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ENERGY CONSERVATION POLICY IN THAILAND: PERCEIVED EFFECTIVENESS OF POLICY IMPLEMENTATION

By

Sasitorn Sinbanchongjit-Suwannathep

A Dissertation Submitted in Partial

Fulfillment of The Requirements for The Degree of

Doctor of Philosophy (Development Administration)

School of Public Administration

National Institute of Development Administration

ISBN 974-231-474-8

2003

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ABSTRACT

Title of Dissertation	:	Energy Conservation Policy in Thailand: Perceived Effectiveness of Policy Implementation
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Degree	:	Doctor of Philosophy (Development Administration)
Year	:	2003

The Energy Conservation Policy (the Energy Conservation Promotion Act (B.E. 2535) and the establishment of the Energy Conservation Promotion Fund are considered to be key instruments of the energy policy to promote the implementation of energy conservation activities in Thailand. This study is to determine whether such instruments have been implemented and have achieved their objectives, that is, promoting the implementation of energy conservation activities, reducing the country's energy consumption and greenhouse gas emission. The objectives of this study are: (1) to assess the effectiveness of energy conservation policy implementation by considering whether the policy to promote energy conservation activities has achieved its objectives and intended outcome, (2) to investigate the factors affecting the effectiveness of energy conservation policy implementation, and (3) to propose policy measures and policy alternatives that promote effective policy implementation.

To investigate the factors influencing policy effectiveness, two major hypotheses were proposed: hypothesis 1: higher amounts in supporting funds, technical support, policy knowledge and experience, and external funds are more likely to increase the effectiveness of policy implementation; and hypothesis 2: less external impact and compliance limitations are more likely to increase the effectiveness of policy implementation.

Designated factories, the sample for the study, were chosen by considering the type of designated factories, TSIC group, and location of factories. Five hundred and seventy questionnaires were distributed to the selected designated factories from March to September 2002 and 200 usable questionnaires were used for data analysis. Path analysis technique with stepwise regression was a statistical technique employed for data analysis.

The research results responding to the above objectives reveal that:

(1) The designated factories have implemented approximately 40% of the energy conservation activities prescribed by the Act, including assigning the person responsible for energy (PRE), submitting energy consumption data twice a year, conducting preliminary energy audits and submitting reports to DEDP (Department of Energy Development and Promotion). Delays in implementation are caused from the implementing agency (DEDP), whether in forms of report approval delay or of fund disbursement delay. Moreover, some energy consultant companies that assisted the designated factories to undertake the energy audit could perform only minimum requirements of the factories and could not accelerate the implementation as intended. These difficulties need to be handled immediately if the government wishes to promote the implementation of energy conservation activities.

However, most factories perceive that if the policy is implemented as intended, then the objectives of the policy, the reduction in energy consumption and in greenhouse gas emission and higher productivity in their factories would be attained.

(2) Of ten proposed factors, eight affect the effectiveness of policy implementation, namely supporting fund, technical support, policy knowledge and experience, external fund, external impact, compliance limitations, compliance ability, and degree of compliance with the policy. The remaining two factors are not statistically significant and should be reconsidered in future studies. These are compliance willingness and compliance cost.

Among eight factors found to influence the effective policy implementation, supporting fund, is the most significant factor, followed by degree of compliance, technical support, external fund, compliance ability, compliance limitations, policy knowledge and experience, and external impact. Therefore, both major hypotheses were accepted in this study.

The study suggests that to attain policy implementation effectiveness, the government should strengthen the compliance ability of the factories through providing higher amounts in supporting funds and additional technical support. These kinds of support will enhance financial capability and human capability of the factories and also lessen compliance limitations.

Moreover, the government should emphasize availability of and accessibility to external funds that can support investment in energy conservation measures or projects due to internal budget constraint in the factories. The government should function as a coordinator between the factories and the financial institutions by raising awareness on energy conservation issues to the financial institution executives through demonstrating the real costs and benefits of energy conservation projects and to instill more confidence on a payback or return of investment from such projects. This function of the government will enhance financial capability of the factories and degree of compliance with the policy, which will enhance effective policy implementation.

At the same time, the government should lessen the external impacts that may affect compliance with the policy and the effectiveness of policy implementation. Uncertainties in economic circumstance or instability of energy prices are lessening the compliance ability of the factories; they may unable to make an appropriate plan to allocate or reserve their resources, which will affect the implementation of energy conservation activities due to a lower priority in implementation. These situations are beyond the factories' control. Therefore, they need the government to take action on this issue by providing accurate information and up to date data and also relaying important messages to them for their preparation to handle such uncertainties.

To accelerate the implementation of energy conservation activities, it is necessary to demonstrate a success of implementation. The government may need to exhibit best practices; some factories may be selected to perform as the leaders in implementation. The criterion used to select the factories can be the previous energy conservation knowledge and experience of the factories. The findings support this issue since it reveals that the factories that have such knowledge and experience are able to comply with policy more than the have-not factories. Policy knowledge and experience, together with several kinds of support (financial support or technical support: training, educating, or disseminating information) can strengthen compliance ability of the factories and lessen compliance limitations and also enhance degree of compliance with the policy and consequently policy implementation effectiveness.

Finally, the research proposes recommendations, which include policy implications, management options, and direction for future research.

ACKNOWLEDGEMENTS

An undertaking as arduous as a dissertation cannot be successfully completed without the help and support of many people. I am deeply indebted to the following outstanding individuals for their kind assistance.

Firstly, I would like to express my deepest appreciation to Dr. Pairote Pathranarakul, chairman, Associate Professor Dr. Thavanrat Vorathepputtipong, major advisor, and Associate Professor Dr. Pichit Pitakthepsombat, methodology advisor, for their useful guidance and strong support throughout the undertaking and writing of the dissertation. Without them, there would have been no dissertation. Moreover, all the professors in the Ph.D. program at the School of Public Administration, NIDA also deserve an extraordinary thank you. Special thanks to Professor Dr. Sombat Thamrongthanyawong, a former dean for his moral support and encouragement during my study.

Secondly, I would like to thank the King Mongkut's University of Technology Thonburi (KMUTT) for allowing me to study the Ph.D. Program. Several people at KMUTT deserve special appreciation: Assistant Professor Nantha Go-Wong, a former dean of the School of Liberal Arts, Assistant Professor Nuanthip Tantisawetarat, a dean of School of Liberal Arts and all my colleagues at Social Sciences and Humanities Department, in particular Ajarn Chalarat Chaiyasith, deserve thanks for their moral support and encouragement and for their kindness in performing my duties during my study leave.

Special thanks to all following people who supported and helped me gathering the valuable data and information regarding the study and also gave useful comments and suggestions during the conduct of the research: Ms. Sunee Laothreepetch, Ms. Sukanya Limpiyapirom, Mrs. Amaraporn Achavangkool, Mr. Yospong Guptaputra, Mr. Pinyo Tanthumart, Mr. Phrutapong Sarakasettrin, Mr. Thammasorn Tangaya, Mr. Kamol Tanpiput, and Mrs. Buppha Poolkerd. I greatly appreciate all key informants for their opinions, suggestions and recommendations on the implementation of the Energy Conservation Promotion Act, which are invaluable to this study.

I am also grateful to the Energy Conservation Promotion Fund Committee for providing financial support during the study, and Indiana University, USA for giving me an opportunity to be an exchange student between NIDA-IU in the Spring 2001 semester: Professor Dr. Randall Baker at SPEA, and Tun Myint and his wife deserve thanks I am grateful for their full support and help during my study at IU, Professor Dr. Surapongse Sotanasathien of Thammasart University for his kind advice to solve some difficulties on framing the proposal; and my classmate, Mrs. Chit-rapee Subsandee and her parents for many-kinds of support and encouragement, which made me relaxed and comfortable during my study.

Lastly, I wish to express my strong appreciation to my parents (Mr. Jit and Mrs. Arporn Sinbanchongjit), my younger brother and sisters, and my beloved husband (Mr. Thammasak Suwannathep) and his parents for all their support, understanding and love, encouragement, and patience over the years of my study. There were no doubt times when I may not have fulfilled my duties as a daughter and wife because of the stress of study. Without their moral support and understanding, I may have been unable to overcome the difficulties that occurred during the study. I really love them all.

Sasitorn Sinbanchongjit-Suwannathep
March, 2003

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ABBREVIATIONS

Abbreviations	Equivalence
ADB	The Asian Development Bank
BAU	Business as Usual
BERC	Bureau of Energy Regulated and Conservation
CDG	The Comptroller General Department
CH_4	Methane
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CONS	Energy Conservation Concerns
DEDP	Department of Energy Development And Promotion
DFs	The Designated Factories
DSM	Demand-Side Management
ECAs	Energy Conservation Activities
ECCT	The Energy Conservation Center of Thailand
ECMs	Energy Conservation Measures
ECP Act	The Energy Conservation Promotion Act B.E./ 2535 (1992)
ECP Fund	The Energy Conservation Promotion Fund
ECPFC	The Energy Conservation Promotion Fund Committee
EGAT	Electricity Generating Authority of Thailand
EPC	The Energy Policy Committee
GDP	Gross Domestic Product
Gwh	Giga Watt - Hour
INECE	International Network for Environmental Compliance and Enforcement
kcal	Kilocalorie (10^3 Calories)
kg	Kilogram (10^3 Grams)
kgoe	Kilogram of Oil Equivalent (10^3 Grams of Oil Equivalent)
ktoe	Kilo Ton of Oil Equivalent (10^3 Tons of oil equivalent)
KVA	Koli-volt Ampere
kWh	Kilowatt-hour (10^3 Watt-hours)
LPG	Liquified Petroleum Gas
METI	The Ministry of Economy Trade and Industry

Abbreviations	Equivalence
MITI	The Ministry of International Trade and Industry
MJ	MEGAJOULE (10^6 JOULES)
MMscf	Million Standard Cubic Feet
MMscfd	Million Standard Cubic Feet Per Day
MOTIE	The Ministry of Trade, Industry and Energy
Mtoe	Million Ton of Oil Equivalent (10^6 Tons of oil equivalent)
MW	Megawatt (10^6 Watts)
NEA	The National Energy Administration
NEPC	The National Energy Policy Council
NEPO	The National Energy Policy Office
NESDB	Office of the National Economic and Social Development Boarc
NIC	The Newly Industrialized Countries
NO_x	Nitrogen Oxide
OECD	The Organization for Economic Cooperation and Development
PREs	Persons-Responsible for Energy
RES. AND COM.	Residential and Commercial
SO_2	Sulphur Dioxide
TSIC	Thailand Standard Industry Classification
UNEP	United Nations Environment Programme
UNESCAP	United Nation Economic and Social Commission for Asia and the Pacific

CHAPTER 1

INTRODUCTION

1.1 Statement of the Problem

The emergence of two-oil crises in the 1970s and the early 1980s triggered a dramatic increase in energy prices on the world market. These events correctly signaled that energy would no longer be an invisible and unimportant factor in the economic lives of individuals and nations (Hollander and Schneider, 1996: 274). It also reinforced concerns about depletion of natural resources from intensive exploitation in the industrial countries.

Uncertainties of future energy prices and availability of energy supplies became major issues and received high priority in policy agendas. The governments of both developed and developing countries searched for new sources of energy, for example, renewable energy; they supported research and development in energy technologies, and they also proposed energy conservation programs to reduce energy demand in their countries. Efficient use of energy helps protect the economy from foreign energy supply disruptions while saving foreign currency and reducing energy related environmental impacts (Sankar, 1984: 125; Christie, 1993: 27; Hollander and Schneider, 1996: 273; Dincer, 1999: 852; and Toke, 2000: 840).

However, the oil-price increases of the 70's proved to be temporary. It did not come from resource scarcity that had driven up prices but from a combination of short term underproduction and distribution imbalances that allowed the OPEC producers to raise prices during that time. A few years later, oil prices fell down as new non-OPEC sources entered into the world market and reduced OPEC's power to control oil prices. As a result, energy policy no longer enjoyed the priority status it once had and programs promoting energy efficiency were being reduced or being eliminated in many countries. However, countries like USA, EU countries, Australia, New Zealand, and Japan view energy efficiency as an important issue. They have advocated

implementation of energy efficiency programs at the individual, organizational, and national levels by providing powerful incentives for consumers and firms to invest in energy efficiency and by sponsoring energy efficiency research and development.

Many scholars mention significant reasons for governments to advocate energy conservation. For example, Anderson (1993: 21), Fukasaku (1995: 1063-1076), Cooper (1996:253), Dincer (1999: 852), Boyd et al (2000: 289-296), Toke (2000: 835-854), and Hoerner and Mult (2000) noted the different reasons for supporting energy efficiency and also noted there was no conflict among them. These reasons were considered as a means of moving towards sustainability; a means to improve the balance of payments through reduced oil imports; a means to reduce energy costs to promote economic competitiveness and to increase productivity, and a means to reduce a wide range of energy related environmental impacts. Currently, energy efficiency policies and measures are considered as key elements of many countries' efforts to meet their Kyoto Protocol Commitments. Annex 1 of the Protocol states that, "Parties shall implement and/or further elaborate policies and measures, in accordance with their national circumstances, on energy efficiency, renewable energy resources and market imperfections, and shall apply market instruments. Moreover, they shall co-operate to enhance their policies and measures, and share related information and experience." (IEA, 2000:1).

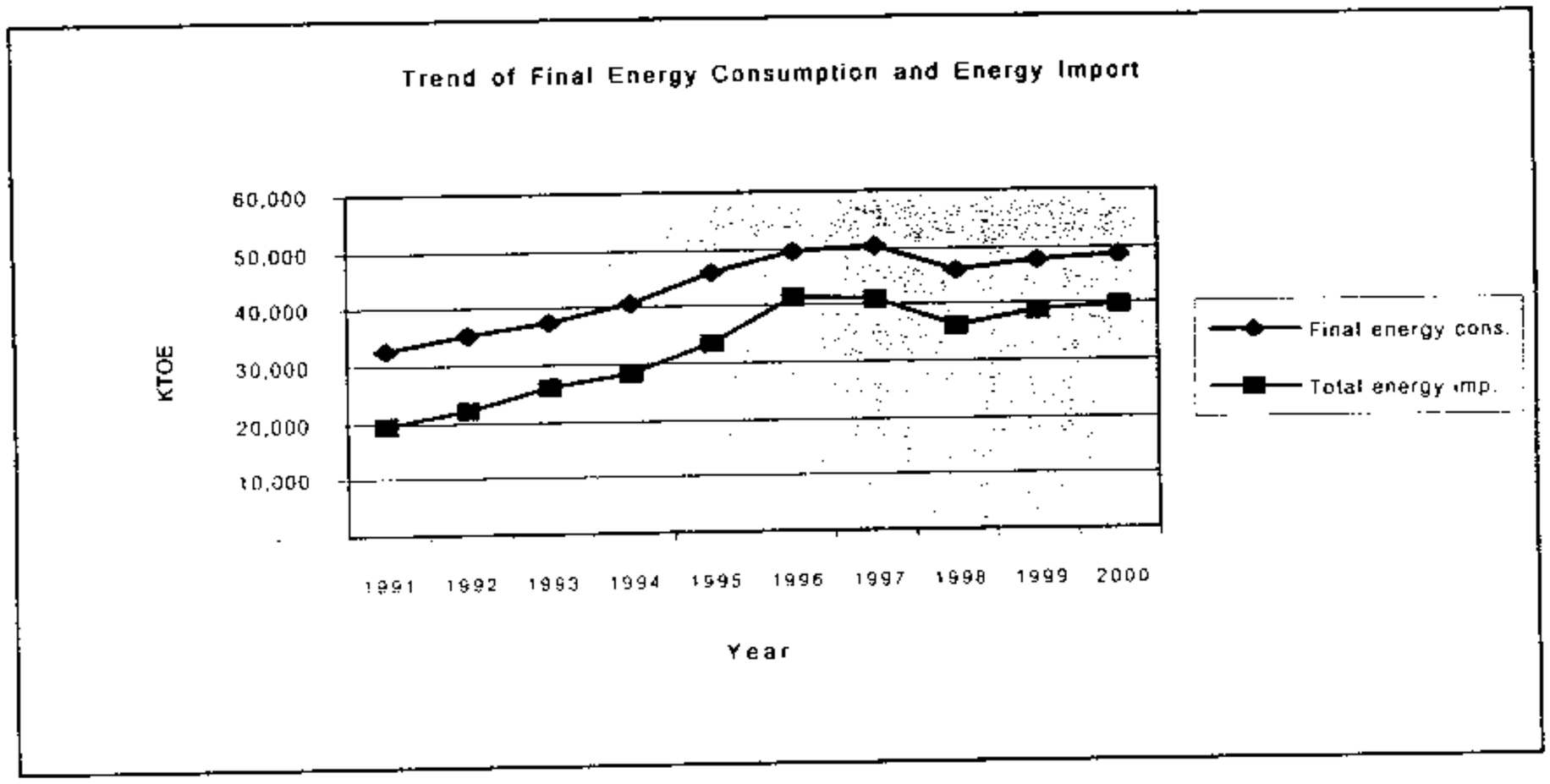
Similarly in Thailand, the government has strongly advocated implementation of energy conservation programs since the emergence of the first oil crisis, and continues to support these programs to this day. Major reasons of such support can be briefly summarized as follows:

1.1.1 High Growth of Energy Demand in Thailand

Prior to the economic recession in Thailand in 1997, Thailand had a higher than average economic growth rate. The success in economic development during the last two decades caused a rapid increase in the demand for energy in the entire economy and particularly in the industrial sector. Industrial development seems to be an engine for economic growth. In 1998, as a result of the Asian economic crisis, final energy consumption in Thailand decreased for the first time in over 30 years.

However, a year later, it rebounded to almost the same level as in 1997, as shown in figure 1.1.

Figure 1.1 Trend of Final Energy Consumption and Energy Import.



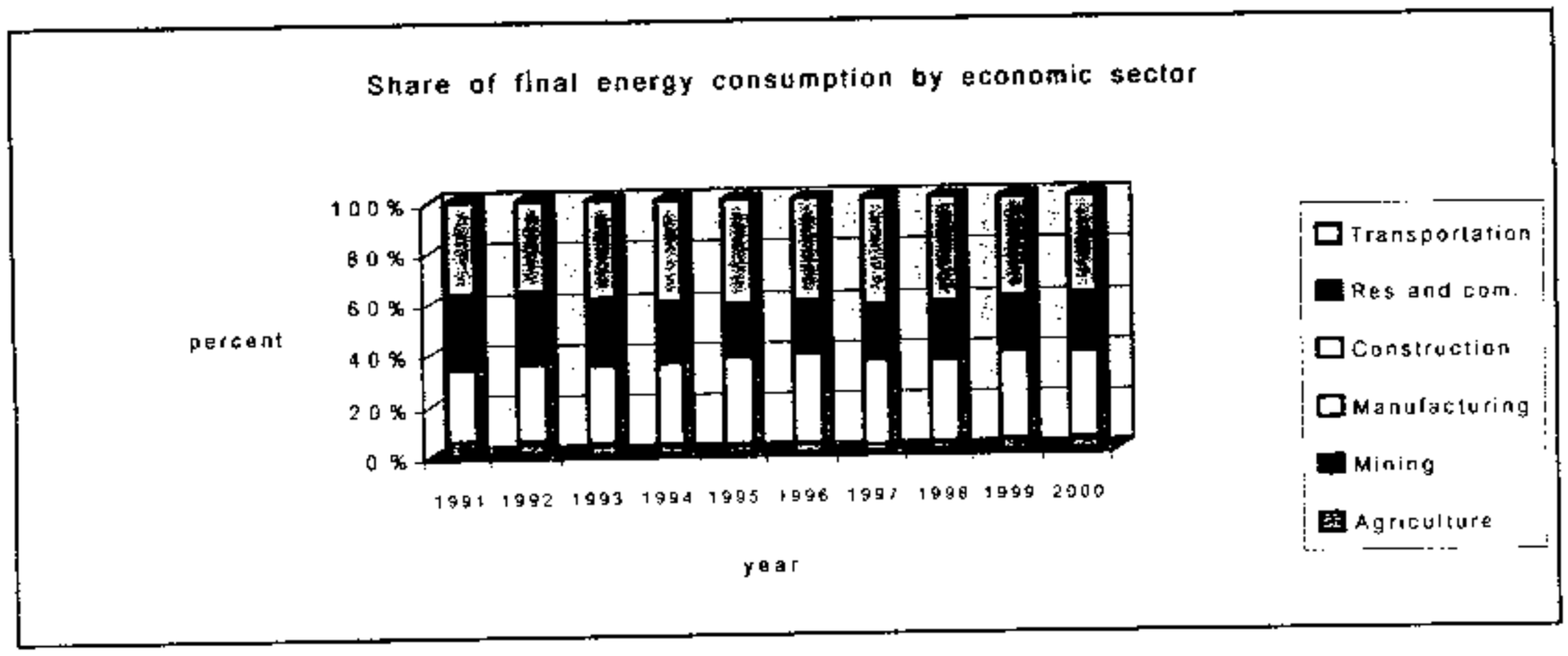
Source: Department of Energy Development and Promotion (DEDP), 2001b: 11.

Final energy is defined as the sum of all energy, both renewable and non-renewable, converted to an equivalent of oil. Final energy includes modern sources such as oil, gas, electricity, etc, and traditional sources such as wood, coal, charcoal, husks, etc. In Thailand, the largest energy consumer sector is the transportation sector, accounting for 38.6 percent in 2000 or 18,652 kilo tons of oil equivalent (ktoe) (details shown in figure 1.2). The industrial sector is the second largest consumer of energy, accounting for 34.6 percent of total energy consumed in 2000 or 16,741 ktoe followed by the residential and commercial sectors, agricultural sector, and mining sector, which are 21.8%, 4.5%, and 0.2% respectively.

The previous levels of energy consumption are employed to forecast the energy demand in the future. A study conducted by NEPO (2000d) presented the energy demand forecast for Thailand during the 2000-2025 period. The economy was divided into five sectors including industry, transport, commercial, residential, and

agriculture. The projection is based on the demographic and macroeconomic environment.

Figure 1.2 Share of Final Energy Consumption by Economic Sectors



Source: DEDP, 2001b: 13.

Three scenarios were developed, labeled Base, High, and Low scenarios. Each scenario was considered in two aspects: business- as- usual (BAU) and energy conservation concerns (CONS). The Base scenario employs the economic growth targets of the government for 1997-2001, which average 1.0-1.1% annually. The High and Low scenarios also use the same growth assumptions of the National Economic and Social Development Board (NESDB) for the period 1997-2001, but different assumptions are made for the period beyond. This dissertation describes only the energy demand forecasts of the Base Scenario. The rest of the scenarios can be seen on the NEPO website.

The final energy demand of the BAU during 1995-2025 is displayed in table 1.1. Final energy demands will grow from 48.74 million tons of oil equivalent (Mtoe) in 1995 to 158.87 Mtoe in 2025. The industry sector will share a major part accounting for 42% of total, followed by the transportation sector, residential, commercial and agriculture accounting for 39%, 14%, 3% and 2% respectively.

Table 1.1 Final Energy Demand in the BAU Case During 1995-2025.

Unit: Mtoe

Sectors	1995[1]	2000[2]	2005[3]	2015[3]	2025[3]
Transport	18.82	21.31	26.15	40.65	64.67
Residential	10.30	12.74	14.33	16.97	19.75
Industrial	15.98	17.56	23.85	39.57	65.25
Agricultural	1.58	1.75	1.9	2.49	3.47
Commercial	20.5	2.34	2.71	3.88	5.72
Total	48.74	55.71	68.94	103.56	158.87

Source: NEPO, 2000 d: 2

Notes 1 real figure

2 estimated figure

3 predicted figure

The potential of energy saving based on the CONS scenario reveals the greatest saving potential in the transportation and industry sectors, accounting for 56% and 30% respectively, of total energy saved. The detail is shown in table 1.2.

Table1.2 Projected Energy Demand and Energy Saving by Sectors

Projected Sectoral Demand (BAU Scenario)					**Projected Total Energy & Electrical Savings from CONS Scenario**			
Sector	1995 Total energy	1995% Electrical	2025% Total energy	2025% Electrical	2025 Total Energy Saving (ktoe)	2025% Total energy saving	2025 Electrical Saving (ktoe)	2025% Electrical Saving
Transport	39%	0%	39%	0%	12.773	56%	0.4	0%
Industry	32%	46%	42%	51%	6,955	30%	2,828	54%
Residential	21%	28%	14%	25%	1,381	6%	878	17%
Commercial	4%	25%	3%	23%	1,638	7%	1,535	30%
Agricultural	3%	2%	2%	1%	252	1%	16	0%
Total	100%	100%	100%	100%	22,999	100%	5,289.4	100%

Source: NEPO, 2000d: 3

The forecast suggests that future energy demands will gradually increase because of the expansion of economic activities; however, energy conservation programs can ameliorate potential energy shortage problems.

1.1.2 High Dependence on Import Petroleum Products

From figure 1.1, total final energy consumption in 2000 was 48,399 ktoe, an increase of 1.34% over last year. Meanwhile, total energy imported in 2000 was 39,730 ktoe, increasing by 1.96% over the previous year and accounting for 82.19% of the final energy consumed in Thailand.

