3)	3 (3)	1 (3)	2 (3)

Notes:
0-Not important; 1-Minor importance; 2-Important; 3-Very Important
Numbers in parenthesis were the authors' initial assessments prior to the return of the questionnaire.

In any case, population should not only be looked at as numbers that directly cause the environmental problem. More important, people and their good habits and attitudes are the ultimate solution to local environmental problems, especially if they are united in purposely solving such problems. This was clearly demonstrated in the case of Tungsong, as indicated earlier, and could also explain the high ratings the city gave to population-related factors.

Regional income (measured by regional gross domestic product) could also impact the adoption of new environmental practices. For instance, Rayong is located in the Eastern Board that is a prime area for industrial private and foreign direct investments. The income generated by the investments and other economic activities in this region naturally spills over to Rayong. Thus, Rayong agreed that regional income had been an important factor in the adoption of new practices to thwart the negative environmental impacts of increasing incomes and consumption.

Similarly, although Chiang Mai disagreed, regional income could also be an important factor for the city's adoption of new environmental practices. Chiang Mai City is at the heart of the Chiang Mai Metropolitan Area, one of the five metropolitan areas in Thailand, which include the Bangkok Metropolitan Area. Metropolitan regions are prime economic growth areas in terms of growth and level of economic activities that certainly impact on the environment.

Chiang Mai, Rayong, and Tungsong confirmed with their high ratings the importance of both the allocation from national government and their own revenue generation in the adoption of new local environment practices. The funding from the Ministry of Energy for the environmental and energy projects in the three cities was considered as part of this national allocation. Meanwhile, the costs of operation and maintenance of the biogas power plant project in Rayong are charged to the annual budget of the city. This is not to say that the project is earning the city some net income from the revenue from electricity or fertilizer sales. In fact, it is more of a showcase project rather than a successful commercial undertaking.

Unlike the projects in Rayong and Chiang Mai, the scale of the projects in Muangklang and Tungsong did not make financing a critical consideration. Nevertheless, we think the budget allocation from the national government and internal revenue generated by the cities were an important, if not very important, input in the implementation of new practices.

2.6 Practice diffusion to other cities and the role of ICLEI and CCP

The reputation of the project in Rayong as an innovative approach to addressing solid waste concerns has reached other cities in Thailand and Southeast Asia. According to the local officials interviewed in Rayong, more than 10,000 visitors have toured the biogas facility. In Thailand, the next city planning to undertake a similar project is Nakhon Ratchasima (Korat) and Chonburi. The local officials we interviewed in Rayong said that neighboring municipalities are implementing the solid waste management practices of the city. Elsewhere in Southeast Asia, the ICLEI CCP workshops were instrumental in promoting also the solid waste components of the project in Yogyakarta, Indonesia, and Cebu City, Philippines.

The EC-ASEAN Cogen program that adopted the Rayong biogas power project as a full-scale demonstration project was also instrumental in promoting the project in Southeast Asia. The program organized "cogeneration days" and sometimes "cogeneration weeks" throughout whole of Southeast Asia and presented the Rayong biogas project as a model waste-to-energy solution.

A review of literature indicates that the following cities have adopted or at least considered adopting similar biodiesel projects like the one in Chiang Mai:

- Bogor, Indonesia
- Baguio City, Philippines
- Makati City, Philippines
- Nhong Pling, Nakhon Sawan

Box 1 briefly describes the biodiesel activities in these other cities.

Box 1: Other community biodiesel projects in Southeast Asia

Bogor, Indonesia \1

The City of Bogor was considering as a CDM project the use of biodiesel from waste cooking oil for its garbage trucks fleet and for the proposed BRT.

Baguio City, Philippines \2

Baguio City considered replicating the use of biodiesel as an alternative fuel for jeepneys in the city. The idea came after a visit of Baguio City delegation to Chiang Mai on 10-14 January 2005. Chiang Mai was testing the production of biodiesel from waste or used cooking oil and piloting its use among the city's song teaws. The delegates likewise visited the Chitlada Palace in Bangkok where the production plant of bio-fuel is located. The bio-fuel is also being pilot-tested in government fleets of the palace.

Makati City, Philippines \3

Makati City launched the project dubbed "PNP (Philippine National Police) bio-diesel" in July 2008 at the Makati City Police Office. The bio-diesel would be a blend of 40% diesel and 60% bio-diesel from used cooking oil. The used cooking oil would be provided by McDonald's stores in Makati. Every 10 days, McDonald's used cooking oil would be sent to the Makati Used Cooking Oil Centers where the PNP bio-diesel will be made. The idea was conceived as a solution to the rising oil prices that had strained the Police Station's budget. At the diesel price of P57.65 per liter

and 10 patrol cars using diesel, the biodiesel could save the Makati City Police P38,000 per month or P500,000 per year.

Nhong Pling, Nakhon Sawan, Thailand \4
Nakhon Sawan Province in Northern Thailand was generating 1.3 million liters of used cooking oil per year from households and restaurant. With 100% funding from the government, the conversion of used cooking oil to biodiesel was demonstrated in Nhong Pling Municipality. A biodiesel unit with 150 liters per day production (similar to the one we saw in Chiang Mai) was set up and intended to be operated 20 days per month. The unit cost US$2,700 using local materials. The biodiesel produced was used in one-stroke agricultural engines without any engine adjustment. However, Nhong Pling found there was not enough supply of used cooking oil to meet their biodiesel demand of 3,000 liters per month. Used cooking oil was imported from nearby municipalities.

References:

1. Roesli, Indra (2007). "Bogor Leading to Sustainable Public Transportation," presentation at the Fourth Meeting of the Kitakyushu Initiative Network, 25-26 June, Kitakyushu City.
2. ICLEI (2005), "Tracker," Oct 2004-Mar 2005.
3. "Makati police to Use 'PNP biodiesel'," Sun.Star Manila, 30 July 2008, http://www.sunstar.com.ph/static/man/2008/07/30/feat/makati.police.to.use.pnp.bio.diesel..html uploaded 24 October 208.
4. Jaruyanon, Pongsiri and Wongkot Wongsapai (2007). "Biodiesel Technology and Management from Used Cooking Oil in Thailand Rural Areas," downloaded from the internet.

Tungsong claimed that more than 100 persons from various local government organizations in Thailand—including special officers, district officers, teachers, administrators, and local leaderships—had looked at their solid waste management practices, but it was not certain which ones had actually replicated them. Tungsong has a twinning agreement with Naga, which might have benefited from the practices in Tungsong.

As indicated, ICLEI was instrumental in disseminating information about the CCP projects in the four cities. In fact, the CCP program organized a number of regional CCP workshops held in Indonesia, the Philippines, and Thailand. The workshops were coupled with site visits or study tours to the projects of the host countries and were venues for signing twinning agreements between cities in the three Southeast countries. ICLEI also facilitated under the CCP program exchange visits between "sister" cities as part of these twinning agreements. For example, Naga and Tungsong exchanged visits to learn from each other's solid waste management program. Similarly, Baguio and Chiang Mai exchanged visits to learn from each other's sustainable transport projects.

