

# CDM (Clean Development Mechanism) Business in Southeast Asia: Its Implementation and Implications\*

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## I. Introduction

In recent years climate change<sup>1)</sup> has become one of the most challenging issues for sustainable development.<sup>2)</sup> It has the potential

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- 1) Climate change is a phenomenon caused by the warming of the Earth. This is due to the so-called greenhouse effect which is a necessary and natural phenomenon caused by the presence and accumulation of greenhouse gases in the atmosphere. The United Nations Framework Convention for Climate Change (UNFCCC) defines the phenomenon as a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods (UNFCCC Article 1).
- 2) Sustainable development refers to a mode of human development in which resource use aims to meet human needs while preserving the environment so that these needs can be met not only in the present, but also for generations to come. The term 'sustainable development' was used by the Brundtland Commission in 1987 and was defined as "development that meets the needs of the present without compromising

of becoming a grave threat to humankind if left unchecked. It is challenging because of its multifaceted nature, affecting almost all economics sectors. It is no mere environmental issue that could be fixed by technology or finite human and capital resources. It is urgent in the sense that we are not far from the tipping point at which climate change's devastating impact becomes irreversible.<sup>3)</sup>

Due to geological and geographical factors, Southeast Asia is vulnerable to a range of climatic and natural hazards such as earthquakes, typhoons, sea level rise, volcanic eruptions, droughts, heat waves, and tsunamis which are becoming more frequent and severe. In addition, the geophysical and climatic conditions shared by the region have also led to common and trans-boundary environmental concerns such as air and water pollution, urban environmental degradation and trans-boundary haze pollution (ADB 2010, Tay & Paungmalit 2010, Dupont 2007, Clapp & Dauvergne 2003, Sari 2003).

Southeast Asia is also particularly vulnerable to the impact of climate change due to several factors. First, a high concentration of population and economic activity along long coastlines leaves Southeast Asia exposed to sea level rise. Second, the physical impact

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the ability of future generations to meet their own needs.”

3) The observed climate change trends in Southeast Asia include increase in temperature, decrease in rainfall, Southeast Asia level rise, increased frequency, duration and intensity of extreme weather events, such as droughts, storms, floods and typhoons, and heat waves (an increase in the number of hot days and warm nights and decrease in the number of cold days and nights), significant increase in heavy precipitation events and more tropical cyclones. Climate change has also caused forest and peat-land fires and trans-boundary smoke haze, land/forest degradation and soil erosion, damaged coastal and marine resources, and increased the risk of outbreaks of infectious diseases.

of climate change is expected to be unevenly large. Third, the population is heavily reliant on climate-sensitive sectors such as agriculture, fisheries, forestry, and natural resources in terms of national income and employment. Fourth, the high incidence of poverty in the region leads to greater vulnerability. Fifth, these countries have limited financial, technological, and institutional capacity. In most Southeast Asian countries, as in other parts of the world, adaptive capacity, that is what and how to adapt to climate change, is constrained by the limited availability of experts, accurate information on the climate change situation at the national level, and adaptation options, as well as scientific uncertainty, the current state of technology, the availability of financial resources, and short time horizons. Finally, there is also uncertainty concerning the effectiveness of adaptation options, for example, the cost of taking action today compared with the cost of action after adverse climate impacts (Mertz 2009, Christensen 2007, Cruz 2007, Yohe & Tol 2002).

National plans of action and platforms have been created to respond to the challenge of climate-related hazards (ADB 2009, Urwin & Jordan 2008, Parry 2007, Wilbanks 2007, Klein 2002, Young 2002, McCarthy 2001, Smit & Pilifosova 2001). Especially, in an attempt to develop, Southeast Asian countries have opted for trade or market-related mechanisms aimed at addressing climate change challenges, which include access to support through the Kyoto Protocol's Clean Development Mechanism (CDM), establishing market mechanisms to reduce greenhouse gas<sup>4)</sup>

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4) A greenhouse gas (GHG) is a gas in an atmosphere that absorbs and emits radiation within the thermal infrared range. This process is the fundamental cause

(GHG), especially CO<sub>2</sub> which accounts for over 80% of GHG.<sup>5)</sup>

The CDM is a market-based mechanism under the Kyoto Protocol whereby projects in developing countries can earn saleable credits equivalent to the amount of CO<sub>2</sub> they reduce or avoid. A wide range of project types can qualify under the CDM.<sup>6)</sup> The CDM was designed to meet the dual objectives of helping developed countries fulfill their commitments to reduce emissions and assisting developing countries in achieving sustainable development.

CDM projects earn tradable, saleable certified emission reduction (CER) credits, each equivalent to one ton of CO<sub>2</sub>. These credits can be used by industrialized countries (Annex I countries) to meet a portion of their emission reduction targets under the Kyoto Protocol. Further, the mechanism assists developing countries (non-Annex I countries) in achieving sustainable development by encouraging investment in climate change mitigation projects, transfer or diffusion of technology, and improvement in the livelihood of communities through the creation of employment or

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of the greenhouse effect like global warming. The primary greenhouse gases in the Earth's atmosphere are water vapour (H<sub>2</sub>O), carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O), and ozone (O<sub>3</sub>). Since the beginning of the Industrial Revolution, the burning of fossil fuels has contributed to a 40% increase in the concentration of CO<sub>2</sub> in the atmosphere from 280 ppm to 397 ppm, despite the uptake of a large portion of the emissions by various natural sinks involved in the carbon cycle. CO<sub>2</sub> emissions produced by human activities come from consumption of carbon based fuels, principally wood, coal, oil, and natural gas.

5) 'ASEAN Cooperates on Climate Change', available on the Internet at <http://www.aseansec.org/21248.htm>.

6) The project types vary from wind energy projects that earn credits by displacing electricity generated from the burning of fossil fuels, to projects that install more efficient cook stoves, to projects that are credited for destroying industrial waste gases.

increased economic activity.

Briefly, the CDM aims to facilitate the implementation of additional renewable, alternative, and energy efficiency projects in developing countries through the sale of CERs. CDM can contribute to achieving the economic and sustainable development objectives of CDM host countries. Therefore, to achieve the objective of the CDM project in Southeast Asia, it is necessary to support the successful implementation of CDM business through regional institutional capacity building and improving the region's competitive position among CDM host countries for attracting more investment.

Based on the CDM in general, this paper gives an overview of the performance of the CDM business in Southeast Asia and its policy implications. It is worth having this macro-perspective because the various Southeast Asian countries have significant CDM potential, which may be better utilized if a coordinated regional approach is employed. To do this, this paper proposes a hypothesis, inspired by the environmental Kuznets curve, that there are four stages of sustainable development that countries pass through at different stages in economic growth. Following this hypothesis we measure the variables that represent the status of the CDM business of Southeast Asia by introducing two basic variables, CO<sub>2</sub> emissions and the scale of CDM business. From the results we could find the position of the CDM business in Southeast Asia compared with the other major CDM countries and the world standard. There are few studies aimed at discerning the status of sustainable development of Southeast Asia in terms of the CDM business. To our knowledge, this study is the first to examine the subject.

In the next section, we explain the economics of CDM. Based on a theoretical overview we propose a model and data for analysis to navigate the CDM business in Southeast Asia. In section 3, we overview the performances of CDM in Southeast Asian countries and present the results of analysis to discern the position of the business. In Section 4, we propose several policy implications for the development of CDM in the region. This includes, for example, suggestions of more regional cooperation amongst the Southeast Asian countries, which may be pursued within the established regional framework provided by ASEAN and Korea-ASEAN cooperation that would play the role of facilitating more efficient implementation of the CDM. Finally, section 5 summarizes the main arguments and presents a conclusion.

## II. Model and data for navigating the CDM business in Southeast Asia

### 1. Model and data for analyzing the CDM business in Southeast Asia

CDM recipients could receive the benefits in both environmental and economic terms through FDI inflows to CDM business. While other FDI could cause environmental problems, FDI for CDM projects plays the role of protecting the environment by reducing GHG such as CO<sub>2</sub> and, at the same time, fosters capital accumulation,

job creation, technology transfer, and other positive elements for economic growth. Furthermore, from the perspective of the CDM investing country it is a cheaper means of reducing CO<sub>2</sub> and could create additional economic interests by CER acquisition and sales at the emission trading market.

To analyze the current position of the CDM business in Southeast Asia and to suggest its policy implications, we develop a model for analysis. As mentioned above, the sustainable growth of Southeast Asia should involve two elements; one is reducing GHG emissions and the other is maximizing the capacity of CDM business. Therefore, through the analysis of these two goals, we are able to present the current position of the business and the direction to pursue in the future.