The higher energy demand in Thailand has caused a severe dependence on energy supplies from foreign sources. Most of the petroleum products in Thailand are imported The value of petroleum products imported increased from 82.5 billion Baht in 1990 to 304 billion Baht in 2000. Such value accounted for 6.2% of GDP or 12.2% of total imports in 2000 (details shown in table 1.3) (DEDP, 2001b: 21). These indicators suggest that Thailand has to provide much of her foreign currency for importing energy, which places a heavy burden on the country's economy, especially in recent years when Thailand faced an economic crisis and, in 1997, was forced to borrow from the IMF.

Table 1.3 GDP, Total Import Value and Petroleum Products Import

Unit: billion Baht

Item	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
GDP	2183.5	2506.6	2830.9	3170.3	3634.5	4185.6	4608.5	4727.3	4635.9	4688.4	4891
Total Import Value	853.0	959.4	1030.2	1170.8	1369.3	1763.6	1832.8	1924.3	1774.1	1907.4	2494
Petroleum Products Import (PPI)	82.5	78.8	80.4	85.6	84.4	106.0	154.3	180.3	142.4	178.8	304
Share of PPI to Import	9.8	8.4	7.8	7.5	6.4	6.2	8.7	9.6	8.3	9.8	12.2
Share of PPI to GDP	3.7	3.2	2.9	2.8	2.4	2.6	3.5	3.9	3.2	4.0	6.2

Source: DEDP, 2001b: 21

Moreover, the recent instability in the world oil market has caused increases in world petroleum prices, which also affects the domestic petroleum price and is seriously threatening the economic performance and Thailand's ability to recover

from the recession. So far, the government has taken short-term measures by raising the domestic energy price to cope with the disturbances in the international market. However, the most suitable approach in the long run should be the pursuit of a policy for efficient consumption of energy.

1.1.3 Increasing Awareness of Greenhouse Effect

It is accepted that the major cause of global warming is from burning of fossil fuels, which emerged from the economic activities, whether from production or consumption (Kushler, 1989: 153-168; Scheraga, 1994: 799; Jaffe and Stavins, 1994: 804). Most of the expanded production comes from fossil energy sources namely; coal, oil, and natural gas, which implies that global emissions of greenhouse gases will also increase significantly, greatly increasing the risk and potential impact of climate changes. Since 1970, global carbon emission from combustion of fossil fuels has gradually increased, reaching 5.8 billion metric tons in 1990 and 6.2 billion metric tons in 1997(EIA, 2002: 5). Moreover, global carbon emissions are expected to rise to 7.8 and 9.8 billion metric tons in 2010 and 2020 (IEA, 1998 cited in Dincer, 1999: 846). Therefore, increasing energy efficiency by 20-30% over the next two to three decades will not only reduce the energy bill but it will also reduce greenhouse gas emissions by 4 to 6 billion tons per year and substantially curb local and regional air pollution (MEM, 1998: 4).

In Thailand, the figure of air pollutant emissions by types from energy consumption illustrates that there was a gradual increase in CO_2 emission from 1993 to 2000. Table 1.4 shows the details of such figures. Carbon dioxide emissions increased from 108,269 kiloton in 1993 to 146,560 kiloton in 2000. Consequently, the conservation of fossil fuels is prominent in any strategy to reduce the threat of global warming and also is the cheapest and quickest way of combating global warming (Brown, 1998: 1; Glasson, et al., 1999: 11; Smith, 2001: 5-11).

Table 1.4 Estimated Air Pollutant Emissions by Types from Energy Consumption [1/]

Year	Sectors	Energy Consumption ktoe	CO_2	CO	NOx	CH_4	SO_2	10^3 ton SPM
1993		**46,398**	**108,269**	**2,897**	**489**	**57**	**1,265**	**71**
	Transport	14,581	35,683	350	170	3	90	13
	Power 3/	13,575	40,977	12	104	1	900	44
	Manufacturing	9,724	22,939	109	105	3	249	6
	Res. & Com.	6,687	3,002	2,350	31	49	4	0
	Others 4/	1,831	5,668	76	79	1	22	8
1,994		**50,700**	**121,278**	**2,808**	**528**	**55**	**1,326**	**76**
	Transport	16,336	39,960	405	191	3	100	14
	Power 3/	15,224	45,639	14	116	2	941	48
	Manufacturing	10,770	26,419	112	115	3	257	6
	Res. & Com.	6,429	3,251	2,201	29	46	5	0
	Others 4/	1,941	6,009	76	77	1	23	8
1995		**56,455**	**137,246**	**2,677**	**587**	**52**	**1,428**	**101**
	Transport	18,754	46,938	446	219	4	120	17
	Power 3/	16,795	49,911	23	127	2	987	71
	Manufacturing	12,940	31,009	133	137	3	296	5
	Res. & Com.	6,093	3,588	2,001	27	42	3	0
	Others 4/	1,873	5,800	74	77	1	22	8
1996		**61,452**	**153,492**	**2,586**	**638**	**50**	**1,410**	**147**
	Transport	20,094	51,405	482	230	4	69	18
	Power 3/	18,794	56,471	22	142	2	1,042	113
	Manufacturing	14,517	34,950	151	153	4	275	7
	Res. & Com.	5,914	4,055	1,852	26	39	5	0
	Others 4/	2,133	6,611	79	87	1	19	9
1997		**63,963**	**158,201**	**2,650**	**657**	**51**	**1,407**	**233**
	Transport	21,399	54,837	507	252	4	73	20
	Power 3/	20,857	61,796	24	156	3	1,056	200
	Manufacturing	13,789	31,669	147	150	3	259	5
	Res. & Com.	6,025	4,027	1,898	26	40	2	0
	Others 4/	1,893	5,872	74	73	1	17	8
1997								
	Transport	**58,724**	**143,354**	**2,664**	**603**	**52**	**915**	**193**
	Power 3/	18,856	47,982	472	216	4	63	17
	Manufacturing	19,904	57,461	25	150	3	605	160
	Res. & Com.	11,761	27,543	125	118	3	231	7
	Others 4/	6,044	3,678	1,961	27	41	1	0

Table 1.4 Estimated Air Pollutant Emissions by Types from Energy Consumption [1/] (Continued)

Year	Sectors	Energy Consumption [2] ktoe	CO_2	CO	NOx	CH_4	SO_2	10^3 ton SPM
1999		60,886	147,450	2,732	637	54	877	285
	Transport	18,991	47,649	465	214	4	21	17
	Power 3/	20,128	57,347	27	153	3	616	252
	Manufacturing	13,046	30,954	134	138	3	228	6
	Res. & Com.	6,270	3,899	2,021	27	43	1	0
	Others 4/	2,451	7,601	85	105	1	11	10
2000		61,733	146,560	2,759	640	55	587	185
	Transport	18,649	46,401	453	208	4	21	16
	Power 3/	20,886	57,788	31	161	4	341	153
	Manufacturing	13,395	30,922	136	137	3	220	6
	Res. & Com.	6,459	4,306	2,051	28	43	1	-
	Others 4/	2,308	7143	88	106	1	4	10

Source: DEDP, 2001d: 26

Note: [1/] Emissions are estimated according to Revised 1996 IPCC Guidelines for GHG Inventories. CO_2 emission excludes emission from international bunker oil and renewable energy and non CO_2 emission excludes emission from international bunker oil.
[2/] Energy consumption (excluding electricity) by end-use sectors.
[3/] Electricity generation from power sector excludes hydro electric.
[4/] Others include agriculture, construction, and mining.

1.1.4 High Potential in Energy Saving in Major Economic Sectors

Soontorn and Surprenant (1996: 243-253) noted that the results of the studies conducted by the Energy Research Institute of Chulalongkorn University, the Energy Conservation Center of Thailand, Chaing Mai University, Asian Institute of Technology, and the King Mongkut Institute of Technology strongly indicated that there were immense potentials for energy conservation in major economic sectors in Thailand. For example, Bangkok commercial buildings can conserve 23-48% of their total electricity consumption from lighting retrofits and the resultant interactions with air-conditioning systems (Busch, et al., 1994 cited in Soontorn and Surprenant, 1996: 249).

In the industrial sector, which is highly energy intensive, efficiency is well below that in developing countries compared to industrialized countries. It has been estimated that the technical potential of energy efficiency improvement in this sector is around 30-50% of total energy used (UNESCAP, 1999). However, not all energy savings that are technically possible are also economically viable. Approximately half of them are both technically and financially sound, and cost effective. Even though cost effective opportunities are available, many businesses do not, at present, use such opportunities. There is evidence that in a complex world, people and managers have many concerns and most have higher priorities than energy efficiency. Moreover, some view energy efficiency investment as risky in a world of fluctuating and uncertain energy prices and so a promised return will not materialize. Therefore, it is necessary to build a clear understanding among factory owners or managers that energy conservation is a crucial measure to reduce both production costs and the greenhouse effect.

1.1.5 Increasing Role of Energy Conservation to Curb Energy Problems

With the results of the significant problems on energy consumption matters mentioned above, policies were developed to curb the growth of energy demand and increase the domestic energy supply, in particular, natural gas to substitute for imported oil. The major approaches to cope with the high growth in energy demands are firstly to conserve energy by using efficiency and being economical, and secondly to substitute energy imports (or known as fuel switching) (ADB, 1987: 1). The Thai government has done both to lessen the problems. For the first approach, the government launched an energy conservation program in the early 1980s and finally, in 1992, the program was developed into the Energy Conservation Promotion Act B.E. 2535 (1992) (hereafter known as the ECP Act). The second alternative can be achieved by developing domestic energy resources, particularly natural gas instead of imported oil, or promoting utilization of renewable energy. Obviously, it is increasingly apparent that conservation has played a central role in solving energy problems since the fuel switching approach is still in the research and development process and not cost effective at present (Christie, 1993: 28). Consequently, a policy

is needed to be a frame to support implementation of energy conservation activities and to overcome several barriers during implementation.

This dissertation will pay special attention to the first alternative, to conserve energy.

1.2 Significance of the Problems

Prior the enactment of the Energy Conservation Promotion Act B.E. 2535, the government initiated energy conservation programs beginning in the late 1970s after Thailand was attacked by the oil price crisis. At the beginning, the programs were executed on a voluntary basis. The organizations that were interested in carrying out energy conservation activities were able to request support from the National Energy Administration (NEA), currently the Department of Energy Development and Promotion (DEDP).

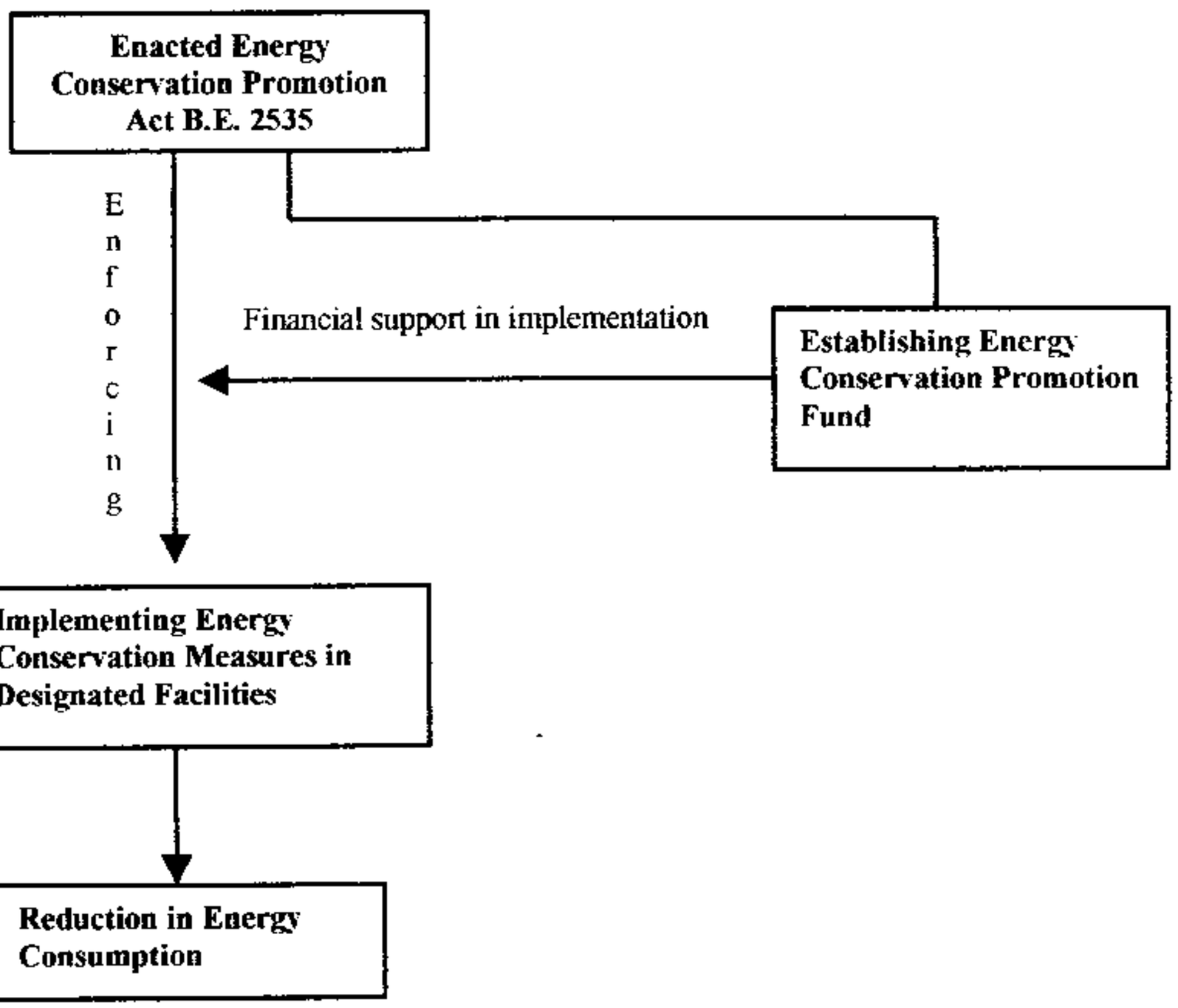
Several kinds of support, such as a free energy auditing service, energy conservation technology information and advice have been provided by NEA. Import tax exemptions for importing energy conservation machines or equipment, and low interest rate loans to invest in energy conservation projects were also part of the program. In 1985 with support from the Federation of Thai Industries, the Energy Conservation Center of Thailand (ECCT) was established as a core for energy conservation promotion. However, the results of energy conservation activities during this period seemed unsatisfactory in that reduction in energy consumption was not achieved. Several reasons for this failure can be identified, namely, the loan provided was limited in amount and complicated in application. As well, the import tax exemption did not function well, and the factory owners were not aware of the importance of the energy conservation issue. Most of them mainly focused on production expansion rather than cost reduction through energy conservation. Furthermore, the cost of reduced production due to plant stoppages for refitting can far outweigh minor cost savings.

As a result, the government revised the energy conservation program and formulated a mandated policy. In April 1992, the Energy Conservation Promotion Act

(ECP Act) was enacted and the large energy consumers were required to comply with the ECP Act. Within this Act, the Energy Conservation Promotion Fund (ECP Fund) was established as a key mechanism to support and promote the undertaking of energy conservation activities in Thailand.

The relationship of the ECP Act and ECP Fund is illustrated in figure 1.3. Attempts to utilize the enforcement of the ECP Act and financial support from the ECP Fund to promote the implementation of energy conservation activities are expected to produce the desired reduction in energy consumption.

Figure 1.3 The Relationship of the ECP Act and the ECP Fund in Promoting Energy Conservation Implementation.



The promulgation of the ECP Act in 1992 focuses on the high-energy consuming facilities, particularly the large industries and buildings that are categorized as the designated facilities. These designated facilities are mandated to comply with the ECP Act; otherwise, they will be penalized. The designated facilities

are the facilities that consume either one or a combination of the following: electricity from an energy distributor's system, thermal steam from energy distributors or from self-generation, as from January 1 to December 31 of the past year at a total volume of 20 million Mega-joules or more of electrical energy equivalence (DEDP, 1992). Since the designated facilities have a large potential to conserve energy in the short term, they became the first target group to comply with the ECP Act. To comply with the ECP Act, the owners of designated facilities have to implement the following activities.

1) Assign at least one person to take a full time position at the designated facilities to take full responsibility with regard to an energy conservation program;
2) Submit information on energy production, consumption, and conservation to the Department of Energy and Development and Promotion (DEDP);
3) Keep records of information on energy consumption and installation or modification of machinery or equipment that effects energy consumption and conservation;
4) Set targets and plans for implementing energy conservation; and
5) Audit and analyze operations to achieve such targets and plans for energy conservation.

Moreover, to support the compliance with the ECP Act, the Energy Conservation Promotion Fund (ECP Fund) was set up to be used as working capital and as grants or subsidies in carrying out energy conservation work. The incentives provided by the ECP Fund are as follows:

1) One hundred percent of the cost, but not exceeding 100,000 baht per facility for the preparation of the preliminary energy audit report;
2) Fifty percent of the cost, but not exceeding 500,000 baht per facility for the formulation of an energy conservation plan based on a detailed energy audit;
3) Up to 60% but not exceeding 10 million baht per measure for any implementation of any approved energy efficiency measures in the form of interest subsidies.

The two main criteria that the designated facilities need to meet for any energy conservation measure are a minimum economic internal rate of return (EIRR) of at least 9 percent and a maximum financial internal rate of return (FIRR) not higher than market interest rate (based on the Krung Thai Bank) plus two percent. These incentives provided for the designated facilities seem to be the largest incentives for energy efficiency in all Asia, if not in the world (Brulez and Rauch, 1999).

Besides establishing the ECP Fund to support the implementation of the ECP Act, the implementing agency (DEDP) also provided training courses for the persons responsible for energy (PREs) in the designated factories to enhance their capabilities in performing energy audit and conservation functions. At the same time, energy consultants were also registered and listed at DEDP to assist the designated facilities to perform energy conservation projects. The major activities done by the registered consultants (RCs) are conducting preliminary energy audits and detailed audits at the designated facilities. The consultation fee will be partially paid by the ECP Fund and the balance left is to be paid by the designated facilities.

By considering the support to the designated facilities whether in kind or in cash, the implementation of the ECP Act should be executed as intended. However, approximately 10 years since the Act has been promulgated and enforced it seems that the progress in implementing energy conservation activities as mentioned in the Act has gone slowly. The data recorded at DEDP shows that 1,591 designated buildings and 2,497 designated factories should have been required to comply with the ECP Act as of June 30, 2001 (DEDP, 2001a: 4). In fact, only a small percentage of the designated facilities have been required to comply according to the requirements of the ECP Act. Several problems and constraints have occurred in undertaking energy conservation activities whether from the inability of designated facilities or from the administrative complexity of implementing agencies. Moreover, the policy instruments designed by the policy makers have been unable to appropriately perform as intended.

For example, the establishment of the ECP Fund to provide financial support in compliance with the ECP Act, has not eliminated the obstacles that still exist. The problems have occurred from requesting financial support. The procedures and

guidelines for obtaining ECP Fund support are complicated, difficult to understand, especially for facility owners and energy managers; therefore, it has taken more time for disbursement of the ECP Fund and a lot of documents are required. In addition, the amount of the provided fund is inadequate to invest in energy conservation measures. The designated facilities, particularly factories, are required to use additional sources of funds for investment. It seems that most of designated factories are reluctant to invest in energy conservation measures.

In addition, energy consultants were only able to meet minimum requirements for their responsibilities due to a shortage of energy professionals, and a lack of training and experience both inside and outside the company; therefore, they are unable to produce high quality work.

Beside the constraints of the Fund and the capability of energy consultants, the economic atmosphere during the last few years did not favor an investment climate. The economic recession caused a contraction of economic activities and also affected implementation of the Act in all designated facilities. However, most of them can fulfil at least some functions required by the Act.

Research is necessary to discover what is actually going on during the implementation of the Act, and to what extent the Act is able to accomplish its goals. What are major factors affecting the effectiveness of its implementation and what are the policy measures required to solve such problems? This study proposes to examine these issues. The brief objectives of the study will be shown in the next section.

1.3 Major Objectives of the Study

This study has three major objectives as follows:

1) To assess the effectiveness in the implementation of the energy conservation policy by considering whether the policy to promote energy conservation activities has achieved its objectives and intended impacts,
2) To investigate the factors affecting the effectiveness of energy conservation policy implementation, and

3) To propose policy measures and policy alternatives that promote effective policy implementation.

1.4 Scope of the Study and Limitations

1.4.1 Scope of the Study

In this study, the Energy Conservation Promotion Act B.E. 2535 will be representative of the energy conservation policy. As mentioned in the previous section, there are two entities needed to comply with the ECP Act; namely the designated factories and the designated buildings, which are classified by the annual amount of energy consumption. The characteristics of each category are shown in the following paragraph.

The designated factories are:

1) A single factory or factories under the same address which are allowed by an energy distributor to install one or more transformers of which the combined capacity is 10,000 kW or 11,750 kilo-volt ampere (KVA) or more; or
2) A single factory or factories under the same address which consume, either one or more combinations of the following form of energy: electricity from an energy distributor's system, thermal steam from an energy distributor or from self generation. As from January 1 to December 31 of the past year the total value was 200 million Mega-joules or more of electrical energy equivalence.

The factories with the energy consumption volume mentioned in item 1) and 2) above are or will be the designated factories according to the following timing:

Year 1: Factory size above 10 MW, effective on July 17, 1997 (288 Factories);

Year 2: Factory size from 3 MW up to 10 MW, effective on July 17, 1998 (604 Factories);

Year 3: Factory size from 2 MW up to 3 MW, effective on July 17, 1999 (411 Factories); and

Year 4: Factory size from 1 MW up to 2 MW, effective on July 17, 2000 (1,194 Factories)

Up to June 30, 2001, there were 2,497 designated factories required to comply with the ECP Act.

The designated buildings are:

1) Buildings with energy consumption of more than 1,000 kW or those authorized to install one or more transformers with a total capacity of 1,175 kilo-volt ampere (KVA) or
2) Buildings with electricity and/or commercial energy consumption and/or consumption of thermal steam in the past year in a total volume of 20 million Mega-joules or more electrical equivalence.

The Royal Decrees for the designated buildings were signed and published on August 1995 and came into effect 120 days later on December 12, 1995. As recorded by DEDP, the number of current designated buildings is 1,589 units (as June 30, 2001).

1.4.2 Limitations of the Study

Ideally, the study of effectiveness of policy implementation should be done on all designated facilities. However, due to budget and time constraints, this study is unable to cover all designated facilities; therefore the study is limited to the designated factories. All four types of designated factories throughout Thailand will be considered as a target population. The period of study is focused on the first half of the year 2002. Related data and information on policy implementation is based on what happened in this period. The effective policy implementation in this study would be considered only from the perception of PREs of the designated factories; in fact the effectiveness should be measured by using empirical data, which would be more valid and reliable. Since the study has been conducted during the initial stage of policy implementation, then the researcher was unable to attain such data.

The recommendations for improvement are based on the results from the designated factories side, although some of the results may well apply to designated buildings.

Theoretically, to assess the effectiveness of policy implementation, one should view it from both the implementers' perspective and the target groups' perspective. However, this study is limited to focus only on the target group side; because it is believed that the effectiveness of policy implementation will be attained if the target groups comply with the policy.

1.5 Definitions

This section intends to clarify several concepts exploited in the study, which are:

1.5.1 Energy Conservation

The ECP Act defines the term energy conservation as to produce and use energy efficiently and economically (DEDP, 1992: 1).

Several energy scholars also apply similar meanings to the term energy conservation. For example, energy conservation is "the careful and sparing use of energy with a view to conserving the natural resources from which energy is derived (especially fossil hydrocarbons) and minimizing environmental pollution" (Couhnihan, 1981: 53). Siddayao (1983: 199) viewed that the terms "energy conservation" and "energy efficiency" are often used interchangeably. The term also takes on specific notions, depending on the conceptual framework within which the term is used. The term "conservation" and "efficiency" are often used solely in connection with a reduction in energy usage. In fact, if energy is viewed as an input of any activity, its use must be viewed in terms of its ability to perform the work it was intended to do, at minimum total cost to society.

Moreover, energy conservation can be defined as deliberate reduction in the use of energy below some level that would prevail otherwise. An important subset of effective energy conservation measures consists of the substitution of some form of costly or scarce energy resource by some other that is more readily available and economical (Munasighe and Schramm, 1983: 176).

For Mack (1980 cited in Siddayao, 1983: 199), the term conservation implies the "preservation and management of limited physical stock" of some resources.

Slesser (1978: 144) mentioned that conservation is about using less energy, but the interpretation of that statement varies widely. At one extreme there are people, notably in environmental movements, who believe that we should all simply use less energy. At the other extreme, we have the technical fix-view that if less energy can achieve the same result in production, comforts, and mobility as before, then by all means do it.

Energy conservation can be defined as lowering the rate of energy consumption, as a consequence of either more technically efficient use of energy or of decreased demands for energy usage or of behavioral changes (Cooper, 1996: 259).

Humphrey and Buttel (1982: 153) mention that energy conservation involves increasing the energy efficiency, or lowering the energy intensity, of a given process. There are two components to this term. First, energy conservation is the substitution of non-energy resources for energy, for example, using more household insulation so that less energy is required for home heating or cooling. The second facet of conservation is changes in the behavior of individuals or changes in social life styles.