ICLEI Southeast Asia Secretariat also published newsletters in the internet that further spread information about the CCP projects and activities. Needless to mention, ICLEI website is the final repository of these information. The projects were published as selected case studies highlighting not only climate change mitigation benefits but also specific co-benefits.[16]

[16] "Co-benefits" has no universal definition but these refer to social, economic, energy, and other environmental benefits of climate mitigation actions.

Table 7: Co-benefits of the climate mitigation action in the CCP cities in Thailand

CCP cities	Co-benefits of climate actions
Chiang Mai	Improved air quality by reducing NOx, SO2, and particulate matters emissions
	Reduced hazardous health impacts from air pollution and toxins from overusing vegetable oil
	Improved community environmental consciousness and awareness of sustainable transport options
	Increased community livelihood opportunities
Rayong	Reduced wastes going to landfill and thus extended life of the landfill
	Increased reliance on clean alternative fuel and thus reduced dependence on fossil fuel
	Strengthened collaboration and communication among community members
	Reduced expenditures on waste collection and disposal
	Enhanced environmental consciousness of the community
	Increased income from selling electricity and fertilizer
Muangklang	Reduced expenditures from electricity savings and increased funds to finance other needs of the city
	Increased energy efficiency and use of renewables
	Increased public awareness on potentials of renewable energy
Tungsong	Increased income from sale of fertilizer
	Diverted substantial volume of waste going to the landfill
	Improved waste management in the public markets
	Reduced expenses for building cleaning and maintenance
	Increased protection of soil from pollution
	Improved nutrient content of the soil and avoided water pollution run-off

Source: ICLEI (2004), "SEA-CCP Case Outlines.".

3 Case Studies*

3.1 Chiang Mai City: Recycling used vegetable oil as biofuel

3.1.1 Background

Chiang Mai City (also sometimes written as "Chiengmai") is the largest and most culturally significant city in northern Thailand, and is the capital of Chiang Mai Province. It is located some 700 km north of Bangkok, among some of the highest mountains in the country. The city stands on the Ping river, a major tributary of the Chao Phraya River. Elevated into a municipality in 1933, Chiang Mai City is the first municipality in Thailand. The responsible area was expanded from 17.50 square kilometers to 40.216 square kilometers in 1983.

* This is based on the field reports updated with the written responses on the questionnaire and documents received during the interviews, including those conducted in Bangkok. The order is based on the schedule of field visits to the four cities.

While the city (thesaban nakhon) of Chiang Mai[17] officially only covers most parts of the Mueang Chiang Mai district with a population of around 150,000, the urban sprawl of the city now extends into several neighboring districts. The Chiang Mai Metropolitan Area has a population of almost one million people, nearly half the total population of Chiang Mai Province.

As part of its master plan for improving air quality in 2000-2010, Chiang Mai had been producing and using biodiesel as an alternative fuel for *songteaws*, the main public utility vehicles in Chiang Mai. In 2002, songteaws accounted for 25% of the city's transportation sector GHG emissions, or 5.5% of the city's total GHG emissions. A shift to 20% biodiesel blend from used vegetable oil would reduce 724 tons of CO2 a year from songteaws. A demonstration project for 1,000 songteaws was launched in June 2004 with the assistance of the Ministry of Energy and the Pollution Control Department. The objectives of the demonstration project were to demonstrate the use of biodiesel, construct small-scale biofuel plants at the community level, and promote the use of biofuel to mitigate the harmful environmental and health impacts caused by pollutant emissions. The total budget of the project was 9.821 million baht (about USD300,000). The demonstration project was expected to result in 267 tons of CO2 emission reductions.

3.1.2 Findings

Apparently, the original project idea to promote widespread use of biodiesel from waste cooking oil among songteaws has not materialized. Rather biodiesel from waste cooking oil is being produced by private entrepreneurs and used only in the villages to fuel pick up trucks and agricultural machineries. A conversation with a songteaw driver revealed that songteaw drivers had not trusted biodiesel from waste cooking oil. They had preferred to buy from service stations—Bangchak and PTT, names they can trust more—that have sold the 5% biodiesel blend (B5).[18] Notwithstanding, the city of Chiang Mai is also now planning to produce first generation biodiesel from energy crops (most likely palm oil) and use it for its own fleet of vehicles, of which 90% are already using biodiesel. The three-year plan will plant energy crops on vacant lots.

The findings below, therefore, do not only refer particularly to the original target project, that is, the demonstration project on the use of biodiesel in song teaws, but in general to the use of biodiesel in Chiang Mai.

Milestones

The project started with research and development and cost –effectiveness and impact studies conducted by national government agencies targeting a pilot number of song teaws. It continued with community training conducted by a local but internationally recognized university in Chiang Mai. In the meantime, the city government went on in installing the biodiesel facility and took care of the organizational aspects of the project.

Date	Actor	Description of the action

[17] Unless otherwise specified, "Chiang Mai" refers to Chiang Mai City.

[18] As will be mentioned next, Bangchak and PTT started selling the B2 (2% blend) following a government promotional project, ahead of the biodiesel from used cooking oil.

June 2004-January 2005	Ministry of Energy	Funded a research and development project to develop biodiesel from waste cooking oil
February-October 2005	Pollution Control Department	Conducted cost-effectiveness study; studied effects of biodiesel use on ambient air quality, engines, and human health
September 2005-July 2006	Energy Management and Conservation Center of Chiang Mai University	First training workshops on biodiesel production for more than 550 participants; the one-day workshops train six to eight people per day on production procedures, input materials, and safety. The training also gives instructions on how to build a 150-liter biodiesel plant like the one shown in Figure 4.
September 2006-August 2007	Energy Management and Conservation Center of Chiang Mai University	Second set of training workshops
2007	Municipal Enterprises Control Section, Chiang Mai City	Purchasing of used animal and plant oil biodiesel production machine; preparation of production location and water supply system
2008	Municipal Enterprises Control Section, Chiang Mai City	Setting up of a biodiesel management board of directors; coordinate with district offices, organizations, communities and corporate for used animal/plant oil purchasing; sourcing for staffs and system control supervisor; training for all officers and related persons

Figure 4: The biodiesel plant processing used cooking oil developed by Chiang Mai University

Key actors

The national government played very important roles in the project. In the first place, the project was initiated by the Department of Alternative Energy Development and Efficiency (DEDE) of the Ministry of Energy as part of their biodiesel program. DEDE also provided some technical expertise in developing the project. The Pollution Control Department (PCD) of the Ministry of Natural Resources and Environmen, on the other hand, conducted the cost-effectiveness and environmental impact assessment studies.

