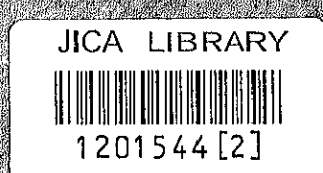


Office of Natural Resources and Environmental Policy and Planning
The Kingdom of Thailand

**The JICA Sector Study
on
Climate Change Program Loan
in
Thailand**

Final Report



October 2010

JAPAN INTERNATIONAL COOPERATION AGENCY

**VALUE PLANNING INTERNATIONAL, INC.
ALMEC CORPORATION
KOKUSAI KOGYO, CO., LTD.**

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1 Baht (THB) = 2.726 Yen
(Exchange rate of September 2010)

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LIST OF ABBREVIATION

Abbreviation of the Agencies /Departments / Ministries

BB	Bureau of Budget (MoF)
BMA	Bangkok Metropolitan Administration
BMTA	Bangkok Mass Transit Authority
BTS	Bangkok Mass Transit System Public Company Limited
DDPM	Department of Disaster Prevention & Mitigation, (MOInt)
DEDE	Department of Alternative Energy Development and Efficiency, (MOEN)
DEQP	Department of Environmental Quality Promotion(MNRE)
DGR	Department of Groundwater Resources(MNRE)
DMCR	Department of Marine and Coastal Resources, (MNRE)
DMR	Department of Mineral Resources(MNRE)
DNP	Department of National Park, Wildlife and Plant Conservation (MNRE)
DOA	Department of Agriculture (MOAC)
DOF	Department of Fisheries (MOAC)
DTP	Department of Town and County Planning and Public Works (MOInt)
DWR	Department of Water Resource, (MNRE)
EGAT	Electricity Generating Authority of Thailand
FTI	Federation of Thai Industries
GISTDA	Geo Informatics and Space Technology Development Agency
LDD	Department of Land Development, (MOAC)
MD	Marine Department (MOT)
MEA	Metropolitan Electric Authority
MNRE	Ministry of Natural Resources and Environment
MOAC	Ministry of Agriculture and Cooperatives
MOE	Ministry of Education
MOEN	Ministry of Energy
MOF	Ministry of Finance
MOI	Ministry of Industry
MOICT	Ministry of Information and Communication Technology
MOInt	Ministry of Interior
MOT	Ministry of Transport
MOTS	Ministry of Tourism & Sports
MRTA	Mass Rapid Transit Authority of Thailand
NESDB	Office of National Economic and Social Development Board (OPM)
NRCT	National Research Council of Thailand
OAE	Office of Agricultural Economics(MOAC)
ONEP	Office of Natural Resources and Environmental Policy and Planning, (MNRE)
OPM	Office of Prime Minister (OPM)
OTP	Office of Transport and Traffic Policy and Planning, (MOT)
PCD	Pollution Control Department, (MNRE)
PEA	Provincial Electric Authority

PONRE	Provincial Natural Resources and Environment Office
PSO	Office of the Permanent Secretary for MNRE
PTT	Petroleum Authority of Thailand
REO	Regional Environment Office
RFD	Royal Forest Department (MNRE)
RID	Royal Irrigation Department, (MOAC)
RTSD	Royal Thai Survey Department (Ministry of Defence)
SRT	State Railway of Thailand
TGO	Thailand Greenhouse Gas Management Organization
TMD	Thai Meteorological Department (MOICT)
TRF	The Thailand Research Fund

Other abbreviation

ADB	Asian Development Bank
AEDP	Alternative energy development plan
A/R	Afforestation/Reforestation
BMR	Bangkok Metropolitan Region
BRT	Bus Rapid Transit
CBDRM	Community-Based Disaster Risk Management
CCPL	Climate Change Programme Loan
CDM	Clean Development Mechanism
CNG	Compressed Natural Gas
DSM	Demand side Management
GHG	Green House Gasses
EEDP	Energy Efficiency Development Plan
EEIP	Energy Efficiency Improvement Plan
Encon Program	Energy Conservation Program
FCPF	Forest Carbon Partnership Facility
HFCs	Hydro fluorocarbons
JICA	Japan International Cooperation Agency
M-MAP	20-year Mass Rapid Transit Master Plan in Bangkok Metropolitan Region
MRTS	Mass Rapid Transit System
MSW	Municipal Solid Waste
NAMA	National Adequate Mitigation Action
NESDP	National Economic Social Development Plan
NGV	Natural Gas Vehicle
PDD	Project Design Document
PDP	Power Development Plan
PIN	Project Idea Note
PM	Particulate Matter
PMx	Policy Matrix
REDD	Reduced emissions from deforestation and forest degradation
REDP	Renewable Energy Development Plan
THB	Thai Baht



Map of Thailand

Source: http://www.freemap.jp/asia/asia_thai_all.html

1. INTRODUCTION

1.1 BACKGROUND OF THE STUDY

Disturbing effects caused by global warming have already been reported as shown in the Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report. Countermeasures have been sought through collective international actions against Climate Change, which is one of the most serious concerns, humanity needs to address in the 21st century. Current GHG emission per capita of Thailand does not exceed the world average (4.1 tonnes per capita for Thailand, 4.5 tonnes per capita for the World; World Development Indicators 2005). However, Thailand has already initiated various policy measures against Climate Change, as a counter measure for various situations such as prolonged drought, flooding, coastal erosion.

The Thai government and JICA have drafted the Policy Matrix (PMx)¹ in June 2010 in order to formulate the Climate Change Program Loan (CCPL). Both parties decided to review the Policies and Actions under the five sectors; Energy, Transport, Agriculture and Forestry, Disaster Prevention, and Coastal Erosion by way of consulting the applicable agencies with the technical aspects raised in the PMx. Other significant sectors such as waste management mitigation measures, water and health adaptation measures are not covered in this study.

1.2 THE PURPOSE AND THE PROCESS OF THE STUDY

The purpose of the Study is to review the PMx for CCPL and to facilitate the drafting of the Background Paper. The study was conducted using the following steps;

- 1) Identify the concerned issues based on past papers which included modifications by JICA (Thai Government papers, past mission records, and the draft PMx and so on) and other relevant information.
- 2) Specify actions under the PMx, by discussing with the concerned government agencies based on the information received and by exchanging the opinions on the target issues.
- 3) Explain the draft of the Background paper, based on the initial discussions and discuss the possible cooperation by Japan, and finalize the Background paper.

When the Study Team started the initial discussions with the relevant agencies in July 2010, it became apparent that some actions were not well acknowledged even within the agencies. It took more time than we had expected to reach the final draft of the PMx. The process of how the initial PMx was elaborated was referenced in the main document² of the Policy Advisor. The study team did not re-select the actions by analysing the overall sectors from the beginning given that the respect agencies prepared actions applicable to the PMx for the CCPL from their own initiatives. A number of proposals expressed by the relevant agencies were revised based on mutual agreement.

¹ The process of drafting was described in the final report of the Policy Advisor of the Climate Change Program Loan.
² Main document of the final report of the Policy Advisor of the Climate Change Program Loan.

1.3 CONTENTS OF THE REPORT

Each sector has the following three sections.

1) The situation and expected impact of climate change

Historical GHG emission data for Thailand and expected damage were integrated with reference to the existing documents.

2) Strategies, policies, and work plans for climate change

This part elaborated on existing Thai Government policies for Climate Change based on the collected policy papers such as the Master Plans and Action Plans. There were only three specific master plans clearly named in the Master Plan for Climate Change prepared by the Ministry of Agriculture and Cooperatives (MOAC), Department of National Park, Wildlife and Plant Conservation, and the Bangkok Metropolitan Agency. Since there are a substantial amount of policy papers which contribute to mitigation and adaptation measures, the study team collected these policies and integrated them into the report.

3) Background of the policy matrix

This part contained how the respective actions for the PMx were reviewed and revised, based on the materials received and discussion with the relevant agencies.

The fiscal year for the Thai Government is from October to September of the following year. The years described for the Government policies and plans, comply with the Thai fiscal year, unless it is specifically noted.

1.4 THE SUMMARY OF THE PMX

The Key Strategies and Outcomes identified under the PMx for the CCPL were drafted as outlined in the following Table 1.4.1. There could be one or there may be multiple policies and actions attached to the respective outcomes. The policies and actions were roughly categorized as follows;

- 1) *The actions which must be implemented as major countermeasures against Climate Change.* These contain the conventional policies contributing to the reduction of GHG emissions such as energy, transportation, forest fire control and reforestation.
- 2) New policies and initiatives which were introduced to mitigate Climate Change with an international cooperation framework, such as the CDM (Clean Development Mechanism) and the REDD (Reduced emissions from deforestation and forest degradation)
- 3) Introduction of new technologies and management systems. New technologies, such as the introduction of renewable energy like bio fuels. New management approaches such as conducting fire control, tree planting focusing on capacity development of local

government authorities with participation from the local residents. These approaches are different from the conventional controls adopted by central government agencies and legislation.

These policies and actions contain those which have been formulated even before Climate Change became an urgent issue to be reflected in policies, but have been already existed for the purpose of development, and those need to be progressed in response to the various consequences of Climate Change. When policies under the name of Climate Change Mitigation are introduced in the future, one has to consider not only the mitigation impact, but also the benefits such as improving the local environment and the livelihoods of the residents. According to the development of policies for the Thai Government, the actions may need to be revised, subject to the monitored findings based on the first year of the CCPL.

Table 1.4.1 Key Strategies and Outcomes of the Policy Matrix (PMx)

Category	Key Strategy	Outcome
Adaptation	Enhance Agricultural Sector	Sustainable agricultural production
		Improve water resource management
	Prevent Natural Disaster	Enhance disaster prevention capacity
	Sustainable Coastal Zone Management	Evaluate coastal hazard zone / endangered species habitat
		Sustainable management of the marine ecosystem.
	Sustainable protection of the hinterland	
Mitigation	Reduce GHG in Key Sectors	Energy
		Transportation
		Forest conservation and restoration
		Bangkok metropolitan area
Cross-cutting issues	Knowledge Management on Climate Change	Capacity building to cope with climate change
		Master plan preparation for climate change

2. ENERGY

2.1 THE SITUATION AND EXPECTED IMPACTS OF CLIMATE CHANGE IN THE ENERGY SECTOR

2.1.1 PROFILE

This chapter covers energy related issues as shown on the Table 2.1.1.

Table 2.1.1 The Contents Covered by This Chapter

Sub-sector	Energy saving	Alternative energy
Power generation	○	○
Industries	○	○
Transport	Chapter 3	○ (Biofuel production)
Demand side and others	○	○

Source : the Study Team

Since 1980s there has been a highly prioritized national policy for energy in Thailand. Thailand's energy demands have been growing constantly and have managed different economic difficulties, partly because of strong local industrial demand.

In comparison to neighbouring countries, Thailand has developed an advanced power generation/distribution system. Due to its geographic location and rich soil, Thailand can produce high calorific agro-products such as palm, cassava and tapioca. Hence, Thailand is in an ideal place to be able to utilize alternative energy sources including wind (long coastline), solar (located in the tropics), biomass and biogas (large agricultural producer).

Thailand's production of fossil fuel has been mainly limited to natural gas and condensate, the country has a vested interest in alternative energy resources. Since the use of alternative energy resources will enable the country to fore fill a greater portion of its energy needs, reduce the country's GHG emissions and reduce the expenditure on the importation of fossil fuels.

Thailand's GHG mitigation measures in the energy sector have consisted of the promotion of energy efficiency and increased use of alternative energy sources, and the relevant agencies are implementing respective mitigation plans, based on the national strategy for climate change.

The Encon program which has been practiced since 1995 (2005-2011 is the third phase) encompasses the whole sector, and covers both the aspects of energy security and climate change mitigation of the energy strategy proposed by the Minister of Energy.

For the financial aspect, the program is equipped with the Encon fund, which supports project implementation.

With regards to energy conservation, Thailand has been successful in achieving internationally recognized higher efficiencies for power generation and distribution, which are mainly attributable to the introduction of modern technologies such as combined cycle power.

generation.

Yet, the Encon program stipulates further reductions in energy use, with the focus on the demand side. The plan has set a target of 10.8% for the reduction in energy use for 2011 when compared to 2005, which is equivalent to 7.8 million tons of oil (transport sector's 3.4 thousand ktoe, equal to 4.7% inclusive). (See Table 2.1.2)

While the target for the industrial sector is a reduction of energy use by 3,200 ktoe (kilo tonnes of oil equivalent), which equates to an overall reduction of 4.4%, it was said that 55% of the target had already been fulfilled toward the end of 2009, and so far the progress seems satisfactory, this includes the reductions attributable to the Encon act and soft loans, which already exceeded the final target figure (Table 2.1.3).