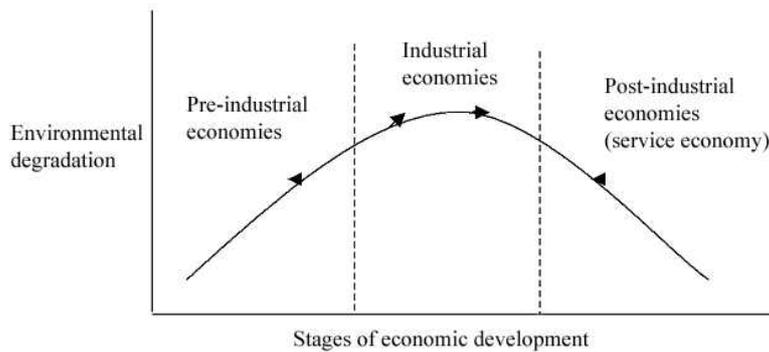
First of all, to ascertain the current status of the CDM business in Southeast Asia we adopt the hypothesis of an inverted-U relationship between environmental degradation and economic growth, which is known as the environmental Kuznets curve by analogy with the income-inequality relationship postulated by Kuznets.<sup>7)</sup> The hypothesis assumes that at low levels of economic development, both the quantity and the intensity of environmental degradation are limited to the impacts of subsistence economic activity on the resource base and to limited quantities of biodegradable wastes. As agriculture and resource extraction intensify and industrialization takes off, both resource depletion and waste generation accelerate. At higher levels of development, structural change towards information-based industries and services, more

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7) S. Kuznets, *Economic Growth and Structural Change* (New York, Norton, 1965) and *Modern Economic Growth* (New Haven, Yale University Press, 1966).

efficient technologies, and increased demand for environmental quality result in a leveling-off and a steady decline of environmental degradation, as seen in <Figure 1>.

<Figure 1> The environmental Kuznets curve: a development–environment relationship



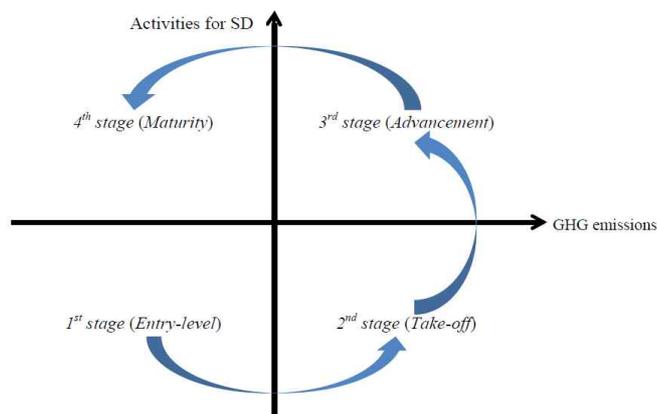
Following the reasoning of the environmental Kuznets curve, it would be reasonable to assume that in terms of GHG emissions and activities for sustainable development, a country usually takes the following four stages. At the 1<sup>st</sup> stage, which is regarded as *Entry-level*, a country has low GHG emissions and low activities for sustainable development because its economic exploitation and development would be primitive. At the 2<sup>nd</sup> stage, which is regarded as *Take-off*, a country has high GHG emissions and low activities for sustainable development because economic exploitation is fully pursued whereas the policies for sustainable development and avoiding environmental problems would not be fully implemented. At the 3<sup>rd</sup> stage, which is regarded as *Advancement*, a country has high GHG emissions and high activities for sustainable development because economic growth

is accomplished and policies for sustainable development would be sufficiently implemented to deal with environmental problems. Finally at the 4<sup>th</sup> stage, which is regarded as *Maturity*, a country has low GHG emissions and high activities for sustainable development because the economy has moved into the carbon-saving economy. <Table 1> summarizes the hypothesis on GHG emissions and the activities for sustainable development according to the different economic development statuses of each country. Furthermore, <Figure 2> illustrates the hypothesis graphically.

<Table 1> Hypothesis for GHG emission and the activities for sustainable development

	1 <sup>st</sup> stage	2 <sup>nd</sup> stage	3 <sup>rd</sup> stage	4 <sup>th</sup> stage
Status (Position)	<i>Entry-level</i>	<i>Take-off</i>	<i>Advancement</i>	<i>Maturity</i>
GHG emission	<i>Low</i>	<i>High</i>	<i>High</i>	<i>Low</i>
Activities for SD	<i>Low</i>	<i>Low</i>	<i>High</i>	<i>High</i>

<Figure 2> Diagram for the status of GHG emission and the activities for sustainable development



<Table 2> presents the proxy variables which are related to GHG emissions and the activities for sustainable development of the countries in which CDM business exists. We adopt both CO<sub>2</sub>/GDP and CO<sub>2</sub>/population as proxies for GHG emissions; and the number of CDM projects, CER issued, and amount of FDI investment for CDM as proxies for activities for sustainable development. Especially, CO<sub>2</sub> emissions need to be normalized to offset the effect of the differences in the size of economy and population of each country.

<Table 2> Proxy for GHG emission and the activities for sustainable development

Proxy for GHG emissions (X variable)		Proxy for the activities for SD (Y variable)		
CO <sub>2</sub> / GDP	CO <sub>2</sub> / population	No. of CDM projects	CER issued	Investment amount

First, we calculate the ratio of total CO<sub>2</sub> emissions per GDP (million \$) or the ratio of CO<sub>2</sub> emissions per capita as a proxy variable to represent the relative size of the GHG emissions of each country. Further, the number of CDM projects, CER issuance, and FDI for CDM are measured as proxy variables for the scale of activities for sustainable development of each country. We calculate these variables for major CDM business countries such as Brazil, China, India, Mexico, and South Korea, and the Southeast Asian countries that we are interested in. Finally, regions including ASEAN, Latin America, Asia & Pacific, Africa, Europe & Central Asia, and the Middle East the variables are measured as well.

<Table 3> presents the data sources and countries that we collect

data on.<sup>8)</sup> Then, we measure the average of each variable and compare the number of variables with the average. The analysis of the difference between the number of variables and the average would give the position of the CDM business of each country including Southeast Asian countries in terms of the CDM business of the world.

<Table3> Description of the data set

Variables	Definition	Data Source	Baseline
CO <sub>2</sub> / GDP	Amount of CO <sub>2</sub> (Million ton) / GDP (Million U.S\$)	CD4CDM, World Bank	2011
CO <sub>2</sub> / population	Amount of CO <sub>2</sub> (Million ton) / Population (per capita)	CD4CDM, UNDP	2011
No. of CDM projects	Amount of CER issued (Million ton) by CDM Executive Board	CD4CDM	2012.6
CER issued	Amount of CER issued (Million ton) by CDM Executive Board	CD4CDM	2012.6
FDI Investment	Amount of FDI investment for CDM project (Million U.S\$)	CD4CDM	2012.6

Notes: The data are available at the website <http://www.cd4cdm.org>; <http://www.undp.org>; <http://databank.worldbank.org>

8) List of countries of CDM business are as below. Argentina, Bahamas, Bolivia, Brazil, Chile, Colombia, Costa Rica, Cuba, Dominican Republic, Ecuador, El Salvador, Guatemala, Guyana, Honduras, Jamaica, Mexico, Nicaragua, Panama, Paraguay, Peru, and Uruguay are for Latin America (20 countries); Bangladesh, Bhutan, Cambodia, China, Fiji, India, Indonesia, Lao PDR, Malaysia, Mongolia, Myanmar, Nepal, North Korea, Pakistan, Papua New Guinea, Philippines, Singapore, South Korea, Sri Lanka, Thailand, and Vietnam are for Asia & Pacific (20 countries); Albania, Armenia, Azerbaijan, Bosnia and herzegovina, Cyprus, Georgia, Kyrgyzstan, Macedonia, Malta, Moldova, Montenegro, Serbia, Tajikistan, Turkmenistan, and Uzbekistan are for Europe & Central Asia (15 countries); Algeria, Angola, Burundi, Cameroon, Cape Verde, Congo DR, Côte d'Ivoire, Egypt, Equatorial Guinea, Ethiopia, Gabon, Ghana, Kenya, Lesotho, Liberia, Libya, Madagascar, Malawi, Mali, Mauritius, Morocco, Mozambique, Namibia, Niger, Nigeria, Rwanda, Senegal, Sierra Leone, South Africa, Sudan, Swaziland, Tanzania, Togo, Tunisia, Uganda, Zambia, and Zimbabwe for Africa (25 countries); Iraq, Israel, Jordan, Kuwait, Lebanon, Oman, Qatar, Saudi Arabia, Syria, United Arab Emirates, and Yemen for Middle East (11 countries). The data are available at the website <http://www.cd4cdm.org>; <http://www.undp.org>; <http://databank.worldbank.org>.

### III. Analysis of the CDM business in Southeast Asia

#### 1. Outline of CDM in Southeast Asia<sup>9)</sup>

The nine potential CDM host countries in Southeast Asia (Cambodia, Indonesia, Laos, Malaysia, Myanmar, the Philippines, Singapore, Thailand, and Vietnam) show significant differences in both CDM project development and in establishing the related policy and institutional framework.<sup>10)</sup> These differences can be partly explained by country-to-country differences in CDM potential, for instance those resulting from the structure of the energy sector and the investment climate. Nevertheless, the overall region's potential is not yet sufficiently exploited to secure a sustainable competitive position in the global CDM market. Given the relatively small size of these countries compared to key competitors in the global CDM market, particularly China and India, a rationale exists for exploring the potential benefits of increased regional cooperation among the countries.

Within Southeast Asia, the CDM projects developed so far fall into such categories as methane avoidance and biomass energy projects. The potential of Southeast Asian countries is still widely under-deployed. The countries that are most advanced in the CDM

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9) This section is based on the report of various report or contents provided by UNFCCC and is available on the internet at <http://cdm.unfccc.int>. Also, the statistics is based on the reports or contents provided by UNEP and are available on the internet at <http://www.cd4cdm.org/CDMJpipeline.htm>.