As shown below, local organizations and agencies also had their share in implementing and promoting the project as well as, very important, in sustaining the project and expanding into other areas of biodiesel production (for example, producing biodiesel from energy crops). Particular mention should be made of the local academic community. Chiang Mai University, among other universities, has been involved in the development (design, construction, and testing) of biodiesel equipment and also conducted teraining of communities. Other universities in Northern Thailand also took upon themselves R&D and training

Key actors	**Contributions or role in the project**
EPPO, Ministry of Energy	Funded the R&D phase of the project
DEDE, Ministry of Energy	Developed 2% biodiesel blend (B2) and tested in Chiang Mai; responsible for managing, coordinating, and promoting the project

Key actors	Contributions or role in the project
Pollution Control Department	Testing and analyzing air pollution from cars using biodiesel, checked the car capacity the registered in the project
Public Service Car Association	Tested cars using biodiesel
Energy Management and Conservation Center, Chiang Mai University \1	Developed and conducted training on the biodiesel production technology
Marine Department and Songklanakarin University	Constructing the biodiesel manufacturing system
Department of Energy Business	Testing, measuring and comparing the biodiesel and biodiesel mix with diesel quality
Public Works Bureau of Chiang Mai	It is currently actively pursuing the development of the project to produce biodiesel from energy crops for use in government vehicles.
Municipal Enterprises Control Section of Chiang Mai City	Purchasing of used animal and plant oil biodiesel production machine; preparation of production location and water supply system; setting up of a biodiesel management board of directors; coordinate with district offices, organizations, communities and corporate for used animal/plant oil purchasing; sourcing for staffs and system control supervisor; training for all officers and related persons
Board of Biodiesel Management Directors	Identify project mission, production duties, operation plan, management system/production office etc.
Production and administrative staff	System control (8 hours per day working hour); purchasing and sourcing of materials/equipments for production including finance and account tasks
Mass communication, radio and television	Project good public image and relation; facilitated raw material purchase

\1 People met during the visit at Chiang Mai University told that the training is offered only to communities within Chiang Mai. But news articles name communities from other provinces benefiting from this training. For example, the above-mentioned first workshop built model communities at tambons in Nong Kaew, Chiang Mai; Kamphaeng Din, Phichit; and Kud Nam Sai, Khon Kaen. ("Workshop on biodiesel in Chiang Mai," *The Nation*, 9 October 2006, URL:http://www.nationmultimedia.com/option/print.php?newsid=30015744 downloaded 2 July 2008.)

Policy process stages

The immediate issue being addressed by the project was air pollution. Chiang Mai City realized that to address this issue, the solution is to provide clean substitute to fossil fuels in transport. Thus, the objective of the project was to provide clean fuels for transport to reduce air pollution. The project was framed under the city's Master Plan for Improving Air Quality 2000-2010. The project is also part of the Strategic Plan 2005-2011 of the National Energy Policy Committee, an interagency body

recommending solutions to energy issues. However, the popularity of biodiesel has increased recently because of very high oil prices. Economic and environmental considerations are thus the main motivations for increasing the use of biodiesel, particularly under the plan of the local government to produce biodiesel from energy crops. It may be added that Chiang Mai City wanted to set itself as an example or model in this regard.

The original biodiesel project was an offshoot of an air pollution project conducted by the City with the PCD and the US Environmental Protection Agency in early 2000. The project was also developed by the Advisory Council for Air Pollution, which a multi-sectoral advisory body or council that works with the local government.[19]

The original project also led many entrepreneurs to train on the production of biodiesel using the technology developed by Chiang Mai University. However, right now the number of producers has reached saturation that there is not enough feedstock (waste cooking oil) to run all these equipment. Earlier, the project also faced technical problems related to the waste water treatment system.

The project has been influenced by rising oil prices as well as increasing energy demand.

Mutual reference among city governments

Chiang Mai charged the Energy Management and Conservation Center with the collection and processing of data for the project. This explains why Chiang Mai reported that only 1-2 staff are involved in data collection and processing. Chiang Mai shares information with other cities, particularly neighboring municipalities, including Nong-keaw Tambon Administrative Organization, Amphur Hangdong, Cheing Mai province and Tumbol Umong Municipal, Lampoon province. On the other hand, Chiang Mai City also benefited from the training conducted by Nong-keaw Tambon Administrative Organization and Tumbol Umong Municipality.

Sources of information	Data or type of information
Energy Management and Energy Saving Institute, Chieng Mai University	production manuals, documentations and expert speakers
speaker from Tumbol Umong Municipal, Lampoon province	documentations, books and CDs
speaker and training from Nong-keaw Tambon Administrative Organization, Hangdong	documentations, books and CDs

Political factors

Chiang Mai considered political will of the mayor and autonomy of local government as the most important political factors in the adoption of new practice or implementation of environment projects. In fact, the present mayor is initiating a new

[19] In fact, similar advisory councils have been established to help address local issues. These councils are part of decision-making in Chiang Mai City.

first generation biodiesel (from crops) project that would supply biodiesel to the city's mini-bus fleet. And the city will be using its own resources to realize the project.

The knowledge introduced by experts (by ICLEI and the Chiang Mai University) was considered to have given a minor role. Chiang Mai did not think that the other political factors contribute at all.

	None	Minor	Important	Very Important
Political will of the Mayor				√
Pressure by citizens or NGOs to the local government	√			
Individuals or organizations who coordinated different stakeholders to introduce and execute the policy, both within and outside the city government	√			
Civil society networks	√			
Knowledge introduced by experts (such as researchers and consultants)		√		
Autonomy of the local government vis-à-vis national and provincial governments (scope of mandate, freedom of decision-making, self-reliant budget)			√	

Socioeconomic factors

Chiang Mai considered the financial factors as very important in the adoption of new local environmental practices. Understandably, with a big city like Chiang Mai, projects would tend to be big and thus would require substantial amount of financial resources.

Share of urban population to total population was deemed an important factor. Indeed, many of the environmental problems in a big and growing city, for example, air pollution and solid waste, are affected by urbanization rate. Chiang Mai should be no exception.

	None	Minor	Important	Very Important
Population	√			
Urbanization rate in terms of:				
o Growth of urban population	√			
o Share to total population			√	
Regional GDP	√			
Revenue				
o Allocation from national government				√
o Internal revenue generation				√

Practice diffusion to other cities

Chiang Mai City did not think that other cities have adopted their practice. However, a review of literature showed that the following cities had adopted similar biodiesel projects, that is, biodiesel production from waste cooking oil:

- Bogor, Indonesia
- Baguio City, Philippines
- Makati City, Philippines
- Nhong Pling, Nakhon Sawan

It seems that these projects were at least inspired by the knowledge of the project in Chiang Mai. Bogor in Indonesia is an active member of ICLEI network and must have learned about the Chiang Mai experience from intercity workshops organized by ICLEI. Baguio City in the Philippines, as described below, had exchanged experiences with Chiang Mai City, also in the framework of ICLEI. The project in Makati City must have been borne out of ICLEI networking activities, as Makati City is also an active ICLEI member in the Philippines. The community biodiesel project in Nhong Pling in Thailand was implemented by Chiang Mai University and a local university.

The biodiesel projects in these other cities are briefly described below.

Box 2: Other community biodiesel projects in Southeast Asia

Bogor, Indonesia \1

The City of Bogor was considering as a CDM project the use of biodiesel from waste cooking oil for its garbage trucks fleet and for the proposed BRT.

Baguio City, Philippines \2

Baguio City considered replicating the use of biodiesel as an alternative fuel for jeepneys in the city. The idea came after a visit of Baguio City delegation to Chiang Mai on 10-14 January 2005. Chiang Mai was testing the production of biodiesel from waste or used cooking oil and piloting its use among the city's song teaws. The delegates likewise visited the Chitlada Palace in Bangkok where the production plant of bio-fuel is located. The bio-fuel is also being pilot-tested in government fleets of the palace.