UNESCAP notes that energy conservation is achieved when growth of energy consumption is reduced, measured in physical terms. It can be the result of several processes or developments, such as productivity increases or technological progress. Also, another way to conserve energy is to consume less, possibly sacrificing output, consumption or comfort. Energy conservation and energy efficiency are similar but not the same. Energy efficiency can be achieved when energy intensity in a specific product, process or area of production or consumption is reduced, but does not involve sacrifices or reduction of output, consumption or comfort. It follows then, that promotion of energy efficiency will contribute to energy conservation and is therefore regularly an integral part of energy conservation promotion policies (Hollander and Schneider, 1996: 274; and UNESCAP, 1999)

In summary, the term "energy conservation" can be defined as the reduction in the use of energy that can be gained as a consequence of more technically efficient use of energy, or of a decrease in energy demand, or of a change in behavior, without sacrifice to output, consumption, and comfort. This study employs this meaning when using the term energy conservation.

1.5.2 Public Policy

For the definition of public policy, many policy scholars give several definitions. Dye, for example, defines that "Public policy is whatever government chooses to do or not to do" (Dye, 1984: 1). Lasswell and Kaplan (1950: 71) say, "Public policy is a projected program of values and practices". Frohock (1979: 11) mentions, "Public policy is, in its most general sense, the pattern of action that resolves conflicting claims or provides for cooperation". Anderson (1975: 3) articulates that policy is a purposive course of action followed by an actor or set of actors in dealing with a problem or matter of concern. In addition, Roberts also defines, "Public policy is a set of interrelated decisions taken by a political actor or group of actors concerning the selection of goals and means of achieving them within a specific situation where these decisions should, in principle, be within the power of these actors to achieve" (Roberts, 1971 cited in Jenkins, 1978: 15). Nakamura and Smallwood (1980: 31) say that policy can be defined as a set of instructions from policy makers to policy implementers that spell out both goals and the means for achieving these goals.

1.5.3 The ECP Act

The ECP Act means the Energy Conservation Promotion Act B.E. 2535 and represents the energy conservation policy or the Policy in the study.

1.5.4 The ECP Fund

The ECP Fund means the Energy Conservation Promotion Fund or the Fund.

1.5.5 Effectiveness of Policy Implementation

In this study, the effectiveness of policy implementation is considered as the extent to which the policy implementation has achieved its intended objectives. However several criteria may be used to measure the effectiveness of policy implementation, namely, policy goal attainment, efficiency (Rossi and Freeman, 1989), constituency satisfaction, clientele responsiveness, and system maintenance

(Nakamura and Smallwood, 1980). The research literature on policy effectiveness will be presented in chapter three.

1.5.6 The Designated Factory

The designed factory (DF) is a factory that is mandated to comply with the Act.

1.5.7 The ECAs

The ECAs mean the energy conservation activities that the DF is required to perform to comply with the Act.

1.6 Benefits of the Study

This study provides the following benefits:

1) Information on the current situation of implementation on the ECP Act in the designated factories;
2) Knowledge on proper assessment methods that can be applied to other public policies; and
3) The findings that can be used for the policy makers, planners and implementers as a framework for launching and guiding the policy actions designed to support and encourage designated facilities to conserve energy.

1.7 Organization of the Study

The study is presented in seven chapters.

Chapter one covers the statement and significance of the problems, which refers to high growth in energy demand, high dependence on energy import, the awareness of greenhouse effect, and the role of energy conservation to curb energy problems. This chapter also includes the objectives of the study, scope of the study and limitations, key definitions used in the study, the benefits of the study, and the organization of the study.

Chapter two presents an overview of energy conservation policy in selected Asian countries (China, Indonesia, Korea, and Japan), energy policy and energy conservation in Thailand, and the governing bodies responsible for energy policy and implementation. In addition, the substance of the Energy Conservation Promotion Act B.E. 2535 (1992), the Energy Conservation Promotion Fund, and the organization responsible for energy conservation policy and implementation are also described in this chapter.

Chapter three reviews previous studies regarding the effectiveness of policy implementation, and the evaluation of the energy conservation policy. Also included is a theoretical framework, a proposed model for analysis, logical relationships between the dependent variable (effectiveness of policy implementation) and independent variables (supporting fund, technical support, availability of and accessibility to external funding, policy knowledge and experience, external impact, compliance limitations, compliance cost, compliance ability, compliance willingness, and degree of compliance).

The methodology part is shown in chapter four, which covers the sampling procedures, data collection, operationalization of variables and measurement, the research hypotheses, and validity and reliability tests.

Chapter five exhibits the characteristics of samples by type of designated factories, TSIC group, and location of the factories; descriptive statistics of variables involved in the study; the results of the study, and findings and discussion.

Chapter six displays the qualitative results obtained from the open-ended questions in Part V of the questionnaires and from in-depth interviews. The qualitative results cover not only opinions of the PREs regarding implementation of energy conservation activities prescribed by the Act, but also the opinions of key informants in the government agencies and energy scholars on implementation of energy conservation activities.

The last chapter is the conclusion and recommendations, policy implications and management options, and recommendations for future research.

CHAPTER 2

ENERGY POLICY AND ENERGY CONSERVATION

This chapter contains four major sections: (1) overview of energy conservation policies in some selected Asian countries; (2) review of energy policy and energy conservation in Thailand; (3) energy conservation policy in Thailand; and (4) chapter conclusion.

2.1 Overview of Energy Conservation in Asian Countries

Prior to the emergence of two-oil crises, the energy policy in all countries typically focused on the development and management of energy resources and the supply side; few countries were concerned with energy use or demand management. The emergence of oil price shocks caused sudden and dramatic trade imbalances. In addition, an economic recession stimulated all countries to consider the efficient use of energy. As a result, some oil-importing countries introduced energy conservation promotion activities and laws as emergency measures in the 1970s and the early 1980s. The countries who initiated energy conservation laws during these periods were the United Stated of America, Japan, and Republic of Korea (UNESCAP, 1999). There were others that followed and promulgated energy conservation laws in their countries, e.g. members of the European Union such as Germany, Sweden and Denmark etc.

Energy conservation policies in some Asian countries, namely China, Indonesia, Japan, and Korea, also evolved. The details of each country are as follows:

2.1.1 China

The study on "Energy Conservation as a Mega-policy: The Case of China" done by Gan (1995: 161-175) mentioned that the initiatives of the energy

conservation policy came from the dramatic economic changes over the past two decades as a result of the open-door policies in 1979 and economic reforms of the 1980's and early 1990's. Also, the influence of energy and environmental issues in the economic transformation had an impact. Development of energy was considered as a strategic area of policy making because energy shortages would block the growth of industrial production and constrain economic output. The Chinese government began to increase the energy supply, particularly through investment in electric power generation. It invested in the construction of coal-burning, hydroelectric and nuclear power plants in order to meet pressing energy demands. Meanwhile, China suffered from severe inefficiencies in energy use: one dollar of production output in China consumed four or five times more energy than was required in industrial countries. As a result, the policy makers began to pay more attention to energy conservation and the development of energy-saving technology.

According to the Gan study, energy policy evolution in China can be classified into five periods. The first period, **the Period of Awakening**, began after 1979 and 1980 when the government was awakening to the seriousness of the problem. A second stage, **the Period of Policy Formulation,** was from 1980 to 1983 when energy policies dealt with serious energy crises and environmental problems. The third period, **the Period of Policy Strengthening,** started during 1983-1988 when the government strengthened the institutions required to implement them. The fourth stage, **the Period of Policy Assessment** during 1988-1991, called for careful assessment and recalibration of energy policies and technology choices. The final stage, **the Period of Policy Adjustment**, started in 1991 when the government began to adjust, refine, and integrate its energy and environment policy. The brief details in each period can be summarized below.

2.1.1.1 The First Period, 1979-1980

Before the late 1970s, China's economy was dominated by the Maoist ideology, particularly the concept of a self-reliant economy. Most leaders believed that external factors could not attack its economy, the energy crisis in particular, since China's economy exploited the domestic energy supply. In fact, what the leaders thought was wrong. China encountered a severe energy shortage; domestic energy

supply could not serve the rising demand. As a result, government action was urgently required to handle energy problems. This was the first time energy conservation measures were in the government leaders' minds. They began to set annual saving targets for energy saving and proposed financing, technology, and implementation measures.

2.1.1.2 The Second Period, 1980-1983

The second phase of the energy policy evolution brought a dramatic shift in the government's agenda. The influence of energy experts and environmental officials affected the perceptions of top leaders about the relationships among economic development, energy, and the environment. Later on these issues were integrated into public policy making. Since the 1980s, approximately 30 laws and regulations concerning energy conservation have been formulated and implemented (Ruqui, 2002: 22). Moreover, the energy conservation issue has become a higher priority in economic development plans.

The early energy conservation policy focused on projects that could yield quick economic returns, namely, investment in improved technologies by upgrading low efficiency industrial boilers or investment in co-generation systems; both of the projects provided economic returns within one or two years.

2.1.1.3 The Third Period, 1983-1988

The regulatory enforcement in energy conservation emerged in the third period when the State Science and Technology Commission (SSTC) played a central role in shaping energy conservation policy. Regulatory enforcement regarding energy conservation was introduced. For example, "the Energy Conservation Technology Policy" was introduced in 1985, "Technology Standards for Appraising Rational Use of Electricity in Industrial Enterprises" and "the Notice for Disseminating Energy Conservation Technology Measures" were promulgated in 1987. In addition, institutions such as the Energy Conservation Department were established or strengthened at the national level and within provincial and local governments. State enterprises also formed energy conservation units to implement the policy. Management controls for energy conservation were made part of the management responsibility system in manufacturing industries and played vital roles

in achieving energy-saving targets. Economic incentives were used later to complement the management enforcement system.

2.1.1.4 The Fourth Period, 1988-1991

New technologies for energy conservation became the main focus during the fourth phase. The outdated energy technologies were the main causes of inefficiency and the government officials were aware of this limitation. Consequently, many research projects were initiated. The Ministry of Energy began to express interest in energy policy research and sponsored demonstration projects aimed at disseminating new energy technologies, equipment, and products, including improved coal combustion, renewable energy, and rural energy conservation technologies.

2.1.1.5 The Fifth Period, 1991-1995

An historical event in China's economy occurred in this period. Its economy was shifted to a market-oriented economy. This marked the end of the centrally planned economy. The new economic system created uncertainty among the government leaders. They began to investigate options for energy conservation in the future. In the early 1990s, the "Outlines of Technical Policy of Energy Saving" were formulated to guide the development and application of energy-saving technologies (Ruqui, 2002: 22). Government agencies sponsored research projects regarding energy issues such as the projects on "Coal Industry under the Transition toward a Market Economy" and "Energy Conservation under the Regulation of a Market Economy". In addition, they also promoted clean coal technology assessment in response to the concern of reducing CO_2 emissions. New organizations were established in China to deal with the issues of environmental protection and natural resources management. The Energy Conservation Investment Corporation was also established to promote energy conservation investment.

Based on the review of the evolution of the energy policy in China, it can be concluded that the factors affecting the initiation of energy conservation policy in China involved the energy crisis and environmental concerns. Furthermore, energy experts and government leaders, including Zhao Ziyang, the former chairman of the Communist Party, advocated conservation.

Even though China recognized the importance of the promotion of energy conservation, it still paid more attention to expanding energy supplies to serve the domestic energy demand. As much as 93.8% of energy investment funds were allocated for expanding the energy supply, while only 6.2% was used in energy conservation investment (Zhang, 1995: 159-166). As a result, there was a deficiency of investment for energy conservation. In order to encourage future energy conservation investment, Zhang proposed that the Chinese government should provide economic incentives for energy conservation and at the same time the subsidies for energy consumption should be eliminated. Moreover, cooperation with international funds has been recommended to ease financial constraints and promote transfers of technology and know-how.

2.1.2 Indonesia

Indonesia is quite different from other countries presented in this study because Indonesia has its own energy resources, particularly fossil fuels, which are considered as a major source of foreign currency. Because of these resources, the energy prices of both the petroleum products and electricity in Indonesia are relatively low (Sudarsono, 1999: 4).

From 1969 to 1997, Indonesia's economy grew at 6.8 per cent per annum. This high economic growth had been accompanied by a high growth in commercial energy demands of about 15 per cent per annum (Sudarsono, 1999: 4). In the meantime, the finiteness of fossil energy resources pushed Indonesia to take action to optimize the utilization of energy resources.

To achieve this objective, the utilization of energy resources needed to be shifted from the export of energy, towards energy use, in support of the industrialization process to attain sustainable development.

The energy development policy in Indonesia includes five principle issues, namely: energy diversification, intensification of exploration for energy sources, energy conservation, energy pricing, and the environment (Indarti, 2001: 2-3).

The principle of conservation is applied at all stages of utilization, beginning with energy use at its source up to its end use to ensure the fulfillment of future

generations' needs. The energy conservation effort applies to both the upstream and the downstream sides. The upstream side means that energy conservation is implemented through increasing the efficiency of energy source extraction, while downstream conservation is concerned through increasing efficiency of energy end-use in all sectors (Indarti, 2001: 3).

More recently, the Ministry of Mines and Energy realized that the energy conservation program should be institutionalized. As a consequence it formulated a Master Plan on National Energy Conservation. This plan was intended to provide guidelines to all concerned public and private sector entities on the implementation of the energy conservation policy. The government agency, acting as the coordinating agency on energy conservation, is the Ministry of Mines and Energy.

With respect to the Indonesia context, the researcher found that the major reason for supporting energy conservation activities in Indonesia was the concern of economic expansion, which causes a high growth in energy demand. Even though Indonesia is an oil-exporting country, they realize that their energy resources are finite and may be unable to support economic development over a long period of time. Therefore, the energy conservation plan included both increasing the efficiency of energy source extraction and increasing efficiency of energy use.

2.1.3 Japan

Since Japan relies heavily on foreign energy supplies to fuel its economic growth (approximately 80% of primary energy supply is from import), the two-oil crises in the mid 1970s and early 1980s severely attacked its economy. In response to these crises, the Advisory Committee for Energy introduced a set of energy policies. Energy supply security was given the highest priority, and this was to be achieved through (1) reducing dependence on petroleum by diversifying energy sources; (2) stabilizing petroleum supplies; (3) promoting energy conservation; and (4) researching and developing other energy sources (Fukasaku, 1995: 1063-1076), such as nuclear power and other "oil alternatives", energy supply sources (i.e., coal, natural gas, renewable energy (Dooley, 1999: 2). With respect to developing other energy sources, nuclear power energy plays an important role in the energy policy. Its output

nearly doubled between 1985 and 1996. Several accidents at nuclear facilities in Japan caused public debates on this issue and many efforts have occurred to block the establishment of nuclear power plants. The Japanese government still insists on continuing expansion of its nuclear energy system by providing "grants" or "subsidies" to local communities willing to host nuclear facilities. The Japanese government believes that it will need to increase electric power generation from nuclear plants by more than 50% over 1997 levels by 2010.

With regard to energy supply security, stabilizing petroleum supplies and conserving energy were emphasized. In particular, energy conservation was ranked a high priority as a means to secure domestic energy supplies, which are unaffected by international political factors. Moreover, to confirm support on energy conservation, a law to promote energy conservation was adopted in 1977, and in 1997 was transformed to the "Law Concerning the Rational Use of Energy (or known as the Energy Conservation Law)". Therefore, conservation law has been a fact of life in Japan since the first oil crisis (Ishiyama, 1999: 1; and Fukasaku, 1995: 1063-1076). Japan is recognized as the country that successfully implemented energy conservation programs. Its energy intensity per GNP has decreased dramatically over the past two decades as well, energy conservation technologies are more advanced in Japan. With the increase in end use energy efficiencies, Japan's commitment to reduce 6% of greenhouse gas emissions from 1990 levels within a five year period from 2008 to 2012 can be achieved.

Despite the achievement in the reduction of energy consumption in its country, Japan never neglected to improve energy efficiency matters. In 1993, the "Law Concerning the Rational Use of Energy" was amended with a goal of further enhancing the efficiency of energy use. At the same time, the Japanese government established the "Recycled Resources Utilization" or known as Energy Conservation Assistance Law' and applied it to involve assisting business operators who voluntarily tackle such activities as the rationalization of energy use and utilization of recycled resources (IEA, 2002: 2).

The most recent and important development in energy efficiency in Japan is the revised Energy Conservation Law was issued on June 5, 1998. The point of the

revised law is intended to force the factories, and manufacturers of automobiles and appliances to comply with stricter energy efficiency standards.

The obligations of energy usage are determined by the Ministry of International Trade and Industry (MITI), which was recently changed to the Ministry of Economy, Trade and Industry (METI). The details of the Energy Conservation Law in Japan can be seen in the paper on "Energy efficiency Policies 2000 and 2001" (IEA, 2002: 2).

Based on Japan's experience, the major factors driving the initiation and implementation of energy conservation policy are the awareness of the government on the importance of energy to economic growth and a concern with environmental impacts from energy consumption. A few years after the first oil shock, the Japanese government enacted a law to promote energy conservation in 1977. Japan was the first country in Asia to promulgate such a law. At the same time, the Japanese government introduced several mechanisms to support the implementation of energy conservation measures, such as providing tax incentives, low interest loans, and supporting research and development of energy efficient technology. These mechanisms are still working today.

2.1.4 Korea

The Republic of Korea has experienced rapid economic growth over the past three decades, which transformed its economy from an agrarian economy to a newly industrialized country (NIC). The early stage of Korean industry started with light industries, particularly textiles and after that it shifted gradually to heavy industries such as petrochemical, cement, iron, steel, machinery and automobiles which consumed more energy (Mi-Chung, 1999: 1). Therefore, the Korean economy became highly dependent on imported oil (approximately 97% of its energy requirements).

The two oil crises in the '70s and '80s caused Korea to pay attention to energy efficiency and conservation, together with ensuring a stable supply of energy. At the same time, the Korean government also promoted utilization of nuclear power. These factors have gained a higher priority in its energy policies. To respond to the second oil shock, the Ministry of Energy and Resources was set up in 1978 (later

incorporated into Ministry of Trade, Industry and Energy (MOTIE) to administer the planning and enforcement of national energy policies. In December 1979, Korea promulgated the Rational Energy Utilization Act (REUA), which was aimed at ensuring energy security in an emergency situation and promoting energy efficiency and conservation. Furthermore, to support the implementation of energy efficiency and conservation programs, the Republic of Korea Energy Management Corporation (KEMCO) was set up in 1980 to function as the national energy efficiency center.

Drafting the "Basic National Energy Plan and the Basic Plan for Rational Use of Energy" was (and is) a responsibility of the Minister of MOTIE. The energy plan will be updated every five years. Moreover, the heads of authorities concerned and the city and provincial governors are responsible for drafting and updating the "Action Plan for Rational Use of Energy". The governing body in energy management in Korea is the National Energy Conservation Promotion Committee headed by the Prime Minister and is comprised of not more than 25 members including the Prime Minister.

Recently, the Korean government is pushing for energy conservation and efficiency in an effort to cope with environmental problems such as global warming. Since the early 1990s, Korea's energy policy has focused on three major areas, namely, environmental protection, competitiveness, and safety. Major measures aimed at achieving environmental protection include energy conservation through the improvement of energy efficiency and the expansion of reliance on natural gas and nuclear power, as well as an increase in research and development into energy related technologies (Sohn, 1997: 1-3).

To promote energy conservation, Korean government plans to initiate a "pan-national energy saving campaign" to help strengthen public awareness and participation in the energy conservation movement. In addition, the government plans to promote the transformation of Korea's socio-economic structure into one that recognizes the significance and need to promote and practice energy conservation, it also plans to promote investment in energy-saving facilities and development of energy conservation technologies.

The expansion of reliance on natural gas and nuclear power can be seen as alternative energy sources that reduce dependence on oil-imports and results in reduction of pollutants. In 2002, approximately 119 million kWh was generated by the nuclear plants, supplying nearly 39% of Korean's energy demand; this is expected to grow to 45% in 2015 (UIC, 2003: 1). Nuclear power has been seen as a major element of electricity production.

The second priority of Korea's energy policy is a stable supply of energy as well as a strengthening of its industrial competitiveness. The introduction of deregulation and increased competition among industries in all energy sectors is in progress. Moreover, the government also encourages private participation in power generation projects to develop new energy-related technologies and raise their competitiveness.

The third aspect of the government's current policy is safety management regarding the construction and the use of gas pipeline networks, the construction and use of nuclear reactors in power plants, the use of electricity and the development of coal mining.

The Korean government has a plan to readjust energy prices up to average standards maintained by non- oil producing Organization for Economic Cooperation and Development (OECD) member countries in order to reduce the excessive consumption of energy. The current energy price is comparatively lower than those of the OECD countries. (the Korea Herald, 1997). The revenue gained from a higher energy price will be used to provide financial and tax incentives to investors of energy-saving facilities.

In addition, the regulations related to efficient use of energy will be strengthened in order to meet the standards of advanced countries. Moreover, the production and sale of energy products that fail to meet energy standards will be banned.

The understanding of the evolution of energy conservation policy in some selected countries reveals the driving forces behind the initiation of energy conservation policy. Based on the review, the researcher found that the emergence of the energy crises was a major driving factor to promote the implementation of energy

conservation programs, followed by the awareness of environmental impacts from energy production and consumption. Except for Indonesia, the key driving factors are an expansion of economic growth and finite energy resources. To handle the energy problem, the governments in such countries have initiated laws regarding energy conservation. In addition, they also set up core agencies to regulate the implementation of the laws, together with the provision of several mechanisms to support the undertaking of energy conservation measures.

Among these four countries, Japan is more advanced in implementing energy conservation policies and is acknowledged as the most successful country in energy conservation.

2.2 Review of Energy Policy and Energy Conservation in Thailand

The energy conservation issue is one component of energy policy in Thailand. This section will review the development of energy policy in Thailand and its later extension into energy conservation policy.

2.2.1 The National Economic and Social Development Plan as the Major Policy Source

The period before the first oil crisis in 1973 was known as the era of cheap energy. Nearly 97 percent of the country's commercial consumption of primary energy was from imports (NEA, 1976 cited in Tienchai, 1991: 232). At that time, being dependent on imported oil was not a great concern of energy planners; most discussions were on the development of energy sources to support economic development. Since the main objectives of the First and Second National Economic and Social Development Plan were on accelerating the economic development, the provision of the necessary infrastructure required by the development, including energy development, gained high priority.

There was evidence that energy policy during **the First and Second National Energy Plans (1961-71)** was entirely aimed towards expanding and modernizing the power generation and distribution system within the context of the goal of providing

an adequate supply of electric energy from various sources, namely; hydro, steam, as well as diesel for both industrial and domestic consumption with the gradual reduction of power rates (NESDB, 1966: 36-39). During the First and Second Plan, the power generating capacities increased dramatically whether from hydro, thermal or diesel power plants (Tienchai, 1991: 232).

The Third Energy Plan (1972-1976) is similar to those of the first two plans, which focused on the development of electric energy. Included was a plan to construct new hydroelectric power plants to meet the increasing demand and emergency requirements (NESDB, 1972: 12). Unfortunately, at the beginning of the plan, the first oil shock emerged. The Thai government realized that the existing energy plan was inadequate to deal with this situation since the existing energy plan paid attention to energy supply development and exploration rather than reducing dependence on imported oil. Even when it became aware, the government could not do much to solve the problem due to the lack of experience in the oil business since foreign oil companies undertook these businesses. This became another factor contributing to the government's failure to handle the energy problems. During this period, the energy sector faced insecurity in energy supply, and higher domestic oil prices. It was also difficult to substitute with domestic energy sources (Tienchai, 1991: 233).

In the Fourth Energy Plan (1977-1981), the focus of the energy policy in this Plan called for the formulation of a "Master Plan" for long-term energy development which aimed to develop domestic fuels and energy resources to the maximum extent possible. The exploration and development of natural gas and crude oil resources in the Gulf of Thailand and in the Andaman Sea was also accelerated. The hydroelectric projects were promoted, as well as the development of other potential hydropower dam-sites to maximize the production and utilization of hydroelectric power. With respect to petroleum, the government established an organization, which was to be responsible for controlling the management and allocation of domestic fuel resources. This organization was also responsible for the formulation of oil policy, the acquisition of crude oil, the control of oil production, oil refining and oil reserves for emergency situations (NESDB, 1977: 22). In addition, the government drew up short term and long term measures to curb oil consumption.

The short-term measures include cutting oil selling time, adjusting oil prices, and reducing energy consumption by government agencies. The long-term measures included reducing oil consumption in the industrial and transportation sectors and adjusting oil prices to match world oil prices. Furthermore, the government continued to promote the use of lignite in power generation and planned to construct more hydroelectric dams. To further reduce the dependency on imported oil, a nuclear power plant was introduced in the Energy Plan for the first time.

Unfortunately, despite the government's attempts to curb energy instability problems, particularly in reducing dependency on imported oil, many of the planned objectives were not achieved. The "Energy Master Plan" did not formulate and the reduction in oil consumption gained less than expected targets. Since the government did not seriously enforce them, many measures were ineffective. In addition, the construction of hydroelectric dams could not be done due to public opposition and environmental concerns. As for the nuclear power plant, it was never seriously considered by the authorities (Tienchai, 1991: 233-235).