On the other hand, the results on the demand side³ rely largely on promotion of compact energy efficient fluorescent lamps and progress of the other projects vary widely (Table 2.1.4).

Table 2.1.2 Encon Program

ENCON PLAN (rev.1 → 2008-2011)	Target at 2011	
	ktoe	%
Energy Efficiency Plan	7,820	10.8
(1) Industry sector	3,190	4.4
(2) DSM	1,217	1.7
(3) Transport sector	3,413	4.7
Alternative Energy Plan	10,961	15.6
(1) Renewable	7,492	10.7
- Electricity	1,587	2.3
- Heat	4,150	5.9
- Biofuel	1,755	2.5
(2) NGV	3,469	4.9

Table 2.1.3 Industrial Sector

Measure	Acc.Result 2008 (ktoe)	Acc.Result 2009 (ktoe)	Target 2011 (ktoe)	% of Result 2009 vs Target 2011
1. Industry sector	1,579	2,399	3,190	75
(1) ENCON Act.	452.7	452.7	212	214
(2) Tax Incentive	32.9	142.5	570	25
(3) Soft Loan	432.7	1,017.70	600	170
(4) ESCO Promotion	197.4	222.5	300	74
(5) Energy Audit	114	131.7	551	24
(6) High technology	-	1.7	200	1
(7) DSM Bidding	24	92.8	149	62
(8) Co-Generation	325.1	337.2	608	55

Source : Table 2.1.2 and Table 2.1.3 are Encon result 2009 (EPPO)

³ TGO/MOE promotes room temperature of 25oC. Dress code was relaxed, too.

Table 2.1.4 Demand Side Management

Measure	Acc.Result 2008 (ktoe)	Acc.Result 2009 (ktoe)	Target 2011 (ktoe)	% of Result 2009 vs Target 2011
2. DSM	143.4	255.8	1,217	21
(1) Elec. Appliance Std.				
- MEPs	-	-	179	0
- Labeling	41.9	72.6	158	46
(2) Heat Appliance Std.				
- LPG Stove Std.	1.5	9.0	14	21
(3) Vehicle Std.	-	-	140	0
(4) Building Std.	-	1.3	1	130
(5) High eff. Equipment Promotion				
- High eff. Fuel Wood / LPG Stove	-	2.7	68	4
- CFL	24	83.8	46	182
- T5	-	2.3	407	0.6
(6) Government Campaign	76	90	204	44

Source : Encon result 2009 (EPPO)

With regards to alternative energy, various resources including biomass, solar and wind for power generation are being developed and are already being implemented. They have been targeted to reduce fossil fuel consumption by 7,500 ktoe, which equates to an overall reduction of 10.7% by 2011; this excludes the Natural Gas Vehicle (NGV) target. It should be noted that many of the projects are comparatively smaller in scale.

As mentioned later, the mid-term plan itself has been reviewed and as a result, the numerical targets have been revised, accordingly.

Within the subsector, the biomass power generation method using rice husks, has drawn the attention of stakeholders based on the initial promising results, followed by the use of biofuels for the transportation of vehicles.

With regards to the development of bio ethanol from cassava and sugar cane, into gasohol, or a mixture of the ethanol with petrol, which have an ethanol content of 10% (E10), 20% (E25) and 85% (E85), the Thai market has expanded to 1.24 million liters consumed per day (2008) .

Bio diesel, which is esterified palm oil or exhausted cooking oil, mixed with regular diesel fuel at a compulsory 2% (B2), is already scheduled to be upgraded to a 5% mixture (B5) within 2011. Accordingly consumption would increase from 1.35 million liters (2009) to 3 million liters per day.

The use of biogas generated from tapioca as an alternative to natural gas for vehicle fuel as a Compressed Bio-Gas, or CBG, is now scheduled to be road tested before the end of 2010. Likewise, rich variations of alternative energy resources are being explored as shown in Table 2.3.4 Numerical target of Encon Program.

Table 2.1.5 Biofuel Prevalence

Country	Proportion Mixture	Raw material	Target / compulsory	Public support
Japan	3% (E3)	Biomass	• Target for introduction of 360,000 kl in 2010.	n.a.
Thailand	10% (E10)	Cassava Sugarcane	• Target for E10 introduction of 100 million kl by 2011.	• Tax exemption on ethanol • Subsidy on E10 production • Exemption of corporate tax for newcomers
Philippines	10% (E10)	Sugarcane	• Compulsory for E5 by 2008 and scheduled to upgrade to E10 by 2010.	• Tax exemption on ethanol • Indirect tax exemption on raw material production
U.S.	10% (E10)	Maize	• Legal binding to market 15 million kl of ethanol, 2.78% of petrol by 2006 and 28million by 2012	• Tax reduction on ethanol blended petrol
	85% (E85)		• Targeted on the state of the union 2007 to replace 15% of petrol consumption (140 million kl) with renewable by 2017.	• Subsidy and soft loan for small scale ethanol producers

Source: a report by Ministry of Environment, Japan

2.1.2 GHG EMISSION AND INVENTORY

It has been said that Thailand had a total emission of GHG of 351.3 million tons for year 2005, of which energy & industrial and agricultural activities emitted 343.4 million tons which equates to 98% of the total CO₂ emission. The energy and industrial sectors emitted 254.6 million tons or approx 73% of total CO₂ emission (Figure 2.1.1).

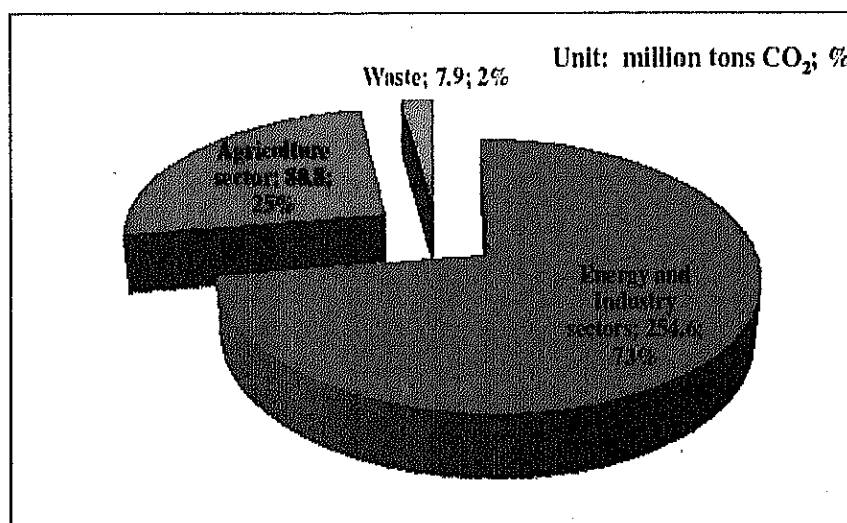


Figure 2.1.1 GHG Emission by Sector (2005)

Source: (Draft) National Master Plan on Climate Change, ONEP, 2009

Further break-down by sub-sector of the Energy and Industrial sector shows electricity and heat takes the biggest share of 91.6 million tons CO₂ or 36% (Figure 2.1.2).

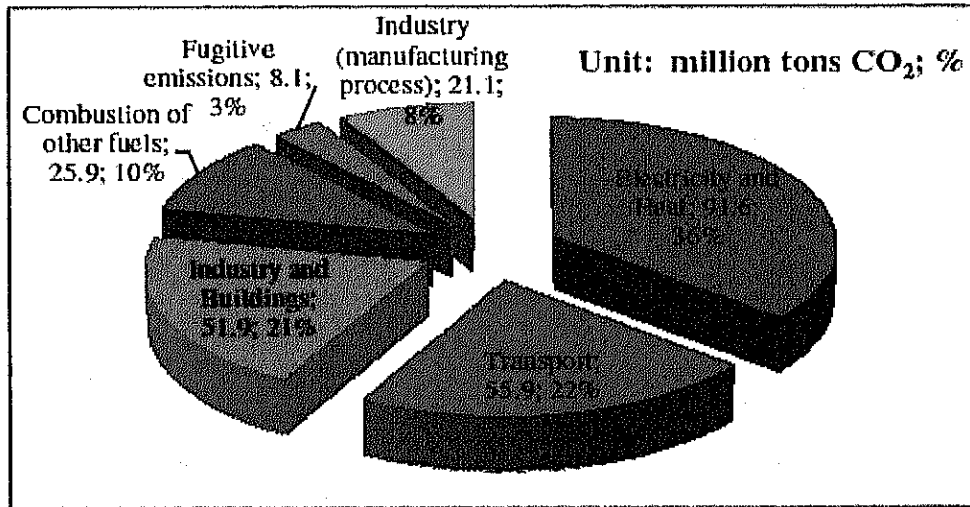


Figure 2.1.2 GHG Emission by Industrial Sector

Source : National Master Plan on Climate Change, ONEP, 2009

Power Generation in 2009 Total = 97,983.4 GWh

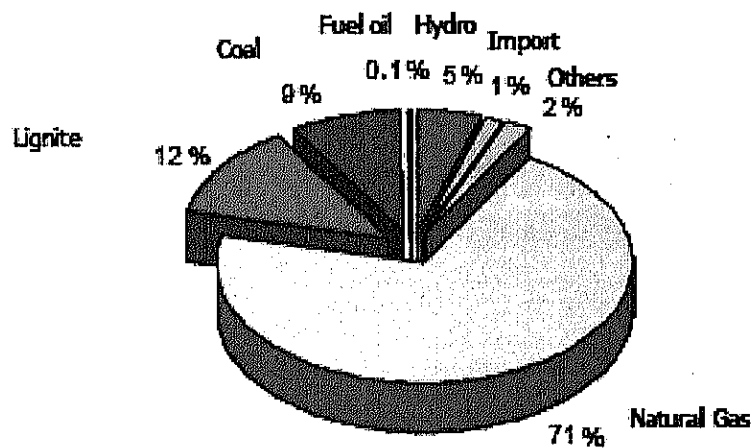


Figure 2.1.3 Energy of Power Generation (EGAT, 2009)

Source : Report on Thailand's power sector, JICA, 2010

When split by method/energy source for power generation, natural gas accounts for 71% of the total generated, which means Thailand produces 92% of its electricity from natural gas, lignite and coal alone (Figure 2.1.3).

Even though its power sector's coefficient for GHG emission is 0.482 kgCO₂/kwh, which is comparable to those of Japan, such as 0.417 of Chubu electric, 0.501 of Chugoku electric and 0.336 of Tokyo electric (figure 2.1.4.), Thailand's power sector has been targeted to reduce its GHG emission to 0.387 kgCO₂/kwh by 2020 in accordance with the Power Development Plan 2010, or PDP 2010,

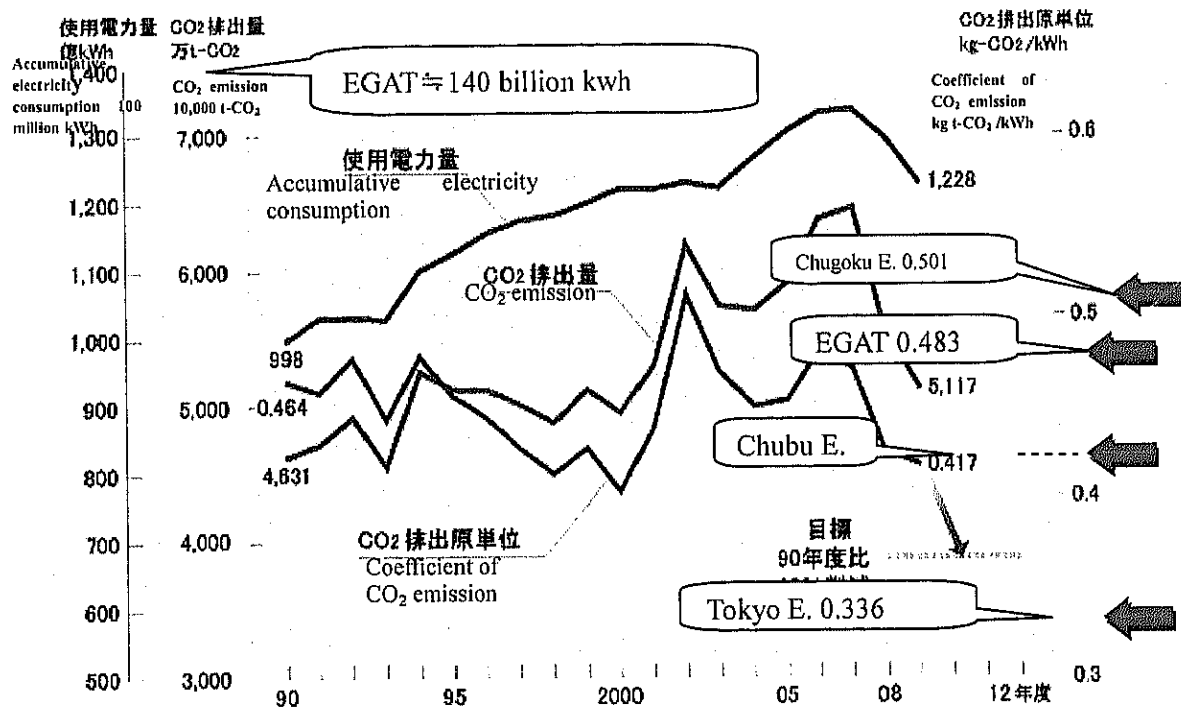


Figure 2.1.4 EGAT's GHG Emission Coefficient and Japanese Power Companies

Source: Chubu Electric Power Co's Website and PDP2010

It has been agreed to fix the target level of GHG emission for the energy sector, and the GHG reduction policy of the sector is well covered by the energy efficiency / alternative energy promotion policies⁴.