Makati City, Philippines \3

Makati City launched the project dubbed "PNP (Philippine National Police) bio-diesel" in July 2008 at the Makati City Police Office. The bio-diesel would be a blend of 40% diesel and 60% bio-diesel from used cooking oil. The used cooking oil would be provided by McDonald's stores in Makati. Every 10 days, McDonald's used cooking oil would be sent to the Makati Used Cooking Oil Centers where the PNP bio-diesel will be made. The idea was conceived as a solution to the rising oil prices that had strained the Police Station's budget. At the diesel price of P57.65 per liter and 10 patrol cars using diesel, the biodiesel could save the Makati City Police P38,000 per month or P500,000 per year.

Nhong Pling, Nakhon Sawan, Thailand \4

Nakhon Sawan Province in Northern Thailand was generating 1.3 million liters of used cooking oil per year from households and restaurant. With 100% funding from the government, the conversion of used cooking oil to biodiesel was demonstrated in Nhong Pling Municipality. A biodiesel unit with 150 liters per day production (similar

to the one we saw in Chiang Mai) was set up and intended to be operated 20 days per month. The unit cost US$2,700 using local materials. The biodiesel produced was used in one-stroke agricultural engines without any engine adjustment. However, Nhong Pling found there was not enough supply of used cooking oil to meet their biodiesel demand of 3,000 liters per month. Used cooking oil was imported from nearby municipalities.

References:
1. Roesli, Indra (2007). "Bogor Leading to Sustainable Public Transportation," presentation at the Fourth Meeting of the Kitakyushu Initiative Network, 25-26 June, Kitakyushu City.
2. ICLEI (2005), "Tracker," Oct 2004-Mar 2005.
3. "Makati police to Use 'PNP biodiesel'," Sun.Star Manila, 30 July 2008, http://www.sunstar.com.ph/static/man/2008/07/30/feat/makati.police.to.use.pnp.bio.diesel..html uploaded 24 October 208.
4. Jaruyanon, Pongsiri and Wongkot Wongsapai (2007). "Biodiesel Technology and Management from Used Cooking Oil in Thailand Rural Areas," downloaded from the internet.

Thus, even if Chiang Mai City did not actively disseminate its experience in community biodiesel production and was not aware of the role of ICLEI, as indicated by their response to such questions in the questionnaire, their participation in the CCP and eventually in ICLEI regional activities had spread the project concept and was taken up by some cities.

3.2 Rayong City: Biogas from municipal solid waste project

3.2.1 Background

Rayong City is located about 180 km east of Bangkok on the shore of the Gulf of Thailand, in the east coast region of Thailand. It is the capital of Rayong Province, and covers the Tambon Tha Pradu and Pak Nam and parts of Tambon Choeng Noen and Noen Phra, all within Mueang Rayong district. Rayong City covers an area of 16.95 sq km and in 2004 had a population of 59,055, population density of 3,484 persons per sq km, and 23,772 households. Faced with increasing generation of municipal solid waste (MSW) as a consequence of rapid economic expansion and growing population, the city of Rayong adopted the community-based management approach to pollution prevention. The approach led to the crafting of an integrated waste management plan that included waste recycling schemes, production of organic fertilizers (composts), and production of biogas to generate electricity. The "Waste-to-Fertilizer and Energy Project" was built by the Rayong City to process 60-70 tonnes of MSW per day. The cogeneration capacity was designed at 625 kW and was expected to produce 5,100 MWh of electricity yearly. The anaerobic digester was also expected to produce organic fertilizer throughout the plant's economic life of 20 years. In 2003, just before the project started operation, Rayong was generating 27,278 tonnes annually, of which 50% are estimated to be organic wastes..

3.2.2 Findings

Milestones

Date	Actor	Description of the action
1999	Rayong City	Start of Integrated Waste Management Program

June 2000	Development of Environment and Energy Foundation (DEE)	As adviser for environmental activities on waste management and join with Rayong municipality to motivate the citizen on waste recycling programmes.
October 2001	Energy Policy and Plan Office, Ministry of Energy	To support the budget for a biogas plant.
October 2002	Rayong City and ICLEI-SEA	Signing of MOA for participation of the city in the CCP program
	Thailand Environment Institute (TEI), CCP Project Coordinator	As assistant. To help municipal staff keep the data and set the measures.
August 2003	Mr.Surapong Phutanapiboon, Old Mayor of Rayong Municipality.	To set the municipal policy and the project idea for environmental activities that adjust to the implementation of the CCP project
April 2004	Mr. Worawit Suppachokchai, Mayor of Rayong Municipality.	To run the CCP Measures especially the biogas plant.
June 2004	Rayong City	Biogas power plant started operation

Key actors

Key actors	Role or contribution in the project
Energy Policy and Planning Office (EPPO) \1, Ministry of Energy	Provided a grant equity to the project amounting to USD3.6 million
Development of Environment and Energy Foundation (DEE)	Developed the project for Rayong City
EC-ASEAN Cogen 3 Programme \2	Provided grant funding equivalent to 15% of capital equity for EPC (Engineering, Procurement, and Construction)
STFE	EPC contractor
Municipal Executive board (old and present)	To set the environmental policies include CCP measures
The municipal citizen and community leaders	To join with us on all of environmental activities (waste sepration acitivities
Municipal officer / CCP staff	To run the project and put the CCP measures to municipal development plan
Thailand Environment Institute (TEI), CCP Project Coordinator	To help and suggest us to run CCP project

\1 EPPO then was called the National Energy Policy Office (NEPO). NEPO became EPPO in 2002 along with government reorganization and restructuring.

\2 The project has been selected as a full scale demonstration project (FSDP) under the EC-ASEAN Cogen 3 Programme. As an FSDP, the project received grant funding to co-finance the purchase of equipment and technical assistance for its engineering design.

Besides EPPO and DEE, the literature shows that a Pol Eak Chartchai Chunhawan Foundation was involved in the early stages of the development of the project.

Policy process stages

Understandably, the mounting waste problem in Rayong City led to the project idea. The immediate cause, however, was the difficulty in seeking a new landfill site as the old landfill had become exhausted. This was aggravated by limited budget and personnel. So solutions had to be found to deal with the growing volume of waste.

Notwithstanding this immediate problem, the project was also undertaken in the context of Rayong Municipality's aim of reducing CO2 emissions by 15% from the community sector as its commitment as participant of the CCP program. It's a part of 10 year environmental Master plan (year 2000) of the city that one goal is to create an environmentally sound society by establishing an effective tool in coherent with the municipality's capacity and local culture to control, prevent, and eliminate the sources of pollution while setting out a strategy to upgrade the quality of the urban environment. This policy response to a mandate from central government to all municipality.

The project was also undertaken in the context of the national strategy on bottom-up participation or community-based management of natural resource and environment problems that had been laid down since the Ninth National Economic and Social Development Plan (NESDP, 2002-2006). Thus, the biogas project was preceded by an intensive campaign to segregate or sort waste at source and to recycle waste. For example, the city had to provide 12-liter and 100-liter plastic bins to segregate organic wastes in households and participating business establishments. The organic wastes collected through these plastic bins are sent to the biogas facility. The Mayor of Rayong City stresses the importance of community participation: "In order to reduce the plant operation cost, we need to encourage people to participate in organic waste sorting in their homes."[20]

Projects like this are consulted with the people and Rayong City residents are regularly and visibly informed about new and ongoing local government projects.[21] The project did face financial difficulty given its large-scale. Large-scale public participation has not been achieved.