The Fifth Energy Plan was launched in 1982. At the beginning of the plan, the world faced the second oil crisis, which caused higher domestic oil prices and impeded economic development. It was time that the government took serious action on energy conservation. Most of the energy planners believed that the world oil price would continue rising so they needed to restructure the plan. At this time, the government actions were focused on promoting measures to conserve energy whether in transport, industrial, or residential sectors. Both the "carrot" and "stick" approaches were considered, with the former consisting of incentive schemes such as import tax exemptions on energy conservation equipment, and the latter including road-use tax increases and switching off street-lights. At the same time, the government restructured domestic energy prices to reflect oil price movements in order to eliminate the distortion in the energy price; it also promoted indigenous energy source development and supported research on the utilization of renewable energy to substitute fossil energy; As well, it streamlined the roles of government agencies in the energy sector.

Tienchai (1991: 235-236) suggested that the Fifth Energy Plan was similar to the Fourth Plan, which contained a vaguely written energy policy that lacked details concerning how the objectives were to be achieved and who would be responsible to undertake the plan. In addition, when the world oil price situation was relaxed, it seemed that the energy conservation measures faded out.

The Sixth Energy Plan (1987-1991) was not much different from the previous plans. The main objectives of this plan were as follows:

1) To reduce imported energy dependency by way of increased indigenous source development;
2) To continue adjusting the energy pricing structure in order to improve consumption efficiency;
3) To promote energy conservation;
4) To encourage private sector energy investment; and
5) To develop suitable forms of energy for the rural sector.

With this plan, Tienchai (1991: 237) said that although the plan's goals did not differ from previous ones, it differed in details and approaches in solving energy problems. Since the energy planners now had experience from the past two oil crises, they could employ more prudent approaches to curb the problems. During this plan, numerous measures were devised to carry out the planned policies, which had varying degrees of success and can be grouped into three categories, namely: supply measures, demand measures, and energy management measures. The supply measures included accelerating indigenous petroleum supply exploration and development and expanding domestic oil refining capacity and deregulating oil imports. The demand measures included revising the oil and gas pricing structure in order to minimize consumption distortion and to improve energy efficiency, and promoting conservation in the utilization of energy. The last measures included restructuring the role of government through streamlining the role of government and limiting the government energy activities and encouraging the private role in energy activities including exploration, development, transportation, and marketing.

Thailand set up the principal development guidelines during **the Seventh Plan (1992-1996)** to sustain the economic growth rate at an appropriate level and with

stability. With these guidelines, it aimed to provide an adequate amount of energy to meet demands of various economic sectors by developing more domestic sources of energy, as well as more joint energy development programs with neighboring countries on energy administration and management. Moreover, the government attempted to encourage a more efficient use of energy, and further liberalize energy development to allow the market mechanisms to function freely and to promote maximum competition, as well as encourage greater participation of the private sector in investment and management in the energy sector (NESDB, 1992: 80).

The Eighth Plan (1997-2001), the framework of energy policy is illustrated as follows (NESDB, 1997: 99-100):

1) To promote petroleum and coal development, increase oil refining and power generation capacities, and to promote the development of alternative energy sources to secure sustainable energy supplies at stable prices;
2) To reform energy-related regulations, promote the use of energy saving machinery and equipment, and encourage cooperative efforts among concerned organizations, conducive to efficient and economical use of energy;
3) To encourage private investment in the oil business and electric utilities, and strengthen the financial position of national enterprises through privatization;
4) To reduce environmental release of lead, carbon monoxide, and sulfur dioxide in the process of energy consumption from a viewpoint of environmental protection; and
5) To develop energy sources in rural regions for the benefit of fostering local industries.

During the Eighth Plan, the crucial event that emerged in this period was the economic crisis, which first began in Thailand and later spread out to Asian countries like Korea and Indonesia. The emergence of the economic crisis had a severe impact on the Thai economy as a whole in the following ways: 1) negative economic growth for the first time in a decade, 2) the devaluation of Baht currency, and 3) the

deterioration of the financial markets. The economic crisis also has had an impact on the energy sector; the empirical data revealed a decline in primary energy consumption by 7.0% in 1998, together with an enormous excess energy supply. Moreover, the crisis raised the cost of new investment capital to energy related enterprises as well as the repayment of existing foreign and local debt (Piyasvasti, 1999: 2).

The government has responded to the crisis by introducing general policy prescriptions: reduction of investment on the supply-side, price adjustments, acceleration of privatization and deregulation, and re-negotiation of specific contracts. For example, there was a substantial delay in implementing the natural gas supply agreement from Natuna (Indonesia), a few delays in the gas purchase from the Thailand-Malaysia Joint Development Area, and 3-5 years delay in about 2,700 MW of power purchase from projects in the Laos PDR (Piyasvasti, 1999: 3).

During the Eighth Plan there have been many activities and events regarding energy issues, which have determined the success and failure of implementing energy policy. These include a successful privatization of the Ratchburi Power Plant, the protest to the construction of a Coal-fired Power Plant at Prachuabkirikhan and the protest of the natural gas pipeline construction in Songkhla. Additionally, at the beginning of the year 2000, a third oil crisis emerged, which impeded economic recovery and depleted national foreign reserves.

At present, Thailand is in **the Ninth Plan (2002-2006)**. Within this plan, the Government has policies to conserve and develop energy as well as promote the efficient use of energy in balance with the country's environment and natural resources (NESDB, 2001). Efforts will be made to reduce dependency on energy sources from foreign countries. Towards this end, the following policies will be pursued:

1) Promote the combined use of energy by further developing the use and exploitation of Thailand's natural gas, which is a domestic resource, as the country's major source of energy.

2) Promote the efficient procurement and use of alternative energy sources by expediting the survey, development and procurement of alternative energy sources as well as by promoting research and development of innovative energy sources for the purpose of energy conservation.

3) Emphasize energy management to increase the competitiveness of Thailand's production sector and enhance the stability of energy prices through appropriate monetary, fiscal and managerial measures.

After a year of implementing the Ninth Plan, the crucial event that affects the energy sector in Thailand is the government administrative reform. Prior to the reform, the responsibility for energy issues was scattered to different agencies. For example, NEPO (National Energy Policy Office) the body that is responsible for formulating energy policy in Thailand belongs to the Prime Minister's Office. DEDP (Department of Energy Development and Promotion), which is in charge in executing energy conservation policy is under the supervision of the Ministry of Science, Technology, and Environment. EGAT (Electricity Generation Authority of Thailand) is under the Ministry of Interior. The scattered energy agencies belonging to several departments causes communication and coordination problems and hinders policy implementation.

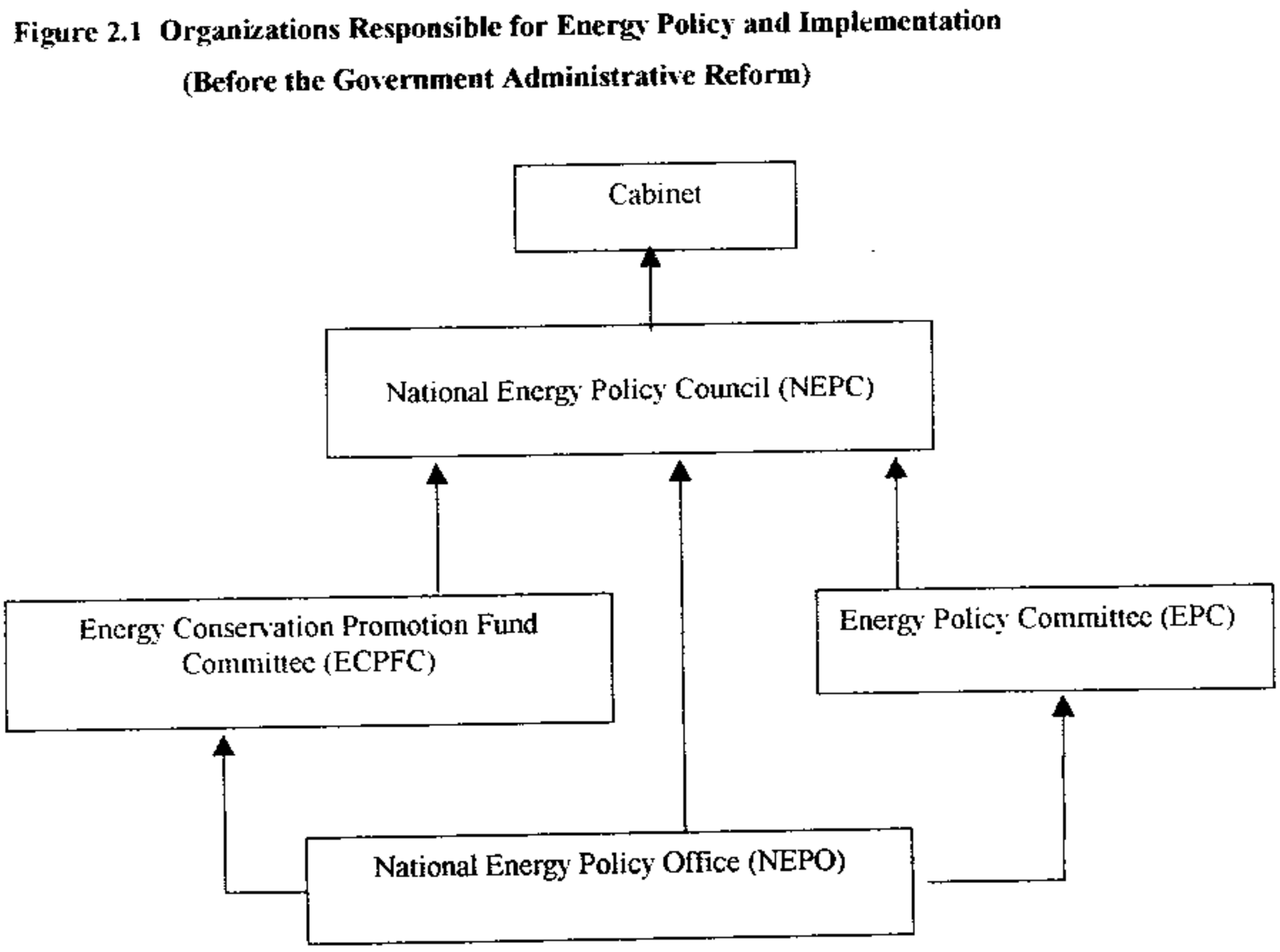
As part of the government administration reform the Ministry of Energy was established at the beginning of October, 2002, to handle energy policy and implementation in Thailand. The scattered agencies, which originally belonged to different Ministries, are now in the process of restructuring and reorganizing under the supervision of the Ministry of Energy. The expectation is that, under the same ministry, close coordination can enhance and accelerate the execution of energy policy in Thailand. However, the establishment of the Ministry of Energy occurred just a few months ago, so more time is needed to observe what will happen to the energy sector under the new Ministry and if the Ministry can perform its duties and benefit the country as intended.

The next section will focus on the governing bodies of the energy sector in Thailand.

2.2.2 Organizations Responsible for Energy Policy and Implementation

The administration of the energy sector in Thailand is done by the National Energy Policy Council (NEPC), which is chaired by the Prime Minister and consists of ministers of all ministries involved in energy policy. The National Energy Policy Office (NEPO) acts as the Secretariat. NEPC was established under the National Energy Policy Council Act, B.E. 2535 (1992). In addition, the Energy Policy Committee (EPC) has been established to assist in the work of the NEPC (NEPO, 2000c: 1). NEPC is responsible for the promotion of energy conservation and the management of the Energy Conservation Promotion Fund as outlined in the Energy Conservation Promotion Act, B.E. 2535 (1992). Accordingly, the Energy Conservation Promotion Fund Committee (ECPFC) has been established to assist the NEPC in the management of the ECP Fund to ensure that allocations are made in compliance with the regulations stipulated in the ECP Act (NEPO, 2000d: 1-6).

Figure 2.1 Organizations Responsible for Energy Policy and Implementation (Before the Government Administrative Reform)



Source: NEPO, 2000d: 1

The authority and duties of the governing bodies in the energy sector will be described in the following section.

2.2.2.1 The National Energy Policy Council (NEPC)

The authority and duties of NEPC can be summarized as follows:

1) To recommend national energy policies and national energy management and development plans to the cabinet.
2) To set up the rules and conditions for prescribing energy prices in accordance with national energy policies and national energy management and development plans.
3) To monitor, supervise, co-ordinate, support and expedite the operations of all committees with authority and duties related to energy, including government agencies, state enterprises and the private sector, to ensure that their operations are in accordance with national energy polices and national energy management and development plans.
4) To evaluate the implementation of national energy policies and national energy management and development plans.
5) To perform other functions as assigned by the Prime Minister or the cabinet.

2.2.2.2 The Energy Policy Council (EPC)

As mentioned in the previous section, the EPC is established to assist the NEPC; its authority and duties are:

1) To recommend national energy policies and national energy management and development plans to NEPC.
2) To provide comments on energy-related programs and projects of various agencies and suggest priorities for such programs and projects.
3) To set petroleum prices and premium rates to be collected for the Petroleum Fund.

4) To perform any other task as may be assigned by the Prime Minister with regard to the management of the Petroleum Fund and other duties under the Royal Decree on the Solution and Prevention of Petroleum Oil Shortage, B.E. 2516 (1973).
5) To recommend policies and measures on energy pricing and monitor tariff adjustments following the automatic adjustment mechanism.
6) To consider and recommend to the NEPC, royal decrees, ministerial regulations and other measures to be enacted under the Energy Conservation Promotion Act.
7) To liaise with ministries, bureaus, departments, local administrations, state enterprises and individuals to encourage proposals and technical appraisals related to national energy polices and national energy management and development plans.
8) To perform any other task as may be assigned by the NEPC or its chairman.
9) To appoint sub-committees to assist with particular tasks as deemed necessary.

2.2.2.3 The Energy Conservation Promotion Fund Committee (ECPFC)

The ECPFC shall have the following authority and duties:

1) Propose to the National Energy Policy Council (NEPC) guidelines, criteria, conditions and priorities for disbursement of the Fund in accordance with the objectives prescribed by the ECP Act,
2) Ensure allocation the ECP Fund is in accordance with the objectives prescribed by the ECP Act and conforms to the guidelines, criteria, conditions, and priorities prescribed by the NEPC,

3) Prescribe rules with respect to criteria and procedures in applying for grants or subsidies from the ECP Fund,
4) Propose remittance rates for petroleum products to the NEPC,
5) Propose the types of petroleum products that shall be exempted from remittance to the NEPC,
6) Prescribe surcharges under the approval of the NEPC,
7) Prescribe the exemption of surcharges,
8) Review and approve requests for promotion and assistance under the section 40(2) in accordance with the guidelines, criteria and conditions prescribed by the NEPC under section 4(8),
9) Prescribe rules with respect to the criteria and procedures in making requests for promotion and assistance under section 41, and
10) Carry out other duties as prescribed under the ECP Act.

2.2.2.4 The National Energy Policy Office (NEPO)

NEPO acts as the Secretariat of the NEPC. The authority and duties of NEPO are derived from three pieces of legislation, namely, the National Energy Policy Council Act, B.E. 2535 (1992), the Royal Decree on the Solution and Prevention of Petroleum Oil Storage, B.E. 2516 (1973), and the Energy Conservation Promotion Act, B.E. 2535 (1992). NEPO's role can be summarized as follows:

1) To carry out duties as stipulated in the National Energy Policy Council Act, B.E. 2535, and the Energy Conservation Promotion Act, B.E. 2535.
2) To develop policies, management and development plans and measures related to Thailand's energy sector in accordance with the National Economic and Social Development Plan and government policies, to be presented to the NEPC.

3) To recommend policies and measures on petroleum taxation and pricing.
4) To propose measures for both solution and prevention of petroleum oil shortages, in accordance with the Royal Decree of B.E. 2516 and to co-ordinate the implementation of these measures with related agencies.
5) To recommend polices, management and development plans, and measures related to tariff structures, demand-side management and load management.
6) To recommend policies, management and development plans, and measures related to new and renewable energy.
7) To provide comments on energy research and on funding requests from the Energy Conservation Promotion Fund for energy related research.
8) To co-ordinate and co-operate with international organizations and foreign agencies in energy related matters.
9) To perform any other task as stipulated in relevant legislation, or as may be assigned by the Primer Minister or the cabinet.

The next section will focus on the energy conservation policy, particularly the development of the policy and the current situation.

2.3 Energy Conservation Policy in Thailand

As mentioned in section 2.2, the Thai government has been involved in energy conservation activities since the late 1970s. In the beginning, energy conservation activities were initiated as a program and were conducted by the National Energy Administration (NEA), presently known as the Department of Energy Development and Promotion (DEDP). In 1985, with support from the Federation of Thai Industries and other organizations, the Energy Conservation Center of Thailand (ECCT) was

established as a core organization for energy conservation promotion. However, the promotion of energy conservation activities during this period was based on a voluntary system. Various incentives were provided to agencies interested in conducting energy conservation activities, namely, low interest rate loans, tax exemptions for importing energy conservation machinery or equipment and free energy auditing services. As a result, the intended goal, reduction in energy consumption, was not achieved. There are many reasons for this failure. For example, the loan provided was limited in amount and took a lot of time to process. Similarly, applications for tax exemptions were complex, focused on production expansion, and took a long time to process. As well, factory owners were not aware of the importance of energy conservation issues. Most of them focused on product expansion rather than cost reduction through energy conservation measures.

Efficient use of energy and its conservation not only reduces investment requirements in energy production, but also reduces the impact of energy consumption on the environment. Therefore, in the Seventh National Economic and Social Development Plan (1992-1996), the government defined strategies for energy sector development. Among these strategies, encouraging efficient use and conservation of energy gained higher importance. This promulgated the Energy Conservation Promotion Act B.E. 2535 (1992) which has been in effect since April 3, 1992.

2.3.1 Major Policy Objectives

The Energy Conservation Promotion Act B.E. 2535 (1992) contains six objectives:

1) to promote energy conservation;
2) to promote the efficient use of energy;
3) to promote the sustainable use of natural resources;
4) to promote the development and use of renewable energy sources;
5) to promote the development of energy conservation technology; and

6) to promote environmental protection.

To provide support for the investment in and operation of the energy conservation program in accordance with the ECP Act, the Energy Conservation Promotion Fund (ECP Fund) was established in the amount of 1,500 million Baht, which was transferred from the Petroleum Fund. In addition, the National Energy Policy Council (NEPC) imposed a remittance rate of 7 satangs/litre on domestic gasoline, kerosene, diesel and fuel oil to raise revenue for the Petroleum Fund, effective from November 1, 1992 (NEPO, 2000b: 2). The amount of the ECP Fund stood at 19,286 million Baht during 1994-1999 (NEPO, 2000b: 1).

2.3.2 Essence of the ECP Act B.E. 2535 (1992)

2.3.2.1 Target Groups Required to Comply with the ECP Act

As mentioned in chapter one, two groups of agencies are required to comply with the Act, namely, designated factories and designated buildings, which are classified by the annual amount of energy consumption.

The designated factories are:

1) A single factory or factories at the same address which are allowed by the energy distributor to install one or more transformers of which combined capacity is 10,000 kW or 11,175 kilo-volt ampere (kVA) or more; or
2) A single factory or factories at the same address which consume, either one or a combination of the following: electricity from an energy distributor's system, thermal steam from an energy distributor or from self-generation, from January 1 to December 31 of the past year at a total volume of 200 million mega joules or more of electrical energy equivalent.

The factories with energy consumption volume mentioned in item 1)-2) above are or will be considered as designated factories according to the following timing:

Table 2.1 Designated Factories Classified by Category and Energy Consumed (As May 31, 2001)

Category	Energy Consumed during the previous year	No. of Designated Factories
Year One	≥ 10 MW	288
Year Two	≥ 3- < 10 MW	604
Year Three	≥ 2- < 3 MW	411
Year Four	≥1- < 2 MW	1,190

Source: DEDP, 2001a: 6

As of May 31, 2001 a total number of 2,497 designated factories were required to comply with the legislation.

The number of designated factories classified by TSIC is displayed in table 2.2.

Table 2.2 Number of the designated factories classified by TSIC (since May 31, 2001)

TSIC	Year one	Year Two	Year Three	Year Four	Total
31 Food	18	108	101	329	556
32 Textile	32	94	59	137	322
33 Wood	3	6	15	62	86
34 Pulp & Paper	14	23	15	30	82
35 Chemical	64	92	68	198	424
36 Non-Metal	37	22	21	43	123
37 Basic Metal	43	47	35	60	185
38 Fabricated Metal	49	187	82	231	549
39 Others	28	25	15	104	172
Total	288	604	411	1,194	2,497

Source: DEDP, 2001a: 7

The designated buildings are:

1) Buildings with energy consumption of more than 1,000 kW or those authorized to install one or more transformers with a total capacity of 1,175 kilo-volt ampere (kVA) or

2) Buildings with electricity and/or commercial energy consumption and/or consumption of thermal steam in the past year in a total volume of 20 million mega joules or more of electrical energy equivalent.

The number of current designated building are 1,589 units as of May 31, 2001 (DEDP, 2001a:3)

Table 2.3 Number of Designated Buildings Classified by Types (Since May 31, 2002)

Types	Number
Hotels	260
Hospitals	214
Educational Institutions	149
Office Buildings	608
Department Stores	204
Others	154
Total	1,589

Source: DEDP, 2001a:3

2.3.2.2 Duties of the Owners of the Designated Facilities

The owners of the designated facilities have to conserve energy, audit and analyze energy utilization in their facilities in accordance with the standards, criteria, and procedures as provided by the Ministerial Regulations issued by the Minister under the recommendation of the National Energy Policy Council (DEDP, 1992: 5)

The owners of designated facilities are required to undertake the following duties:

1) Assign at least one person to take a full time position at the designated facility to take full responsibility with regard to the energy program;
2) Submit information on energy production, consumption, and conservation to the Department of Energy Development and Promotion (DEDP);

3) Keep records of information on energy consumption and installation or modification of machinery or equipment that effects energy consumption and conservation;
4) Set targets and plans for implementing energy conservation; and
5) Audit and analyze operations to achieve such targets and plans for energy conservation.

With the above requirements, the owners of designated facilities have to comply with the Act; otherwise they will incur a penalty.

2.3.2.3 The Implementation Plan of the Designated Facilities

The Royal Decree on Designated facilities and relevant Ministerial Regulations issued under the ECP Act took effect on December 12, 1995. As mentioned previously, buildings were required to comply first and factories later, in 1997. The designated facilities have to undertake the following activities as illustrated in table 2.4 on the date as prescribed in the Royal Decree.

Table 2.4 The Implementation Plan of the Designated Factories (After July 17, 1997)

Activities	180 days (Jun 98)	180 days (Dec 98)	180 days (Jun 99)	180 days (Dec 99)	180 days (Jun 00)	180 days (Dec 00)	180 days (Jun 01)	180 days (Dec 01)	180 days (Jun 02)
1. Appoint the energy manager									
2. Submit data on energy consumption twice a year (within July and next Jan.)									
3. Preliminary energy audit									
4. Detailed energy audit									
5. Set up energy conservation target and plan									
6.Monitoring and analyzing implementation on energy conservation target and plan									

Source: Handbook of Energy Conservation for the Owner of Designated Factories and Buildings (DEDP, 1997).

Details of activities in table 2.4 can be described below and apply to both buildings and factories. It should be noted that the timelines relate to factories only.

1) **Appoint the person responsible for energy (PRE)** the owner of designated factories have to nominate the name of PRE to DEDP within 180 days after becoming a designated facility.
2) **Submit data on energy consumption twice a year (within June and December.):** The facilities that become designated are required to submit the data on energy consumption with the form designed by DEDP (Form Bor Por Or 1) in June and December every year.
3) **Conduct preliminary energy audit:** At the same time of the first submission of data on energy consumption, the owners of designated facilities are also required to undertake the preliminary energy audit which will be conducted by the Registered Consultants (RCs) approved by DEDP. There are two categories of consultants to implement energy conservation in designated facilities, namely, **Category A consultants** (5 consultants) and **Category B consultants** (42 consultants). **Category A consultants** have been entitled to undertake preliminary audits, to prepare audit reports, and to implement measures according to the energy conservation targets and plans. **Category B consultants** have been entitled to undertake preliminary and detailed audits, to prepare audit reports together with the energy conservation targets and plans, and to implement measures according to the energy conservation targets and plans. To support this activity, the amount of 100,000 Baht, as a grant, is provided to the designated facilities by the ECP Fund. The proposal and request form are required to be submitted to DEDP for processing and approval.

4) **Conduct detailed energy audit:** the designated facility's owner has to conduct a detailed energy audit within three years after completing the preliminary energy audit.
5) **Set up energy conservation targets and plans (ECTP):** the designated facility's owner is required to set up energy conservation targets and plans based on the results obtained from the detailed energy audit. The Registered Consultants will undertake this job. Activities 4) and 5) should go together. The ECP Fund also provides a grant to carry out these activities; the financial assistance will cover up to 50% of the comprehensive ECTP plan development, but not exceeding 500,000 Baht per facility. The process for requesting the ECP funding is similar to the grant for the preliminary energy audit.
6) **Monitoring and analyzing the implementation on energy conservation target and plan:** the designated facility's owner has to submit a report on implementation of energy conservation targets and plans to DEDP annually. This annual report is to be approved by the PRE. The content of report should include the result of conducting the energy conservation plan compared to intended targets as well as the problems and barriers during implementation.