2.2 STRATEGIES, POLICIES, AND WORK PLANS FOR CLIMATE CHANGE IN THE ENERGY SECTOR

2.2.1 POLICIES FOR THE ENERGY SECTOR

The Energy Conservation program, or Encon program, whose core energy conservation policy, has three pillars of 1) development of alternative policy, 2) improvement in energy efficiencies, and 3) the strategic management program and the Energy Policy Planning Office, (the Ministry of Energy has been designated as the secretariat).

⁴ PM Abhisit's "Energy policy, strategy No.5 (2008.12)"

Energy Conservation Program

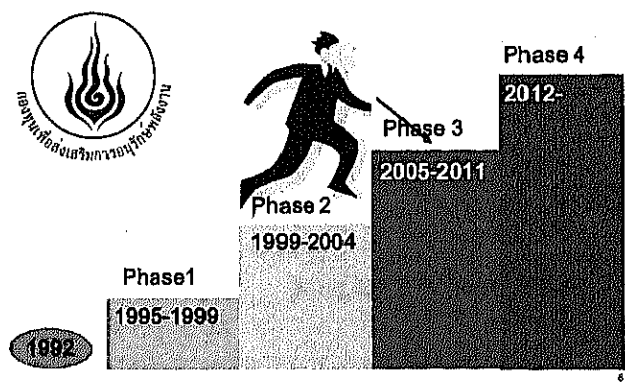


Figure 2.2.1 Encon Program

Source : Thailand's Policy and Measures on EE & RE Promotion

With regard to energy efficiency, there is an Energy Efficiency Improvement Program, or EEIP, implemented under the umbrella of the Encon program. Encon fund⁵, which was established in 1992, is based on the energy conservation act of Thailand. It is the financial tool for the program to facilitate EEIP Implementation. The fund is publicly financed, by the profit from natural gas sales and monitored by the national energy policy council, on whose behalf EPPO serves as the secretariat. There are altogether 5 governmental bodies which have direct access to the fund, as stated in Table 2.2.1.

Table 2.2.1 Encon Fund Related Agencies

	EPPO	DEDE	EGAT	PTT	OPS/MOE
Umbrella program	Encon Program Phase 3				
Financial mechanism	Encon Fund (EPPO: Secretariat)				
Respective plan to implement	EEIP(energy efficiency) 2008–2022	REDP (renewable energy) 2008–2022	PDP2010 (Power development)	REDP for renewables	Cross cutting authority
Esteemed role	Encon secretariat + energy efficiency	Renewables+ Revolving fund, ESCO fund	Demonstration of renewable, etc.	Bio-fuel development and marketing	Overall coordination and access to fund

Source : ENERGY CONSERVATION POLICY IN THAILAND

With regards to the promotion for alternative energy, the DEDE is responsible for managing the Renewable Energy Development Plan, or REDP⁶

In some cases the same program with the introduction of NGV is called the Alternative Energy Development Plan (AEDP)

⁵ Separately the “Adder Cost” is subsidizing private sector investment.

⁶ DEDE has implemented a number of energy efficiency projects and has inter-sectoral track record of project implementation.

The target was to replace 10.7% of total energy consumption with alternative energy sources by the year 2011, which equates to 15.6% if NGV is added.

Financially the program has been supported by the Encon Fund and promotional subsidies from private sector companies, the so called "Adder Cost", which offers different rates of subsidies depending on the type of energy source, and is financed by a part of electricity income.

2.2.2 POLICY AGAINST CLIMATE CHANGE

With regards to the energy efficiency promotion for the power sector, comprehensive measures have been taken, and although depending on the project, there are some disparities of the success rates. As a whole the sector's performance is high, especially with regards to the power generation and distribution.

With regards for the introduction of alternative energy, it has been made compulsory for the smaller private sector companies of power generation, or SPP/VSP (Small Power Producer/Very Small Power Producer), to utilize renewable energy. Measures have been discussed with the respective stakeholders on how to achieve the demand for extra capacity for power distribution, particularly for the VSPPs, which is another side of higher efficiency for power distribution (this means there is a limited capacity for newcomers).

With regards to the Demand Side Management (DSM)⁷ while on the one hand a good extent of the awareness has been built into society, on the other hand there has been a reluctance to upgrade appliances to more energy efficient ones (i.e. air conditioning, refrigerator, energy efficient cooking stove, etc.) and to utilize biofuel for transport vehicles. This is partly due to higher cost of the alternative energies, and the initial cost for the upgraded appliances verses the long cost savings.

It has been noted that the Asian Development Bank or ADB has assisted PEA (Provincial Electricity Authority) for the supply/funding of field experts for the initial investigation to help implement a demand side education program. According to PEA, 6 provinces have already been covered as of August 2010.

2.2.3 SCHEDULED PROJECT, FINANCIAL RESOURCE AND PLAN FOR CLIMATE CHANGE MEASURES

Currently the following projects for energy efficiency promotion/ alternative energy promotion have been scheduled as per Table 2.2.2.

⁷ Higher efficiency air-conditioner, heat reserve air-conditioning and labeling on home appliances

Table 2.2.2 Major Projects of Renewable Energy/Energy Efficiency (RE/EE)

	Project	Agency	Outline	Government budget	Progress/target	Execution
Overall	Encon Act	EPPO DEDE	Legal binding of EE/RE promotion	n.a.	By 2008, 452.7 ktoe energy reduction	Energy users (companies)
	Tax incentive	DEDE	Capital compression 125% Tax reduction 30% of energy saving BOI Incentives	n.a.	By 2008, 32.9 ktoe energy reduction	Revenue authority BOI
Renewables	Biomass Power + Heat	DEDE	By 2011 Power gen 2,800 MW Heat 3,660ktoe	1,065.5 million THB	By 2008, 1,655 MW and 2,406 ktoe	SPP/VSP+ heat suppliers
	MSW Power + Heat	DEDE	By 2011 Power gen 78 MW Heat 15 ktoe	1,293 million THB	By 2008, 5 MW	ditto
	Biogas Power + Heat	DEDE	By 2011 Power gen 60 MW Heat 470 ktoe	308.2 million THB	By 2008, 45.7 MW and 144 ktoe	ditto
	Solar Power + Heat	DEDE	By 2011 Power gen 55 MW Heat 5 ktoe	2,296 million THB	By 2008 Power 34 MW Heat 0.5 ktoe	ditto
	Wind power	DEDE	By 2011 Power gen 115 MW	825.5 million THB.	By 2008 3.1 MW	SPP/VSP
	Mini hydro	DEDE	By 2011 Power gen 165 MW	4,904.5 million THB.	By 2008 66 MW	EGAT/SPP/VSP
	Gasohol	DEDE	3 million liters in market by 2011	118 million THB	By 2008 1.24 million liters	PTT and others
	Biodiesel	DEDE	2011 B5 compulsory	173.3 million THB	2010 B2 compulsory	PTT and others
	NGV	MOT	To replace 14.6% of fuel consumption by 2014	Approx. \$ 260 mil+ Tax reduction	2009 7%replaced	Taxi companies and others
Ditto but not on EPPA list	Clean coal technology	DEDE	R&D on clean coal	106 million THB	Campaigned	DEDE
	Hydrogen/Fuel cell	DEDE	R&D on Hydrogen/Fuel cell	73 million THB	Legal infrastructure	DEDE
	Adder cost ⁸	MOE EGAT MEA/ PEA	Subsidy on RE introduction	\$ 5-6 million per year on average	156 projects, 2% of new IPPs subsidized (~2009.9)	SPP/VSP + others

⁸ While DEDE's alternative energy projects are to directly implement introduction of alternative energy, the Adder cost is a subsidy to private sector companies.

	Project	Agency	Outline	Government budget	Progress/target		Execution	
Energy efficiency	Soft loan	Revolving fund	DEDE	2003 to present accum. 7 billion THB.	Lower interest rate for approved companies (80% + EE equipment introduction)	2003-2009 400 million ktoe, power reduction 200MW+	Managed by NGO for companies	
		ESCO fund	DEDE	Accum. 290 million THB.	Loan, investment and technology support to ESCO vendors	17 projects approved. 300 ktoe energy reduction by 2010	Managed by NGO for companies	
	EE consultation	DEDE	Fielding expert to companies	No figure disclosed	unknown	Companies		
	High tech promotion	DEDE	High technology introduction	No figure disclosed	unknown	Companies		
	DSM bidding	EPPO	Subsidy on most efficient cases	Subsidy total 379 million THB	2008-2010 98 ktoe energy reduction per annum	Companies (bidding winners)		
	Co-generation	EPPO	EPPO purchases power from Co-gen vendors	Data not available	unknown	Companies		
	Labelling	DEDE/EGAT/TGO	Labelling on certified products MEPS standard	No figure disclosed	152 Project by 2011 1217 ktoe energy reduction 40 products on GHG reduction	Companies		
	LPG stove promotion	DEDE	LPG stove Standardization Promotion	No figure disclosed	unknown			
	New building code	Min of construction	Construction standard for energy efficiency	No figure disclosed	unknown			
	High efficiency equipment	Fluorescent light replacement	EGAT/MEA/PEA	Total 33 billion THB.	Replacing T12 & T8 with T5	2008-2009 20.7MW power saving		
		Others	DEDE	Heat pump R&D	No figure disclosed	unknown		
	Government Campaign	Education	MOE/EGAT/MEA/PEA, etc	Awareness building at schools	No figure disclosed	unknown		
SME			HR development, energy diagnosis	No figure disclosed	unknown	Agencies		
Others			MEA's air-con cleaning PEA's customer service	—	2009-2011. MEA to clean 15,000 air-conditioner PEA services to customers	MEA/PEA		

Source: interview and "Thailand's Policy and Measures on RE & EE Promotion"

In general alternative energy projects are comparatively smaller in scale. Some of energy efficiency projects have achieved concrete outcome, such as soft loan.

2.2.4 FUTURE PLAN AND DIRECTION OF POLICY

Both EEIP and REDP have been scheduled by the respective agencies to complete drafting action plans within 2010. Both of EEIP and REDP are to cover a period of 2008-2022, particularly REDP may have to be revised as early as 2011, in order to maintain a realistic plan. Therefore the referred numerical targets will have to be reviewed as well as it's affected for the completion of the PMx.

2.3 BACKGROUND OF THE POLICY MATRIX CONTENTS ON ENERGY

2.3.1 REVIEW OF THE POLICY MATRIX AS OF JUNE 2010

For the initial discussion in the development of the PMx, a series of possible options were considered including; wind mapping⁹, reduction of imported oil. These options were consolidated and used to develop an exhaustive and practical matrix in order to ascertain their viability.

As a consequence of the discussions, it was decided to deploy the EE & RE projects of EGAT (Electricity Generation Authority of Thailand).

Initially EGAT suggested replacing the turbines at Mae Mo power station together with selected projects of renewable energy development, partly because those are the project scheduled on PDP 2010 during the 3 year period of CCPL implementation, and consideration of other projects may not contribute to GHG emission more than those suggested.

However upon consideration, due to an acknowledged concern on environmental issues at Mae Mo thermal power station and the possible duplication with DEDE's project for renewable energy development, it was finally eliminated from the draft Policy Matrix.