External factors	Influences on the project

[20] Cogen 3, undated. "Cogen experience overview," p. 16. During the interview with Khun Prasong of STFE, he stresses the importance of community participation in waste segregation at source. The biogas plant was designed to process purely organic wastes (mostly food and kitchen wastes as well as market wastes). To be sure, wastes can be segregated as they are dumped at or near the plant site. But this extra waste handling increases tremendously the operational cost of the biogas plant and is not good for the health of waste handlers.

[21] For example, the people have been informed and consulted on a related project we learned during our field visit to Rayong. The local government is planning to put up a plastic recycling plant besides its biogas power plant. The recycling plant will process 10 tons of plastic bags everyday and will be the second of its kind in Asia (after India) and the first in Thailand and Southeast Asia. This recycling plant will be commissioned within the next three years. Like with the MSW to biogas plant, Rayong city government wants to pioneer this approach in solving the problem on municipal solid waste.

The central government's policy	To support the budget to the local government that to be a leader to solve the city's pollution on the energy saving and renewable energy.
Development of Environment and Energy Foundation (DEE)	Know-how and capacity building
Rule of ICLEI	A networking of the cities that help Rayong to learn a new knowledge and technology pass the networks.

Mutual reference among city governments

For the CCP project, Rayong sent a qusetionnaire to all offices that have a stake in the project, internal and external to collect all data for CCP Greenhouse Gas Emissions software. 10-12 staff are involved in data collection and processing. Information is shared with other municipalities, particularly those that join the CCP program. ICLEI taught the information requirement of the program. ICLEI organized CCP workshops that provided opportunity for the sharing of information as well as inspired other cities, like Rayong City, to follow.

Sources of information	Data or type of information
All division of municipality	Units and cost of electricity, fule
Rayong PEA	Units and cost of electricity of communities and public lights
Public Health and Environmental Division	Amount and composition of waste
Survey	Traffic Volumes / Vehicle kilometers traveled
Thailand Environment Institute (TEI), Metropolitan Electricity Authority, Ministry of energy, International Institute for Energy Conservation	Accompaniment data to set the measures

Political factors

Below is Rayong City government's assessment of the extent of influence of the following political factors on the project:

	None	Minor	Important	Very Important
Political will of the Mayor				√
Pressure by citizens or NGOs to the local government				√
Individuals or organizations who coordinated different stakeholders to introduce and execute the policy, both within and outside the city government			√	
Civil society networks			√	

Knowledge introduced by experts (such as researchers and consultants)			√	
Autonomy of the local government vis-à-vis national and provincial governments (scope of mandate, freedom of decision-making, self-reliant budget)				√

The political will of the Mayor, autonomy of local government, and social pressure by citizens or NGOs are considered by Rayong City as very important factors in the adoption of new practice or policy. Rightly so, the former and incumbent mayors were both credited for the participation of Rayong City in the CCP campaign of ICLEI. Both mayors dared to try new approaches in addressing the solid waste management of the city. It was the idea of the former mayor that gave birth to the waste-to-biogas facility that, although has its share of flaws, is the first of its kind in the region and Thailand. Now, the new facility that is being built to convert plastic bags back to petroleum will be similarly the first of its kind, if not in Southeast Asia, at least in Thailand.

It was also very important to have a great deal of local government autonomy to be able to undertake such big environment projects, even if, as will be shown later, those needed financial allocation from the national government.

Rayong City's environment projects were also apparently a response to pressure from its citizens and NGOs. We were not able to clarify this point but given the amount of waste that had been generated in the city before the project it would be easy to understand if such pressure in fact existed.

Rayong City organized Ad-hoc Teams for Environment to build and strengthen community networks to preserve environmental quality in their respective communities.[22] This group initiated many activities to promote and persuade the people to participate in segregating and collecting wastes. These activities included trading recycled wastes for eggs at established waste banks, hydro-microorganism fermenting activity, which produced odourless waste that can be used as liquid fertilizer and deodorizer to get rid of foul smell in restrooms, drainage ditches, or refuse dumps.[23]

Rayong City government also worked with national and international experts in the development and implementation of the project. DEE experts assisted in the technical design of the project. The experts from the EC-ASEAN Cogen Programme also provided technical expertise in the implementation of the project as a full-scale cogeneration project, meanwhile receiving financial assistance from the Programme.

Socioeconomic factors

The scale of the project and it being designed as a solution to accompanying problems of growing urbanization, made the latter and revenue generation, through both allocation from the national government and the city's internal revenue generation,

[22] UNESCAP, 2003. "Integrating environmental considerations in to national development plan and its implementation: Waste management project in Rayong Municipality," URL:http://www.unescap.org/DRPAD/VC/conference/bg_th_45_iec.htm downloaded 2 August 2008.
[23] See in next field report related project of Tungsong municipality.

very important factors in the adoption of the new environmental practice. Regional GDP, which is a measure or indicator of economic activity in the area around Rayong City, and extent of urban population, which is an indicator of structure of demand, were considered important factors.

	None	Minor	Important	Very Important
Population				
Urbanization rate in terms of:				
• Growth of urban population				√
• Share to total population			√	
Regional GDP			√	
Revenue				
• Allocation from national government				√
• Internal revenue generation				√

Practice diffusion to other cities

The reputation of the project as an innovative solution to addressing the waste problem has reached other cities in Thailand and Southeast Asia. According to the local officials interviewed in Rayong, more than 10,000 visitors have toured the biogas facility. In Thailand, the next city planning to undertake a similar project is Nakhon Ratchasima (Korat) and Chonburi, even if it seems there is more progress in Nakhon Ratchasima than in Chonburi.. Elsewhere in Southeast Asia, ICLEI has promoted similar projects in Yogyakarta, Indonesia, and Cebu City, Philippines. In fact, Yogyakarta and Rayong have a twinning agreement on technical cooperation on waste as well as transportation management. Yogyakarta replicated the public participation method of Rayong by cooperating with medical staff to promote waste segregation at households while they checked community's health status.[24]

Indeed, ICLEI has leading role in disseminating successful experiences of cities in dealing with local environment problems. ICLEI facilitates exchange visits between cities, organizes national and regional seminars and workshops, and publishes information through its newsletters and websites.

3.3 Muangklang Municipality

3.3.1 Background

Muangklang Municipality is also in Rayong Province and located 50 km from Rayong City and 229 km from Bangkok. Muangklang has a population of more than 20,000 but its population density remains less than 3,000 persons per sq km. Thus Muangklang is classified as a township or subdistrict municipality (thesaban tambon).[25] The ICLEI CCP case study on Muangklang was on achieving energy efficiency in streetlights using solar PV as source of power. Streetlights and traffic

[24] ICLEI (2004*). Indo-CCP News*, vol 5, July.