10) Brunei has not joined the Kyoto Protocol and is excluded from CDM.

process seem to be Malaysia and Indonesia, followed by Thailand, Vietnam, and the Philippines.

First, in the global context, the CDM business in Southeast Asia seems to be minimal but shows great potential. <Table 4> illustrates the trend of CDM projects registered. We can know that since 2006, the amount of investment in CDM projects in Southeast Asia has steadily increased and even the impact of the global recession from 2011 seems to not be significant when compared with China and India.

By June 2012, in Southeast Asia a total of 483 CDM projects had been registered since the first CDM project was launched in the region in 2006. This is 10.3% of the total number of CDM projects registered of the world (4,685) and the number ranked at 4<sup>th</sup> place following China (2,363, 50.4%), India (908, 19.4%), and Latin America (629, 13.4%). In terms of the Asia & Pacific region the share of CDM projects in Southeast Asia is 12.5% of the projects registered in that region. More than 80% of the registered projects are located in China, India, Brazil, or Mexico. Also, the majority of registered projects are concentrated in five countries in Southeast Asia: Indonesia, Malaysia, the Philippines, Thailand, and Vietnam. In particular, Indonesia, Malaysia, and Vietnam's number of CDM projects reached 70.4% of the total in the region.

On the other hand, if we consider the amount of CDM investment, as shown in <Table 5>, it reached \$8.9 billion. This is just 3.9% of the total amount of investment in CDM projects registered in the world (\$231.4 billion) and this ranked at 4<sup>th</sup> place following China (\$152.8 billion, 66.1%), India (\$39.6 billion, 17.1%), and Latin

America (\$18.4 billion, 8.0%). In terms of the Asia & Pacific region CDM project investment in Southeast Asia is just 4.4% of total investment in the region. More than 90% of applicable funds were invested in China, India, Brazil, and Mexico. Also, the majority of registered projects are concentrated in four countries in Southeast Asia: Indonesia, Malaysia, Thailand, and Vietnam. In particular Indonesia and Vietnam's investment of CDM projects is 73.1% of the total in Southeast Asia.

Furthermore, based on the 2012 CERs being issued as shown in <Table 6>, we can know that the share of CERs in Southeast Asia is 4.2% of the total, meaning that the magnitude of projects is relatively minimal compared with the number of CDM projects in Southeast Asia. If we analyze the CDM projects in Southeast Asia in more detail, the CER/GDP ratio and number of projects/GDP ratio are smaller than the average and those of China and India. This means that the projects in Southeast Asia are relatively inefficient and outnumbered by other those in other Asian countries. If we consider the CDM business of Southeast Asia in terms of one unit, this has a meaningful outcome.

However, when we look into the individual country cases, the outcome is not as impressive as it appears in <Table 7>. For example, for Vietnam (Vietnam is the 1<sup>st</sup> place in CDM projects in terms of numbers), the share of the number of CDM projects is 3.0% of the total of Asia and Pacific and 2.5% of the total of the world. In terms of investment amount, for Vietnam, the share is 1.6% of total of Asia & Pacific and 1.4% of the world total.

<Table 4> Trend of CDM projects

Host country	Projects (Registered)	Share of total	FDI Investment										Share of Investment
			2004	2005	2006	2007	2008	2009	2010	2011	2012	All years	
Asia & Pacific	3871	82.6	5	276	5,081	11,070	13,791	26,906	44,357	65,397	37,264	204,147	88.2
China	2363	50.4	70	1,610	6,308	11,987	21,324	35,181	44,998	31,370	152,849	66.1	
India	908	19.4	5	114	1,455	4,262	1,383	4,428	7,050	17,484	3,418	39,599	17.1
ASEAN	483	10.3			981	288	407	720	1,545	2,702	2,265	8,908	3.9
Cambodia	6	0.1			10		6	4		3	6	28	0.0
Indonesia	81	1.7			482	53	227	121	905	627	827	3,242	1.4
Laos	4	0.1				1				208	157	366	0.2
Malaysia	110	2.3			251	69	53	298	48	201	17	938	0.4
Myanmar		0.0											0.0
Philippines	58	1.2			97	25	99	49	33	99	1	403	0.2
Singapore	2	0.0					3		27			30	0.0
Thailand	73	1.6				140	19	98	55	243	76	631	0.3
Vietnam	149	3.2			141			150	477	1,321	1,181	3,271	1.4
Rest of Asia	117	2.5		91	1,035	213	14	434	581	213	210	2,791	1.2
Latin America	629	13.4	46	493	3,914	1,857	1,726	1,428	687	3,004	5,266	18,420	8.0
Africa	94	2.0		132	818	336	75	1,150	712	1,518	286	5,028	2.2
Middle-East	49	1.0			5	612	43	165	60	1,171	9	2,065	0.9
Europe and Central Asia	42	0.9		9	129	6	6	82	70	826	589	1,716	0.7
<b>Total</b>	<b>4,685</b>	<b>100.0</b>	<b>51</b>	<b>909</b>	<b>9,947</b>	<b>13,882</b>	<b>15,641</b>	<b>29,731</b>	<b>45,885</b>	<b>71,916</b>	<b>43,413</b>	<b>231,376</b>	<b>100.0</b>

Source: <http://www.cd4cdm.org/CDMJPipeline.htm>.

<Table 5> CDM registered and CERs issued

	CDM registered		2012 CERs		CDM processing in total		2012 CERs	
	Number	share (%)	kCERs	share (%)	Number	share (%)	kCERs	share (%)
Asia & Pacific	3,871	82.6	1,774,829	80.5	7,333	81.3	2,030,902	79.3
China	2,363	50.4	1,288,064	58.4	4,028	44.7	1,419,813	55.5
India	908	19.4	276,818	12.6	2,159	23.9	373,349	14.6
ASEAN	483	10.3	92,515	4.2	917	10.2	115,997	4.5
Latin America	629	13.4	316,347	14.4	1,230	14.0	358,446	14.0
Africa	94	2.0	63,235	2.9	261	2.9	101,310	4.0
Middle east	49	1.5	30,854	1.4	98	1.1	34,063	1.3
Europe & Central Asia	42	0.9	18,672	0.8	99	1.1	35,738	1.4
<b>Total</b>	<b>4,685</b>	<b>100.0</b>	<b>2,203,938</b>	<b>100.0</b>	<b>9,021</b>	<b>100.0</b>	<b>2,560,460</b>	<b>100.0</b>

Source: <http://www.cd4cdm.org/CDMJPipeline.htm>.

&lt;Table 6&gt; Selected indicators of CDM

Host region/ country	Total number of projects	Total exp. Ann. red. ktCO <sub>2</sub>	Total GHG emissions MtCO <sub>2</sub>	Nominal GDP (IMF) Mill US\$ 2010	Emission intensity CO <sub>2</sub> /GDP tCO <sub>2</sub> /US\$	No. of projects /ktCO <sub>2</sub> emissions	CER/ GDP	No of projects / GDP Bill US\$	CERs/ Country Emissions
Asia & Pacific	7,333	974,782	12,374.3	10,302,505	0.001	5,925.99	9.46	7.12	7,877.48
China	4,028	640,532	8,190.0	5,745,133	0.001	4,918.19	11.15	7.01	7,820.90
India	2,159	218,529	1,523.8	1,430,020	0.001	14,168.84	15.28	15.10	14,341.37
ASEAN	917	78,548	1,292.5	1,788,386	0.001	7,094.78	4.39	5.13	6,077.21
Cambodia	10	2,021	12.8	11,360	0.001	7,812.50	17.79	8.80	15,790.52
Indonesia	174	24,299	554.3	695,059	0.001	3,138.90	3.50	2.50	4,383.42
Lao PDR	10	1,444	6.9	6,341	0.001	14,492.75	22.78	15.77	20,929.99
Malaysia	168	10,348	193.4	218,950	0.001	8,686.66	4.73	7.67	5,350.32
Myanmar	1	678	12.7	35,646	0.000	787.40	1.90	0.28	5,338.09
Philippines	93	5,620	100.9	189,061	0.001	9,217.05	2.97	4.92	5,569.39
Singapore	8	1,960	38.8	217,377	0.000	2,061.86	0.90	0.37	5,050.86
Thailand	191	10,134	236.9	312,605	0.001	8,062.47	3.24	6.11	4,277.69
Vietnam	262	22,044	135.8	101,987	0.001	19,293.08	21.61	25.69	16,232.63
Latin America	1,230	178,216	2,789.7	4,373,827	0.001	4,409.08	4.07	2.81	6,388.37
Europe & Central Asia	99	31,704	509.5	215,965	0.002	1,942.95	14.68	4.58	6,222.19
Africa	261	70,256	2,241.9	1,253,667	0.002	1,164.17	5.60	2.08	3,133.68
Middle East	98	20,976	1,195.6	1,573,609	0.001	819.68	1.33	0.62	1,754.46
Total (91 countries)	9021	1,275,934	16,869.1	16,465,906	0.001	5,347.64	7.75	5.48	7,563.73

Source: <http://www.cd4cdm.org/CDMJpipeline.htm>.