Relevancy of the Policy Matrix and overview of energy sector in Thailand are indicated in the Table 2.3.2.

⁹ Map with geological distribution of wind resources

Table 2.3.1 Draft PMx (Energy Sector) as of June 2010

Action	Year1 2009/2010	Year2 2010/2011	Year3 2011/2012	Agency	Ministry
K4. Create low carbon society O5. Reduce GHG in energy sector					
Replace efficient turbines in Maemo Thermal Power Station	4 units replaced in 2009	Prepare for replacement of 6 units in 2013		EGAT	MOE
Develop Renewable Energy: Mini-Hydro, Wind; Solar; and Bio-Mass	Develop Renewable Energy: Mini-Hydro, Wind; Solar; and Bio-Mass			EGAT	MOE
Completion of Encon Program Phase 3 (2008-2011) (18)	Effort to reduce energy use 10.8% by 2011	Effort to reduce energy use 10.8% by 2011	Effort to reduce energy use 10.8% by 2011	EPPO	MOE
Prepared 15-year Renewable Energy Master Plan, Cabinet approval in Jan 2009 (14/15)	Prepare action plan for each subsector	Implement action plan	Implement action plan	DEDE	MOE
Increase renewable energy share to total energy demand (12)	More than 7% in 2009 (6.4% in 2008)	Effort to achieve 10.7% by 2011	10.7% in 2011	DEDE	MOE

* The number indicates reference No. of the original long list initially assessed by JICA.

Table 2.3.2 Reviewing the Policy Matrix in the Energy Sector

		Reference	Policy Matrix	Conclusion	
Policy	Overall	Encon program	Yes	Exhaustive and comprehensive	
	EE	Gen	EEIP	Included in above	
		Trans	EGAT (Grid)	No	Highly efficient
		Dist	MEA/PEA	No	ditto
	RE	Gen	REDP	Yes	Important
		Trans	EGAT(Grid)	No	Highly efficient
		Dist	MEA/PEA	No	On internal discussion
Consumer	Stats	No	May be referable on figures		
Practice	EE	Gen	EGAT Mae Mo station	Delete	Dropped due to environment issue
			EGAT Other projects	No	Possible but weak impact
		Other	PTT	No	Limited possibility of contribution
			Others	No	ditto
	Trans	EGAT (Grid)	No	Highly efficient	
		Dist	MEA/PEA	No	ditto
	RE	Gen	EGAT Renewable	Delete	Dropped due to possible duplication
		Others	DEDE/PTT + others renewable	Yes	Important
		Trans	EGAT Grid	No	Internal discussion ongoing
		Dist	MEA/PEA	No	ditto
	End users	EGAT/DEDE/TGO DSM		No	May possibly be added, depending on discussion.
EGAT etc. Load management		No	Confirmation of impact is not clear		

Source: hearing from agencies

2.3.2 REVISED PMX AS OF AUGUST 2010

Following is the current PMx of energy sector.

While the Encon Program touches upon both Energy Efficiency and Renewable Energy in order to provide comprehensive coverage, and based on recognition¹⁰ that energy efficiency in Thailand has been well practiced for power generation, transmission and distribution, the priority was placed on the field of renewable energy.

Table 2.3.3 Revised PMx (Energy Sector) as of August 2010

Action	Year1 2009/2010	Year2 2010/2011	Year3 2011/2012	Agency	Ministry
Completion of ENCON Program Phase 3 (2008-2011) (18)	Effort to reduce energy use 10.8% by 2011	Effort to reduce energy use 10.8% by 2011	Effort to reduce energy use 10.8% by 2011	EPPO	MOE
Prepared 15-year Renewable Energy Master Plan, Cabinet approval in Jan 2009 (14/15)	Prepare action plan for each subsector	Implement action plan	Implement action plan	DEDE	MOE
Increase renewable energy share to total energy demand (12)	More than 7% in 2009 (6.4% in 2008)	Effort to achieve confirmed numerical target by 2011	Achieve confirmed numerical target by 2011	DEDE	MOE

* The number indicates reference No. of the original long list initially assessed by JICA.

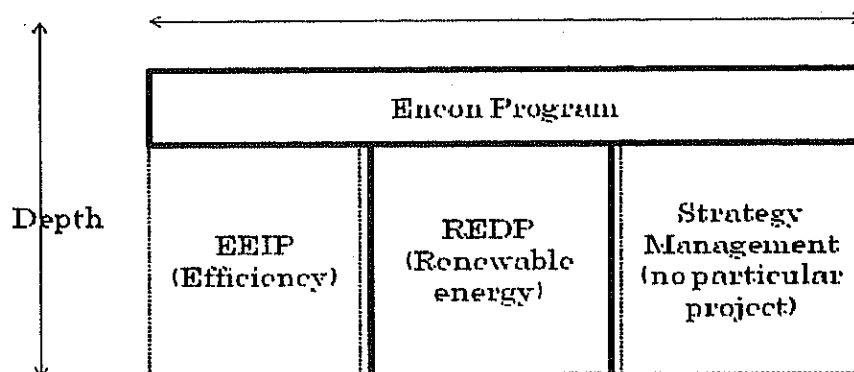


Figure 2.3.1 Conceptual Structure of PMx

Source: the Study Team

Since the entire matrix include actions related to renewable energy highlight Thailand's abundant and various sources of renewable energy development. This further emphasized the relevance of the matrix to the country and secures in-depth consideration into renewable energy. It is envisaged to further extend discussions on energy efficiency measures, including demand side management (DSM) for residents and other measures taken by local industries.

¹⁰ Shikoku Electric Power Co's Report (JICA, 2010) P4-42

(1) Completion of encon program phase 3

The action is to aim at completion of Encon Program phase 3, which is a policy on implementation by the Ministry of Energy.

The program stipulates 3 major pillars including promotion of 1) development of alternative policy, 2) improvement in energy efficiencies, and 3) the strategic management program including HR development and in particular 1) and 2) are equipped with numerical target toward 2011.

Since the program has been designed rather exhaustively and comprehensively, and the availability of the numerical data has been confirmed as per Table 2.3.4., the EPP0's annual statistic on the result of Encon program would be appropriate, as the source of monitoring indicators.

Table 2.3.4 Numerical Target of Encon Program

Potential & Targets								
Energy Type	Potential	Existing	2008-2011		2012-2016		2017-2022	
	MW	MW	MW	ktoe	MW	ktoe	MW	ktoe
Power								
Solar	50,000	32	55	6	95	11	500	58
Wind	1,600	1	115	13	375	42	800	89
Hydropower	700	56	165	49	281	73	324	88
Biomass	4,400	1,610	2,800	1,463	3,220	1,682	3,700	1,938
Biogas	190	46	60	27	90	40	120	54
MSW	400	5	78	35	130	58	160	72
Hydrogen			0	0	0	0	3.5	1
Total		1,750	3,273	1,587	4,191	1,907	5,608	2,290
Heat Energy	ktoe	ktoe		ktoe		ktoe		ktoe
Solar	154	1		5		17.5		38
Biomass	7,400	2,781		3,660		5,000		6,760
Biogas	600	224		470		540		600
MSW		1		15		24		35
Total		3,007		4,150		5,582		7,433
Biofuels	M t/day	M t/day	M t/day	ktoe	M t/day	ktoe	M t/day	ktoe
Ethanol	3.00	1.24	3.00	805	6.20	1,686	9.00	2,447
Biodiesel	4.20	1.56	3.00	950	3.64	1,145	4.50	1,415
Hydrogen			0	0	0	0	0.1 Mkg	124
Total			6.00	1,755	9.84	2,831	13.50	3,986
Total Energy Demand (ktoe)		66,248		70,300		81,500		97,300
Total RE Demand		4,237		7,492		10,319		13,709
Share of RE Demand		6.4%		10.6%		12.7%		14.1%
NGV (mmscfd)		108.1	393.0	3,469	596	5,260	690	6,090
Total Alternative Energy Demand (ktoe)				10,961		15,578		19,799
Share of Alternative Energy Demand				15.6%		19.1%		20.3%

Source : Thailand's Policy and Measures on EE & RE Promotion

The program has a clear target to reduce energy by 10.8% before the end of 2011 against 2008 (see Table 2.1.2). According to the EPP0, the referred plan of the EEIP is being upgraded to the Energy Efficiency Development Plan (EEDP) in the near future and a concrete action plan on EEIP is also being developed, by respective departments, any revisions to the numerical targets for the stage monitoring need to be carefully reviewed.

(2) Implement prepared 15-year renewable energy master plan, approved by cabinet in jan 2009

The action is to monitor the 15 years program, for 2008-2022, developed by the DEDE based on the Encon program.

The master plan stipulates current status and ongoing promotion of alternative energy deployment, mid to long term perspectives, and is an integral part of the Encon program with regards to the renewable energy development.

The title of the plan has 2 variations of Alternative Energy Development Plan (AEDP) and Renewable Energy Development Plan (REDP), which is attributable to inclusion of NGV development, in order to minimize duplication with transport sector part; this paper refers to REDP without NGV factor.

According to the DEDE, the government of Thailand will start a concrete action plan on REDP by respective department¹¹ as from September 2010, and it is scheduled to revise the REDP as early as the first half of 2011. Therefore close attention should be paid during the monitoring practice to pursue any revision of the plan.

(3) Increase renewable energy share to total energy demand

The action is to review progress of renewable energy introduction annually. The target of share is indicated on Table 2.3.2 and it is appropriate to deploy as numerical indicator.

While during the preparatory stage the target was supposed to have been 10.7%, it was consequentially revised to 9.2%, and will duly be adjusted upon consolidation of the concrete action plan by each department. Therefore the matrix stipulates as “confirmed numerical target” and it should be reconfirmed during the stage of monitoring with most up-to-date figures.

The actions were briefed as stated above, and it is recommended to unify the monitoring window for EPPO to review the statistic, and any detailed confirmations can be requested from the DEDE as appropriate.

The actions on PMx have exhaustively been explained. With regard to monitoring of progress, EPPS’s annual statistics can be referred to as a unified window of information. When necessary, the DEDE and other agencies can be contacted for detail information.

¹¹ Bureau of Energy Development, Bureau of EE Promotion, Bureau of Energy Research, Bureau of Bio-Fuel Department

2.4 RECOMMENDATION FOR ENERGY SECTOR

2.4.1 FUTURE STRATEGY AND DIRECTION

While it has been recognized that the energy sector as a whole would implement energy conservation policy in parallel with the national strategy, it was confirmed that: 1) both the DEDE and the EPPO share the same view, that is to focus more on the Demand Side Management for further reduction of GHG, 2) the agencies have not satisfactorily engaged in meaningful dialogue with JICA to obtain Japan's cooperation for Thailand's future energy strategy/development. Therefore it would be prudent to factor the Demand Side Management more into the action, if there is opportunity for review of the actions of the CCPL for year 2 and onward.

(1) Position of Thai Government

Since the climate change measures taken by the energy sector in Thailand have corresponded with energy conservation measures on industrial policy, and it further endorses the economy of satisfaction, which is "the pillar" of national economic development strategy, the corrective measures are on the way to be constantly implemented. Practical action plans are also consolidated and/or periodically reviewed by respective agencies, and the numerical targets and time frame of project implementation have been reviewed as well, which encourages constant update of relevant information through frequent follow-up works.

(2) Industrial sector

Thai industries have paid close attention to the issue of climate change in general, including EGAT's own policy to deal with climate change, which has proactively been on a publicity drive due to EGAT's Corporate Social Responsibility (CSR) perspective. Also the Federation of Thai Industries (FTI) has actively promoted the introduction and the practice of the Kyoto mechanism.

However for many of private sector companies the merits and incentives gained as a result of GHG reduction are not fully recognized. This may result in the lowering of the achievements for the Demand Side Management measures such as peak-shift of power demand, there still are some room of improvement other than the Kyoto mechanism.

Since it has been recognized that Thailand would take positive measures to reduce GHG emission on international framework development, particularly UNFCCC's COP16 and depending on progress of negotiation, the country may become a prospect to deal with Japan on carbon credit transfer, which could possibly be granted by the National Adequate Mitigation Action (NAMA). Therefore close attention should be paid to local industry's undertakings.

(3) Civil society and others

While Thailand has achieved medium level economic development, reliance on agriculture is still comparatively high and accordingly the interest of the media, education sector and the

general public on climate change tend to remain high.

According to the EPPO, the government campaign on energy efficiency has obtained a good outcome. Having synergy between the national energy strategy and the direct positive economic affects it has on households; the awareness for energy efficiency has rather penetrated into Thai society.