[25] We have mentioned in the first field report that there are three kinds of municipalities in Thailand: city municipality or simply city (thesaban nakhon), district municipality or town (thesaban muang), and sub-district municipality or township (thesaban tambon).

signals had accounted for 33% of Muangklang's corporate emissions when in March 2004 the local government completed the retrofitting of three traffic signals using solar PV and replacement of incandescent lamps with light emitting diodes (LEDs). The primary goal of the demonstration project was to raise public awareness on the potential benefits of renewable energy. Indeed, the energy-efficient street lights were estimated to reduce 65 tonnes of CO2 equivalent emissions.

The project was one of the measures identified under the CCP.[26] However, Muangklang has since then considered its solid waste management program as its main contribution in curbing global warming.[27] Indeed, Muangklang's solid waste management program, in our opinion, can easily be considered best practice at least for a small municipality. It involves recycling and reuse of organic wastes but, in the words of the mayor of Muangklang, using "zero energy." He has also branded his approach as "never full sanitary landfill".

Figure 5: Simplified presentation of SWM at Muangklang

[26] The other projects identified by the CCP were energy efficiency in buildings, inspection and maintenance of 56 vehicles, paper recycling at the municipal office, and saving energy by contacting high tank for water storage.

[27] To be sure, Muangklang has other initiatives to reduce GHG emissions besides through solid waste management. These include organic treatment of waste water from households and energy efficiency programs in transport. (Ballasiano, Katia, "Local Authority Efforts to Stop Global Warming Case Study: Muang Klang Municipality, Rayong Province, Thailand, URL://http://www.muangklang.com/general/Stop-Global-Warning/case-study-Muangklang.html)

A simplified presentation of the solid waste management program in Muangklang is shown in Figure 5. Organic or biodegrable wastes mostly coming from the market and households are recycled into composts, liquid fertilizer, and enzymes used for liquid cleanser. They are also cooked and re-used as animal feeds for pig and ducks. The pig and duck manures are also treated with the enzymes so that they become organic fertilizer themselves. The organic wastes are also re-used to feed earthworms that in turn excrete rich organic fertilizer. (One kilogram of earthworm—the natural producer of compost—can consume one kilogram of organic wastes.) Although not shown in the figure, some organic wastes are also left to decompose using the enzymes and generate worms that are fed into fish. Some organic wastes are also processed to produce biogas that fuel stoves to boil water used for washing and cleaning pigs in the slaughter house. The enzymes are produced mainly from the liquid residue (leachate) of the biogas digester. The whole system reduces and recycles organic wastes using "zero energy" and aims at "never full sanitary landfill."

3.3.2 Findings

Milestones

Date	Actor	Description of the action
2003	Municipality	Changed and improved the air conditioners and the lighting in the office building. Putting the city traffic lamp used by the solar cell.
2004	Municipality	Buying the land for the city's recreation area .
2006	Municipality	Buying the land for the city's recreation area (The second times) Completing to activated the new local law for the new residents to install the fat trapping bin for conserving the river.
2008	Municipality	Reduced and reused the organic waste management programme. Completing to made the local law to solve the traffic jam.
2008	Municipality	Buying 2 vehicles for the city public transportation.

Since the participation of Muangklang in the CCP program in 2002-2004, Muangklang has embarked on a solid waste management and other programs to reduce GHG emissions. The enzymes produced from organic wastes are also used to treat waste water before it is discharged into the river. Muangklang also has separate programs to reduce GHG emissions from transport and save energy in offices.[28] But solid waste management has been at the core of all these local efforts to contribute in stopping global warming.

[28] Full descriptions of all these programs are available from their websites and published brochures but they need to be translated from Thai.

Key actors
The Mayor of Muangklang has been the key force behind these local environmental initiatives, from conception to delivering and monitoring results. But he acknowledged as well the contributions[29] of the community leader, councilors, and the officers.

Policy process stages
The Mayor seems to be the originator of all the local environmental initiatives in Muangklang. He claims that they evolve from his participation in several international gatherings to protect the environment at the local level. These initiatives are now part of a local campaign to contribute to reducing GHG emissions and stopping global warming.[30]

To communicate its programs to the people, even right from conception, Muangklang operates its own radio station, 104 FM, that broadcasts live every council meeting. In this way, the people are made aware of the discussions on issues, and decisions are immediately communicated to them.

Financing is apparently not an issue. Muangklang generates and receives sufficient funds to implement its programs.

Muangklang has received assistance from the Thailand Environment Institute (TEI) in formulating its climate change program.

Political factors
The political will of the mayor and knowledge of experts are viewed by Muangklang as the most important political factors in the adoption of new practice. It is not hard to see why this is the case for Muangklang, where environmental initiatives are practically personal crusades of the mayor. At the same time, he gives a lot of credit to the knowledge he acquired from talking to experts during international meetings and other gatherings. He gives minor importance to the other political factors. The exception is individuals or organizations who coordinated stakeholders. He thinks it is not an important factor. This is also not hard to see given Muangklang's approach, which is centered on the mayor.

	None	Minor	Important	Very Important
Political will of the Mayor				✓
Pressure by citizens or NGOs to the local government		✓		
Individuals or organizations who coordinated different stakeholders to introduce and execute the policy, both within and outside the city government	✓			
Civil society networks		✓		

[29] He did not mention the specific contributions of these stakeholders.
[30] From the interviews conducted in Chiang Mai, Muangklang, and Tungsong, it appears that there is some national movement in Thailand towards "stopping global warming" involving local governments in the country.

Knowledge introduced by experts (such as researchers and consultants)			√	
Autonomy of the local government vis-à-vis national and provincial governments (scope of mandate, freedom of decision-making, self-reliant budget)		√		

Socioeconomic factors

It is perhaps the size of municipality and the lack of urgency in addressing environmental problems that make socioeconomic factors unimportant or of minor importance in the case of Muangklang. Nonetheless, Muangklang's local government budget come from its share of government national taxes (40%), government allocation based on the municipality's population (40%), and local government taxes (20%).[31] So it is clear that these projects would not have been possible without those funds coming from the national government.

	None	Minor	Important	Very Important
Population		√		
Urbanization rate in terms of:				
• Growth of urban population		√		
• Share to total population		√		
Regional GDP	√			
Revenue				
• Allocation from national government	√			
• Internal revenue generation		√		

Practice diffusion to other cities

Muangklang claims that Tungsong Municipality has adopted its lighting retrofit project. This has been made possible through information disseminated by Muangklang through its website, presentations during workshops, and project brochures. Muangklang also acknowledges the role of ICLEI through the CCP campaign in disseminating its own and other cities' experiences.

[31] These estimates are from the Mayor of Muangklang.

3.4 Tungsong Municipality

3.4.1 Background

Tungsong is in Nakhon Si Thammarat province 747 km south of Bangkok. The town itself is 60 km from Nakhon Si Thammarat airport. But despite of its some distance from the airport, it can boast of very good road infrastructure that makes land travel to Tungsong very comfortable. Tungsong has produced organic fertilizer from household sewage and livestock manure and organic fertilizer and liquid detergent from market waste since 2001. From the 31 metric tonnes organic wastes produced in and collected from the market yearly as of 2004, Tungsong had produced 12,000 kilograms of organic fertilizer and 36,000 liters of liquid detergent. The organic fertilizers were worth USD 10 cents per kg, while the liquid detergents were valued at USD 25 cents per liter. Annual income from the organic fertilizer production was estimated at USD1,200. On the other hand, the liquid detergents reduced expenses for building maintenance and reduced GHG emissions at the rate of 29 tonnes of CO2 equivalent per year.[32]

Figure 6: The liquid detergents from organic wastes produced in Tungsong

3.4.2 Findings

Milestones

The environment policy and program of Tungsong started during the time of the former mayor of the municipality. And the present mayor was happy to acknowledge that his present programs are a continuation of his predecessors'. When the city signed a Memorandum of Understanding with ICLEI in October 2002 to undertake the CCP, it had been actively implementing a solid waste management program aimed at reducing impacts of climate change.