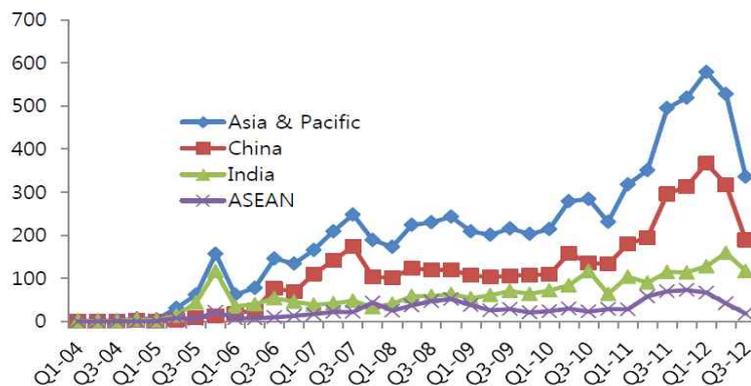
&lt;Table 7&gt; CDM registered and CERs for individual country in Asia &amp; Pacific

Asia & Pacific	Total Number	Share (%)	Registered	kCER2012	Share (%)
China	4028	55.0	2363	1,419,813	69.91
India	2159	29.5	908	373,349	18.38
Vietnam	262	3.6	149	21,248	1.05
Thailand	191	2.6	73	19,649	0.97
Indonesia	174	2.4	81	31,579	1.55
Malaysia	168	2.3	110	30,335	1.49
South Korea	104	1.4	70	104,769	5.16
Philippines	93	1.3	58	10,685	0.53
Pakistan	55	0.8	15	8,702	0.43
Sri Lanka	28	0.4	7	1,907	0.09
Papua New Guinea	11	0.2	6	1,979	0.10
Cambodia	10	0.1	6	960	0.05
Lao PDR	10	0.1	4	977	0.05
Nepal	10	0.1	6	987	0.05
Singapore	8	0.1	2	564	0.03
Bangladesh	5	0.1	3	1,110	0.05
Mongolia	4	0.1	4	378	0.02
Bhutan	3	0.0	2	503	0.02
Fiji	3	0.04	2	271	0.01
Total	7,326	100%	3,869	2,030,902	100%

Source: <http://www.cd4cdm.org/CDMJpipeline.htm>.

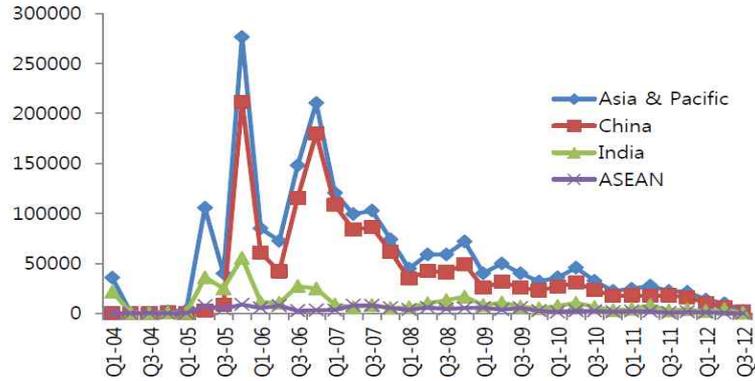
Furthermore, as we see in <Figure 3> the number of CDM project has steadily increased since 2004 and especially the numbers increased sharply after 2010 but suddenly plunged in 2012. The trend of ASEAN is not much different from that of China and India. The global recession, which was mainly due to the EU's fiscal crisis, the U.S. credit rate degrading, and emerging markets' downturn, accelerated after the middle of 2011. Thus, the CDM projects and related FDI investment declined as well. In terms of CERs issued as we see in <Figure 4> the expected CERs recorded a peak in the 1<sup>st</sup> quarter of 2006 but declined gradually after 2007. In 2012 the amount is lower than the starting point in 2004. This is also due to the global recession which resulted in a decline of investment in CDM projects.

<Figure 3> Trend of number of CDM projects



Source: <http://www.cd4cdm.org/CDMJIpipeline.htm>.

&lt;Figure 4&gt; Trend of CERs issued



Source: <http://www.cd4cdm.org/CDMJIpipeline.htm>

Next, in terms of project type, the most popular CDM projects in Southeast Asian countries are both methane avoidance and biomass energy projects as seen in <Table 8>. By the end of 2011, the number of methane avoidance projects was 162 and the share was 39.0% of total CDM projects in Southeast Asia and the number of biomass energy projects is 59 and the share is 14.2% of total CDM projects in Southeast Asia. The sum is 53.2% of the total. The number seems to be much higher than the average of Asia (2% for methane avoidance) and it is attributed to the fact that Southeast Asian countries have a comparative advantage in this CDM type. Exceptionally, for Vietnam hydro CDM projects are most popular. The number is 92 by June 2012, and the share is 80.7% of the total in Vietnam. This is due to the development projects in the GMS (Greater Mekong Subregion).

<Table 8> Type of CDM projects in Southeast Asia

Types	2006	2007	2008	2009	2010	2011	2012	Total
Cambodia All types	1		2	1		1		5
Biomass energy	1							1
Methane avoidance			2			1		3
EE own generation				1				1
Indonesia All types	8	4	9	21	16	17		75
Methane avoidance (most waste water)	2	1	2	14	8	8		35
Biomass energy	3	2	3		1	2		11
Landfill gas		1	1	3	1	1		7
Cement	1							1
Hydro					1	5		6
EE industry			1			1		2
EE supply side			1	1				2
Fossil fuel switch				1	2			3
Fugitive			1					1
Geothermal	1			1	2			4
N <sub>2</sub> O				1				1
PFCs and SF <sub>6</sub>					1			1
Solar	1							1
Lao PDR All types		1				1		2
Hydro						1		1
EE industry		1						1
Malaysia All types	12	14	9	43	9	19		106
Methane avoidance (composting & waste water)		7	7	37	5	7		63
Biomass energy (mostly palm oil solid waste)	11	3		3	4	9		30
Landfill gas	1	1	1	2		1		6
EE industry		3						3
Fossil fuel switch						1		1
EE supply side				1				1
Hydro			1			1		2
Philippines All types	7	8	5	20	6	11		57
Methane avoidance (most manure)	5	6	1	18	2	5		37
Biomass energy		1	1	1	1	1		5
EE own generation						1		1
Landfill gas			2	1	1	1		5
Hydro			1		1	3		5
Wind	1							1

Types		2006	2007	2008	2009	2010	2011	2012	Total
	N <sub>2</sub> O					1			1
	Geothermal	1							1
	EE own generation		1						1
Singapore	All types			1		1			2
	Landfill gas					1			1
	Biomass energy			1					1
Thailand	All types		5	5	20	12	24	3	68
	Methane avoidance (Mostly waste water)		1	3	18	6	18		46
	Biomass energy		4	1		2	2	1	10
	EE own generation					3			3
	Landfill gas			1	1	1	2		5
	Solar						2	1	3
	Wind							1	1
	N <sub>2</sub> O				1				1
Vietnam	All types	2			18	27	58	9	114
	Hydro	1			7	25	52	7	92
	Biomass energy					1	1		2
	Fugitive	1							1
	Wind				1				1
	Methane avoidance				7		5	2	14
	Landfill gas				2	1			3
	Reforestation				1				1

Source: <http://www.cd4cdm.org/CDMJPipeline.htm>.

Briefly speaking, the potential of Southeast Asia for development of CDM business is huge considering its natural resources, environmental situation, and the threat of climate change. However, compared with its potential the CDM business is relatively minimal compared to other regions such as China, India, and Latin America in terms of both the number of projects and the investment amount. Also, CDM projects are mostly dependent on the demand-side factor. Southeast Asian countries need to develop supply-side initiative for CDM projects in the region to cope with climate change and enhance the sustainable development of the region. It also shows that CDM projects need to be distributed to other sectors such as wind, hydro,

and landfill gas to strengthen the foundation of the CDM business in Southeast Asia and utilize various potentialities that the region has.

## 2. Analyzing the CDM business in Southeast Asia

To analyze the model mentioned above, we designate the horizontal axis ( $X$ ) as the average of GHG emissions and vertical axis ( $Y$ ) as the scale of CDM business. Each point represents the combination of these two variables of each country and region. In other words, the point (combination) shows how far a country is from the average of each variable.

Following this reasoning, we can know that 3<sup>rd</sup> quadrant (the lower left side, which is below the average in both  $X$  and  $Y$ , *Entry-level (E)* from <Figure 2>) represents the combinations in which both GHG emissions and scale of CDM business are lower than average. The 4<sup>th</sup> quadrant (the lower right side which is above the average in  $X$  and below the average in  $Y$ , *Take-off (T)* from <Figure 2>) represents the combinations in which GHG emissions are higher than average and the scale CDM business is lower than average. The 1<sup>st</sup> quadrant (the upper right side, which is above the average in both  $X$  and  $Y$ , *Advancement (A)* from <Figure 2>) represents the combinations in which both GHG emissions and the scale of CDM business are higher than average. The 2<sup>nd</sup> quadrant (the upper left side, which is below the average in  $X$  and higher the average in  $Y$ , *Maturity (M)* from <Figure 2>) represents the combinations of GHG emissions which are lower than average and the scale of CDM business higher than average.

Therefore, for sustainable economic growth we believe that the 2<sup>nd</sup> quadrant (*M*) is the most desirable country group and the 4<sup>th</sup> quadrant (*T*) is the worst situation. Also, if we ascertain the situation (location) of a country we could more easily determine a suitable policy to help a country to reach the desirable situation (*M*). We believe that this is applicable to Southeast Asian countries.