2.3.2.4 Energy Conservation Measures Prescribed by the ECP Act

The energy conservation measures prescribed by the ECP Act are different for the designated factories and the designated buildings. The details of each are described below:

1) Energy Conservation Measures for the Designated Factories

According to the ECP Act (1992), energy conservation in factories means one of the following measures:

(1) Improvement in combustion efficiency of fuels;
(2) Prevention of energy loss;
(3) Recycling of energy wastes;
(4) Substitution of one type of energy by another type;
(5) More efficient use of electricity through improvements in power factors, reduction of maximum power demand during the period of the electricity system's peak demand, use of appropriate equipment, and increased efficiency through other approaches;
(6) Use of energy-efficient machinery or equipment as well as the use of operation control systems and materials that contribute to energy conservation; and
(7) Other means of energy conservation as stipulated in the Ministerial Regulations.

2) Energy Conservation Measures for the Designated Buildings

According to the ECP Act (1992), energy conservation measures in the designated buildings means one of the following:

(1) Reduction of heat from the sunlight that enters the building;
(2) Efficient air-conditioning including maintaining room temperatures at an appropriate level;
(3) Use of energy efficient construction materials and demonstration of qualities of such materials;
(4) Efficient use of light in the building;
(5) Use and installation of machinery and equipment; and
(6) Other measures for energy conservation as prescribed in the Ministerial Regulations.

2.3.3 Current Situation in Energy Conservation Implementation Process of Designated Factories

The passage of the Royal Decree on Designated Factories and Ministerial Regulations under the ECP Act became effective in July 1997. The factories in which energy consumed is at the level as prescribed by the Royal Decree are required to comply with the ECP Act.

As of September 30, 2002, the total number of all designated factories was 2,558 units, which is comprised of 301 year one factories, 625 year two factories, 444 year three factories, and 1,188 year four factories. All of them have to comply with the ECP Act. The year one factories have had to comply since July 1997, year two since July 1998, year three since July 1999 and year four since July 2000. As a result, each category of factory is in a different phase of the energy conservation implementation process.

The results of implementing energy conservation activities prescribed by the ECP Act during July 1997 to September 2002 indicate that there is considerable delay in compliance with the ECP Act. The figures of designated factories undertaking energy conservation activities are presented in table 2.5 and 2.6.

Table 2.5 Number of Designated Factories Undertaking Energy Conservation Activities (As September 30, 2002)

Category	No. of DF.	Energy Conservation Activities									
		Act 1		Act 3		Act 4		Act 5		Act 6	
		Imp	App	Imp	App	Imp	App	App	Imp	App	Imp
Year One	301	289	271	248	236	48	21	13	5	0	0
Year Two	625	534	441	454	429	75	31	26	6	0	0
Year Three	444	338	280	252	226	20	3	11	0	0	0
Year Four	1,188	685	498	505	275	2	0	0	0	0	0
Total	2.558	1,846	1,490	1,459	1,166	145	55	50	11	0	0

Source: DEDP, 2002: 4-14

Note: Imp: Implemented, App: Approved

Act1: Appointing PRE, in the bracket is a number of PRE

Act2: Submitting energy production and consumption data (will be presented in next table).

Act3: Conducting preliminary energy audit.

Act4: Conducting detailed energy audit.

Act5: Setting up energy target and plan (ECTP).

Act6: Monitoring and analyzing the implementation of energy conservation activities.

Table 2.6 Number of Designated Factories Implementing Activity 2 (Submitting Data on Energy Production and Consumption twice a year) (As September 30, 2002).

Category	Jul-Dec 97	Jan-Jun 98	Jul-Dec 98	Jan-Jun 99	Jul-Dec 99	Jan-Jun 00	Jul-Dec 00	Jan-Jun 01	Jul-Dec 01	Jan-Jun 02
Year One	183	190	191	241	257	256	251	248	229	183
Year Two	0	0	323	415	474	479	483	472	430	338
Year Three	0	0	0	0	300	303	327	326	310	252
Year Four	0	0	0	0	0	0	748	604	527	434

Source: DEDP, 2002: 4-14

1) The Implementation of Year One Designated Factory

According to the energy conservation implementation process, currently the designated factories, particularly year one factories, should have implemented all six steps. However, the fact is that they are delaying in complying with the process.

As of September 30, 2002, 289 factories have assigned the PRE (Personal Responsible for Energy) and 271 designated factories with 603 PRE got approval of DEDP. A hundred and eighty-three factories submitted the data on energy production and consumption. Two hundred and forty-eight factories have submitted preliminary energy audits and 236 were approved. As well, 247 have requested financial support from the ECP Fund to carry out the preliminary audit and 246 got approval, accounting for 24.60 million Baht. Sixty factories requested financial support from the ECP Fund to conduct detailed energy audits, of which 55 factories got approval; the total amount from the Fund was 17.65 million Baht. Only 48 designated factories submitted the report on the detailed energy audit. Of these, 21 factories have yet to get approval. In addition, 13 factories submitted the ECTP and 5 factories got approval. None of the factories have undertaken activity six.

The evaluation report conducted by NEPO (2000d: 4) indicated barriers and problems causing implementation delay. These problems originated from the factories themselves, the consultant companies, and the DEDP. The details of barriers and problems will be presented later.

2) The Implementation of Year Two Designated Factories

Five hundred and thirty-four factories have reported the appointment of 1,100 PREs, but only 765 PREs in 441 factories were approved by DEDP. Three hundred and thirty-eight factories have submitted the energy production and consumption data of January to June 2002 and 468 factories requested financial support for conducting a preliminary energy audit. Of these, 464 factories have been approved, accounting for 46.4 million Baht. In addition, 454 factories delivered reports on the preliminary energy audit and 429 factories got approval. Ninety-five factories have requested financial support to undertake a detailed audit, 91 factories were approved in the amount of 21.7 million Baht. Seventy-five factories proposed reports on a detailed energy audit; however, only 31 factories got approval. Twenty-five factories submitted the ECTP to DEDP and six factories got approval. None of them have reached activity 6.

3) The Implementation of Year Three Designated Factories

The total number of year three designated factories is 444. There are 338 factories who have appointed 546 PRE, but only 413 PRE in 280 factories have been approved. Two hundred and fifty-six factories submitted requests for financial support from the ECP Fund for undertaking a preliminary energy audit and 253 got approved, accounting for 25.30 million Baht. Regarding the submitting of the preliminary energy auditing reports, 252 factories have done so, but only 226 factories received approval. Further, 35 factories processed the request of financial support for undertaking detailed energy audits; as a result, 4.01 million Baht has been approved for 26 factories. Twenty factories delivered the detailed energy audit report and three factories got approval. Eleven factories executed the ECTP but none have received approval yet.

4) **The Implementation of Year Four Designated Factories**

There are 1,188 year four designated factories as of September 30, 2002. Of these, 685 have appointed 982 PREs, but only 498 PREs in 679 factories have been approved. In addition, 478 requested financial support for conducting preliminary energy audits; 463 got approval, accounting for 46.30 million Baht. Five hundred and five factories delivered reports on preliminary energy audit, of which 275 reports have been accepted. The further processes have not been implemented yet. Only 252 factories submitted the data on energy production and consumption as of September 30, 2002.

As of September 30, 2002, 1,490 designated factories have appointed 2,460 approved PREs. As well, 1,207 factories have submitted the data on energy production and consumption and 1,426 designated factories have or are applying for financial support from the ECP Fund to carry out the preliminary energy audit. The amount of approved funds stemming from these applications totals 142.6 million Baht. A total of 1,166 factories conducted a preliminary audit. In addition, 172 designated factories have or are applying for financial support from the ECP Fund to conduct detailed energy audits, and 43.4 million Baht worth of funds have been approved. Fifty-five factories have submitted the detailed energy audit report and got approval. At present, 11 designated factories have submitted the report on detailed energy audit and have received approval. None of designated factories have reached activity six of the energy conservation activities prescribed by the Act.

2.3.4 Barriers and Obstacles to the Energy Conservation Implementation Process

NEPO (2000c) reports that the problems and barriers that delayed and derailed the energy conservation implementation in designated factories and buildings originated from the designated facilities and energy consultants companies and also from the implementing agency itself, which means DEDP. The details of problems and barriers can be summarized as follows:

1) **Problem on delaying the appointment of energy managers:-** There are some difficulties to find qualified persons who meet the

criteria specified by the ECP Act. In other words, if the energy managers resigned, the designated facilities need to recruit new ones and report the new appointment to DEDP. As a consequence, there is a delay in processing.

2) **Problem in delaying submitting the information on energy production and consumption:-** Most energy managers do not clearly understand how to fill the given form and some required information is not available.

3) **Problem of complicated procedures to comply with the ECP Act:-** The designated facilities are not allowed to conduct the preliminary and detailed energy audits by themselves, even if they have capability to do so. They need to hire energy consultants registered at DEDP to function on their behalves and submit the name of the consultant to DEDP to get approval at first, which takes a long time.

4) **Problem of inadequacy of staff:-** DEDP is understaffed; it needs to hire Accredited Consultants (ACs) to act on behalf of DEDP to assist the designated facilities in the energy conservation implementation processes under the supervision of the DEDP.

5) **Problem of scarcity of financial resources:-** To conduct the detailed energy audit, the financial support from the ECP Fund provides only 50 percent of total cost; therefore the designated facilities need to find additional sources of funding, which is difficult at the present time, as Thailand is still recovering from the recent recession.

6) **Problem of limited amount of ECP Funds provided:-** Due to the criteria established, the ECP Fund provides financial support to all private designated facilities of up to 100,000 Baht for conducting preliminary energy audits (the government designated facilities are able to obtain full amount of cost). However the real cost for carrying out a preliminary energy audit, especially in large facilities,

is higher than this, so they need to use their own money or to borrow from financial institutions to pay the total cost, which is difficult in the current economic atmosphere. As a result, there is a delay in implementing this process.

2.3.5 Organizations Responsible for Energy Conservation Policy and Implementation

Three government agencies are involved in the ECP Act, namely, the Department of Energy Development and Promotion (DEDP), the National Energy Policy Office (NEPO), and the Comptroller General's Department (CGD). The detailed functions and responsibilities of each agency are described below:

1) Department of Energy Development and Promotion (DEDP)

DEDP is the agency responsible for the compulsory program; the objective of this program is to promote energy conservation in the designated factories, the designated buildings, whether existing or under design or construction, the government buildings, and existing non-designated factories and buildings.

2) National Energy Policy Office (NEPO)

NEPO (2000a:7) is the implementing agency who undertakes the energy conservation projects in the voluntary program. The objective of this program is to support and to collaborate with other agencies in both public and private sectors to achieve the following:

(1) Efficient use of energy in the production process of both the agriculture and rural industries;

(2) Wider utilization of renewable energy, which creates less adverse impact on the environment;

(3) Marketing of products and services contributing to energy conservation; and

(4) Promotion of studies, research and development on energy and energy conservation technologies as well as the

application of study/research outcomes to actual utilization in factories, buildings and households.

The voluntary program is comprised of three main projects, namely: Renewable Energy and Rural Industries, Industrial Liaison, and Research and Development.

3) Comptroller General Department (CGD)

CGD is the government agency responsible for disbursement of the ECP Fund to the requested designated facilities approved by the ECP Fund committee.

2.3.6 Policy Implementation Programs

2.3.6.1 Energy Conservation Program

Following the Act, there are main three energy conservation programs, which include a compulsory program, a voluntary program, and a complementary program. The compulsory program is under supervision of DEDP; voluntary and complementary programs are under supervision of NEPO The details of each program and responsible agencies are shown below:

Table 2.7 Energy Conservation Program in Thailand

Compulsory Program Under DEDP	Voluntary Program under NEPO	Complementary Program Under NEPO
• Existing designated facilities and building projects • Government building projects • Designated factories and building under design and construction stages • Public awareness campaign under DEDP responsibility	• Promotion of renewable energy utilization • Promotion of small power producers using renewable energy • Industrial liaison project on energy conservation • Research and development project • Existing non-designated factories and buildings	• Human resource and development project • Public awareness campaign under National Energy Policy Office • Legal management project

Source: NEPO, 2000a: 1. (Before the government administrative reform in October 4, 2002)

2.3.6.2 Demand-Side Management Program (DSM)

Besides three energy conservation programs mentioned above, the Demand Side Management Program (DSM) is another program that intends to promote the reduction in electric consumption, which has been undertaken by the Electricity Generation Authority of Thailand (EGAT). Thailand adopted a DSM program in 1992. DSM activities are composed of two groups of activities: (1) Energy Efficiency (lighting, refrigerators, air conditioners, and industrial motors); and (2) Load Management (direct control load and thermal energy storage). In addition, DSM has two principal interrelated objectives. First, is to reduce peak demands in order to avoid major capacity additions. The second objective is to bring reduction in electricity use to address the energy problem (Duangjai and Byold, 1997: 7). There are six major sub-programs under DSM, namely: a residential program, a business/government/state enterprise program, an industrial program, an energy demand management program, an awareness building program, and a DSM evaluation program (for details see EGAT,1993).

2.3.7 Energy Conservation Promotion Fund

The Energy Conservation Promotion Fund (ECP Fund) has been established under the ECP Act (article 24). The main objective of the ECP Fund is to provide financial support to designated factories and buildings for investment in and operation of energy conservation programs. At the same time, the ECP Fund can also be used to support other agencies that wish to undertake energy conservation, including activities on renewable energy projects, energy-related research and development, human resource development and training, and public awareness programs (DEDP, 1992).

2.3.7.1 Sources of the Fund

Article 24 of the ECP Act stipulates that the capital and assets of the ECP Fund will be from the following sources:

1) The money transferred from the Petroleum Fund in the amount determined by the Prime Minister;
2) The remittances from petroleum producers and importers at the rates prescribed by the NEPC;

3) Surcharges for use of electricity (collected from designated factories/buildings that violate or fail to comply with the Ministerial Regulations);
4) Subsidies from the government from time to time, as appropriate;
5) Money or property received from the private sector, both local and abroad, and
6) Interest and other benefits incurred from this Fund.

The Finance Ministry will keep the money and assets of the ECP Fund and will handle the procedures in disbursement of the ECP Fund under the ECP Act.

2.3.7.2 Uses of the Fund

As mentioned in the ECP Act, the ECP Fund will be spent on the following activities:

1) As working capital, grants, or subsidies for investment in and operation of energy conservation programs, or for solving environmental problems resulting from the energy conservation measures of the government agencies or state enterprises,
2) As working capital, grants or subsidies to the private sector for investment in and operation of energy conservation programs and solving environmental problems owing to energy conservation programs,
3) As grants or subsidies to government agencies, state enterprises, education institutions, or private organizations in the following matters:
   (1) Energy conservation programs or programs relating to environmental protection or correction of environmental problems due to energy conservation programs;
   (2) Investigating, studying, researching energy development and promotion of energy conservation

activities, protection and correction of environmental problems owing to energy conservation as well as formulation of energy policy and planning;

(3) Demonstration projects or pilot projects on energy conservation or environmental protection and correction of environmental problems resulting from energy conservation;

(4) Education, training and conferences regarding energy conservation;

(5) Advertisements, publications, and public relations with respect to energy development, promotion, and conservation as well as environmental protection and environmental correction resulting from energy conservation; and

(6) Administrative expenditures for energy conservation promotion efforts in accordance with the ECP Act.

2.3.7.3 Qualification of Fund Users

Besides the government agencies, state enterprises, and education institutions, the private organization eligible to obtain the ECP Fund should be a juristic persons under Thai or foreign laws, whose business is directly related to energy conservation or environmental protection or correction of environmental problems as a result of energy conservation and do not have a political or profit orientation in their energy conservation activities.

2.3.8 Measures to Deal with Non-Compliance with the Policy

The ECP Act also contains punishment clauses for those who violate or fail to comply with the Ministerial Regulations. If any owner of a designated facility violates or fails to comply with the Ministerial Regulations issued under Article 9 and 19, they shall pay the surcharge for the use of electricity. In addition, the ECP Act stipulates other punishment clauses under Article 53 to 61, concerning provision of false

information and failure to comply with the Ministerial Regulations issued under Article 11 and 22, and Article 35 to 37 of the ECP Act.

2.4 Chapter Conclusion

This chapter displayed the evolution of energy conservation policies in some selected countries in Asia, namely China, Indonesia, Japan, and Korea as well as Thailand. Based on the review, the research found that these countries began the promotion and implementation of energy conservation activities after they were attacked by the first oil crisis. A few years later, their governments promulgated laws regarding energy conservation and established core agencies to execute the law. At the same time, the governments also provided several support systems to facilitate the undertaking of energy conservation activities or projects. The support included tax incentives for energy efficient technology, low interest loans to invest in energy conservation projects, and training arrangements or education. In addition, the substance of the ECP Act and ECP Fund, the agencies involved and the current situation of energy conservation implementation were briefly shown.

The next chapter reviews previous research on policy effectiveness and presents a model for analysis.

CHAPTER 3

THEORETICAL FRAMEWORK AND A PROPOSED MODEL FOR ANALYSIS

The main objectives of this chapter are to review previous literature regarding policy implementation effectiveness and major factors contributing to the effectiveness of policy implementation, particularly energy conservation policy, and to propose a model for analysis.

3.1 Theoretical Framework: Literature Review

3.1.1 The Concept of Policy Process and Policy Evaluation

3.1.1.1 The Policy Process

Various scholars describe the term "policy process" in a similar manner, which is a sequential phase. For example, Lasswell (1963: 15-16) differentiated between a series of functional activities in what he termed the decision process: intelligence, recommendation, prescription, innovation, application, appraisal, and termination. The policy process in his view is sequential, differentiated by function, and cumulative. Sequential in this sense means that each stage represents a distinctive activity required by a system to move to the next stage. Cumulative means that each round of activities produces results that are fed back into the process.

Jones (1977: 10-12) expressed policy process in terms of subsystems that contribute to an overall process: problem identification, program development, program implementation, program evaluation, and program termination. Anderson (1975: 26) stressed the sequential aspects of the process as cited by both Laswell and Jones; in his view, the stages are comprised of problem formation, formulation, adoption, implementation, and evaluation.

Polsby (1969 cited in Jones 1977: 10-12) presented his view of policy process based on the legislative perspective as: policy initiation, incubation, modification, adoption, implementation, and appraisal. Similar perspectives are also supported by the works of others. For example, Alexander (1985: 403-426) proposes four phases of policy process: stimulation, policy, program, and implementation; Brewer and deLeon (1983: 10) offer six steps: initiation, estimation, selection, implementation, evaluation, and termination. The exact specification of stages varies with the purposes of the authors. For Putt and Springer (1989: 30), they visualize the policy process in five stages of activity-simulation: recognizing and defining issues, clarification: specifying needs and solutions, initiation: deciding to go forward, implementation: putting programs into practice, and evaluation: assessing results.

Nakamura and Smallwood (1980: 27) suggest that the policy process can be conceived of as a system of functional environments-policy formation, policy implementation, and policy evaluation. Each of these contains a variety of actors and arenas and each is connected to the others by various communications and compliance linkages. In their view, a policy system is cyclical rather than hierarchical; however, it does not mean that all the actors in the system have equal power to dominate the policy process. The actor in one environment can be significantly influenced by the actors in other environments. Closely aligned to Nakamura and Smallwood, Rist (1995: xiv) views three processes of the policy cycle: policy formulation, policy implementation, and policy accountability.

In summary, it can be noted that the policy process covers three major steps, which are policy formulation, policy implementation, and policy evaluation. Among different steps of the policy process, policy evaluation plays the most important part. Without policy evaluation, it is extremely difficult, if not impossible, to know whether a given policy implemented to solve a problem effectively achieved its objectives. It is a principal feedback stage of the policy process, which provides information to stakeholders to know what happened following the initiation of policy; it also provides a description of implementation activities. At a greater level of complexity, evaluation is intended to identify the degree to which a policy has succeeded in achieving its intended

objectives. Finally, policy evaluation can provide insight into reasons why policies have succeeded or failed and can suggest courses of action for improving the attainment of policy objectives (Putt and Springer, 1989: 48).

Policy evaluation will show to what extent the policy achieved its intended outcomes, which is the thing that the government wants to know after allocating resources, whether in terms of human or materials, to the programs. The results from policy evaluation can be used to justify, to extend or terminate the program. The next section will describe the concept of policy evaluation.

3.1.1.2 The Concept of Policy Evaluation

Policy evaluation is research that retrieves systematic information about the cost and impact of policy outcomes for the purposes of altering or refining the policy to better accomplish its goals (Polivka and Steg, 1978: 702). With systematic, empirical information about the impact of policies, better decisions can be reached, ineffective programs can be abandoned or radically modified, effective programs can be expanded, and budgets can be allocated more efficiently. In addition, the evaluation research also can generate new knowledge that can be incorporated into public decision-making processes.

Thayler and Fine (2001: 103), in their study "Evaluation and Outcome Measurement in the Non-Profit Sector: Stakeholder Participation", propose that evaluations can be done for several reasons. Evaluations can be used to measure program output or impact, to assess program implementation, to determine strategic planning, to assess the quality of operations, and to measure client satisfaction.

The following section will describe the definition of policy evaluation, type of policy evaluation and evaluation criteria.

1) Definition of Policy Evaluation

There are several definitions of policy evaluation. For example, Scriven (1991: 1) says "Evaluation is the process of determining the merit, worth and value of a thing". Fischer (1995: 2) defines policy evaluation as the activity of applied social science typically referred to as "policy analysis" or "policy science". Weiss (1998: 4) mentions, "Evaluation is the systematic assessment of the operation and/or the outcomes

of a program or policy, compared to a set of explicit or implicit standards, as a means of contributing to the improvement of the program or policy". Based on her definition, there are five key elements. The first is systematic assessment. The emphasis on system indicates the research nature of evaluation procedures; whether it is quantitative or qualitative research, it should be conducted with formality and rigor. The second and third elements in the definition focus on the investigation of the operation and outcomes of the program. Some evaluations may be focused on investigating to what extent the program follows prescribed practices. Others may be concentrated on the outcomes or effects of the programs. The fourth element is looking to a standard for comparison. Once the evidence, whether on process or outcome, has been collected, the investigators need to compare it to some set of expectations, which may come from the official statement of goals or from the expectations of other actors in the program or on the policy scene. In addition, the objectives of program sponsors, program managers, practitioners, and participants can be criteria for the evaluation. The fifth element in the definition of evaluation focuses on the purpose for which it is done.

Evert Vedung defines the term "evaluation" as "a careful retrospective assessment of the merit, worth, and value of administration, output, and outcome of government interventions, which is intended to play a role in future, practical action situations" (Vedung, 1997: 3; Poland, 1979: 3). From his perspective, evaluation is a retrospective assessment of public interventions. He does not include prospective appraisals (i.e., scrutinizing of courses of action considered but not yet adopted even as prototypes) in his definition. He argues that prospective assessment, ex ante assessment, forethought evaluation, needs assessment, and analysis for goal setting does not belong to evaluation. If these terms are included, evaluation becomes an umbrella, covering all kinds of analyses of, in, and for public intervention. Vedung suggests it is not reasonable to let "evaluation" refer to almost any intellectual effort in the public sector. The reason that Vedung gave for not including ex ante assessment in the evaluation is drawn from the origin and history of evaluation research. The demands of the early evaluation movement for empirical data on policy and program results emerged in opposition to prevailing emphasis on analysis of planned interventions. If evaluation is allowed to embrace even

planning, this significant historical line of distinction will be obscured. Hence, in his book "Public Policy and Program Evaluation", he has confined evaluation to after-the-fact assessment. Such assessment concerns adopted interventions in the sense of ongoing or terminated policies, programs, program ingredients, and the like.

Vedung also proposes that sometimes evaluation is restricted to ongoing activities, leaving out assessment of finished policies and programs. This perspective is similar to David Nachmias in "Public Policy Evaluation" (Nachmias, 1979: 4), who viewed evaluation from a scientific perspective. "Policy evaluation research is the objective, systematic, empirical examination of the effects of ongoing policies and public programs on their targets in terms of goals they are meant to achieve". Furthermore, Wholey, et al. (1970: 23) note, "Evaluation assesses the effectiveness of an ongoing program in achieving its objectives". Rutman (1980: 17) says, "Program evaluation research refers to the use of research methods to measure the effectiveness of operating programs".

Vedung strongly stresses that evaluation should not be confined to ongoing activities only, it should extend to include the assessments of terminated operations, since this type of evaluation will be helpful to assist in improving ongoing operations. This is the evaluation that Michael Scriven calls summative evaluation. Therefore, based on the perspectives of Vedung, evaluation should include all retrospective or ex-post study of policies and programs, ongoing as well as terminated, and comprise all kinds of ex-post analyses of administrative processes, outputs, and outcomes of public sector activities.

In contrast to Vedung, Rossi and Freeman (1989: 18) view the larger perspective of evaluation, when they maintain, "Evaluation research is the systematic application of social research procedures for assessing the conceptualization, design, implementation, and utility of social intervention programs".