Date	Actor	Description of the action
1996-2000	Mayor Parewansa Udomsak	1) Aim to reduce global warming: a) save electricity at dept of municipalities; monitoring teams of electricity usage in the workplace of city hall; e.g. turning on of AC only between 9-4 b) unplugging of electronic device and electrical applicances c) reporting of electricity usage every month by each department

[32] These statistics will be updated from the interview. The information is with the translator.

		d) team leader-Piyanard (Khun Ae) e) realized electricity saving (consumption and cost) in the library 2) Organic waste bank at 135 branches in Nakhon Si Thammarat province; exchange waste with appliances, food, motorcycle, etc by accumulating points 3) Collecting of hazardous wastes 4) Planting of tree during special occasions; using recycled papers to plant young trees for nursery 5) Fertilizer from human wastes, animal wastes, apply on trees 6) Liquid enzyme deodorizer placed on drainage and sewage and pig sty
2001-2006	Mayor Songchai Wongwatcharadumrong	1) Aim to reduce global warming by: a) Promoting bicycle and planting of trees at least once month b) Waste bank c) Recycled paper d) Biogas from organic wastes from market and households e) Collect organic wastes from restaurant and communities to produce enzyme f) Produce liquid detergent g) Control use of gasoline by each department h) Reduce electricity usage; turn on aircon at 1 pm i) Reporting

Since the CCP, Tungsong has expanded its solid waste management program producing liquid detergents to cover the entire municipality. Led by the sanitary district office, Tungsong has organized community leaders to effect the production and sale of this product from organic wastes. The program has been expanded recently with the award from the Energy Policy and Planning Office (EPPO) of the Ministry of Energy to process the growing volume of organic wastes to produce biogas for water heating. Tungsong is also treating human wastes to produce organic fertilizer. It continues to operate a waste recycling bank.

Key actors

Tungsong maybe made as a classic example of the roles of strong commitment from executive leadership, competent and diligent performance of local government officials and staff, and active participation of constituents or community in the successful implementation of local environment initiatives. These three actors together form an unshaken “triangle” of success. And Tungsong had clearly recognized that when it identified the three key actors below.

Key actors	Contributions or role in the project
Mayor	Control objectives and provides continuous concerns (encouragement) to the efforts of local officials
People	Discipline, responsible, unity with objectives of local government, knowledge of actions for improvements
Local officials	Responsible in fulfilling their duties; implement and attain objectives of the mayor through cost-effective activities; within budget limitations; and beneficial to the environment even if unprofitable financially

The successful promotion of the environment and other sustainable development programs is handled by the chief librarian of Tungsong's Public Library, Khun Ae. In fact, Khun Ae apparently is the focal point of all internationally-sponsored local environmental initiatives, including the CCP.[33] The library headed by Khun Ae is also responsible for organizing all information, education and communication campaigns, including in fact administering the comprehensive and artistic website of the municipality.[34] The contact of Khun Ae with students makes them as her prime instrument for promoting and disseminating the municipality's environment and sustainable development programs. It must be noted that Khun Ae works with very young and dynamic staff.

The implementation of the program, on the other hand, rests with the Sanitary District Office, headed by Khun Supanee, who is assisted by Khun Sorawot as her main technical staff. Khun Supanee has been responsible for organizing and maintaining the informal association or network of community leaders, most of them women, that produce and sell the liquid detergents from organic wastes. Khun Sorawot, on the other hand, manages the new biogas facility built by EPPO and the composting facility for human wastes.

The mayor is of course on top of these programs. His strong political will to undertake these programs cannot be underestimated as a source of success. He has been involved in partnerships with other cities and participates in international programs that promote environmental protection and sustainable development at the local level.

Policy process stages

Like in Muangklang, the solid waste management program was in the framework of the municipality's environment and climate change program. Similarly, Tungsong also received assistance from the Thailand Environment Institute (TEI), in formulating its climate action plan. Again, like Muangklang, Tungsong was financially sufficient in implementing its local environmental initiatives although it had received technical assistance from local and international organizations in terms of capacity building and strategy formulation, and financial and technical assistance from national government for bigger projects (particularly the biogas from waste project).

[33] One of them, for example, is the Urban Green Map, which is a local land-use planning project sponsored by UN Habitat, UNEP, among other international organizations. One output of this project is the environmental categorization of Tungsong's land area.

[34] We observe that the websites of Tungsong and Muangklang are very similar. Khun Ae apparently is a very good friend of Mayor Somchai, and perhaps that is the connection.

Figure 7: The biogas project in Tungsong sponsored by EPPO

The challenges Tungsong had to overcome were, therefore, political in nature. These included obtaining cooperation of the local people or communities and their trust in local government leadership. It also had to make sure that there was enough number of officers assigned to the project.

Tungsong acknowledged that news or information about how other cities had recognized and solved environmental problems had influenced its own decision-making process. Similarly, knowledge of catastrophic environmental events elsewhere had influenced its own decision to undertake environmental projects.

Mutual reference among city governments

As part of its environmental management activities, Tungsong gathers data and information daily and weekly, and reports a summary or conclusion once a month for the person responsible. It has 25-strong staff in its environment department (or its equivalent) and employs two more persons dedicated to just gathering information. Tungsong has collected information from TEI, DEDE, and the Ministry of Industry.

Tungsong admitted that it does not actively share information to other cities, and denied any role of ICLEI in this regard.

Political factors

Tungsong ranked the political will of the mayor, knowledge introduced by experts (in their case, particulary by TEI), and their autonomy as a local government unit as very important political factors. Meanwhile, it considered coordinating individuals and organizations (project leaders) and civil society networks as important political factors.

	None	Minor	Important	Very Important
Political will of the Mayor				√
Pressure by citizens or NGOs to the local government	√			
Individuals or organizations who coordinated different stakeholders to introduce and execute the policy, both within and outside the city government			√	
Civil society networks			√	
Knowledge introduced by experts (such as researchers and consultants)				√
Autonomy of the local government vis-à-vis national and provincial governments (scope of mandate, freedom of decision-making, self-reliant budget)				√

Socioeconomic factors
As indicated below, Tungsong gave high importance to people factors, more than money, although the latter also do matter from their point of view.

	None	Minor	Important	Very Important
Population				√
Urbanization rate in terms of:				
o Growth of urban population				√
o Share to total population				√
Regional GDP			√	
Revenue				
o Allocation from national government			√	
o Internal revenue generation			√	

Practice diffusion to other cities
Tungsong reported that in 2008 a total of 109 persons from 20 different government departments, local government organizations, schools, and hospitals from Thailand have visited Tungsong to look at their solid waste management practices. The representatives from local government organizations included special officers, district officers, teachers, administrators. But there was no information on which of these cities actually adopted Tungsong's solid waste management practices. Tungsong has a twinning agreement with Naga City in the Philippines, which might have benefited from Tungsong experience.