<Figure 5> ~ <Figure 10> represent the mapping of the combinations of CO<sub>2</sub> emissions and CDM activities for each country and region and <Table 9> summarizes the results of our analysis.<sup>11)</sup> First of all, <Figure 5> is the case of CO<sub>2</sub>/GDP and the number of CDM projects. We can determine that 6 out of 9 Southeast Asian countries (Indonesia, Malaysia, Myanmar, the Philippines, Singapore, and Thailand) are located in the 3<sup>rd</sup> quadrant (*E*). Three countries (Cambodia, Laos, and Vietnam) are located in the 4<sup>th</sup> quadrant (*T*). <Figure 6> is the case of CO<sub>2</sub>/GDP and CER issued. 4 out of 9 Southeast Asian countries (Myanmar, the Philippines, Singapore, and Thailand) are located in the 3<sup>rd</sup> quadrant (*E*). 4 countries (Cambodia, Laos, Malaysia, and Vietnam) are located in the 4<sup>th</sup> quadrant (*T*). Only Indonesia is located in 2<sup>nd</sup> quadrant (*M*). <Figure 7> is the case of CO<sub>2</sub>/GDP and the amount of FDI investment. 5 out of 9 Southeast Asian countries (Malaysia, Myanmar, the Philippines, Singapore, and Thailand) are located in the 3<sup>rd</sup> quadrant (*E*). Two countries (Cambodia and Laos) are located in the 4<sup>th</sup> quadrant (*T*). Indonesia is located in the 2<sup>nd</sup> quadrant (*M*). Vietnam is located in the 1<sup>st</sup> quadrant (*A*). ASEAN located in the 3<sup>rd</sup> quadrant (*E*) in all 3 cases.

Thus, the majority of Southeast Asian countries (15 out of 27 cases,

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11) See the <Appendix 1> for the figures.

55.6%) are located in the 3<sup>rd</sup> quadrant (*E*), which means that both the GHG emissions and CDM activities are below the average. Nine cases (33.3%) are located in the 4<sup>th</sup> quadrant (*T*) which is the worst situation. Only 1 case (Vietnam) and 2 cases (Indonesia) are located in the 2<sup>nd</sup> (*M*) and 1<sup>st</sup> (*A*), respectively. Therefore, we believe that Southeast Asian countries are still located in primitive situation (*E*) or even the worst situation (*T*) in terms of the CDM business for sustainable development.

Next, <Figure 8> presents the case of CO<sub>2</sub>/population and No. of CDM projects. Seven out of 9 Southeast Asian countries (Cambodia, Indonesia, Laos, Myanmar, the Philippines, Thailand, and Vietnam) are located in the 3<sup>rd</sup> quadrant (*E*). Two countries (Malaysia and Singapore) are located in the 4<sup>th</sup> quadrant (*T*). <Figure 9> is the case of CO<sub>2</sub>/population and CER issued. Six countries (Cambodia, Laos, Myanmar, the Philippines, Thailand, and Vietnam) are located in the 3<sup>rd</sup> quadrant (*E*). Two countries (Malaysia and Singapore) are located in the 4<sup>th</sup> quadrant (*T*). Only Indonesia is located in the 2<sup>nd</sup> quadrant (*M*). <Figure 10> is the case of CO<sub>2</sub>/population and the amount of FDI investment. Five out of 9 Southeast Asian countries (Cambodia, Laos, Myanmar, the Philippines, and Thailand) are located in the 3<sup>rd</sup> quadrant (*E*). Two countries (Malaysia and Singapore) are located in the 4<sup>th</sup> quadrant (*T*). Indonesia and Vietnam are located in the 2<sup>nd</sup> quadrant (*M*). ASEAN is located in the 3<sup>rd</sup> quadrant (*E*) in all 3 cases as well. Thus, the majority of Southeast Asian countries (18 out of 27 cases, 66.7%) are located in the 3<sup>rd</sup> quadrant (*E*), which means that both the GHG emissions and CDM activities are below the average. Six cases (22.2%) are located in the 4<sup>th</sup> quadrant (*T*), which

is the worst situation. Only, 3 cases (for Indonesia and Vietnam) are located in the 2<sup>nd</sup> quadrant (*M*). There are no cases in the 1<sup>st</sup> quadrant (*A*). Therefore, here we believe that Southeast Asian countries are currently located in primitive situations or even in the worst situation for CDM business.

<Table 9> Summary of the analysis of the CDM business in Southeast Asian countries

Country/ Region	Proxy of GHG emission ( <i>X</i> variable)					
	CO <sub>2</sub> / GDP			CO <sub>2</sub> / population		
	Proxy of the activities for sustainable development ( <i>Y</i> variable)					
	No. of CDM projects	CER issued	Investment	No. of CDM projects	CER issued	Investment
Cambodia	<i>T</i>	<i>T</i>	<i>T</i>	<i>E</i>	<i>E</i>	<i>E</i>
Indonesia	<i>E</i>	<i>M</i>	<i>M</i>	<i>E</i>	<i>M</i>	<i>M</i>
Lao PDR	<i>T</i>	<i>T</i>	<i>T</i>	<i>E</i>	<i>E</i>	<i>E</i>
Malaysia	<i>E</i>	<i>T</i>	<i>E</i>	<i>T</i>	<i>T</i>	<i>T</i>
Myanmar	<i>E</i>	<i>E</i>	<i>E</i>	<i>E</i>	<i>E</i>	<i>E</i>
Philippines	<i>E</i>	<i>E</i>	<i>E</i>	<i>E</i>	<i>E</i>	<i>E</i>
Singapore	<i>E</i>	<i>E</i>	<i>E</i>	<i>T</i>	<i>T</i>	<i>T</i>
Thailand	<i>E</i>	<i>E</i>	<i>E</i>	<i>E</i>	<i>E</i>	<i>E</i>
Vietnam	<i>T</i>	<i>T</i>	<i>A</i>	<i>E</i>	<i>E</i>	<i>M</i>
ASEAN	<i>E</i>	<i>E</i>	<i>E</i>	<i>E</i>	<i>E</i>	<i>E</i>
Latin America	<i>E</i>	<i>E</i>	<i>E</i>	<i>E</i>	<i>E</i>	<i>E</i>
Brazil	<i>E</i>	<i>M</i>	<i>M</i>	<i>E</i>	<i>M</i>	<i>E</i>
Mexico	<i>E</i>	<i>M</i>	<i>M</i>	<i>E</i>	<i>M</i>	<i>M</i>
Asia & Pacific	<i>T</i>	<i>A</i>	<i>A</i>	<i>E</i>	<i>E</i>	<i>M</i>
China	<i>A</i>	<i>A</i>	<i>A</i>	<i>A</i>	<i>A</i>	<i>A</i>
India	<i>A</i>	<i>A</i>	<i>A</i>	<i>M</i>	<i>M</i>	<i>M</i>
South Korea	<i>E</i>	<i>M</i>	<i>E</i>	<i>T</i>	<i>A</i>	<i>T</i>
Europe & Central Asia	<i>T</i>	<i>T</i>	<i>T</i>	<i>E</i>	<i>E</i>	<i>E</i>
Africa	<i>T</i>	<i>T</i>	<i>T</i>	<i>E</i>	<i>E</i>	<i>E</i>
Middle East	<i>E</i>	<i>E</i>	<i>E</i>	<i>E</i>	<i>E</i>	<i>E</i>

Note: *E*, *T*, *A*, *M* represent *Entry-level*, *Take-off*, *Advancement*, and *Maturity*, respectively.

In terms of individual country cases, Indonesia seems to be in the most desirable (*M*) situation among Southeast Asian countries. Cambodia, Laos, Malaysia, Singapore, and Vietnam show mixed results but seem to be in undesirable situation (*T*). Other countries, Myanmar, the Philippines, and Thailand seem to be in primitive situation (*E*).

On the other hand, China is in the 1<sup>st</sup> quadrant (*A*) in all cases and is absolutely much higher than average. India is in the 1<sup>st</sup> quadrant (*A*) in the first 3 cases but the 2<sup>nd</sup> quadrant (*M*) in the latter 3 cases and is also much higher than average. Brazil and Mexico show some mixed results with *M* and *E* implying that both countries, even though they are leading countries in the CDM business, have room for development in CDM. South Korea also shows mixed results with all quadrants including *T* implying that it needs to promote CDM business more aggressively to reach more desirable situation such as *A* or *M*.

#### IV. Policy implications for the development of CDM business in Southeast Asia

As stated above, we get the result that the majority of Southeast Asian countries are located in the 3<sup>rd</sup> quadrant (*E*) or the 4<sup>th</sup> quadrant (*T*) which means that both GHG emissions and CDM activities are below the average and/or in the worst situation. Therefore Southeast Asian countries need to enhance CDM business more aggressively to move forward to the regions of *A* or *M*.