Based on Rossi and Freeman, evaluation can be involved in any stage of intervention programs. In the planning stage, evaluation will focus on the extent and severity of the problems requiring intervention and on the design of programs to ameliorate them. In the conduct of ongoing programs, evaluation helps to determine the degree to which the programs are effective-that is how successfully they are reaching

their intended target populations. In addition, evaluation may be conducted as impact assessment to estimate the effects of the intervention and their magnitudes or may be undertaken for accountability purposes. Evaluation can be used as an aid to decisions concerning whether programs should be continued, expanded, or curtailed; evaluations may consider costs in relation to benefits and compare an intervention's cost effectiveness with that of alternative strategies for allocating scarce resources.

Evaluation may determine what is working, what is not working, what to change, and what to keep. Evaluation is a process used to assess the quality of what is going on (Kaufman and Thomas, 1980: 195). Policy evaluation emphasizes evaluating alternative public policies, as contrasted to describing them or explaining why they exist (Nagel, 1986: 248). Thomas R. Dye defines policy evaluation as 'learning about the consequences of public policy" (Dye, 1984: 344). David Nachmias (1980: 3) proposes, "Policy evaluation research is concerned with the study of the impacts of policy outputs".

Lester and Stewart (2000: 7) offer, "Policy evaluation is concerned with what happens as a result of the public policy, that is, what happens after a policy is implemented. It is concerned with the actual impact of legislation or the extent to which the policy actually achieves its intended results".

In summary, the term "policy evaluation" refers to a systematic assessment of the operation of the policy to determine to what extent the policy has achieved its intended objectives or to determine the degree to which the policy is effective". This dissertation exploits this definition when policy evaluation is mentioned.

2) Types of Policy Evaluation

Evaluation models come in many varieties and are useful in different contexts and environments. Each type is designed to answer different questions. Evaluation models are also designed to address different questions and to begin at different points. The ultimate goal of all the models is to support and assist in useful decision-making. This section will describe the different types of evaluation models, which may be similar or different and sometimes overlap, among several scholars.

There are several types of evaluation corresponding to what extent evaluators consider to be significant. One type of evaluation is not better than another; each is

appropriate to a different set of research questions. Evaluation is both science and art. The artful part of evaluation is the successful matching of the level of the evaluation and the appropriate scientific design within the resource and time constraint. David Nachmias presents two distinct but interrelated types of evaluation, namely, process evaluation and impact evaluation (Nachmias, 1979: 5; 1980: 3). **Process evaluation** is concerned with the extent to which a particular policy or program is implemented according to its stated guidelines (Posavac and Carey, 1997: 7; Nachmias, 1979: 5). This approach emphasizes the internal dynamics and actual operation of a program in an attempt to understand its strengths and weaknesses (Paton, 1978: 165). It helps understand what has been done and how, and leads to reflection on how the program might improve its operations (Weiss, 1998: 181) This type of evaluation focuses on an assessment of program activities and client satisfaction with services (Nachmias, 1979:4-5 1980: 3; Felbinger, 1989: 4-5). In addition, Rossi and Wright (1977: 21) refer to process evaluation as developmental evaluation or formative evaluation. Basically, these evaluations attempt to disclose the management problems (Lester and Stewart, 2000: 128). The result of these evaluations can be as basic as pointing out to agencies that they do not have evaluable goals or objectives or informing them that their accounting procedures are shady.

The second, **impact evaluation**, is concerned with examining the extent to which a policy causes a change in the intended direction or with the end results of such program (Nachmias, 1979: 5; Felbinger, 1989: 5-6; Palumbo and Sharp, 1980: 288). For example, such evaluations emphasize whether the program or policy's objectives have been met in the terms of outputs, or whether the policy or program produced the intended result on the target group. In addition, impact evaluation also involves measuring effectiveness, which concerns either "Was the program cost effective? or "What would have happened to the target population in the absence of the program?" (Felbinger, 1989: 5). In brief, impact evaluation is the study of the extent to which a goal has been achieved (or can be viewed as static analysis), whereas process evaluation is the study of how a program has been implemented (or dynamic analysis) (Palumbo and Sharp, 1980: 289). However, Palumbo and Sharp also viewed that impact evaluation should not be done in the absence of process evaluation due to two major difficulties. First, if the policy or program

contains vague or conflicting program goals, conducting impact evaluation may disclose that the policy or program is unable to attain intended goals; consequently can we conclude that the policy failed? Therefore, conducting impact evaluation together with process evaluation will solve such a problem, since process evaluation looks at how the policy is being implemented instead of just looking its impact and it requires a model of implementation to investigate what is going on during policy implementation.

Second, there is the problem of interpreting impact evaluation results. If it shows that the stated goals have not been achieved, it does not tell us whether the failure is due to a flaw in the theory underlying the policy or to poor implementation. Through conducting process evaluation, the reasons can be determined.

Beside the two types proposed by Nachmias, Felbinger (1989: 6-7) added another two, which are policy evaluation and meta-evaluations. **Policy evaluation** concerns the impact of the policy or program on the original problem to which it was addressed. The question likely to ask in this evaluation is, "Has the problem been reduced as a result of the policy or program?"

Meta-evaluations are syntheses of evaluation research findings by looking for commonalities among results, measures, and trends in the literature. Meta-evaluations are very similar to literature reviews in that they are focused on examining the cumulative findings and looking for patterns in the findings across numerous evaluations.

In summary, among four types of evaluation, process and impact evaluation are used in this dissertation, since the emphasise is both on measuring the effectiveness of energy conservation policy by considering to what extent the policy achieved its intended objectives, which covers the reduction in energy consumption, in greenhouse gas emission, and in promotion of energy conservation activities and on uncovering how the policy is being implemented and what is going on during implementation.

The next section will describe the criteria used in policy evaluation.

3) Policy Evaluation Criteria

There are many different criteria that can be used in policy evaluation. For Nakamura and Smallwood (1980: 146-151), public policies can be evaluated in terms of short-term quantifiable output (e.g. amount of energy conserved etc.); long-term

evaluation (e.g. reduction in energy dependency, etc.); or very long-term impacts (e.g. improvement in environmental quality, etc.). They propose five criteria that can be used to evaluate effectiveness in carrying out public policies. The details of their criteria are as follows:

Criterion I-Policy Goal Attainment, this criterion attempts to measure whether or not the tangible results of implementation efforts achieved the intended goals. This approach usually takes the form of a quantitative approach and is growing significantly; it is a dominant focus of much evaluation research. The two basic ingredients of goal attainment evaluation are called goal achievement measurement and impact assessment (Vedung, 1997: 37). The key question in goal achievement measurement is "Are the results in accord with program goals?" The impact assessment issue can be formulated as "Are the results produced by the program?" Goal attainment evaluation is used to measure the effectiveness of a program by asking questions about the substantive content, output, and impacts of the program, not about the program procedures. The major task of evaluators is to determine whether the premeditated program goals have been achieved and then try to find out to what extent the program has contributed to goal achievement.

Criterion II-Efficiency, a second approach is to evaluate policy implementation, which is done by means of efficiency criteria that attempts to evaluate quality of performance, usually in terms of cost. Efficiency can be measured in two ways: as cost-benefit and cost effectiveness (Bardach, 2000: 20). The results from assessment provide a frame of reference for relating costs to program results (Rossi and Freeman, 1989: 375).

Criterion III-Constituency Satisfaction, this criterion attempts to evaluate effectiveness in terms of satisfaction levels of different external groups. Under this criterion, evaluators follow the lead of the policy makers and appraise constituency satisfaction as the relevant indicator of successful performance. This criterion does not emphasize adherence to the precise policy objectives but on the modification and compromise of goals in an effort to reconcile conflicts and accommodate the concerns of those constituency groups, whose goals may shift over time.

Criterion IV-Clientele Responsiveness, the fourth criterion is focused on consumer and clientele satisfaction by focusing on the specific groups who are being

serviced by policies and how responsive these policies are to clients' perceived needs. Policy responsiveness can mean both "reflecting and giving expression to the will of the people" through general public opinion and "responding easily to any and all demands of specific parties at interest" (Pennock, 1952 cited in Rycroft, 1979: 1-19). Moreover, this criterion looks at program adaptability, flexibility, and accommodation in its attempt to meet the consumer or clientele needs and demands.

Criterion V-System Maintenance, based on Frances Fox Piven's explanation (Nakamura and Smallwood, 1980: 151), the fifth criterion of policy effectiveness can be described in terms of holding social institutions together. It means that the political system can continue to exist as a viable entity. This concept represents a very important criterion for evaluating the effectiveness of policy implementation on both the macro scale (e.g., the stability of a national or international political system) and micro scale (e.g., the ongoing viability of individual implementing agencies).

Within this study, the first criterion of Nakamura and Smallwood, policy goal-attainment, will be used for evaluating the effectiveness of the energy conservation policy by considering whether the policy goals (for example, to conserve energy, to reduce energy dependency, and to promote implementation of energy conservation activities) are attainable or not and to what degree or to what extent are the goals being achieved. The next section will briefly review various studies on assessing the effectiveness of policy implementation, on the conditions or factors contributing to the effectiveness of policy implementation, on regulatory compliance and policy effectiveness, and on the evaluation of energy conservation policy.

3.1.2 Previous Studies on the Effectiveness of Policy Implementation

3.1.2.1 Previous Studies on Assessing the Effectiveness of Policy Implementation

Judgements about the extent to which a policy is achieving what it has set out to achieve are the essence of 'effectiveness' (Palfrey, et al., 1992: 86; Smith and Glass, 1987: 31). Effectiveness is meta-criteria, because it can be applied to other criteria. For example, if the agency delivering the service achieves the objective then it can be

judged to be 'effective' as well as more efficient or equitable than it was hitherto. The notion of policy effectiveness implies that a policy has changed and (usually) has improved certain conditions (Nachmias, 1979: 23)

Not all evaluation researches call for effectiveness assessment. The effectiveness assessment question inevitably creates one causal hypothesis to be tested-did the program have an impact above and beyond what would have happened in the absence of program? Research directed toward answering such a question requires a number of prior conditions that make the program potentially evaluable in this sense. Among the requisite conditions for effectiveness evaluation, Brewer and DeLeon (1983: 10) propose three conditions, which are: (1) that the goals or objectives of the program be sufficiently specified to allow for definable outcomes, (2) that the program be well enough defined to determine whether it is present or absent in a given setting, and (3) that some basis for observing or estimating the state of outcomes in the absence of a program be available for comparison to program outcomes. All of these conditions are not easily met and many of the problems associated with program evaluation can be traced to instances in which evaluators or policy-makers have attempted to do effectiveness assessments in a setting where feasibility or developmental evaluation efforts would have been more appropriate.

This section will begin with the study of Chen, Wang and Lin (1997: 27-42) on "Evaluating the Process and Outcomes of a Garbage Reduction Program in Taiwan". The study intended to evaluate both the implementation and the effectiveness of the Garbage Reduction Program (GRP) in Taiwan by using process evaluation and outcome evaluation. Outcome evaluation is used to provide information on program effectiveness. Process evaluation provides information that is important for the generalizability of the program, that is, information on defining what the program is, how the program is implemented, why the program succeeds or fails, and what it would take to implement a similar program.

The authors employed theory-driven evaluation to be a framework of study and to set assumptions for designing and implementing the program. The background and program theory of the Garbage Reduction Program (GRP) in Taiwan are from the concept that the city intended to reduce the residential garbage by replacing everyday

collection of garbage and imposing a no-garbage collection policy every Tuesday, thus forcing the residents to keep their garbage at home. At the same time, the garbage from another source was continued to be collected by the sanitation workers every day. The underlying theory of GRP is that the new policy will force the residents to reduce their garbage since storage of garbage at home will make them feel the inconvenience and the unpleasant smell; as a result, the amount of residential garbage will decrease as intended.

The process evaluation focuses on the following issues: informing residents of the new program, enforcing the policy on the residential collection sites, dumping the garbage on the commercial sites, and residents' reaction to the program. For the outcome evaluation, the purpose was to see whether the GRP actually produced a decrease in the overall volume of garbage in Nei-fu.

The results of the study from process evaluation indicated that the program implementation in Nei-fu, which was comprised of mailing letters to each resident, placing banners in the major streets to inform the residents about the program, using a media campaign, and guarding or patrolling the collection sites, had been implemented successfully. Meanwhile, the results from outcome evaluation were disappointing, since total volumes of residential garbage did not reduce. Residents simply saved Tuesday's garbage at home and disposed of it at the collection sites on Wednesday. Thus the program was unable to achieve its intended goal. The authors explained the reasons for program ineffectiveness that may result from part of program theory not operating as expected. Residents did not feel inconvenienced and did not smell the unpleasant odor of the stored garbage at home. Therefore, they suggested alternative strategies that may achieve the intended goal, namely, education or imposition of a collecting fee according to the amount of garbage generated. Based on this study, it seems that the cost of avoidance of the GRP is low, just the psychological effect, which was not enough to stimulate residents to reduce the garbage. If the cost of avoidance is high, for example, a penalty or fines, the number of residents complying with the program will be high. Consequently, the program will be highly effective.

Palumbo and Sharp (1980: 288-304) presented a paper on "Process versus Impact Evaluation of Community Corrections". Kansas was selected to conduct a process

resources. As noted by Bunker (1972: 75-80), he suggested that actors in an implementing organization vary in terms of their agreement with policy, their power resources, and the salience of the policy issue to them. Thus, process evaluation must focus upon the perspectives of various actors at various levels of influence within the implementing agencies, and upon the strategies and incentives that have the potential for moving them to positions favorable to positive, rather than negative, goal change.

Moreover, the characteristics of the political setting also influence the way a policy is implemented. The crucial political variables include the character of elite support for policy, and the extent to which targets are mobilized to support the policy (Van Horn and Van Meter, 1976: 56). For example, if private citizens and interest groups are mobilized in support of a program, it is more likely that the implementers will accept the policy's goals and objectives and also support the implementation.

Results of the study revealed that the Kansas community correction program had vague and general goals, and it involved large scale change. It was also a complex policy innovation, not only in the number of groups involved, but in the fact that joint action was required among them. Therefore, it needed advance preparation of cooperative networks. It also led to predict that the counties which already had well-developed systems of social services and which began the work of coordinating social-service agencies with corrections efforts would be among the first to adopt community corrections and the most likely to institutionalize community corrections with a minimum of negative change.

3.1.2.2 Prior Studies on Major Factors Contributing to the Effectiveness of Policy Implementation

Effectiveness of policy implementation can be viewed in terms of how well the implementing agencies perform such policy or how well the target groups comply with the policy, which may rely on numerous conditions. This section will briefly review several research studies related to factors affecting the effectiveness of policy implementation.

Van Meter and Van Horn (1975: 445-448), for example, proposed the basic model of policy implementation process in their study. There are six variables that shape the

linkage between policy and performance, which are comprised of policy standards and objectives; policy resources; inter-organizational communication and enforcement activities; the characteristics of the implementing agency; economic, social, and political conditions; and the disposition of implementers. Rawson' study on "Organizational Goals and their Impact on the Policy Implementation Process" and Stewart's study on "Organizational Variables and Policy Impact: Equal Employment Opportunity" also supported the model proposed by Van Meter and Van Horn (Rawson, 1980: 1109-1118 and Stewart, 1980: 870-878). Their studies emphasized the relationship between policy goal and performance of policy implementation. They determined that clarity of policy goals will enhance a successful implementation.

Mazmanian and Sabatier (1981: 5-24; 1983: 41) argue that the extent to which the objectives of a statute or other authoritative policy decision are attained will be a function of (1) the clarity and consistency of its objectives, (2) the adequacy of the underlying causal theory, (3) the extent to which the policy decision structures the implementation process by, for example, assigning implementation to sympathetic agencies and providing adequate sanctions and incentives to induce compliance from recalcitrant actors, (4) the political and management skill of the principal implementing officials, (5) the extent of support for the program from constituency groups and critical sovereigns, and (6) the absence of substantial shifts in socioeconomic conditions undermining the statute's causal theory or political support. If these conditions are not met, one can expect shortfalls in goal attainment (Baum, 1981: 39-62).

Edwards (1980: 148) proposed four factors considered to affect implementation: (1) communication, (2) resources (financial support), (3) dispositions of the implementers (will), and (4) bureaucratic structure.

Chan and Li (2001: 589-601) conducted "A study on the Implementation of ISO 14001 Environment Management Systems in Hong Kong". They found that three major barriers encountered to ISO 14001 implementation are (1) low environmental awareness within the organization, including top management, (2) a lack of resources and experienced quality and environmental management staff, and (3) high implementation cost. Moreover, the size of the firm influences the effectiveness of implementation since

business survival is a primary concern of small firms whereas a large scale operation considers the ISO 14001 standard as a strategic tool to enhance future business. The business type is another important issue in ISO 14001 adoption. Industries with a high potential for greater environmental problems generally need to put more resources, in both financial and human areas, into pollution control processes.

To support ISO 14001, the government should increase efforts on promotion by publishing regular information booklets and setting up related hotlines and web-sites. Moreover, the government needs to arrange training courses and seminars for small and medium enterprises (SMEs) in collaboration with certified corporations. From the experience of the certified companies, SMEs could learn more about the implementation process, the areas of concern and the advantages of the ISO 14001 EMS standards. In order to speed up the adoption of the standard, the government could consider providing financial incentives for the SMEs.

3.1.2.3 Prior Studies on Regulatory Compliance and Policy Effectiveness

The studies of regulatory compliance obtained or avoided give us insight into the problem of the implementation of public policies and solutions to attain effectiveness in policy implementation. Compliance should be considered when laws and regulations are framed; otherwise they may only be words on paper. If the government wants to improve regulatory compliance, it must understand what the target group is doing in real life and use that understanding to formulate and design regulatory requirements. What the government should consider are (1) the characteristics of the market place; (2) how the individual organizations are structured and make decisions; (3) what incentives are likely to motivate both the affected individuals and organizations to comply with the regulation; and (4) the obstacles to their compliance. Moreover, the government must devote resources to that end. Effective policy compliance requires governments to take a number of discrete but linked actions. As well, policy instruments should be chosen carefully in order to maximize compliance.

The concepts or definitions of compliance are exhibited in several studies; for example, DiMento (1989: 109-132) proposes two concepts of compliance: specific

compliance and general compliance. Specific compliance refers to the responses of the entity (business or individual) targeted by a specified incentive or sanction, when the response is believed consistent with societal objectives or regulations. General compliance refers to responsive behaviors of the universe of businesses (or other target entities) those laws or regulations are aimed to affect. In addition, regulatory compliance can be defined as "the obedience by the target population with the regulation" (OECD, 2000). Similarly to the Department of Justice (1994 cited in Circum Network, 1998: 3), compliance refers to the continuing conformity of the regulated group or a member of that group with the prescribed regulatory standards. It will occur when requirements are met and desired changes are achieved (UNEP/IP, 1996:3; USEAP, 1998). The decision to comply with the standards depends not only on the level of the standard, the size and uncertainty of various penalties, but also on how the regulatory agency implements the standards (Langbein and Kerwin, 1985: 854-880). The degree to which a target group complies with a regulation is based on how various characteristics of the target group interact with the design and quality of the regulation.

According to USEAP (1998), the design of requirements affects the success of an implementation of program. If requirements are well designed, then the compliance will achieve the desired results. Besides the design of requirements, another perspective to view success of regulatory compliance can be obtained if it meets some conditions, which will be briefly displayed below. The following literature focuses attention only on the regulated side.

For example, Vandre (1986: 12-20) proposed a set of factors that may affect success of policy compliance, namely (1) top management support, (2) involvement of the board of directors, (3) the adoption of compliance policy statements, (4) allocation of sufficient resources, and (5) assignment of responsibility for the compliance.

USEAP (1998) considers major factors assumed to affect the extent to which compliance with environmental requirements is achieved. There are social and moral (i.e. moral and social values for environmental quality, social respect for the law, clear government will to enforce environmental laws), personal influences (positive personal relationships between program personnel and facility managers, desire to avoid legal

processes, desire to avoid jail, the stigma of enforcement, and adverse publicity), management factors (jobs and training dedicated to compliance, bonuses and salary increases based on environmental compliance), technological factors (availability of affordable technologies), as well as economic factors (desire to avoid a penalty, desire to avoid future liability, desire to save money by using more cost-efficient and environmentally sound practices). Which factors are operating in any particular regulatory situation will vary substantially depending on the economic circumstances of the regulated community, on cultural norms within the community and nation as a whole, and sometimes on the individual personalities and values of managers within the regulated community.

OECD (2000) mentioned several conditions needed for people to obey any rule and regulation. First, the target group has to be aware of the rule and understand it (Winter and May, 2001: 675-698; May and Paterson, 1997), since the ambiguity of the rule may bring about unintentional non-compliance. In addition, poorly conceptualized, badly drafted, and incompletely articulated regulations counteract positive responses to regulations. Diver (1983 cited in DiMento, 1989: 113-132) mentions the "transparency" of law and states that rule makers should "use words with well-defined and universally accepted meaning within the relevant community". Drafting regulations with concern for such points can enhance the business's understanding on how to comply. Secondly, the target group has to be willing to comply. In this sense, the willingness to comply may exist because of economic incentives, positive attitudes arising from a sense of good citizenship, acceptance of policy goals, or pressure from enforcement activities. Any or all of these factors can motivate compliance. Next, the target group must be able to comply (Winter and May, 2001: 675-698). Besides being motivated to comply, regulated groups must have the ability to comply, the willingness to comply is insufficient unless regulated entities are also aware of what is desired and are able to carry out the requisite steps. This means that they must know they are subject to requirements, they must understand what steps to take to create compliance, they must have access to necessary technology and resources to comply, and they must know how to operate any equipment, etc. correctly (USEAP, 1998). Ability to comply can be considered in terms of the

regulated knowledge of rule (which is prerequisite to compliance) and the capacity to comply. Awareness of rules and willingness to comply are insufficient to bring about compliance with regulations if regulated entities do not have the financial capacity to comply (Winter and May, 2001: 675-698). Regulatory compliance often entails investment in new equipment and materials along with reporting and other administrative requirements. Costs regarding such investment are a concern. Regulated entities with greater capacity will perceive the cost of compliance lower than entities with lesser capacity. To support the ability to comply with some regulations that are specific, have more technical requirements, and need huge investments, the government should provide some activities or assistance such as the provision of necessary information and other support such as grants or no-interest, long term loans to further reduce the cost of compliance (Nagel, 1982: 27). Without such assistance, non-compliance may occur. The government can apply the following three conditions together to ensure that the policy will take effect.

Governments need to communicate with the target group to inform it about its rights and duties and to explain, through mass communication networks, how compliance with the rules can be achieved. In this way they can reduce the lack of awareness problem (Coombs, 1980: 885-892). Additionally, to promote continuous compliance, the regulatory message must be consistently and constantly communicated (Krislov, 1972; Pfeffer, Salancik, and Leblebici, 1976; Schwartz and Orleans, 1976; Skolnick, 1968 cited in DiMento, 1989: 109-132).

The use of many kinds of policy instruments (such as taxes, subsidies, financial resources, information provision, or training programs (Coombs, 1980: 885-892) to influence the behavior of the target group will back up other enforcement activities (such as inspection and sanction). Finally there must be adequate execution abilities, such as adequate staff to process any paperwork, enough inspectors to do the inspections, etc, to make the policy workable in practice.

Besides those studies revealing the factors determining compliance with policy, some studies also suggest reasons or conditions not for non-compliance with a given policy. For example, OECD (2000) also identified eight causes of non-compliance from

the point of view of those targeted, namely, failure to understand the law, collapse of belief in law, procedural injustice, cost of regulatory compliance, deterrence failure, incapacitation of those regulated, failure of persuasion, and failure of civil society. These eight causes of non-compliance can be explained based on three conditions mentioned earlier.

Non-compliance related to lack of regulatory knowledge or comprehension by the target group occurs when the requirements are too complex to know and understand. The target group cannot comply with the regulation if they do not understand what is required. In addition, the complexity of rules may raise the cost of compliance, particularly for small and medium enterprises (SMEs). They are less able to employ specialist staff to meet regulatory obligations and this can affect their ability to comply (Ministry of Economic Development, 2001; OECD 1997 cited in OECD, 2000). Greater compliance costs can discourage growth and employment by diverting the energies and resources of firms from more productive uses, and deflecting their focus from their core business. Increased costs can erode international competitiveness where overseas firms face lower compliance costs. This will, in turn, discourage compliance, which harms the relationship between business and government and give advantages to those who do not comply.

Non-compliance related to the willingness of the target group to comply with the rules might occur when the compliance is too costly. In many circumstances, the businesses decide whether to comply or not by the estimated costs and benefits of compliance. If the benefit is over cost, then they will decide to comply. Moreover, non-compliance may be caused from an overly legalistic regulation (regulatory unreasonableness or regulatory unresponsiveness or failure to consider arguments by the regulated that exceptions to the technical rules should be made). Failure to comply may be from odd regulations that may not fit in with existing market conditions or is not supported by cultural norms. In addition, failures of consultation with the target population may cause non-compliance since the regulators may not able to identify unanticipated costs of compliance and understand the cultural norms of the target group. If the target group feels that they are being treated unfairly by the government, or the

regulatory agency, then they will respond by refusing to comply with the rules (Roberts and Blumhm, 1981; Rodgerrs, 1973; Skolnick, 1968; Stigler, 1970 cited in DiMento, 1989: 10-132).