On the contrary with regard to bio-fuel, it is said that there still are some concerns about physical stress during the combustion process, which may damage the car, accordingly the bio-fuel has been accepted by the market mostly on the basis of subsidy (DEDE).

2.4.2 POSSIBLE COOPERATION BY JAPAN

Possible concerns Japan's utilizing cooperation, including technical cooperation and possible projects are listed on Table 2.4.1., in reference to a report consolidated by Shikoku Electric Power Co.; there are more promising opportunities in the promotion of the Demand Side Management, in order to target the local industries and the civil society which were mentioned above.

Since the DSM would be 1) comparatively easy to monitor in terms of number of energy efficient equipment sold, and 2) objectively observable from third party's viewpoint with regard to performance of respective players and/or policies on separated statistics, progress of labeling can be monitored comprehensively and exhaustively, and extended if required.

Further with regard to the power tariff, the case for new systems which have not necessarily achieved "peak-shift", these may be investigated and its result and shared with the international community for future cooperation on the same subject as happens in the other developing countries.

Other environmental technologies would also be a subject of substantive interest, though it may not directly contribute in the reduction of GHG emission, it would be suggested that JICA office in Thailand to keep paying continuous attention.

Table 2.4.1 Possible Cooperation in Future

	Field	Context	Advantage	Challenges and possible solution
Power	Biomass power generation*	Comparative advantage to the other renewable.	Gasification plant easy to stop/resume.	1) Distribution capacity 2) Tar prevention 3) Maintenance
Cross cutting	Capacity building*	TC to fulfill lack of knowledge	Japan has good knowledge	1) Inland training 2) Seminar in Japan
DSM	Heat reserve air-conditioner*	To make use of cheaper power in the night.	Peak shift to be accelerated.	1) Review of tariff 2) Investment subsidy
	Inverter driven air-conditioner	To enjoy higher efficiency.	Variable power demand reduces power consumption	1) Industrial standard and PR 2) Investment subsidy
	Labeling	Cross cutting monitoring of labeling conducted by EGAT, DEDE and TGO.	Promotion of energy efficiency/GHG reduction	1) Inter-agency coordination 2) Monitoring system 3) Periodical review of standard
	Fact-finding survey	Investigation of pros and cons of DSM measures.	To acquire essential knowledge for future cooperation	1) Acceptance of Thai government 2) Coordination with international community

Source : JICA report prepared by Shikoku Electric Power Co., Ltd. and interviews

3. TRANSPORTATION

3.1 THE SITUATION AND EXPECTED IMPACTS OF CLIMATE CHANGE IN THE TRANSPORT SECTOR

3.1.1 CURRENT SITUATION AND CHALLENGE

In Thailand, the number of registered vehicles is increasing year by year. As of December 31, 2009, it totalled 27.2 million (Figure 3.1.1), and about 6.1 million units, 23% of these vehicles, are registered in Bangkok. In the whole of Thailand, motorcycles make-up the largest proportion (60.9%), Vans & Pick Ups (17.3%) and Sedans (15.0%). (Table 3.1.1) In Bangkok, motorcycle still make-up the largest proportion (39.2%), closely followed by Sedans (35.9%).

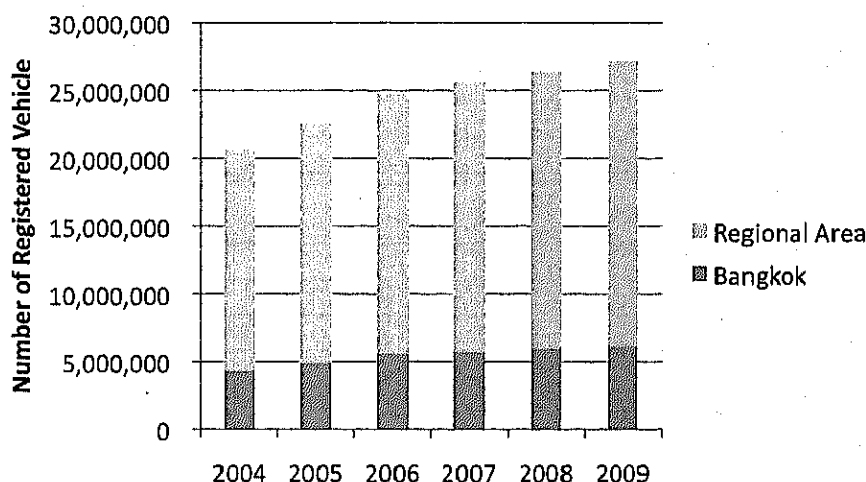


Figure 3.1.1 Trends for Number of Registered Vehicle in Thailand

Source : Transport Statistics Sub-Division, Planning Division, Department of Land Transport

According to the BMA, a total of 17 million trips/day are made in Bangkok. For the total number of trips, cars account for the largest share, 56% (9.5 million trips/day) (Figure 3.1.2). Buses have the next largest share of 35% (6 million trips/day). Mass Rapid Transit (MRT), such as the Skytrain and the Subway, account for only 4% (0.63 million trips/day), and this is lower than that for water transportation (5%). Considering the increasing traffic demand in Bangkok, it is suggested that one of the important measures from the view point of GHG emission reductions is to shift passenger transport from cars to MRT.

**Table 3.1.1 Number of Registered Vehicle by Types in Thailand
(as of December 31, 2009)**

Type of Vehicle	Whole Kingdom		Bangkok	
	Number (Unit)	Share (%)	Number (Unit)	Share (%)
Sedan (Not more than 7 Pass.)	4,078,547	15.0	2,190,150	35.9
Microbus & Passenger Van	383,684	1.4	192,911	3.2
Van & Pick Up	4,696,897	17.3	960,645	15.7
Motor tricycle	1,381	0.0	647	0.0
Interprovincial Taxi	11	0.0	0	0.0
Urban Taxi	90,999	0.3	90,005	1.5
Fixed Route Taxi	4,834	0.0	4,317	0.1
Motortricycle Taxi (Tuk Tuk)	21,615	0.1	9,034	0.1
Hotel Taxi	1,841	0.0	916	0.0
Tour Taxi	795	0.0	710	0.0
Car For Hire	85	0.0	84	0.0
Motorcycle	16,549,307	60.9	2,390,366	39.2
Tractor	171,721	0.6	39,651	0.6
Road Roller	9,759	0.0	3,268	0.1
Farm Vehicle	87,628	0.3	6	0.0
Automobile Trailer	1,987	0.0	1,213	0.0
Public Motorcycle	157,144	0.6	70,531	1.2
Bus	127,553	0.5	34,695	0.6
Truck	791,414	2.9	114,570	1.9
Small Rural Bus	7,375	0.0	0	0.0
Total	27,184,577	100.0	6,103,719	100.0

Source : Transport Statistics Sub-Division, Planning Division, Department of Land Transport

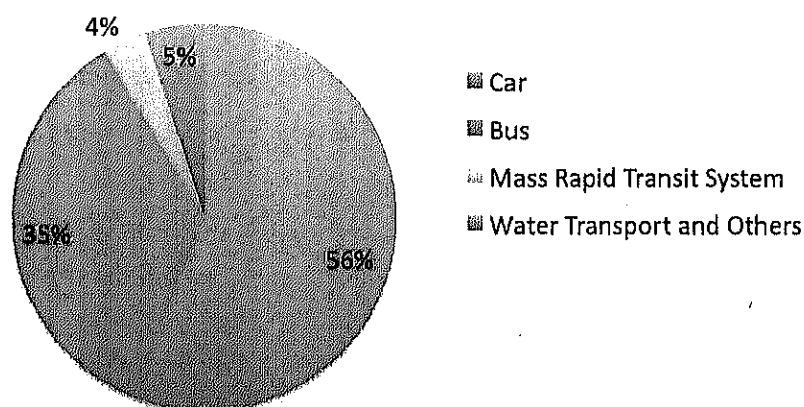


Figure 3.1.2 Transportation Split for Bangkok of the Number of Trips Made

Source : BMA

In order to satisfy the increasing traffic demand in Bangkok, the recently development of MRT has been promoted. In 1999, the first elevated railway, the Skytrain, started operation and covered a total distance of 23.5km, which comprise Mo Chit – On Nut (16.5km) and National Stadium – Sapan Taksin (7.0km). The next MRT was the subway Blue Line which opened in 2004 covered 20km from Bang Sue to Hua Lamphong. However, this far from satisfies the

ever increasing traffic demand in Bangkok, and a MRT network has been planned and several new lines have started construction.

3.1.2 THE CURRENT SITUATION AND FUTURE PROSPECT FOR GHG EMISSION IN THE TRANSPORT SECTOR

In Thailand, the national greenhouse gas emission inventory was produced for 1994, 2000 and 2003. The 1994 inventory was submitted by ONEP to UNFCCC as National Communication¹² in 2000. The total greenhouse gas emissions in 1994 was 286.37 million tCO_{2-eq} (tones of CO₂ equivalent), and the transport sector shared about 14%, 39.922 million tCO_{2-eq}. On the other hand, the total CO₂ emission from fuel combustions was 125.483 million tCO₂, and the transport sector shared about 32%, 39.920 million tCO_{2-eq}. This is the second largest proportion after the energy supply sector.

The total greenhouse gas emissions in 2000 and 2003 were 312.2 and 344.2 million tCO₂, respectively, and increased 9% and 20% respectively, when compared to 1994. There is no breakdown for the transport sector.

The total greenhouse gas emission for the Bangkok Metropolitan Area was estimated by BMA¹³. The emission is 42.75 million tCO₂ and about 50%, 21.18 million tCO₂, of the total is attributed to the transport sector.

These findings indicate that GHG emission reductions in the transport sector are one of the important issues for GHG mitigation in Thailand.

3.2 STRATEGIES, POLICIES, AND WORK PLANS FOR CLIMATE CHANGE IN THE TRANSPORT SECTOR

3.2.1 POLICIES OF SUB-SECTORS

(1) Strategy and plan of climate change mitigation

The followings are policies and plans related to the mitigation of climate change in the transport sector in Thailand. There are climate change mitigation measures in the BMA's action plan as well as in national level policies and plans.

1. "National Strategy on Climate Change Management (2008-2012)" (ONEP)
2. "White paper on Transportation System for Thailand's Sustainable Development (2007)" (MOT)
3. "Master Plan for Sustainable Transport Development and Climate Change Reduction" (OTP) : Start the formulation from October 2010.

¹² Office of Environmental Policy and Planning, 2000. Thailand's Initial National Communication under the United Nations Framework Convention on Climate Change. Ministry of Science, Technology and Environment. Bangkok, Thailand. 100 p.

¹³ Bangkok Metropolitan Administration Action Plan on Global Warming Mitigation 2007 - 2012

4. "Action Plan on Global Warming Mitigation 2007 - 2012" (BMA)

1. "National Strategy on Climate Change Management (2008-2012)" (ONEP)

The outline of the strategy is described in General Overview.

2. "White paper on Transportation System for Thailand's Sustainable Development (2007)" (MOT)

The objective of the white paper is described as follows:

"The primary objective of this white paper is to lay down a firm foundation for future development of Thailand's multi-modal transportation systems."

Descriptions regarding energy savings and climate change mitigations are described in the section 4.3 (Table 3.2.1).

Table 3.2.1 Excerpt from "White paper on Transportation System for Thailand's Sustainable Development (2007)"

<p>4.3 Transport for Energy Saving and Environmental Protection</p> <p>4.3.1 Principles and Rationale</p> <ul style="list-style-type: none">• To reduce consumption of energy which pollutes the environment and causes global warming• To develop alternative energy source for the sake of self-reliance• To promote energy saving and environmental-friendly vehicles and transport systems <p>4.3.2 Implementation Guidelines</p> <ul style="list-style-type: none">• To promote some thrifty and clean energy, such as promotion of CNG-fuelled vehicles and trucks for private and public transport, and to promote the local automobile assemblies using the local contents as major components• To set a target and measures to reduce carbon dioxide emissions from transport systems to mitigate the global warming problems• To study the possibility and the appropriateness for alternative energy, such as bio-diesel, ethanol, and hydrogen, etc in order to reduce the emissions of carbon dioxide from the transport system and from fuel use• To promote thorough coverages with sufficient numbers of CNG refill stations to serve the market demand• To change train mobility system to electricity in order to reduce air pollution and oil consumption• To promote and facilitate the use of non-motorized vehicles with adequate standards• To support transport of oil and gas via transmission pipeline as alternatives to road and rail in order to reduce consumption of energy and traffic congestion

3. "Master Plan for Sustainable Transport Development and Climate Change Reduction" (OTP)

OTP is planning to develop "Master Plan for Sustainable Transport Development and Climate Change Reduction" from October 2010 (planned to finish in April 2012). The master plan will focus on providing an environmental sustainable transport system and on climate change caused by the transport sector. The master plan will have a primary role in climate change issues in Thailand's transport sector.