Tungsong claimed that it had lacked efforts in promoting the project, but boasted of their penchant for continuous learning and education for easy techniques.

The person that completed the questionnaire apparently was not aware of the role of ICLEI.

4 Annexes

4.1 CCP's Five Milestones[35]

The five milestones of the CCP and the tools and methodologies behind each milestone provide a simple, standardized means of calculating greenhouse gas emissions, of establishing targets to lower emissions, of reducing greenhouse gas emissions and of monitoring, measuring and reporting performance. ICLEI has developed several software tools that help cities comply with the methodology.

The five milestones are:

Milestone 1. Conduct a baseline emissions inventory and forecast. Based on energy consumption and waste generation, the city calculates greenhouse gas emissions for a base year (e.g. 2000) and for a forecast year (e.g. 2015). The inventory and forecast provide a benchmark against which the city can measure progress.

Milestone 2. Adopt an emissions reduction target for the forecast year. The city establishes an emission reduction target for the city. The target both fosters political will and creates a framework to guide the planning and implementation of measures.

Milestone 3. Develop a Local Action Plan. Through a multi-stakeholder process, the city develops a Local Action Plan that describes the policies and measures that the local government will take to reduce greenhouse gas emissions and achieve its emissions reduction target. Most plans include a timeline, a description of financing mechanisms, and an assignment of responsibility to departments and staff. In addition to direct greenhouse gas reduction measures, most plans also incorporate public awareness and education efforts.

Milestone 4. Implement policies and measures. The city implements the policies and measures contained in their Local Action Plan. Typical policies and measures implemented by CCP participants include energy efficiency improvements to municipal buildings and water treatment facilities, streetlight retrofits, public transit improvements, installation of renewable power applications, and methane recovery from waste management.

Milestone 5. Monitor and verify results. Monitoring and verifying progress on the implementation of measures to reduce or avoid greenhouse gas emissions is an ongoing process. Monitoring begins once measures are implemented and continues for the life of the measures, providing important feedback that can be use to improve the measures over time.

The five milestones provide a flexible framework that can accommodate varying levels of analysis, effort, and availability of data. This element makes the CCP both unique and innovative, by increasing its transferability amongst local governments. It is the breadth of this program that enables it to cross north/south, developed/developing, metropolis/town boundaries and that has made it successful worldwide.

4.2 Actual schedules of field visits and people interviewed and met

The actual schedules of field visits to the four cities were:

[35] Source: "How CCP works," http://www.iclei.org/index.php?id=810

Chiang Mai City	6 August 2008
Rayong City	8 August 2008
Muangklang Municipality	2 October 2008
Tungsong Municipality	3 October 2008

In addition, interviews were conducted in Bangkok on 29 July 2008 with Mr Prasong Limsirichai of STFE Co. Ltd., the EPC contractor of the Rayong biogas power plant, DEDE staff on 5 September 2008. An interview was arranged with EPPO but the concerned officials and staff were too busy to grant an interview. A questionnaire was also sent to DEE but the company moved to another location and could not be contacted.

The table below lists the people met and interviewed in the course of the study.

Table 8: People interviewed and met during the field visits and interviews

Date, location	Interviewee and designation	Stake in the projects
29 July 2008, STFE Office in Bangkok	Mr. Prasong Limsirichai Deputy Managing Director, Business and Development STFE Co. Ltd.	EPC contractor
6 August 2008, Chiang Mai City	Dr. Capt. Deuntemduang Na Chiengmai Mayor, Chiang Mai Municipality	Owner of the new biodiesel project in behalf of Chiang Mai City
	Ms Rongrong Duriyapunt Chief, Air Quality and Noise Management Subdivision, Public Works Bureau Chiang Mai Municipality	Focal point of ICLEI for the CCP project
	Mr Sakorn Sukprasong Civil Engineer	Involved in the development of the new biodiesel project under the Department of Public Works
	Mr Kiatitsak Phianphouseesakun Civil Technician	
	Mr Benjapong Krotsakul Engineer	
8 August 2008, Rayong City	Mr Varavit Supachokchai Mayor, Rayong City	Owner of the project in behalf of Rayong City
	Mr Thanit Angkawinijwong Vice-Mayor, Rayong City	Owner of the project in behalf of Rayong city
	Mr Dusit Thamsiriruk Director, Public Health and Environment Section Rayong City	In charge of environmental projects and focal point of the ICLEI in this CCP project in Rayong.
	Ms. Nahatai Chaikla Engineer Single Point Energy and Environment Co. Ltd.	Supervising the construction of the plastic recycling plant in Rayong City located beside the biogas plant.
5 September 2008, DEDE Office in	Mr. Prasit Siritiprussamee Engineer, DEDE	Specializes in solar energy at DEDE

Date, location	Interviewee and designation	Stake in the projects
Bangkok	Ms. Lawan Preechametta Senior Policy and Plan Analyst, DEDE	Energy cooperation section of DEDE
	Ms. Munlika Sompranon Policy and Planning Analyst, DEDE	Works in waste management at DEDE
	Mr. Sakchai Suprasert Energy from Waste Group, DEDE	Monitors biogas project in Rayong
	Ms. Suwanna Tuankaipon Engineer, DEDE	Monitors and involved in the development of biodiesel projects of DEDE
	Ms. Ubonratana Punyawut Expert for International Cooperation, P&C Management Co. Ltd.	Assists DEDE in international cooperation projects
2 October 2008, Muangklang, Rayong	Mayor Somchai Chariyacharoen	Conceptualization, design, management of implementation
3 October 2008, Tungsong, Nakhon Si Thammarat	Mayor Songchai Wongwatcharadumrong	Made final decision and provided overall leadership
	Mrs Supanee Chief Sanitary Officer	Supervises environment projects of the municipality
	Khun Piyanard (Ae)	Chief Librarian
	Mr Sorawot Saysing Sanitary Officer	Asst Mrs Supanee in the implementation of the project
	Mrs Somjai Boonmuang	Community leaders
	Mrs Sompit Muangthai	
	Mrs Kaewan Makthong	
	Mrs Weth Muangjin	
	Mrs Kathi Wethnusith	
	Mrs Wantha Puthachat	
	Mrs Wanpen Janthip	
	Mrs Somjit Choopomtaew	
	Police Officer Mr Wiroj Pinyo	

The figures below show the author and the Siam CIE Managing Director with the mayors and some of the people met in the four cities.

Figure 8: Khun Rongrong and the new and young Lady Mayor of Chiang Mai

Figure 9: The Mayor, Deputy Mayor, and Khun Dusit of Rayong City

Figure 10: The Mayor of Muangklang

Figure 11 shows from left Khun Wanpen Janthip, the chairperson of the association of community leaders, Khun Piyanard, the Chief Librarian, Mayor Songchai, Khun Supanee, the head of Sanitary Office, and Khun Ann, staff of Tungsong who assisted SCIE in following up with Tungsong.

Figure 11: The Mayor of Tungsong and key people involved in the solid waste management program