Non-compliance related to the ability of the target group to comply with the rules can come from failures of administrative capacity. Good drafting of regulations does not ensure effective implementation. The government should devote sufficient resources and support, which are aimed at making it feasible for the target group to be able to comply with the policy, and to implement the policies.

In some circumstances, the firms may avoid immediate compliance if they believe that it is likely to be cheaper to negotiate a compliance agreement with the enforcement agency. The negotiation, at least, delays compliance costs or at best it can reduce the cost of compliance. Therefore, the availability of negotiated compliance will affect the degree of compliance. In addition, the decision to comply may be based on hidden benefits of participation in a regulation regime, namely the receipt of information on new technology or management innovation (Langbein and Kerwin, 1985: 854-880). This perspective views that the decision to comply or not depends on negotiability, which will affect costs of and benefits from compliance.

Coombs (1980: 885-892) views five kinds of reasons for noncompliance with the policy, namely communication-based noncompliance (which occurs when the target population does not get the message of policy or the policy contains substantial ambiguity), resource-based noncompliance (which occurs when the policy demands unavailable funds, talent, time or energy), policy-based noncompliance (occurs because of misgivings about the policy itself), action-based noncompliance (occurs because of the onerous nature of the prescribed actions rather than its consequences), and authority-based noncompliance (stemmed from the feeling that the authority prescribing the policy, or the authority's agent, is acting illegitimately or will reap undue benefits from the policy).

This is supported by Kuperan and Sutinen (1998: 309-332), who contend that people tend to obey laws made and implemented by authorities perceived to be legitimate. Legitimacy is a normative assessment by individuals of the appropriateness or

right of enforcement agencies to restrict their behavior (Tylor, 1990 cited in Kuperan and Sutinen, 1998: 309-332). A key determinant of perceived legitimacy is the fairness built into the procedures used to develop and implement laws and regulations. Compliance is higher when the regulated individual or group accords a high level of legitimacy to the enforcement agencies. This perspective can be defined as normative compliance theory. Other alternative theories that explain a driving force to comply are the instrumental perspective and the psychological perspective.

The instrumental perspective views that individuals are driven purely by self-interest and respond to change in the tangible, immediate incentives and penalties associated with an act. The key variables determining compliance are severity and certainty of sanctions. Business tends to comply when information about the meaning and importance of rules and about enforcement indicates that the costs of noncompliance will exceed benefits of noncompliance (DiMento, 1989: 109-132). Based on this view, the nature of the incentive or the penalty may most strongly determine the compliance promoting power of regulatory enforcement.

The psychological perspective views that compliance with rules and regulations is related to both the internal capacities of the target group and external influences of the environment, where the socialization process is the linkage between the target group and society. Two leading psychological theories used to explain this perspective are cognitive theory and social learning theory (Kohlberg, 1969, 1984; Levin and Tapp, 1977; Tapp and Kohlberg, 1977 cited in Kuperan and Sutinen, 1998: 309-332). According to cognitive theory, the key determinants of compliance are the individual's personal morality and level of moral development. In this sense, compliance is greater when regulated entities have a stronger sense of duty to comply with a given regulation. For social learning theory, the key determinant focuses on the effects of the environment such as peers' opinions and the extent of social influence an individual encounters. Compliance based on social factors comes from the desire of the regulated to earn the approval of their peers and the community. The motivation may be a desire to be a "good citizen" and to maintain the good will of their local communities or their clients. Business may also fear a loss of prestige that can result if information about noncompliance is

made public. From this perspective, the government can foster compliance by using some strategies such as providing public awards for outstanding behaviors.

In summary, the prior literature identifies the following factors assumed to determine the degree of compliance with regulations or standards: the awareness of policy or standards, the willingness to comply, and the ability to comply. Regarding the awareness of policy or standards, factors that influence the awareness of rules and regulations are the clarity of rules and regulations, government will, and the communication network provided. The factors expected to influence the willingness to comply are top management support, which can come in several forms, namely the involvement of the board of directors, the adoption of compliance policy statements, the assignment of persons responsible for compliance, and the provision of jobs and training dedicated to compliance. Other factors expected to influence willingness are costs and benefits of compliance, and the relationship between the regulators and the regulated. The factors influencing the ability to comply can be viewed as the allocation of sufficient resources and the availability of expertise and technology.

This study will adopt some of the above factors, namely, willingness to comply, ability to comply, cost of compliance, policy knowledge, financial support, and technical support, to frame the proposed model explaining compliance with the policy and policy effectiveness. The reason that these factors are selected is from the nature of the energy conservation policy. Even though this policy is a mandated policy, it differs from others because this policy has established a fund to promote the implementation of the policy; therefore, whether policy implementation will be effective depends upon the designated factories themselves (compliance willingness, compliance ability, policy knowledge, and compliance cost) and also the factors related to the fund (financial support) as well as support provided by the implementing agency (technical support or advice).

3.1.3 Research on the Evaluation of Energy Conservation Policy in Foreign Countries

The goal of energy conservation and management programs is to improve efficiency of energy use, which means a reduction in the amount of energy needed to

produce a given level of services (Heilman and Walsh, 1992: 43; Boyd and Pang, 2000: 289-296). The evaluation of energy conservation programs began in the early 1980s and has evolved into a well known and successful field both in its own right and as a sub-field of evaluation (Heilman and Walsh, 1992: 42). This section briefly presents previous studies related to the evaluation of energy conservation policies or programs.

Nadel and Ticknor (1992: 48-56) conducted an impact evaluation of a pilot lighting retrofit program for small commercial and industrial customers in 20 economically depressed communities in central and western Massachusetts during the 1985-87 period. Under this program, eligible customers received free energy audits and free installation of energy-efficient lighting equipment, which was offered by the Massachusetts Electric Company.

An impact evaluation was conducted in order to determine actual electric savings achieved, and to experiment with different energy savings analysis methods. Four approaches were proposed to estimate energy savings: (1) engineering calculation, (2) comparison of pre-program and post-program daily kWh use with a control group (3) comparison of pre-program daily kWh without a control group but with a survey on changes in program participants' energy use patterns, and (4) conditional demand analysis. Results from their study showed that the first three approaches produced very similar estimates of overall electricity savings, whereas the fourth one differed substantially from the results of the other three methods. Among the four approaches, the engineering method was the easiest to use and required the least data and data analysis. However, errors may occur since several factors that may affect energy saved were not considered. The daily kWh with control group method is relatively easy to use and appears to work well for this program and savings estimated from this method appear to be more accurate than with the first method. The daily kWh with survey method did not work well, since the follow-up survey did not capture many of underlying changes in participating customer's energy use patterns. The conditional demand method was more complex to use and time consuming to develop equations In addition; it required more data and a powerful statistical program.

Stern, et al. (1986: 147-176) studied "The Effectiveness of Incentives for Residential Energy Conservation". They suggested that the success of a program may depend not only on the size of financial incentives but also on their form and especially on issues involving communication, credibility, marketing, and program implementation. Two classes of criteria were used to judge the program's effectiveness: the level of induced investment in energy efficiency and measured energy saving. They found that the relation between larger incentives and number of participants in conservation programs is weak. In addition, differences in program marketing and implementation are probably responsible for the widely disparate rates of participation in programs offering identical financial incentives. Potential clients are attracted to programs that have energy audits conducted by local agencies or organizations that they trust and that have strong motives to make the program work. Aggressive marketing through word-of-mouth and other attention-getting media increases participation. Based on the Stern *et al.* study, it could be concluded that program marketing and implementation are significant factors that contribute to the success of a program; additionally, trust in their agencies also played an important role in reaching the objectives of the program.

Howarth, Haddad, and Paton (2000: 477-486) reviewed experiences with two programs, which were launched in the early 1990s and funded by the US Environment Protection Agency (EPA): the Green Lights and Energy Star Office Products programs. These programs promoted the adoption of energy-efficient technology through voluntary agreement with private sector firms. The evidence demonstrates that the 'Green Lights' has induced firms to invest in cost-saving lighting systems that they have never done before. Meanwhile, Energy Star Office Products has led suppliers of computers and electronic equipment to substantially improve the energy efficiency of their products in a way that consumer costs can be saved. The study reveals that the success of these programs is based on the ability to correct market failures related to problems of imperfect information and bounded rationality that impair the effectiveness of both intra-firm organization and the relationship between firms marketing energy-efficient equipment and their downstream customers. They conclude that voluntary participation

in programs show significant potential to improve economic efficiency through cooperative engagement between government agencies and private sector firms.

Drezner (1999: iv-v) explored the design of incentive structures in the public sector and the influence of the organizational environment on the use and the effectiveness of market-based policy tools in a non- market setting. He selected the Department of Defense (DOD) as the case study since DOD was the single largest user of energy in the U.S., accounting for 81% of the total government energy consumption and 1.14% of the national energy consumption in 1994. As a result, DOD attempted to comply with mandated energy conservation programs in federal facilities. The major energy conservation policy launched by DOD was a provision for the retention of savings generated by conservation activities. Two-thirds of the savings were retained at the installation that generated the savings; half was to be used for further investment in energy conservation, and half was to be used for general morale, welfare, and recreation activities. This policy built up financial incentives for the installation of an energy manager to establish higher quality and more active conservation programs. The results from his study show that the retention of savings policy failed to achieve its intended outcome because the role required of the financial management community was outside its normal mode of operation and interests and the budget process for allocating resources did not include a mechanism for retention of savings. Moreover, the analysis has shown that in order for retention of savings, or similar policies based on market type mechanisms, to be effective in the public sector context, the required cultural changes and appropriate implementation of mechanisms must be provided for in the policy design.

University of Kiel (1998) conducted a study on "Interdisciplinary Analysis of Successful Implementation of Energy Efficiency in the Industrial, Commercial and Service Sector (InterSEE)". InterSEE analyzed the successful implementation of energy efficiency measures in small and medium sized enterprises (SME) of less energy intensive sectors by carrying out case studies of successful companies as well as of policy programs providing the ground for these activities in Austria, Denmark, Germany, and Switzerland. The empirical findings reveal that successful implementation of energy

efficiency is characterized by multiple factors of influence and their interrelations. First is the consideration that implementation of energy efficiency is a process of innovation. It means that engagement in energy efficiency requires that new patterns of behavior should be evolved-both at the level of the individual actor and at the general organizational level. Innovation is viewed as a change of social, communicative and organizational features, which foster the adoption of energy efficient technologies. Secondly, there must be the attributes of a learning company, which will support change and innovation. This means that to reach energy efficiency goals, the company has to develop gradually from innovation in energy efficiency, to routine practice. Individual measures cannot be seen as separate to everyday company activities but have to be integrated into routine activities. Thirdly, supportive environments through networks and energy service markets must be sought, since networks provide the possibility of finding additional resources through cooperation with other actors, thus enabling synergetic efforts. Moreover, the networks can encourage the exchange of experience and know-how, and provide multiple channels for the diffusion of innovation in energy efficiency. Last, there must be a dynamic understanding of policy-making. In some circumstances, there may be restrictions with functioning of the energy service market resulting from policy interventions. Such restrictions must be signaled to the policy makers, so they can be accommodated in policy development. Hence, an integrated, cyclic and dynamic approach of policy–making represents a useful and empirically backed contribution to energy policy.

Klok (1997) conducted a study on "Successful Energy Conservation at Rynkeby: A Qualitative Case Study of a Successful Energy Conservation Process at Rynkeby Foods A/S". His analysis was based on qualitative data containing historical background, descriptions of the actual decision and implementation processes and the normative orientation of involved actors. The results of study reveals that the fostering factors affected the successful implementation process of energy conservation at a company level are the effort and ability of managers in charge and the organizational culture.

Newcomb (1984: 425-440) conducted a study on "Conservation Program Evaluation: The Control of Self-Selection Bias". He evaluated the weatherization

program of the Seattle City Light Department by determining how much electricity was conserved, and whether the program was cost-effective. The population of his study was the low-income homeowners in Seattle City. The study employed a control group of future program participants in order to avoid the biased estimate that could result because participants were a voluntary, nonrandom group of utility customers. He also conducted surveys, employed energy audit reports and electricity meter data to confirm the similarity of the experimental and control groups prior to the home weatherization program. He found that the electric consumption of the experimental group declined by an average of 3,400 kWh per year, when compared with the control group. By studying the reasons to participate in the program, he found that participants were involved in the program because the program was free, saved on the bills, and increased the value of their homes. In addition, they believed in energy conservation, and wanted to help solve the energy crisis.

The thinking about why firms are less interested in energy conservation investment can be explained by different causes. The first cause may come from internal difficulties, namely lack of knowledge and technical skill (Dincer, 1999: 845-854), less attention from top management, and scarcity of internal resources. The resources were concentrated on those areas deemed crucial to the survival of the firm (Lohani and Azimi, 1992: 533-545; DeCanio, 1993: 906-914; Pye and Elliott, 1998: 413-423; SPRU, 2000) As a result, low priority was placed on energy conservation projects.

Another cause may be from external barriers. These barriers include (1) inefficient pricing policies with end-use energy prices set at levels below the full social costs of additional supplies (Carlsmith, et al. 1990; Dincer, 1999: 845-854; SDD, 2000: 1), (2) uncertainty about fuel prices (Carlsmith et al. 1990; Pye and Elliott, 1998: 413-423), (3) limited access to capital (Howarth and Anderson, 1993: 262-272), (4) unclear government policies, code and standards, (5) limited supply infrastructure, (6) misplaced incentives (Jaffe and Stavins, 1994: 804-810), (7) unavailability of energy-efficient technologies and information (Lohani and Azimi, 1992: 533-545; Howarth and Anderson, 1993: 262-272; Christie, 1993: 32; Johnson, 1994: 873-883; Dincer, 1999:

845-854; Jaffe and Stavins, 1994: 804-810; Howarth, 1997: 1-9; and Klevas and Zinevicius, 2000: 791-798).

A third cause can be attributed to the characteristics of energy conservation projects, which consist of: (1) higher payback required from energy saving investment due to highly perceived risk (Dincer, 1999: 845-854; Lohani and Azimi, 1992: 533-545), (2) separation of expenditure and benefit since the firm expenditure may be from the employee side (they may get less comfort or inconvenience from the projects while the benefit falls to the company), (3) difficulties in monitoring the saving achieved by energy management investment (DeCanio, 1993: 906-914), and (4) costs and risks involved in acquiring information and investing in new technologies (Harris, Anderson, and Stafron, 2000: 867-876; Reddy, 1991: 953-961).

Moreover, other causes of less attention to energy conservation projects may be one of the following. For most firms, energy expenditure is a very small part of production costs; consequently, labor and raw materials, a larger cost, receive more attention before energy (Pye and Elliott, 1998: 413-423; Brown, 2001: 1193-1207). In addition, most industries do not perceive energy as a discrete issue but as a part of broader issues such as cost of manufacturing, environmental compliance, and safety and productivity. Therefore, energy conservation projects affect some of these issues; consequently the decision making process on such projects becomes more complex and sometimes they yield non-energy benefits which are frequently greater than energy savings (Pye and Elliott, 1998: 413-423).

In summary, to promote energy conservation investment, several sets of measures are required, namely (1) information on and availability of energy efficient technology; (2) energy standards that cover voluntary and mandatory technical standards, and (3) financial incentives.

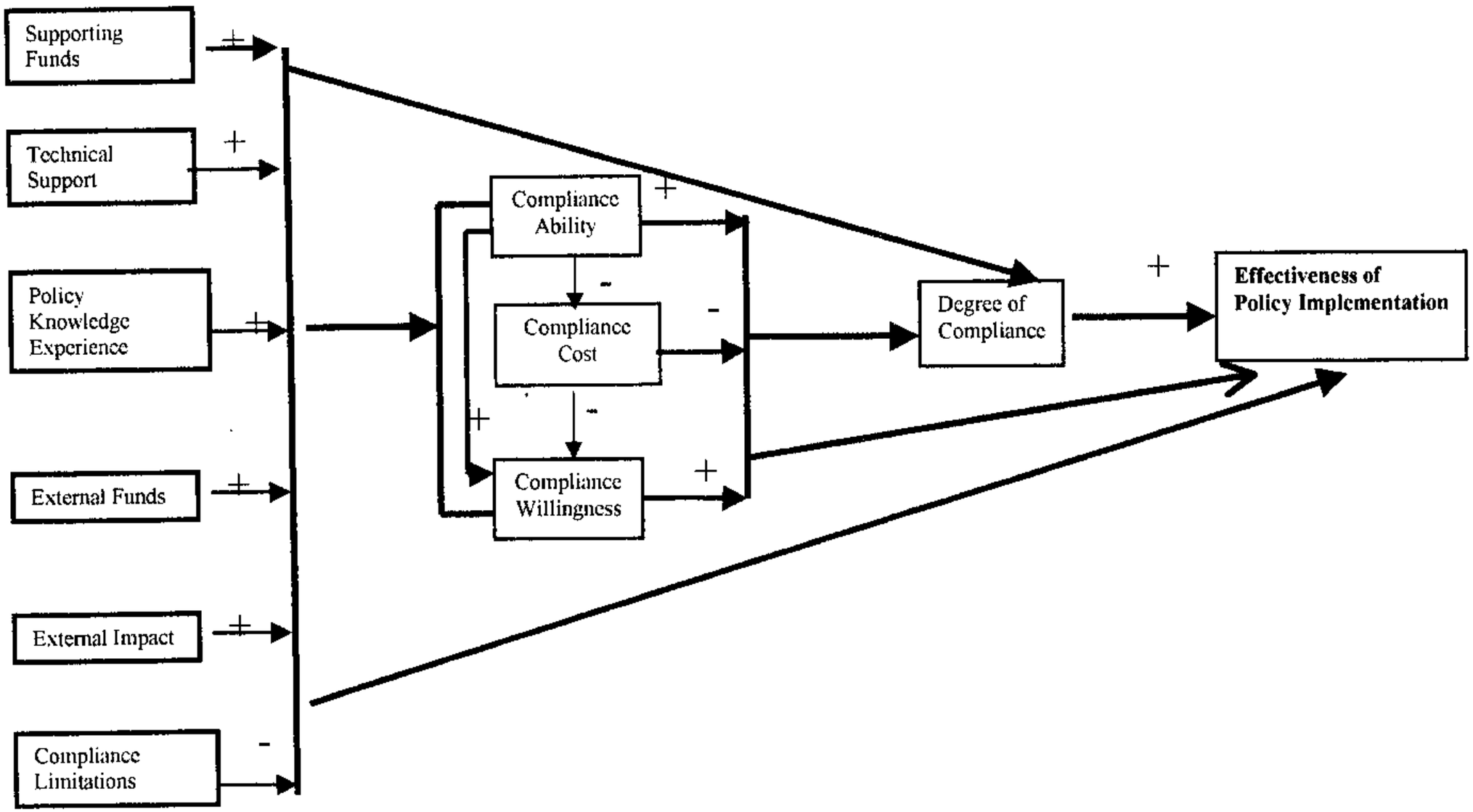
3.2 A Proposed Model for Analysis

3.2.1 Sources of the Model

This section presents a proposed model for analysis by dividing the discussion into two separate subsections: (1) the sources of the model; and (2) the logical relationships between independent and dependent variables.

The proposed factors that are expected to contribute to effective policy implementation are based on previous studies and literature (Van Meter and Van Horn, 1975: 445-448; Sabatier and Mazmanian, 1981: 5-24, 1983: 41; Palumbo and Sharp, 1980: 288-304; Stern, et al., 1986: 147-176; Newcomb, 1984: 425-440; Drezner and Bradley, 1998: 21-32; Drezner, 1999: iv-v; OECD, 2001; De Groot, et al, 2001; Environment Australia, 2001; USEAP, 1998; Winter and May, 2001: 675-698; Coombs, 1980: 885-892; DiMento, 1989: 109-132; Kuperan and Sutinen, 1998: 309-332; University of Kiel, 1998: 8-11). There are ten sets of factors that are expected to support the effectiveness of policy implementation, namely: a supporting fund, technical support, availability of external funds, external impact, policy knowledge and experience, compliance limitations, compliance ability, compliance cost, compliance willingness, and degree of compliance. The proposed model is displayed in figure 3.1. The details of each factor are as follows:

Figure 3.1 A Proposed Model to Study the Factors Contributing to the Effectiveness of Policy Implementation



1) Supporting Fund: Supporting funds refers to the ECP Fund that has been provided as financial incentives to the DFs to perform energy conservation activities prescribed by the ECP Act. Previous studies of many scholars (Stern et al 1986:147-176, UNEP (1996: 3), reveal that the success of policy implementation can be attained if there is appropriate financial support both in terms of size and forms of incentives. Thus, financial incentives would induce the regulated to comply with the policy, raise benefits of compliance over costs, increase compliance willingness and ability and degree of compliance, which would lead to more effective policy implementation.

2) Technical Support: Technical support refers to technical advice, training and seminar arrangements and information provided by the implementing agency (DEDP). Chan and Li (2001: 589-601), Dincer (1999: 845-854), Burby and Paterson (1993: 753-772), UNEP/IP (1996: 3), OECD (2000), proposed that the effectiveness of policy implementation would be gained if the technical support were provided. Technical support contributes clear understanding of the laws and regulations and reduces the cost of compliance whether in terms of time, money, or effort.

This study, then, proposes that technical support provided will decrease the compliance cost and enhance the compliance willingness and ability and also degree of compliance; consequently, it will lead to effectiveness of policy implementation.

3) Policy Knowledge and Experience: Based on research done by UNEP/IP (1996: 3); Winter and May (2001: 675-698); and Dincer (1999: 845-854) lack of knowledge and technical skill is one of the causes of reluctance to invest in energy conservation projects. This concept is applied to this study by considering that the effectiveness of policy implementation will be enhanced if the DFs and PREs have knowledge and experience in energy conservation implementation. Specifically, experience in conducting energy audits or investing in energy conservation projects would be an asset. Therefore, policy knowledge and previous experience in energy conservation implementation can reduce compliance costs and strengthen the DF's compliance willingness and ability and degree of compliance, which would lead to effective policy implementation.

4) External Funds: Applied from the study of Howarth and Anderson (1993: 262-272) the availability and accessibility of external funds seem to be a powerful factor to invest in energy conservation projects. The company may be confronted with internal budget constraint; therefore, availability and accessibility to external funds can eliminate or reduce such problems, which would reduce the compliance costs and also enhance the compliance willingness and ability and degree of compliance and finally strengthen the effectiveness of policy implementation.

5) External Impacts: Studies conducted by Carlsmith, et al (1990) cited in Sutherland (1991: 15-34) and Pye and Elliott (1998: 413-423) reveal that uncertainty about fuel price affects the energy conservation investment. As a result of these findings, this study asserts that uncertainty in the economic situation and in energy prices would discourage compliance willingness and ability and degree of compliance; it would also raise compliance costs, which, in the end, would lessen the effectiveness of policy implementation.

6) Compliance Limitations: The internal constraints of designated factories may have a negative effect on the degree of compliance within the given rules, and lead to ineffective policy implementation. It can occur from lack of awareness of employees, lack of executive support, lack of employee participation, inadequacy of internal budget and so on (Dincer, 1999: 845-854; DeCanio, 1993: 906-914). Therefore, DF's compliance limitations, or lack thereof, would either increase or decrease the DF's compliance willingness and ability and degree of compliance and would increase or lessen compliance cost, which finally would either enhance or inhibit the effectiveness of policy implementation.

7) Compliance Cost: Compliance costs mean the administrative and paper work costs that the businesses incur when meeting an obligation imposed by regulations including administrative burden as well as other associated compliance costs, such as equipment purchases, retooling, and recurrent production costs. They also include the costs associated with identifying and understanding regulatory requirements and may include costs of hiring new staff or training staff to satisfy regulatory obligations

(Ministry of Economic Development, 2001:1). The regulated groups decide to comply or not comply with the laws after they balance the costs and benefits of compliance (Burby and Paterson, 1993: 755). The benefits over costs will motivate the regulated to comply. However, compliance costs can be reduced if the government provides some assistance or incentives such as tax deductions or provides grants or low interest rate loans. With this support, the compliance cost would be less and the compliance willingness and compliance ability and degree of compliance would be greater and would lead to more effective policy implementation.

8) Compliance Ability: Compliance ability is affected by several categories of variables, including staff size, funding availability and amounts, knowledge of conservation opportunities, and awareness and cooperation of other functions or departments within the factory (Drezner and Bradley, 1998: 21-32). To enhance the capacity of the regulated to comply with the laws, provision of support, in the form of financial, technical or information will enable the regulated to understand what constitutes appropriate behavior and also reduce the cost (time, money, effort) of complying with regulatory standards (Burby and Paterson, 1993: 755; Winter and May, 2001: 675-698). Greater compliance ability will lead to greater compliance willingness and degree of compliance and finally to greater effectiveness of policy implementation.

9) Compliance Willingness: Developed from prior studies (OECD, 2000; Winter and May, 2001: 675-698; University of Kiel, 1998 in http://www.nordicht.uni-kiel.de/sme/a1.htm), compliance willingness can be seen as a necessary condition for the regulated to comply with the policy. Compliance willingness can be viewed in several forms such as executive support in compliance, the articulated company's agenda to comply with a given policy, the provision of jobs or training dedicated to compliance, or the involvement of the board of directors. Greater compliance willingness leads to higher degree of compliance and finally greater effectiveness of policy implementation.