4. "Action Plan on Global Warming Mitigation 2007 - 2012" (BMA)

The measures on transportation are the primary initiative in the action plan (Table 3.2.2) . Measures include expansion of MRT, the improvement of the public bus system (BRT: Bus Rapid Transit, etc.), improvement of the traffic system. BMA's action plan has an important role in the climate change mitigating measures in the transport sector in Thailand, because vehicle population or traffic, are highly concentrated in Bangkok.

Table 3.2.2 Excerpt from "Action Plan on Global Warming Mitigation 2007 – 2012"

Initiative 1: Expand mass transit and improve traffic system Objective: Reduce CO ₂ emission from vehicle traffic Action plan 1: Expand the mass transit rail system within the Bangkok metropolitan area Action plan 2: Improve public bus system Action plan 3: Improve traffic system Action plan under consideration: Zone Pricing ¹⁴
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(2) Institutional set-up of climate change policies

"Sustainable Transport Promotion Group", under the Safety Planning Bureau in OTP is in charge of climate change issues, in Thailand's transport sector. The group was newly established in August 2009 and consists of 4 staff.

The duties of the group are as follows:

- 1) To plan policies, plans and measures to realize sustainable transport system.
- 2) To solve the problems raised by land, water, air transportations, and to formulate an action plan and to administrate the preservation of the environment.
- 3) To formulate projects and activities in line with the "National Strategy on Climate Change Management", and to formulate an action plan to realize "Climate change policies regarding safe transportation system".
- 4) To formulate a plan, in line with treaties regarding international transportation related environmental matters, and policies, including memorandums, related to sustainable transport.
- 5) To formulate a domestic and international network for promoting sustainable transport.

3.2.2 MEASURES IMPLEMENTED FOR CLIMATE CHANGE (ACHIEVEMENT AND ON-GOING PROJECTS)

Table 3.2.3 shows the major measures or technologies which have potential to contribute to reduce GHG in the transport sector. It also indicates the measures/technologies already implemented in Thailand.

¹⁴ A method of road pricing. To divide the target area into several zones and to charge a vehicle when the vehicle pass through the boundary

Table 3.2.3 The Major Measures or Technologies which have Potential to Contribute to Reduce GHG in the Transport Sector

Categories		Measures/Technologies	Implemented in Thailand (Yes/No)
Mass Rapid Transit System		Railway	Y (see (1) in details)
		BRT	Y (see (2) in details)
Measures on Traffic Amount/Traffic Flow		Park & Ride	Y
		Public Transportation Priority System	Y (Bus lane)
		Road/Area pricing	N
		Plate number ban	N
		Intelligent traffic signals	Y
Measures on Freight		Freight mode switch	Y
		Logistics freight complex	Y
		Green management certification	Y
Improve Fuel Efficiency per vehicle	Vehicle Technologies	Hybrid vehicle	Y
		Electric vehicle	N
		Fuel cell vehicle	N
		High (fuel) efficiency vehicle	Y
		Eco-drive system	Y
	Behavioural changes, Improvement of Maintenances	Idling stop device	N
		Eco-drive	Y
		Idling stop	N
Fuel Switching	Biofuel	Vehicle Inspection/ Maintenance Program	Y
		Biodiesel	Y (see (3) in details)
	Low carbon fuel	Bioethanol	Y (see (3) in details)
		CNG	Y (see (4) in details)
		LPG	Y

Source : OTP and the JICA consultant's information

(1) Inner-city railway

The development of railway network is one of the most important and urgent priorities in Bangkok, where the vehicle population and traffic demand continue to increase. There is significant potential to reduce GHG through shifting passengers from passenger vehicles or taxis to the railway.

Table 3.2.4 shows existing railway lines, lines under construction and lines which are planned to start construction up to 2012 in BMR (Bangkok Metropolitan Region).

Table 3.2.4 Existing Lines, Lines under Construction, Lines which are Planned to Start Construction up to 2012

Line	Responsible agency	Route/Distance (km)	Construction start / Start operation (as plan)	Budget source	Project cost (Million THB)		
Existing							
Green	BMA	Mo Chit – On Nut (16.5) National Stadium – Sapan Taksin (7.0)	1993/1999	BTSC	40,000		
		Sapan Taksin – Tanon Taksin (2.2)	2004/2009	BMA	3,000		
Blue	MRTA	Bang Sue – Hua Lamphong (20)	1994/2004	Japanese ODA loan	120,858		
Airport Rail Link	SRT	Phaya Thai – Suvarnabhumi Airport (28.5)	2005/2010	Local loan	25,907		
Under construction / Construction planned to be started up to 2012							
Green	BMA	Tanon Taksin – Bang Wa (5.3) On Nut - Bearing (5.3)	2004/2013 2006/2012	BMA BMA	7,000 6,088		
		Bang Sue - Bang Yai (23)	2009/2014	Japanese ODA loan	60,072		
Purple	MRTA	Tao Poon - Parliament (Keak Kai) (1.6) Parliament - Wang Burapha (6.5) Burapha – Ratburana (11.6)	2012/2014 2013/2018 2014/2019	N/A N/A N/A	66,820		
		Red	SRT	Bang Sue - Taling Chan (15) Bang Sue – Rangsit (26)	2009/2015 2011/2015	Local loan Japanese ODA loan	9,000 25,000
		Blue	MRTA	Hua Lamphong - Bang Khea (14) Bang Sue - Tha Phra (13)	2010/2016 2010/2016	Local loan Local loan	58,345 24,778
Green	MRTA	Bearing – Samut Prakan (13) Mo Chit – Sapan Mai (12)	2011/2016 2011/2016	Local loan Local loan	28,029 36,513		
Pink	MRTA	Kaerai - Minburi (36)	2012/2016	N/A	42,067		
Orange	MRTA	Taling Chan - Din Daeng (12.9) Din Daeng - Bang Kapi (13.6) Bang Kapi - Min Buri (11)	2014/2019 2012/2016 2014/2018	N/A	137,750		

Red: Dark Red Line and Light Red Line in M-MAP

Blue: Dark Blue Line in M-MAP

Green: Dark Green Line in M-MAP

Source: M-MAP, MRTA, BMA, SRT

(2) BRT (Bus Rapid Transit)

BRT has a role to complement the network of railways and it is effective in areas where it is difficult to develop railways. There is potential to reduce GHG through shifting passengers from passenger vehicles or taxis to BRT. In Bangkok, the first BRT opened in May 15th, 2010 (Table 3.2.5).

Table 3.2.5 Outline of the Bangkok BRT Route 1

Route Length	15 km
Number of stations	12
Ridership (forecasted) per day	35,000
Number of buses in service	25-30
Bus capacity	80 person
Average speed	30 km/h
Estimate travelling time	30 minutes
Fuel	NGV EURO III
Fare collection system	Contactless smartcard like BTS and MRT. For passenger convenience, BRT ticket can be used in BTS system and, in the future, it can be modified to connect the MRT system, when the common ticket for BSS (Bangkok Smartcard System) is completely implemented.
Fare table	Distanced based from THB. 12-20 (while it is THB. 14-22 for Euro2 buses) which will be applied after 2 January 2011. From May 15, 2010 to August 31, 2010 is the 3.5 months period of trial run so no fares will be collected. Then the flat fare of THB. 10 will be collected after revenue operation on September 1, 2010. After Automatic Fare Collection, AFC, is completely installed on January 2, 2011, the distance based fare structure of THB. 12-20 will be officially applied.
Route	<p>The map displays the route of BRT01, starting at Chongnonsi-Ratchaphruk and ending at Wat Deam. The route is marked with a thick black line connecting 12 stations: 1. Chongnonsi-Ratchaphruk, 2. Ratchaphruk, 3. Sathorn, 4. Abacca Songkhro, 5. Yen Akard, 6. Chan Road, 7. Narairam, 8. Rama III, 9. Charoenrat, 10. Rama IX, 11. Wat Dokmai, 12. Wat Prival, and 13. Wat Deam. The map also shows major roads and landmarks in the central business district of Bangkok.</p>

Source: BMA

(3) Introduction of NGV

Thailand is a natural gas-producing country; therefore, the Thai government promotes its use, not only for power generation but also for automobile fuel. The utilization of natural gas can reduce oil dependency and increase energy security. As for NGV, CNG (Compressed Natural Gas) has low carbon content per unit of heat value, and does not emit PM (Particulate Matter). Therefore, introducing NGV and the conversion of automobiles from using gasoline or diesel to CNG has a potential to reduce GHG and to contribute to improve local air quality. Especially, the switch from gasoline to CNG can reduce GHG.

As of July 2010, the number of NGV in Thailand was 193,352, and the number of CNG station was 412. PTT Public Company Limited has a plan to increase NGV to 265,095 and CNG station to 530 in 2012. BMTA has a plan to replace 4,000 diesel buses with NGV buses,

and already approved by the cabinet in September 2009, however it was decided in August 2010 to postpone the plan.

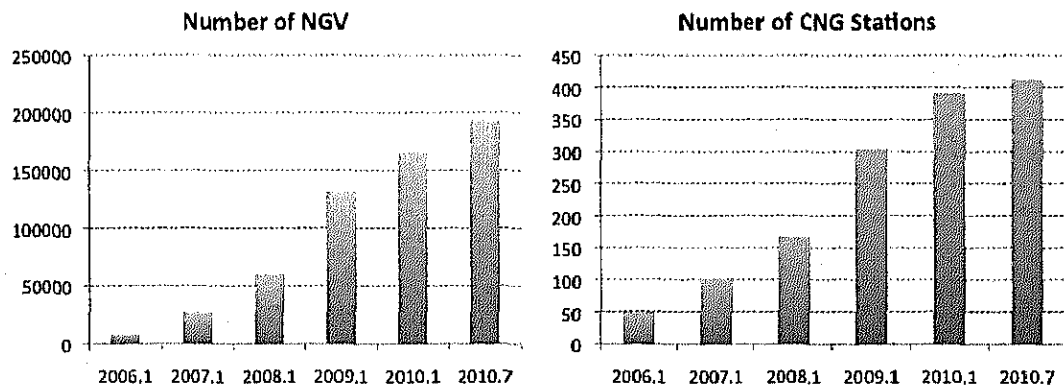


Figure 3.2.1 The Number of NGV and CNG Stations

Source: PTT Public Company Limited Web site (<http://pttweb2.pttplc.com/webngv/en/Default.aspx>)

(4) Introduction of biofuel

Thai government has been promoting the introduction of biodiesel and bioethanol as part of its renewable energy development. Since the introduction of biofuel is not only under the energy policy, but is also related to the agricultural policy, the Ministry of Energy and the Ministry of Agriculture and Cooperatives collaborate to promote biofuel. There is a potential to reduce GHG through fuel conversion from fossil fuels, e.g. gasoline and diesel to biofuel. However, it is not straightforward to estimate the emission reductions, because GHG emissions of biofuel vary significantly for each type of land used for the cultivation of feedstock.

(5) Biodiesel

The Thai government unveiled the action plan on promoting biodiesel in 2007, and plan was to supply 4.5 million liters of B100/day in 2022 (Table 3.2.6). The major feedstock of biodiesel is oil palm. To achieve the planned target, the necessary CPO for the biodiesel production is 1.14 million tons/year and 6 million rai (0.96 million ha) of the planting area is needed (3.63 million rai (0.58 ha) in 2008). The current biodiesel supply as of 2009 is 1.35 million liters of B100/day. The planting area will be increased to 0.96 million ha in 2014 from 0.64 million ha in 2009. As for CPO production, it is planned to increase to 3.4 million tons in 2022 from 1.65 million tons in 2009, and about one third of the CPO, 1.14 million tons will be utilized for biodiesel production.