In this section we try to suggest some policy implications for this in general before we tackle the problems of individual country cases. Although Southeast Asian countries see themselves as natural competitors for CDM investment, it is arguable that there are overall benefits that would result from cooperating at a regional level to boost the individual capacity of each country. ASEAN could provide an established institutional framework for such regional cooperation. Cooperation to enhance the CDM capacity of Southeast Asian countries fits within the existing ASEAN cooperation programs on energy and the environment.<sup>12)</sup> The core that is being suggested here is more coordination amongst Southeast Asian countries in terms of information sharing, increasing technical and legal expertise, and regional capacity-building. Also, policy suggestions including the roles of ASEAN in CDM implementation are worth mentioning here in some detail.<sup>13)</sup>

First of all, we suggest the construction of a regional framework for climate change including CDM business (Letchumanan 2010, Lin 2010, Clapp & Dauvergne 2003, Elliott 2003). ASEAN needs to address climate change, not through a mere and reactive policy on climate change, but through a proactive policy and framework of

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12) Steps in this direction have already been taken. The CDM-ASEAN project, concluded in February 2005, aimed to support the implementation of the CDM in Southeast Asian countries through regional capacity-building and improving competitive position of Southeast Asia for investments in the energy sector. The project focused on the energy sector because of the large number of potential CDM projects and the regional relevance of the sector.

13) For this, we refer to several studies regarding the issue such as 'Improving the Competitiveness of Southeast Asia on the Global CDM Market: Regional Cooperation in ASEAN on CDM in the Energy Sector', Discussion paper, 18 February 2005.

ASEAN Community building, with strategies and actions rooted in the various development and sectorial areas. Further, despite its potential, the role played by ASEAN in international climate change policymaking has remained relatively small. Measures for mitigation and adaptation to climate change have expanded beyond the realm of international policy, into the regional sphere. More generally, ASEAN has to continue to take the lead by making more ambitious commitments to address climate change not constantly based on consensus, but rather based on the emergency of such an immediate issue. Climate change's impact on Southeast Asia is already intensifying, with tragic consequences. Heat waves, droughts, floods, and tropical cyclones have become more severe and frequent in the region, causing extensive damage to property and human health or even life. For the safety of the Southeast Asian people and the benefit of the entire region, Southeast Asian countries need act together more urgently and decisively.

Furthermore, we suggest regional capacity building such as the operational skills of the DNA (Designated National Authority), technical CDM Project assessment including baselines, establishment of local operational entities, project development including the CDM lifecycle, and preparation of proposals and financing/transactional issues. There have already been many donor-funded CDM capacity-building projects in Southeast Asia. However, the effectiveness of these projects has been limited by overlap in the scope and content of the projects, the lack of follow-up and on-the-job training, and the failure to address the role of local government in the CDM.

Second, the possible actions to attract financing for CDM business are recommended (Letchumanan 2010, Lin 2010). These would include: developing a CER risk mitigation mechanism, improving the understanding of the CDM within local debt and equity markets, increasing willingness to invest, establishing local support infrastructure such as Operational Entities to lower project development costs and increase local stakeholder involvement in project execution, establishing an ASEAN based fund to support CDM projects through either the purchase of credits or the supply of equity/debt to CDM projects as a longer-term option, and enhancing the involvement of advanced countries (such as Singapore) in the CDM as these countries have the most mature capital markets in the region. The policy implementations to realize these suggestions should be followed up in a consistent fashion to achieve successful steps towards regime cooperation within ASEAN on the CDM.

Third, we need to utilize the role of advanced countries. As mentioned above, it would be useful to think about the role of advanced countries in the region such as Singapore (Lin 2010, Sari 2003). Singapore could play the role of facilitating the implementation of the CDM business in Southeast Asia. Singapore has few, if any, CDM opportunities because it is a small city-state which does not have natural resources for CDM business. However, Singapore has been making itself a regional service center for renewable energy projects and has been trying to become an environmental financing hub for the region.<sup>14)</sup> Furthermore, Singapore has long been a key

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14) For example, the Renewable Energy Exchange acts as a “matchmaker” between potential investors and potential project developers. Potential investors are often on

financial center in the region. There are more than 500 local and foreign financial institutions offering a wide array of financial products and services in Singapore. Singapore is well-placed to provide financial support services for the CDM business. It is also a natural candidate as a source of equity and debt financing for the business in the region. Singapore would continue to attract potential investors to the region and to contribute to tap CDM opportunities throughout Southeast Asia.

Also, advanced countries such as the U.S., China, Japan, and South Korea could provide technology transfers and cooperation for the region to strengthen cooperation in meteorology addressing climate information and prediction services as well as financial assistance. ASEAN has to commit to pursue this collaboration so as to be better armed to cope with climate change issues in a proactive and responsible manner. This has to be combined with commitment to secure legally binding agreements as well.

Finally, ASEAN need to improve baseline determination and data availability (ADB 2005, 2009). The problem that CDM project developers frequently encounter is the inadequacy of data to calculate baseline emission factors. A centralized collection of such data and its continuous updating and publication would help address this

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the lookout for profitable and viable investment opportunities. However, apart from the specialized few with a specific interest in socially responsible investment or sustainable development / “green” investment, the majority of potential investors tend to shy away from renewable energy projects which are perceived to be riskier and to have less predictable revenue returns. Singapore seeks to address this concern by conducting basic due diligence on potential projects so that the projects that are introduced to potential investors have investment potential. On the other hand, project developers are often in search for equity investors and joint venture partners.

problem. Southeast Asian countries could reduce transaction costs further by providing this data to the region. As it has to collect this data anyway, there is little additional burden and consistent quality standards can be achieved. With an increasing integration of the CDM business in Southeast Asia, this would be of increasing importance and utility.

It would be unrealistic to promote ASEAN as some sort of unified supplier of CERs in the near future. We admit that pursuing this sort of integration would be taking too many steps ahead of the consensus of Southeast Asian countries regarding economic, political, and environmental perspectives. Southeast Asian countries will not support such integration unless these pre-requisite conditions are met. We may have to put aside as non-viable such a pan-ASEAN emission trading scheme to be realistic. However, as Southeast Asia has been coalescing into one unit as the so-called ‘ASEAN Economic Community’ in economic terms, the possibility to act as one body for sustainable development is strengthening.<sup>15)</sup> The more aggressively the policy mentioned above is adopted and implemented in the region, the faster we could get to the point in which both sustainable development and economic prosperity in Southeast Asia are accomplished, even if this takes a long period of time.

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15) ASEAN has emphasized regional cooperation in the “three pillars”, which are security, sociocultural integration, and economic integration. The regional grouping has made the most progress in economic integration by creating an ASEAN Economic Community (AEC) by 2015.

## V. Conclusion

In this paper, we tried to provide an overview of the performance of the CDM business in Southeast Asia in terms of sustainable development and discern its position. In brief, we could get the results that the CDM business in Southeast Asia is in the stage of entry-level or take-off, implying the necessity of more aggressive adoption and implementation of the business. It is believed that the modest performance of the CDM business in Southeast Asia is attributable to structural forces in the CDM market as well as domestic factors that hinder the realization of the CDM's potential.

We argue that one of the ways by which individual Southeast Asian countries can enhance their capacity is through regional cooperation, in particular on the fronts of information exchange and institutional capacity-building. ASEAN needs to reinforce the provision and support for the establishment of institutional framework for the pursuit of such cooperation. Finally, we also analyze the role that advanced countries such as Singapore can play to facilitate the implementation of the CDM in Southeast Asia.

We believe that ASEAN's position on climate change needs to be strengthened beyond the declarations which the body has been issuing since 2007. While the political body has also formed the ASEAN Working Group on Climate Change (AWGCC) as well as the ASEAN Climate Change Initiative (ACCI), the two bodies lack the mandate to provide relevance to ASEAN's various climate change statements and declarations.

However, even the latest ASEAN Summit, overshadowed by

political bickering and posturing which has pushed out climate change from the agenda, shows that ASEAN is still not serious about the greatest threat to the region. The future of Southeast Asia will not be secure without strong, unified ASEAN action on climate change. Concerns about food security, access to clean water and energy, poverty alleviation, and disaster mitigation all hinge on how Southeast Asian countries together are able to deal with climate change and global warming. To effectively do so, ASEAN must act as one unit, emphasize the vulnerability of this region to climate change, and add its voice to the negotiations for a fair, ambitious, and binding global climate deal.

The CDM is an ambitious project with the potential of laying the foundation for international cooperation to cope with climate change and its adverse effects. The CDM allows developing countries to benefit from financial transfers which help promote sustainable development. By expanding its scope and participation, the CDM also has the potential to become a cornerstone of the post-Kyoto regime. By realizing their full CDM potential, Southeast Asian countries could achieve both the sustainable economic development and environmental security for the people in the region.

This paper does not look into individual country cases in detail. We need to see the performance of the CDM business in the various Southeast Asian countries and compare the characteristics of the business in each country, including an evaluation on a country-by-country basis. It is beyond the scope of this paper to do so. We leave this task to future studies.