Table 3.2.6 The Outline of the Action Plan on Promoting Biodiesel (2007)

Year		2009	2010	2011	2012	2013	2014	2015
Planting area	Million rai	4	4.5	5	5.5	5.9	6	6
	Million ha	0.64	0.72	0.80	0.88	0.94	0.96	0.96
FFB production	Million ton	9.18	10.17	12.06	13.56	13.86	15.57	16.75
CPO production	Million ton/year	1.65	1.83	2.23	2.51	2.56	2.88	3.1
CPO for food	Million ton/year	1.06	1.11	1.17	1.23	1.29	1.35	1.42
CPO for Biodiesel	Million ton/year	0.47	0.34	0.77	0.8	0.84	0.87	0.89
CPO for export	Million ton/year	0.08	0.38	0.25	0.48	0.42	0.65	0.78
Stock of CPO	Million ton/year	0.15	0.15	0.19	0.2	0.21	0.22	0.23
B100 demand	Million liter/day	1.35	1.35	3.02	3.14	3.31	3.42	3.53
Year		2016	2017	2018	2019	2020	2021	2022
Planting area	Million rai	6	6	6	6	6	6	6
	Million ha	0.96	0.96	0.96	0.96	0.96	0.96	0.96
FFB production	Million ton	17.81	18.42	18.65	18.67	18.58	18.52	18.40
CPO production	Million ton/year	3.29	3.41	3.45	3.45	3.44	3.43	3.4
CPO for food	Million ton/year	1.49	1.57	1.64	1.73	1.81	1.9	2
CPO for Biodiesel	Million ton/year	0.92	0.95	0.98	1.02	1.05	1.1	1.14
CPO for export	Million ton/year	0.87	0.88	0.81	0.7	0.56	0.42	0.25
Stock of CPO	Million ton/year	0.24	0.25	0.26	0.27	0.29	0.3	0.31
B100 demand	Million liter/day	3.64	3.75	3.87	4.01	4.15	4.32	4.50

Source : Thailand, Department of Alternative Energy Development and Efficiency, Ministry of Energy

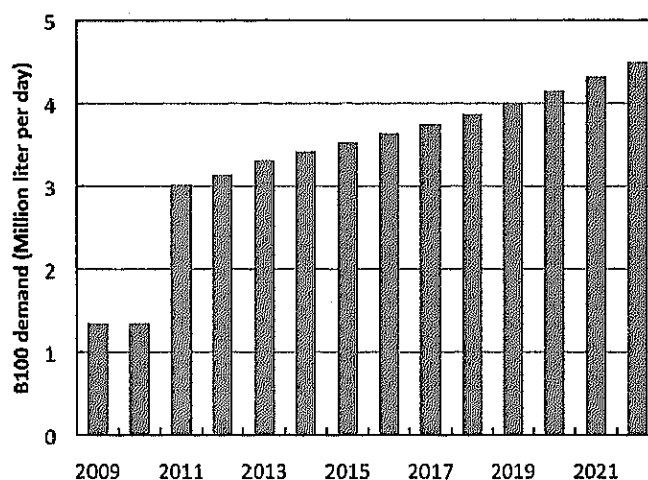


Figure 3.2.2 B100 Demand in the Action Plan

Source : Thailand, Department of Alternative Energy Development and Efficiency, Ministry of Energy

Biodiesel production in Thailand has been increasing since 2007 (Table 3.2.3). Currently, the production is about 1.7 million liters/day and supplied to the market as B5 (5% blend with petroleum diesel) or B2 (2% blend with petroleum diesel).

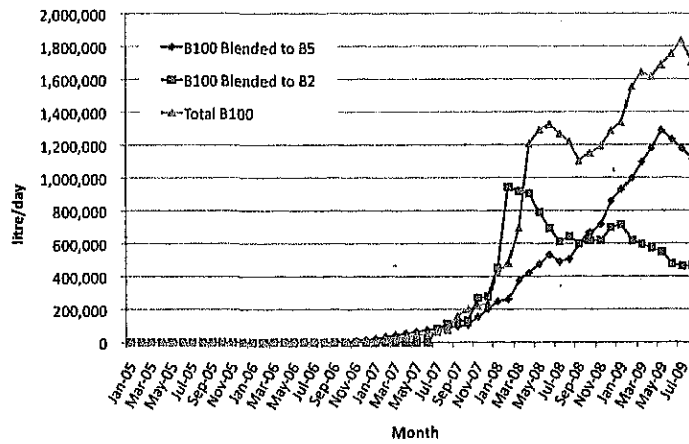


Figure 3.2.3 Biodiesel Supply in Thailand

Source : Thailand, Department of Alternative Energy Development and Efficiency, Ministry of Energy

(6) Bioethanol

Thailand has implemented a 15-year ethanol plan (2008 – 2022). Thailand’s bioethanol production is based on molasses (a by-product of cane sugar production) and cassava. The Government has set targets of bioethanol production and consumption of 3.0 million liters/day through 2011, 6.2 million liters/day in the medium-term (2012 – 2016) and 9.0 million liters/day in the long term (2017 – 2022) (Table 3.2.7). The supply in 2009 is 1.1 million liter/day and is supplied to the market as E10 (10% blend with petroleum gasoline) or E20 (20% blend with petroleum gasoline) or E85 (85% blend with petroleum gasoline). These blended ethanol’s are called gasohol.

Table 3.2.7 The 15-year Ethanol Plan (2008 – 2022)

	(million liter/day)					
	Short Term				Medium Term	Long Term
	2008	2009	2010	2011	2012-2016	2017-2022
Target	3.0	3.0	3.0	3.0	6.2	9.0
Actual Production	0.9	1.1	-	-	-	-

Source : Ministry of Energy

(7) Others

OTP had been studied comprehensively about the possibilities of CDM (Clean Development Mechanism) in the transport sector in Thailand from 2008 to 2010. In the study, the following contents had been studied.

- 1) To list up the possible GHG reduction measures in the transport sector in Thailand and assess which measures can be realized as CDM projects.
- 2) To estimate the emission reductions and assess the feasibility as a CDM project for several projects including a subway, CNG vehicles, biofuel.

- 3) To prepare PDD¹⁵ (Project Design Document) of the blue line extension.
- 4) To enhance capacity of officers of MOT and other related agencies regarding CDM through OJT and training.

In addition, MRTA aims to promote/use the blue line extension and the purple line as CDM projects. As for the blue line extension, MRTA is considering to promote/use as a CDM project based on the PDD developed in the OTP study. As for the purple line, PIN (Project Idea Note) has been prepared with the support of JICA.

3.2.3 PLAN TO MITIGATE CLIMATE CHANGE, EXPECTED PROJECTS AND INVESTMENT TARGETS

(1) Inner-city railway

Regarding a plan for a rail-based mass transit system (subway, elevated railway, etc), in BMR (Bangkok Metropolitan Region), the OTP had developed M-MAP (20-year Mass Rapid Transit Master Plan in Bangkok Metropolitan Region) since November 2008, and it was approved by the cabinet on March 2010. Figure 3.2.4 and Table 3.2.8 shows the outline of the M-MAP.

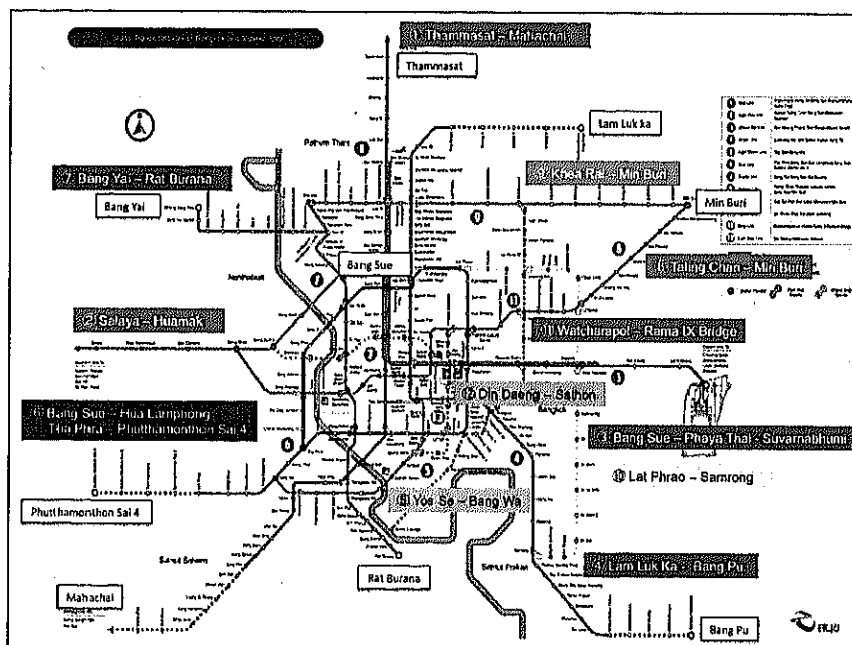


Figure 3.2.4 12 Routes of Rail Mass Transit for the Future (2010 - 2029)

Source: M-Map, OTP, 2009

¹⁵ A necessary document in the submission of a CDM project to UNFCCC. Describe, for example, GHG emissions of the proposed project.

Table 3.2.8 12 Routes of Rail Mass Transit for the Future (2010 - 2029)

Line	Route	Distance
Major Trunk Routes		
Dark Red	Thammasat – Mahachai	80.8
Light Red	Salaya – Huamak	58.5
Airport Rail Link	Bang Sue – Phaya Thai - Suvarnabhumi	36.4
Dark Green	Lam Luk Ka – Samut Prakan	66.5
Light Green	Yos Se – Bang Wa	15.5
Dark Blue	Bang Sue – Hua Lamphong –Tha Phra – Phutthamonthon Sai 4	55.0
Purple	Bang Yai – Rat Burana	42.8
Orange	Taling Chan – Min Buri	37.5
Minor Trunk Routes		
Pink	Khea Rai – Min Buri	36.0
Yellow	Lat Phrao – Samrong	30.4
Grey	Watcharapol – Rama IX Bridge	26.0
Light Blue	Din Daeng – Sathon	9.5
Total		495

Source: M-Map, OTP, 2009

M-MAP can be divided into three phases.

- 1) Networks being expedited in accordance with cabinet resolution

Comprising route networks that will connect medium- to high-density residential areas with business and commercial intercity areas. Most can be actualized and opened for service within 2014 (98.5km) and within 2016 (52.5km). Combined with the existing and under construction networks, the total length will be 236km covering a service area of 370 km² and accommodating 3.3 million people.

Table 3.2.9 Networks Being Expedited According to Cabinet Resolution

Line	Route	Distance	Passengers (Persons – Trips/day)	
			2019	2029
Dark Red	Bang Sue – Rangsit – Thammasat	36.3	252,000	335,000
	Bang Sue – Hua Lamphong	6.5	114,000	202,000
Light Red	Bang Sue – Phaya Thai – Makkasan	9	61,000	19,000
	Makkasan – Hua Mak	10	32,000	80,000
	Bang Sue – Taling Chan	15	*	*
Dark Green	Mo Chit – Saphan Mai	11.4	135,000	300,020
	Bearing – Samut Prakan	12.8	83,000	138,000
Dark Blue	Bang Sue – Tha Phra - Hua Lamphong	19	324,000	467,000
	Tha Phra – Bang Khae	8	111,000	140,000
Purple	Bang Yai – Bang Sue	23	151,000	217,000

*: Under construction

Total distance (the sum with existing line): 236 km, Total cost: THB. 319,750 million, Total passengers: 2,823,000 persons-trips/day

Source: M-Map, OTP, 2009

2) Additional networks within 2019

Comprising extension of the primary networks and new primary and secondary networks. Connection is emphasized in dense residential, business, and commercial areas in the city area. When complete in 2019, Greater Bangkok will have a mass transit network with a total distance of 277 km with a coverage area of 525 km² and 3.8 million inhabitants.

Table 3.2.10 Additional Networks within 2019

Line	Route	Distance	Passengers (Persons – Trips/day)	
			2019	2029
Dark Red	Hua Lamphong – Bang Bon	18	128,000	171,000
Light Red	Taling Chan- Salaya	14	44,000	69,000
Airport Rail Link	Bang Sue – Phaya Thai	7.9	25,000	35,000
Dark Green	Saphan Mai – Khu Khot	7	46,000	83,000
Light Green	National Stadium – Yos Se	1	21,000	27,000
Purple	Bang Sue – Rat Burana	19.8	351,000	494,000
Orange	Taling Chan – Thailand Cultural Center	17.5	373,000	483,000
	Thailand Cultural Center – Bang Kapi	9	104,000	185,000
	Bang Kapi – Min Buri	11	66,000	142,000
Pink	Khae Rai – Pak Kret	6	31,000	49,000
	Pak Kret – Lak Si	12	113,000	179,000
	Lak Si – Outer Ring Road	10.5	50,000	83,000
	Outer Ring Road – Min Buri	7.5	24,000	37,000

Total distance (the sum with existing line): 377 km, Total cost: THB. 624,380 million, Total passengers: 4,379,000 persons-trips/day

Source: M-Map, OTP, 2009

3) Additional networks within 2029

Comprising extension of the primary networks to communities and business centres according to the comprehensive city plan as well as providing extended secondary networks to accommodate medium-density areas. Within 2029, Greater Bangkok will have a mass transit network with a total distance of 495 km with a coverage area of 680 km² and 5.13 million inhabitants.

Table 3.2.11 Additional Networks within 2019

Line	Route	Distance	Passengers (Persons – Trips/day)	
			2019	2029
Dark Red	Bang Bon – Mahachai	20	-	59,000
Light Red	Bang Bamru – Makkasan	10.5	-	276,000
Dark Green	Khu Khot – Lam Luk Ka Samut Prakan – Bang Pu	6.5	-	34,000
		7	-	29,000
Dark Blue	Bang Khae – Phutthamonthon Sai 4	8	-	88,000
Yellow	Lat Phrao – Phattanakarn Pattanakarn – Samrong	12.6	-	191,000
		17.8	-	122,000
Grey	Watcharapol – Lat Phrao Lat Phrao – Rama IV Rama IV - Rama IX Bridge	8	-	88,000
		12	-	138,000
		6	-	120,000
Light Blue	Din Daeng – Sathon	9.5	-	305,000

Total distance (the sum with existing line): 495 km, Total cost: THB. 811,070 million, Total passengers: 7,670,000 persons-trips/day

Source: M-Map, OTP, 2009

(2) BRT Master Plan

In Bangkok, where the demand for using buses is high, introductions of BRT has been planned to improve the convenience of buses and to supplement the railway. There are also plans to introduce BRT in other local cities such as Chaing Mai and Khon Kaen.

Table 3.2.12 Integrated Bangkok BRT Master Plan (2009)

No.	Route	Distance (km)	Remarks
1	Chong Nonsi – Ratchaphruk	15.9	Under BMA master plan
2	Chong Nonsi – Suk Sawat	19.5	Under construction by BMA
3	Min Buri – Param 9	26	-
4	SaMeaDum - Param 2 - SukSaWas - Ratchaprug	20	-
5	Bang Na – Suvarnabhumi	10	-
6	SounRatChaKan - Mochit	14	-
7	Ratchapruerk - Phutamonton sai 4	23	-
8	Watprasrimahatad - Ramintra - Nawamin - Srinakarin - Samrong	37	-
9	Bangyal - Tallngchan - Ratchapruerk	24	-
10	Ramintra- Praditmanunthama - Param 9	22	-

Source : Report of BRT Integrated Network Plan, OTP, 2010

Regarding BRT in Bangkok, both OTP and BMA developed a master plan. However, due to the similarity of network proposal by OTP and BMA with the objective to increase the service area of public transportation, these master plans have been revised and integrate both networks of OTP and BMA to the most suitable BRT. The outline of the integrated Bangkok BRT Master Plan is shown in Table 3.2.12.

3.2.4 FUTURE PLANS AND DIRECTION OF THE THAI GOVERNMENT

MOT/OTP is planning to develop a "Master Plan for Sustainable Transport Development and Climate Change Reduction" from October 2010. The master plan will focus on an environmental sustainable transport system and the associated climate changes caused by the transport sector, and the master plan will have a primary role in climate change issues in Thailand's transport sector. The development of the master plan will continue until early in 2012. The target year of the master plan is expected to be 2013 to 2018. Within this period, every related department under MOT should develop an action plan.

3.3 BACKGROUND OF THE POLICY MATRIX CONTENTS ON TRANSPORT

3.3.1 REVIEW OF THE POLICY MATRIX AS OF JUNE 2010

Table 3.3.1 shows the Policy Matrix as of June 2010 under the Outcome 6 of "Reduce GHG in the transportation sector" and Key Strategy 4 "Reduce GHG in key sectors". The appropriateness of each action is assessed in this section.

Table 3.3.1 Draft Policy Matrix (Transport Sector) as of June 2010

Action	Year1 2009/2010	Year2 2010/2011	Year3 2011/2012	Agency	Ministry
K4. Reduce GHG in key sectors O6. Reduce GHG in transportation sector					
Promotion of Mass Transit System (MRTA) (49b)	- MRTA has operated the Blue Line -Purple Line (MRTA) and Red Line (SRT) has started construction	To develop a Mass Transit System under the Master Plan to be approved by the cabinet	To develop Mass Transit System under the Master Plan	MRTA SRT OTP	MOT
Promotion of Mass Transit System (BMA) (49c)	-BTS (Green line) has been in operation since 1999 -BRT under implementation	To manage BTS/BRT	To manage BTS/BRT	BMA	
Reduction of fossil fuel in transportation sector(51)	Cabinet Approval in Aug 2009 to replace diesel engines of BMTA's 4,000 buses with CNG	To implement the replacement project	To implement the replacement project	BMTA OTP	
K6. Knowledge management on Climate Change Enhancement of integrated management to address climate change					
Capacity Enhancement of OTP (49)	New group: Sustainable Transportation Promotion Group (STP) was established in Aug. 2009	Implementation under the new group	Implementation under the new group	OTP MOT	

*The number indicates reference No. of the original long list initially assessed by JICA.

(1) Promotion of Mass Transit System (MRTA/BMA) (49b/49c)

In the BMR (Bangkok Metropolitan Region), the number of motor vehicles and amount travelled has increased tremendously, and this has significant negative effect on the economy

and to people's living condition. Due to the heavy traffic congestions and the resultant increases in air pollutants and greenhouse gases emissions. To alleviate these issues, the development of mass rapid transit network is an urgent priority for the transport sector in the BMR. In the BMR, the first mass rapid transit system (MRT), the Green line, was developed and started operation in 1999. The second MRT was the subway Blue Line which was funded by a Japanese ODA loan and has been in operation since 2004. However, there are still only two lines in operation; therefore, the anticipated expansion of the MRT network to improve traffic conditions in the BMR is eagerly awaited.

Promotion of the MRT is stated as the first measures in transport sector in the "National Strategy on Climate Change Management (2008-2012)", and it is also one of the most important measures in BMA's "Action Plan on Global Warming Mitigation 2007 - 2012" as well.

Under these circumstances, the Thai government developed the master plan for MRT, M-MAP (20-year Mass Rapid Transit Master Plan in Bangkok Metropolitan Region) and this was approved by the Cabinet in March 2010. In accordance with M-MAP, the Thai government has actively been promoting the development of the MRT network (see 3.2.3 in details). In regard to the BRT (Bus Rapid Transit) that can complement the rail-based network, the OTP and the BMA integrated their master plans and have already started to develop the necessary lines.

Promotion of mass rapid transit is one of the most important measures or projects in the transport sector in the BMR, since it will contribute not only to an improved transport systems in the BMR, but it also contributes toward the mitigation of climate change and it improves the local environment. Also it reflects the policy of the Thai government and BMA.

Based on the above assessments, it is appropriate to include "Promotion of Mass Transit System" in the PMx. However, MRT in the BMR are controlled by OTP, MRTA, SRT and BMA depending on the lines; therefore it is better to describe actions separately for each organization.

(2) Reduce fossil fuel in bus service (51)

In the BMR, buses are the dominant means for transportation, BMTA (Bangkok Mass Transit Authority) owns and operates about 3,500 buses. Diesel buses emit not only greenhouse gases such as carbon dioxide, but they also emit local air pollutants such as PM and NOx, and are a major cause of air pollution in the BMR. Therefore, it is necessary to reduce emissions from buses through measures such as fuel conversions and their replacement by the use of low emission vehicles.

NGV (Natural Gas Vehicle; Vehicles fuelled with CNG (Compressed Natural Gas)) emits very low amount of PM, therefore it is an effective measure to improve local air quality, by converting the vehicle fuel from diesel or gasoline to CNG. CNG has low carbon content per unit of energy, therefore, conversion of fuel from diesel or gasoline to CNG has potential to reduce CO₂. However, diesel engines have high fuel efficiency and it is improving year by year through technological improvements. Therefore, it is generally recognized that

greenhouse gases emissions from NGV and diesel vehicles are almost same and cannot reduce greenhouse emission effectively through conversion of vehicle fuel from diesel to CNG. The chassis dynamometer tests of BMTA's CNG buses in 2003 by MLIT Japan showed that CO₂ emissions from CNG buses are relatively higher than diesel buses especially at lower vehicle speeds. Another concern in regards to greenhouse gases for CNG buses is the leakage of CH₄. It has been pointed out that retrofitted CNG buses emit more CH₄ than completely new CNG buses. Therefore, introductions of CNG buses can contribute to improve local air pollution, however it does not ensure that greenhouse gases will be reduced effectively.

Based on above assessments, it is recommended to exclude the action "Reduce fossil fuel in bus service" from the PMx.

(3) Development of institutional and organizational framework of the OTP (49)

In order to promote climate change mitigations effectively in the transport sector, a core organization is needed to develop the policy and framework for the mitigation measures. In this regard, in August 2009, the Ministry of Transport established a new group named "Sustainable Transport Promotion Group" under the Safety Planning Bureau in OTP to tackle climate change issues in Thailand's transport sector. The group has 4 staff with practical experiences and academic backgrounds in the fields of transport and environment. However, to tackle the climate change issues, a broad array of knowledge and experiences are required, such as policy making, science, international politics, international negotiation, up-to-date information on climate change mitigation/adaptations in the world, etc. Therefore, to work on these important issues, it seems that the group should be enhanced in terms of its capabilities, skills and experiences. The group is planning to develop a "Master Plan for Sustainable Transport Development and Climate Change Reduction" from October 2010. The master plan will focus on an environmental sustainable transport system and the climate change issues caused by the transport sector, and the master plan will have a primary role in climate change issues in Thailand's transport sector.

The OTP is the key and most important organization to help promoting climate change mitigations in Thailand's transport sector, and it should be strengthened in terms of institutional and organizational aspects, to be able to promote climate change mitigations effectively and efficiently.

Based on the above assessments, it is appropriate to include "Development of institutional and organizational framework of the OTP" in the PMx. However, in the joint meeting with OTP, ONEP, MRTA, BMA, SRT, BMTA and JICA at OTP on August 17th 2010, it was suggested to modify the title "Capacity Enhancement of OTP" to an appropriate alternative, because the actions include not only capacity enhancement but also establishment of new group and development of master plan. It is recommended to revise the title of this action.

3.3.2 REVISED POLICY MATRIX AS OF AUGUST 2010

Based on the assessments in the former section, and meetings with each agency in August 2010, the original PMx is revised.

Table 3.3.2 shows the revised PMx for the transport sector. These revised actions obtained total agreement at the joint meeting on August 17th 2010 with attendance of responsible persons from every agency.

Table 3.3.2 The Revised Policy Matrix (Transport Sector)

Action	Year1 2009/2010	Year2 2010/2011	Year3 2011/2012	Agency	Ministry
K4. Reduce GHG in key sectors O6. Reduce GHG in transportation sector					
Promotion of Mass Rapid Transit (MRT) (49b/49c)	- Blue Line in operation; - Purple Line under construction	- Develop MTS according to Master Plan; - Purple Line under construction; - Blue Line (Extension) starts construction; - Green Line (North), selection of contractors; - Green Line (South), selection of contractors	- Develop MTS according to Master Plan; - Purple Line under construction; - Blue Line (Extension) under construction; - Green Line (North) starts construction; - Green Line (South) starts construction - Pink Line, selection of contractors - Orange Line, selection of contractors (Din Daeng - Bang Kapi)	MRTA OTP	MOT
	- Red Line (Bang Sue - Taling Chan) under construction; - Airport Rail Link has been operated since 2010	- Develop MRT according to Master Plan; - Red Line (Bang Sue - Rangsit) starts construction	- Develop MRT according to Master Plan; - Red Line under construction	SRT OTP	MOT
	- BTS has been operated since 1999 - Extension from Sathorn to Taksin Road starts operation	- Extension from On Nut - Bearing starts operation	- Extension from Taksin to Bang Wa starts operation	BMA OTP	MOT
	- BRT (Sathorn to Ratchaphruk) started operation in 2010	- Develop BRT according to Master Plan	- Develop BRT according to Master Plan	OTP BMA	MOT MOInt
Development of institutional and organizational framework of OTP (49)	- Institutional framework development of OTP - New group: Sustainable Transportation Promotion Group (STP) established in Aug. 2009	- Development of the Master Plan	- Development of the Master Plan	OTP	MOT

*The number indicates reference No. of the original long list initially assessed by JICA.

The details of each action are shown below. The background of each action is already described in section 3.3.1.