**Key Words:** CDM (Clean Development Mechanism) business, CER (Certified Emission Reduction), Sustainable development, Global warming, Climate changes, GHG (Greenhouse Gas) emission and reduction, Southeast Asia, ASEAN

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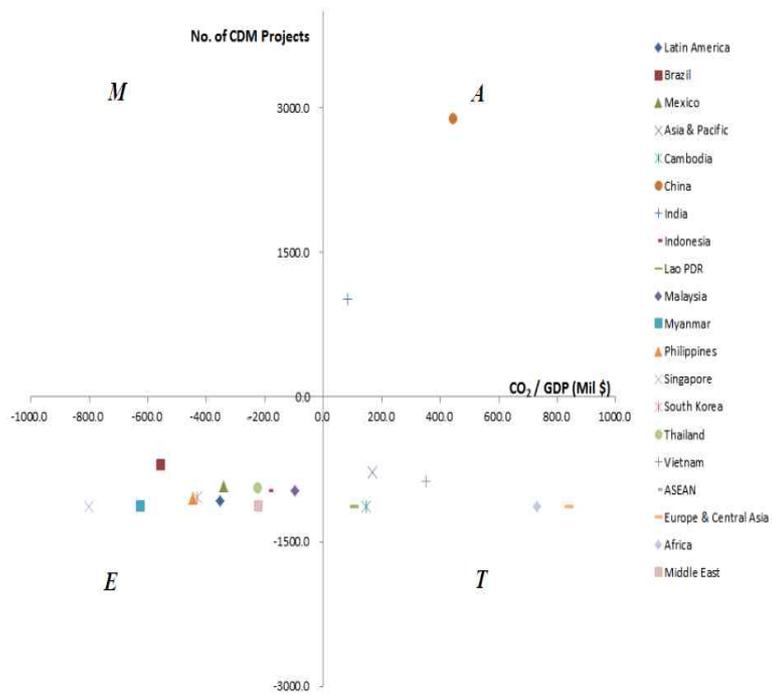
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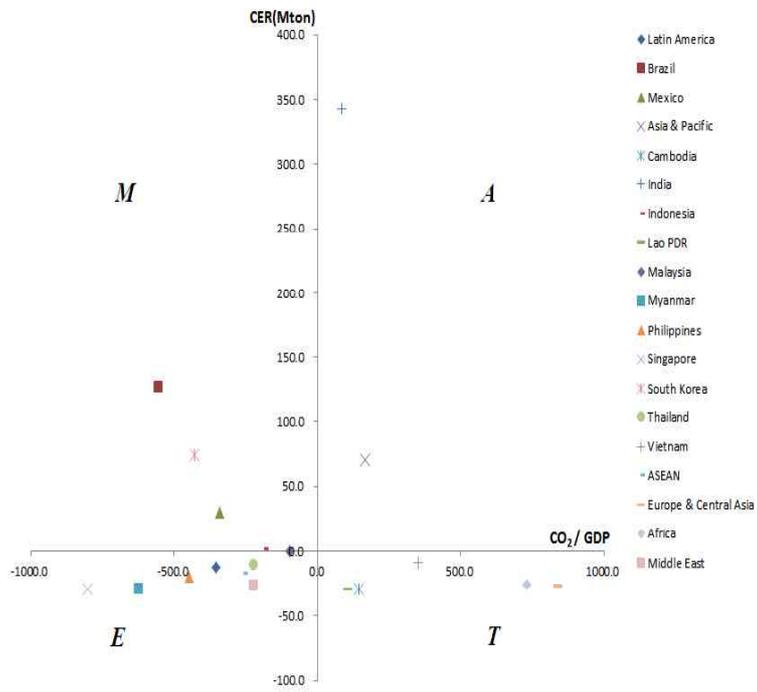
<Appendix 1>

<Figure 5> Analyzing the CDM business in Southeast Asian countries (Case 1)



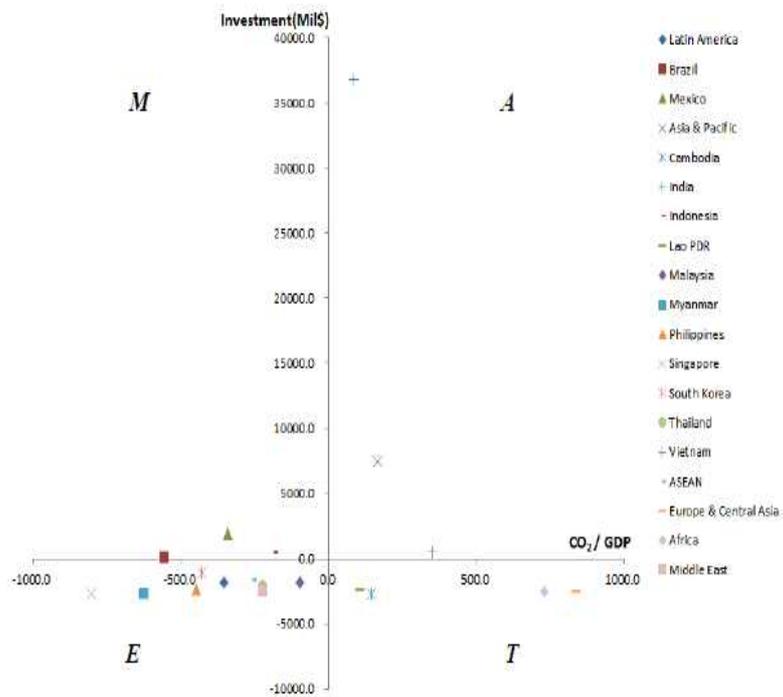
Note: See <Table 10> in <Appendix 2> for the numbers for each variable.

<Figure 6> Analyzing the CDM business in Southeast Asian countries  
(Case 2)



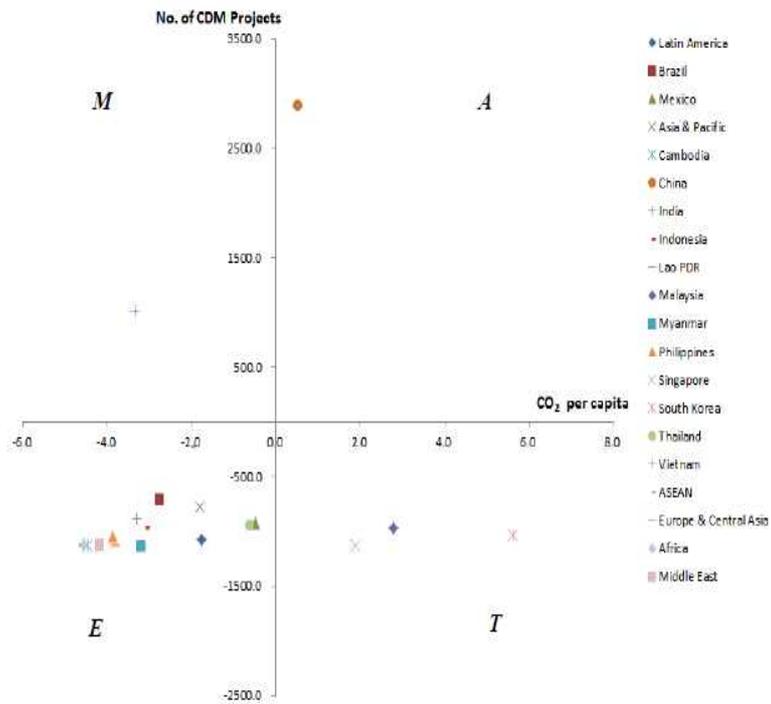
Notes: China is not marked here but is located in 1st quadrant (A) (444.6, 1,389.7).  
See <Table 10> in <Appendix 2> for the numbers for each variable.

<Figure 7> Analyzing the CDM business in Southeast Asian countries (Case 3)



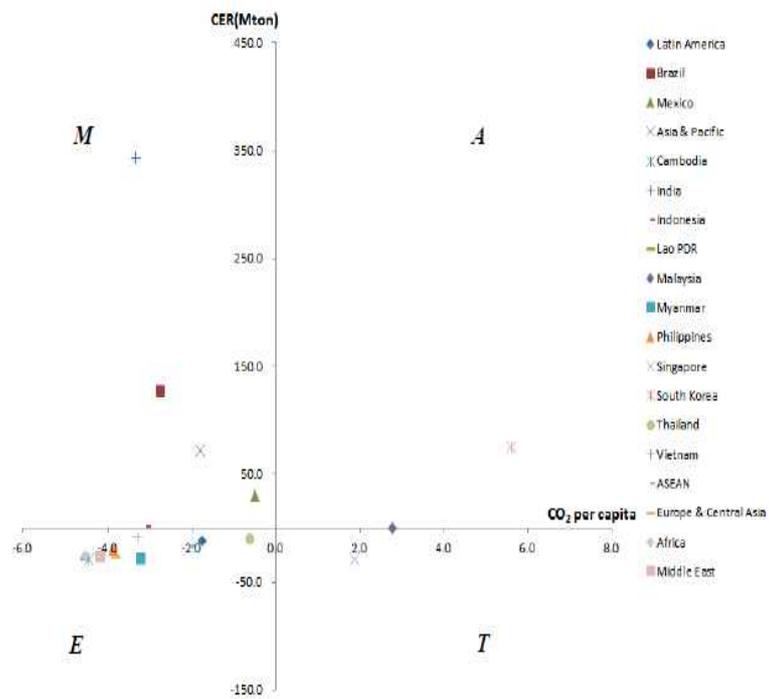
Notes: China is not marked here but is located in 1st quadrant (A) (444.6, 150,094.5). See <Table 10> in <Appendix 2> for the numbers for each variable.

<Figure 8> Analyzing the CDM business in Southeast Asian countries  
(Case 4)



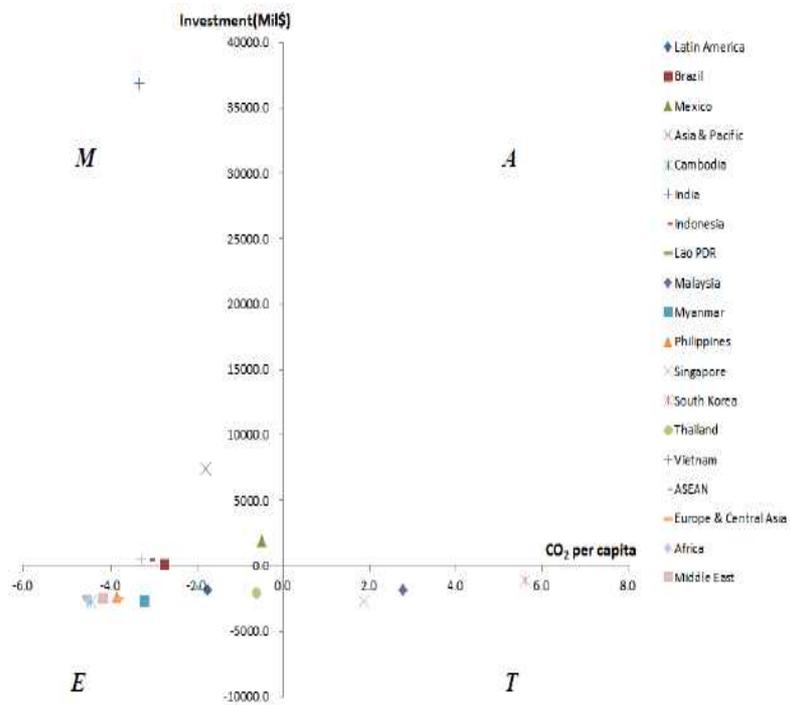
Note: See <Table 10> in <Appendix 2> for the numbers for each variable.

<Figure 9> Analyzing the CDM business in Southeast Asian countries (Case 5)



Notes: China is not marked here but is located in 1st quadrant (A) (0.5, 1,389.7). See <Table 10> in <Appendix 2> for the numbers for each variable.

<Figure 10> Analyzing the CDM business in Southeast Asian countries (Case 6)



Notes: China is not marked here but is located in 1st quadrant (A) (0.5, 150,094.5). See <Table 10> in <Appendix 2> for the numbers for each variable.

## &lt;Appendix 2&gt;

&lt;Table 10&gt; Numbers of each variable for country/region

Country/Region	<Figure 5>	<Figure 6>	<Figure 7>	<Figure 8>	<Figure 9>	<Figure 10>
	(X, Y)	(X, Y)	(X, Y)	(X, Y)	(X, Y)	(X, Y)
	(CO <sub>2</sub> /GDP, No. of CDM projects)	(CO <sub>2</sub> /GDP, CER issued)	(CO <sub>2</sub> /GDP, Investment)	(CO <sub>2</sub> /population, No. of CDM projects)	(CO <sub>2</sub> /population, CER issued)	(CO <sub>2</sub> /population, Investment)
Cambodia	(145.8, -1,132.6)	(145.8, -29.2)	(145.8, -2,726.5)	(-4.5, -1,132.6)	(-4.5, -29.2)	(-4.5, -2,726.5)
Indonesia	(-183.4, -968.6)	(-183.4, 1.5)	(-183.4, 487.5)	(-3.1, -968.6)	(-3.1, 1.5)	(-3.1, 487.5)
Lao PDR	(107.2, -1,132.6)	(107.2, -29.1)	(107.2, -2,388.5)	(-4.5, -1,132.6)	(-4.5, -29.1)	(-4.5, -2,388.5)
Malaysia	(-97.7, -974.6)	(-97.7, 1.2)	(-97.7, -1,816.5)	(2.8, -974.6)	(2.8, 1.2)	(2.8, -1,816.5)
Myanmar	(-624.7, -1,141.6)	(-624.7, -29.0)	(-624.7, -2,754.5)	(-3.2, -1,141.6)	(-3.2, -29.0)	(-3.2, -2,754.5)
Philippines	(-447.3, -1,049.6)	(-447.3, -19.4)	(-447.3, -2,351.5)	(-3.9, -1,049.6)	(-3.9, -19.4)	(-3.9, -2,351.5)
Singapore	(-802.5, -1,134.6)	(-802.5, -296)	(-802.5, -2,724.5)	(1.9, -1,134.6)	(1.9, -296)	(1.9, -2,724.5)
Thailand	(-223.2, -951.6)	(-223.2, -10.5)	(-223.2, -2,123.5)	(-0.6, -951.6)	(-0.6, -10.5)	(-0.6, -2,123.5)
Vietnam	(350.6, -880.6)	(350.6, -8.9)	(350.6, 516.5)	(-3.3, -880.6)	(-3.3, -8.9)	(-3.3, 516.5)
ASEAN	(-258.3, -225.6)	(-258.3, -17.2)	(-258.3, -1,641.0)	(-2.0, -225.6)	(-2.0, -17.2)	(-2.0, -1,641.0)
Latin America	(-354.4, -1,081.1)	(-354.4, -12.2)	(-354.4, -1,833.5)	(-1.8, -1,081.1)	(-1.8, -12.2)	(-1.8, -1,833.5)
Brazil	(-534.6, -713.6)	(-534.6, 127.0)	(-534.6, 35.5)	(-2.7, -713.6)	(-2.7, 127.0)	(-2.7, 35.5)
Mexico	(-342.2, -922.6)	(-342.2, 30.4)	(-342.2, 1,888.5)	(-0.5, -922.6)	(-0.5, 30.4)	(-0.5, 1,888.5)
Asia & Pacific	(167.4, -776.0)	(167.4, 71.4)	(167.4, 7,452.9)	(-1.8, -776.0)	(-1.8, 71.4)	(-1.8, 7,452.9)
China	(444.6, 2,885.4)	(444.6, 1,389.7)	(444.6, 150,944.5)	(0.5, 2,885.4)	(0.5, 1,389.7)	(0.5, 150,944.5)
India	(84.6, 1,016.4)	(84.6, 343.2)	(84.6, 36,844.5)	(-3.3, 1,016.4)	(-3.3, 343.2)	(-3.3, 36,844.5)
South Korea	(-430.5, -1,038.6)	(-430.5, 74.6)	(-430.5, -1,108.5)	(5.6, -1,038.6)	(5.6, 74.6)	(5.6, -1,108.5)
Europe & Central Asia	(841.5, -1,132.7)	(841.5, -26.5)	(841.5, -2,582.9)	(-3.8, -1,132.7)	(-3.8, -26.5)	(-3.8, -2,582.9)
Africa	(731.9, -1,132.2)	(731.9, -26.1)	(731.9, -2,553.4)	(-4.6, -1,132.2)	(-4.6, -26.1)	(-4.6, -2,553.4)
Middle East	(-221.2, -1,132.8)	(-221.2, -26.7)	(-221.2, -2,548.0)	(-4.2, -1,132.8)	(-4.2, -26.7)	(-4.2, -2,548.0)
Average	(981.0, 1,043.5)	(981.0, 30,123.1)	(981.0, 2,754.5)	(4.8, 1,043.5)	(4.8, 30,123.1)	(4.8, 2,754.5)

<국문요약>

## 동남아시아 청정개발체제 사업의 현황 및 시사점

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1997년 온실가스문제로 인한 지구온난화 등 전 지구적 차원의 환경변화에 대응하기 위해 교토의정서가 합의되었다. 교토의정서 하에서 확정된 온실가스 감축을 위해 도입된 방안의 하나인 청정개발체제(CDM, Clean Development Mechanism) 사업은 지속가능발전을 위한 유망한 사업의 하나로 주목받고 있다. 또한 청정개발체제 사업은 최근 각국 정부의 지원과 관련 시장규모의 급속한 확대 등으로 지속적으로 성장해 오고 있다. 이러한 추세는 향후 더욱 강화될 것으로 예상되며 특히 동남아시아의 바이오에너지 사업은 청정개발체제 사업의 좋은 사례로 주목받고 있다. 동남아시아는 바이오에너지 사업에 필요한 자연환경과 풍부한 천연자원 그리고 사업의 성장 잠재력을 갖고 있다고 평가된다. 하지만 동남아시아는 동 사업의 발전을 위해 필요한 기술, 비즈니스 노하우, 자본 및 전문가 등이 부족한 실정이다. 본 연구에서는 먼저 동남아시아의 청정개발체제 사업의 현황 및 가능성에 대해 개괄적으로 살펴보고 동 사업의 지속적 발전을 위한 정책적 시사점에 대해 논의한다. 동남아시아의 청정개발체제 사업의 성공 및 확산은 전 지구 및 지역적 차원의 지속가능 발전에 공헌할 수 있을 것이다. 또한 이를 통해 온실가스 감축을 통한 환경 보전 및 효율적인 자원배분을 담보할 수 있을 것이다. 하지

만 본 연구에서 실시한 역외 국가들과의 비교분석 결과 동남아시아의 청정개발체제 사업은 초기수준인 도입 수준(entry level)에 있는 것으로 평가된다. 그러므로 동남아시아의 청정개발체제 사업이 보다 높은 수준으로의 발전을 위해서는 지역 내, 지역 간 협력이 중요하다고 할 수 있다. 이는 동남아시아의 지속가능한 경제적 발전에 공헌할 뿐만 아니라 화석연료의 고갈, 지구온난화 등 향후 위협요소로 다가올 변화에 대한 선제적이고 적절한 대응이 될 것이다.

**주제어:** 청정개발체제 (CDM, Clean Development Mechanism) 사업, 탄소배출권 (CER, Certified Emission Reduction), 지속가능발전, 지구온난화, 기후변화, 온실가스 배출 및 감축, 동남아시아, ASEAN