10) Degree of Compliance: The degree of compliance with the policy will be considered in terms of the number of energy conservation activities the DF is able

to perform to comply with the policy. As mentioned in the previous section, regulatory compliance can be attained if the requirements are met and desired changed are achieved (UNEP/IP, 1996 and USEAP, 1998). However, the requirements can be achieved if the factors that promoted the compliance are in place. This study selected some factors from prior literature that are expected to determine the degree of compliance with the policy, namely supporting funds, technical support, policy knowledge and experience, external funds, external impact, compliance limitations and compliance ability.

The following section will demonstrate the logical relationships of selected variables in this study.

3.2.2 Logical Relationships between the Independent Variables and the Dependent Variable

Independent Variables

1) Supporting Fund: Supporting Fund means the ECP Fund provided to designated factories (DF) to carry out energy conservation activities. Supporting Fund would be considered as a factor that promotes effective policy implementation. Based on the energy manager's perception, supporting Fund covers two components: the extent to which the Fund is properly allocated and adequately provided and the extent to which the conditions of the Fund are practical. It can be stated that supporting fund directly affects the effectiveness of policy implementation and also indirectly affects effectiveness through compliance willingness, compliance ability, cost of compliance, and degree of compliance. The higher amounts of supporting fund will lead to a greater compliance willingness, compliance ability, and degree of compliance and also lessen the compliance cost, which will finally lead to effective policy implementation.

2) Technical Support: the policy would be undertaken as designed and would achieve its intended outcome if the designated factories obtained technical support from the implementing agency whether in the form of technical support such as technical

advisory services, energy auditing services, training services, and information provided; or financial support. Since the financial support is considered in supporting Fund, it will not be included in this context. It can be stated that the higher levels of technical support will lead to higher compliance willingness, compliance ability, degree of compliance, and also the policy implementation effectiveness. Moreover greater technical support will lessen cost of compliance.

3) Policy Knowledge and Experience: Previous experiences in energy conservation activities both in conducting energy audits or implementing energy conservation measures are expected to influence compliance willingness, compliance ability, and degree of compliance. Based on their knowledge and experiences, the designated factories will clearly understand the benefits of energy conservation implementation and therefore exhibit more compliance willingness, compliance ability, and degree of compliance. Hence, the probability of effectiveness in policy implementation should be higher if most designated factories have knowledge and experience in energy conservation implementation.

4) External Funds: For investment in ECMs, the designated factories are required to provide additional funds due to only partial financial support from the Fund. These may be from their budgets or from financial markets. Availability of external funds for investment in energy conservation projects and accessibility to financial markets, therefore, are considered as significant factors. Higher amounts in external funds will cause greater policy implementation effectiveness through more compliance willingness, compliance ability, and degree of compliance with the policy. Without sufficient financial support from external sources, the ability to comply will be limited and the willingness to comply will be less, which will lead to less effective policy implementation.

5) External Impacts: The perception of economic conditions by the DF directly influences the effectiveness of policy implementation. If the perceived external impact is minimal, whether from economic instability or fluctuation in energy prices, it

will promote compliance willingness, compliance ability, and degree of compliance, and consequently will enhance the effectiveness of policy implementation.

6) Compliance Limitations: Greater compliance limitations will reduce compliance willingness, compliance ability, and the degree of compliance with the policy; the greater internal limitations, the lower compliance willingness, compliance ability, and degree of compliance will be. This will consequently lessen the effectiveness of policy implementation.

7) Compliance Cost: the designated factories may be more likely to comply in cases where the enforcement official can demonstrate that compliance will save money or generate benefits greater than non-compliance. The designated factories that may want to comply might not do so if they feel that the cost of compliance would be an economic burden to their company, particularly when the economic situation is uncertain. Some forms of support provided by the government would reduce the cost of compliance and raise the benefits from compliance, which would consequently increase the compliance willingness and also raise the degree of compliance.

8) Compliance Ability: Compliance ability will be considered in terms of financial, human, and system capabilities, which cover sufficiency of internal funds, staff adequacy both quantity and quality, and existence of energy data collecting and monitoring systems. Supporting fund, technical support, policy knowledge and experience, availability of external funds, low external impact, and less compliance limitations will enhance compliance ability. With greater compliance ability, the designated factories should have more compliance willingness and a greater degree of compliance and, consequently, more effective policy implementation.

9) Compliance Willingness: Compliance willingness directly influences the effectiveness of policy implementation. It also has an indirect influence through the degree of compliance. The higher the compliance willingness, the greater degree of compliance will be, which will result in effectiveness of policy implementation. Compliance willingness can be considered in terms of the support to implement the

policy from top management, both in forms of training support, of setting energy saving targets, or of considering energy conservation issues in equipment purchasing. In addition, it also considers it in terms of employee's awareness and cooperation in implementation.

10) Degree of Compliance: Degree of compliance is a measurement of compliance with the policy, which is considered in terms of number of activities that the designated factories are able to comply with. The higher the number of activities, the greater the degree of compliance will be. Degree of compliance is a function of supporting fund, technical support, policy knowledge and experience, external fund, external impact, compliance limitations, compliance' cost, compliance ability, and compliance willingness. Therefore, degree of compliance is expected to directly influence effectiveness of policy implementation.

Dependent variable: Effectiveness of policy implementation

The effectiveness of policy implementation is employed as the dependent variable and defined in terms of goal attainment (applied from Nakamura and Smallwood, 1980: 146) and the extent that the policy has achieved its objectives and intended outcome based on the designated factory's perception. Goal attainment in this context is covered in three dimensions: the reduction in factory energy consumption, the reduction in energy dependency and in greenhouse gas emission, and the promotion of energy conservation activities (developed from Drezner and Bradley, 2001: 21-32; and University of Kiel: 1998: 9-10). Theoretically, these indicators should be measured by using empirical data, which would be more reliable and valid. However, since this study has been conducted during the initial stage of policy implementation, it is unable to attain such figures, which can be gained when all activities in accordance with the policy implementation are complete. Thus, the researcher employs perceptions on such issues to be the indicators to measure the effectiveness of policy implementation.

The perceptions of the persons responsible for energy (PREs) were collected to be the indicators of effectiveness. The degree of effectiveness is also considered as an indicator of policy effectiveness.

Effectiveness of policy implementation will cover five items:

1) Perceived reduction in energy consumption;
2) Perceived reduction in energy dependency and in greenhouse gas emissions;
3) Perceived greater implementation in energy conservation activities;
4) Perception of the ECP Act as a key mechanism in promoting energy conservation activities; and
5) Perceived effectiveness of policy implementation

Effectiveness of policy implementation is expected to be directly determined by supporting fund, technical support, policy knowledge and experience, external fund, external impact, and compliance limitation and indirectly through compliance ability, compliance cost, compliance willingness, and degree of compliance.

3.3 Structural Equations

Five structural equations are proposed for hypotheses testing.

$$\text{Willingness} = b_{11}\,\text{Supfund} + b_{12}\,\text{Techsup} + b_{13}\,\text{Know} + b_{14}\,\text{Exfund} + b_{15}\,\text{Eximpact} - b_{16}\,\text{Lim} + b_{17}\,\text{Ability} + b_{18}\,\text{Cost} \quad \text{(Eq. 1)}$$

$$\text{Ability} = b_{21}\,\text{Supfund} + b_{22}\,\text{Techsup} + b_{23}\,\text{Know} + b_{24}\,\text{Exfund} + b_{25}\,\text{Eximpact} - b_{26}\,\text{Lim} \quad \text{(Eq. 2)}$$

$$\text{Cost} = b_{31}\,\text{Supfund} + b_{32}\,\text{Techsup} + b_{33}\,\text{Know} + b_{34}\,\text{Exfund} - b_{35}\,\text{Eximpact} - b_{36}\,\text{Lim} - b_{37}\,\text{Ability} \quad \text{(Eq. 3)}$$

$$\text{Compliance} = b_{41}\,\text{Supfund} + b_{42}\,\text{Techsup} + b_{43}\,\text{Know} + b_{44}\,\text{Exfund} + b_{45}\,\text{Eximpact} - b_{16}\,\text{Lim} + b_{47}\,\text{Ability} + b_{48}\,\text{Willingness} + b_{49}\text{Cost} \quad \text{(Eq. 4)}$$

$$\text{Effectiveness} = b_{51}\text{Supfund} + b_{52}\text{Techsup} + b_{53}\text{Know} + b_{54}\text{Exfund} + b_{55}\text{Extimpact} - b_{56}\text{Lim} + b_{57}\text{Ability} + b_{58}\text{Willingness} - b_{59}\text{Cost} + c_{11}\text{Compliance} \quad \text{(Eq. 5)}$$

Where

Effectiveness = Effectiveness of policy implementation

Supfund = Supporting fund

Techsup = Technical support

Know = Policy knowledge and experience

Exfund = External fund

Eximpact = External impact

Limit = Compliance limitation

Ability = Compliance ability

Willingness = Compliance willingness

Cost = Cost of compliance

Compliance = Degree of compliance

b11,....., b 59 and c11 were path coefficients.

3.4 Chapter Conclusion

This chapter covers literature on policy process and policy evaluation, including types of evaluation, which are process evaluation, impact evaluation, policy evaluation, and meta-evaluation and criteria used in policy evaluation, namely goal attainment, efficiency, constituency satisfaction, clientele responsiveness, and system maintenance. It also covers literature on the effectiveness of policy implementation and research on previous experiences in implementing energy conservation policies conducted by several scholars, which is used to develop the framework of study. Based on the literature, this dissertation exploited process evaluation and impact evaluation to frame the extent of the study. Goal attainment criterion is used to judge the effectiveness of policy

implementation. Ten sets of factors are proposed to determine the effectiveness of policy implementation, which are supporting fund, technical support, policy knowledge and experience, external fund, external impact, compliance limitations, compliance ability, compliance willingness, compliance cost, and degree of compliance.

CHAPTER 4

RESEARCH METHODOLOGY

The main objective of this chapter is to present the research methodology, which covers sampling procedures, data collection procedures, operational definitions of variables and measurements, research hypotheses, and finally reliability and validity tests.

4.1 Research Hypotheses

Based on the proposed model displayed in figure 3.1, the study proposes two main hypotheses to be tested.

Hypothesis 1: Higher amounts in supporting funds, technical support, policy knowledge and experience, and external funds are more likely to increase the effectiveness of policy implementation.

Hypothesis 2: Less external impact and compliance limitations are more likely to increase the effectiveness of policy implementation.

4.2 Operational Definitions of Variables and Measurement

This section describes details of operational definitions used in the study and measurement of each variable. Briefly operational definitions and measurements are displayed in table 4.1.

Table 4.1 Data Sources and Measurements of Proposed Variables

Variables and Items	Sources	Measure	Question Number	Reference
Effectiveness in Policy implementation • **Perceived increased productivity according to the ECAs** • **Perceived the reduction in energy dependency and greenhouse gas emissions** • **Perceived utilizing voluntary measures did not induce the reduction in energy use** • **Perceived the Act as a key mechanism to reduce country energy use** • **Perceived effective implementation of the Act**	Survey	• Respondent rating on scale of 1: 'Strongly disagree" to 4: "strongly agree"	**Part IV (no. 29-33)**	**Applied from** Stern et al (1986), Fowler (1992)
Supporting Fund • **Fund is properly and fairly allocated** • **Fund is adequate** • **Fund motivates and encourages implementation of ECAs** • **Fund criteria are impractical (reversed score)** • **Fund achieved goals** • **Fund conditions are proper**	Survey	• Respondent rating on scale of 1: 'Strongly disagree" to 4: "strongly agree"	**Part IV (no. 1-6)**	**Applied from** Stern et al. 1986; Coombs, 1980

Table 4.1 Data Sources and Measurements of Proposed Variables (Continued)

Variables and Items	Sources	Measure	Question Number	Reference
Technical Support **Perception of technical support** • **Helpful technical advice** • **Easy access to technical advice** • **Helpful information provided** • **Adequacy of information provided** • **Helpful training course provided** • **Adequacy of training course provided**	• Survey	• Respondent rating on scale of 1: 'Strongly disagree" to 4: "strongly agree" (Recoding "1 to 2" to "0" and "3 to 4" to "1")	**Part IV (no. 7-12)**	**Applied from** Coombs, 1980; USEAP, 1992
Type of technical support attained • **Technical advice** • **Training courses** • **Energy information** • **Investment advice**		• Respondent rating on scale of 1: Yes and 0: No.	**Part III (no. 31)**	
Frequency of technical support attained • **Technical advice** • **Training courses** • **Energy information** • **Investment advice**		• Respondent rating on scale of 0: Never, 1: 1-3 times, 2: 4-6 times, 3: 7-9 times and 4: above 10 times (Recoding "1" to "0" and "2 to 4" to "1")	**Part III (no. 32)**	

Table 4.1 Data Sources and Measurements of Proposed Variables (Continued)

Variables and Items	Sources	Measure	Question Number	Reference
Policy Knowledge and Experience • **Number of PREs who have been trained in energy conservation issues** • **Number of PREs who have experience in energy conservation activities** • **Previous energy conservation implementation**	Survey	• Reconding to "1" if they have and "0" if not. • Reconding to "1" if they have and "0" if not. • Respondent rating on previous energy conservation activities of the designated factories (Score "1" if yes and "0" if no)	**Part III (no. 20)** **Part III (no. 21.3)** **Part III (no. 22, 24, 25)**	**Applied from** Drezner and Bradley (1998)
External fund • **Ease access to external funds** • **Availability of external funds for energy conservation projects** • **Complicated external fund conditions**	Survey	• Respondent rating on scale of 1: 'Strongly disagree" to 4: "strongly agree"	**Part IV (no. 15-17)**	**Applied from** Howarth and Anderson, 1993
External Impact (X_8) • **Less impact from economic recession** • **Less impact from energy price fluctuation**	Survey	• Respondent rating on scale of 1: 'Strongly disagree" to 4: "strongly agree"	**Part IV (no. 13-14)**	**Applied from** Carlsmith et al. 1990; Pye and Elliott, 1998

Table 4.1 Data Sources and Measurements of Proposed Variables (Continued)

Variables and Items	Sources	Measure	Question Number	Reference
Compliance Limitations • **Budget constraints;** • **Lack of competent staff regarding energy conservation;** • **Employees lack of knowledge;** • **Lack of experience in energy conservation issues;** • **Executives lack of energy conservation policy knowledge;** • **Lack of executive support due to uncertain benefit;** • **Employees lack of awareness;** • **Lack of coordination among departments in factory; and** • **Lack of employee cooperation.**	Survey	• Respondent rating on scale of 1: "less importance", 2: "moderate", and 3" "very importance" "	**Part III (no. 33)**	**Applied from** Dincer, 1999; DeCanio, 1993: Pye and Elliott, 1998
Compliance Cost • **Perceived little impact from cost of compliance** • **Perceived benefit over cost**	Survey	• Respondent rating on scale of 1: 'Strongly disagree" to 4: "strongly agree"	**Part IV (no. 27-28)**	**Applied from** Grindle (1980, 1981). Drezner and Bradley (1998)

Table 4.1 Data Sources and Measurements of Proposed Variables (Continued)

Variables and Items	Sources	Measure	Question Number	Reference
Compliance Ability • **Perceived sufficiency of internal budget** • **Having energy consumption recording and monitoring system** • **Perceived ability of energy staff** • **Perceived experience, knowledge and skills of energy staff**	Survey	• Respondent rating on scale of 1: 'Strongly disagree" to 4: "strongly agree"	**Part IV (no. 23-26)**	**Applied from** Drezner and Bradley (1998); OECD, 2000; Winter and May, 2001
Compliance Willingness • **Perceived willingness to comply** • **Perceived executive support is high** • **Perceived factory staff regularly attend training courses** • **Perceived employees awareness and full cooperation** • **Perceived consideration of energy efficiency issues during purchase of new equipment**	Survey	• Respondent rating on scale of 1: 'Strongly disagree" to 4: "strongly agree"	**Part IV (no. 18-22)**	**Applied from** OECD (2001)
Degree of Compliance	Survey	• Number of energy conservation activities performed by the designated factories and degree of implementation rating on scale of 0: "Do not perform", 1: "Performed but not get approval yet", and 2: "Performed and get approval"	**Part III (no. 26)**	

4.2.1 Dependent Variable

Effectiveness of policy implementation is a dependent variable. Five items were used to measure effectiveness of policy implementation. The respondents were asked to indicate how much they agreed with the statements mentioned in Part IV of the questionnaire, questions 29-33. A four- point Likert scale was used ranging from 1: strongly disagree, 2: disagree, 3: agree, and 4: strongly agree. The summated scale was used for data analysis and the results will be shown and explained in chapter 5. The coefficient alpha is .74 (displayed in table 4.3).

4.2.2 Independent Variables

1) Supporting Fund The researcher proposed six items to measure attributes of the supporting fund provided to the designated factories. This was done by asking the PREs for their perceptions as to how they perceive the attributes of supporting funds, in terms of adequacy of the fund, conditions of the fund, or allocation of the fund. Details of the question are displayed in the Part IV of the questionnaire, question no. 1-6. The scale was based on a four- point Likert scale (ranging from 1: strongly disagree, 2: disagree, 3: agree, and 4: strongly agree). The alpha coefficient is .56 (displayed in table 4.3). The summated scale will be used for data analysis and the results will be shown and explained in chapter 5

2) Technical Support Based on the literature review, technical support was assessed through three sets of questions. First, the PREs were asked to indicate how much they agreed with the statements mentioned in Part IV of the questionnaire, questions no. 7-12. The scale of this set was similar to the supporting fund scale, which was based on a four- point Likert scale (ranging from 1: strongly disagree, 2: disagree, 3: agree, and 4: strongly agree). The Cronbach alpha was .72. The summated scale will be used for data analysis.

Next, the questions related to four types of technical support and also agencies that provided such support were asked. The main question was "Did your factory obtain the following support and from whom" (details in Part III of questionnaire, question no. 26). Four types of technical support concerned in this study were the technical advice on ECAs implementation, training sessions, energy information, and

energy conservation investment advice. The answer would be "yes = 1" or "no = 0". For this measure, the coefficient alpha was .68

Finally, the question, "How often did your factory obtain those four types of technical support?" was asked (details in Part III of questionnaire, question no. 27). The answers ranged from "above 10 times = 4", "7-9 times = 3", "4-6 times = 2", "1-3 times = 1", and "never = 0". The coefficient alpha is .66.

Scores from the three groups of questions were summed together and will be used in data analysis.

3) Policy Knowledge and Experience This variable was measured by asking if the factory has experience in energy conservation implementation. Nine activities were asked (details in Part III of the questionnaire, question no 21, 23, and 24). In addition, it also measured by asking to what extent the PRE has been trained in energy conservation issues (details in Part III of the questionnaire, question no 19) and what experience the PRE has in energy conservation. (Details in Part III of the questionnaire, see question no 20.3. The answer "yes" was scored "1" and "no" was "0". All scores were summed and used in data analysis.

4) External Fund This variable was assessed by a four-point Likert scale (ranging from "strongly disagree" =1 to "strongly agree" =4) by asking the PREs how much they agreed with the following three statements: "Your factory has easy access to external funds due to availability of external funds", "The energy conservation projects are in a higher rank to obtain loans from the financial markets", and "The fund approval conditions of financial institutions are complicated. The summed scores were used in data analysis. A reliability test was conducted and the coefficient alpha was .62.

5) External Impact Two items were assessed with regard to perception of external impact that affected the implementation of energy conservation activities (ECAs) prescribed by the Act. The following statements were rated by the PREs ranging from "strongly disagree" = 1 to "strongly agree" = 4. "The economic recession has less impact on my factory, the executive remain supportive of the ECAs" and "The fluctuation of energy prices has less impact on my factory, and the

implementation of ECAs remains a high priority". The scores of two items were summed and used in data analysis. The coefficient alpha is .70.

6) Compliance Limitations The sum score of nine items measured limitations in complying with the policy, which was developed from prior studies. PREs were asked to what degree your factory had the compliance limitations mentioned in Part III of questionnaire, question no. 28.

The scale ranged from "very important" = 3, "moderate" = 2, and "less important" = 1. The coefficient alpha is .90.

7) Compliance Cost Two items were constructed to assess the perception of cost of compliance that may affect the implementation of the ECAs. The PREs were asked how much they agreed with the following statements: "Cost of compliance with the policy has little impact on total cost of your factory" and "By comparing cost of and benefit from compliance with the policy; it seems that for your factory the benefit exceeds cost". The scores of two items were summed and used for data analysis. The coefficient alpha = .51.

8) Compliance Ability This variable measured the PREs perception on factory ability to implement the ECAs by using internal resources, staff, systems, and expertise. Four statements were constructed and the PREs were asked how much they agreed with such statements. These are displayed in Part IV of the questionnaire, question no. 23-26. The score is based on a four- point Likert scale and ranged from "strongly disagree = 1" to "strongly agree = 4". The coefficient alpha is .69. All scores were summed and used for data analysis.

9) Compliance Willingness There were five statements constructed to measure the factory willingness to comply with the policy. The PREs were asked how much they agreed with the statements displayed in Part IV of the questionnaire, question no. 18-22. Similar to compliance ability, the score was based on a four- point Likert scale and ranged from "strongly disagree = 1" to "strongly agree = 4". All scores were summed and used for data analysis. The coefficient alpha is .74.

10) Degree of Compliance This variable was assessed from the number of energy conservation activities prescribed by the Act, which total seven

activities as mentioned in Part III of the questionnaire, question no. 25. The PREs were asked "To what extent did your factory perform such activities?" The answer could be rated on three scales: "have done and got approval = 2", "have done but not approved yet =1" and "do not perform yet = 0". This score was employed to compute degree of compliance score. If the factory fully implemented all activities and all got approval, the degree of compliance score is 100% (calculated from total score obtained divided by maximum score and multiplied by 100), if they partly implemented, for example three activities were done, then degree of compliance score is 42.86%. The coefficient alpha is .61.

4.3 Sampling Procedures

4.3.1 Sampling Frame

All designated factories as mandated by the ECP Act were the "population sample" in the study. The number of designated factories as listed on May 31, 2001 were 2, 497 factories (detail shown in chapter 2, table 2.1). The sampling unit was framed to the four types of designated factories, which belonged to nine categories of TSIC industry groups (TSIC 31 to TSIC 39). As a result, 2,386 designated factories with clear addresses and with approved PREs were selected to be a sample. One hundred and eighty-eight designated factories (accounting for 13.3% of population) were drawn to be a sample in the study, which was calculated from the Survey System (2001: 1) with a confidence level of 95% and confidence interval of seven.

4.3.2 Sampling Design

Based on the designated factories listed at DEDP, the sampling method employed in the study is a stratified method by classifying all designated factories according to types of designated factories, TSIC categories, and the location of factories. The location of designated factories is classified into six areas, which are Bangkok and metropolitan area, central region, north, northeast, east, and south. However, the size of sample is based on a probability proportionate to size sampling. Mailing questionnaires to each stratum was based on a proportion shown in table 4.2, while disseminating questionnaires was on a random sampling method.

Table 4.2 Number of Target Population Classified by Types of Designated Factories and Number of Usable Questionnaires.

Category	Number of DFs [1/]	Probability proportionate of size sampling	Proportion of sample required	Number of completed questionnaires returned
Year One	288	1.0	22	36
Year Two	604	2.1	45	58
Year Three	411	1.4	30	33
Year Four	1,194	4.2	91	73
Total	2,497	8.7	188	200

Source: 1/ DEDP, 2001b: 4

4.4 Data Collection Methods

Major sources of data used in data analysis were gathered through a questionnaire, which is shown in appendix A, whereas supporting data was from two approaches: documentary analysis and in-depth interviews.

4.4.1 Questionnaires

The researcher estimated that the questionnaire would be returned at a rate of about 25 to 30 percent. Therefore, to ensure that the returned questionnaires could meet the sample required in the study, 570 questionnaires were distributed. At first, 400 questionnaires were mailed during April to July 2002 to the PREs of designated factories selected from the designated factory list with regard to the proportion mentioned in table 4.1. Later on, the researcher began to collect the second round, with the assistance of the DEDP officials; 170 questionnaires with the returned address were sent directly to the PREs who attended training sessions held around the country during May to August. After follow up by calling, 229 questionnaires were returned from both approaches. Fifteen questionnaires were duplicated and are excluded from the data analysis, nine questionnaires were incomplete and contained many missing values, and five questionnaires were out of the sample frame (2 questionnaires were from TSIC 29 (mining industry) and the rest were from TSIC 41

(electricity utilities). The returned questionnaire rate is 40.2 percent. Total usable questionnaires were 200 factories, which was slightly higher than the sample required.

4.4.2 In-Depth Interviews

In-depth interviews were undertaken to obtain the information on the perspective of the policy formulator, implementing agency, related agencies and also the person responsible for energy conservation (PREs).

1) Public Sector

The selected key informants in the public sector include representatives from:

(1) Department of Energy Development and Promotion (DEDP);

(2) National Energy Policy Office (NEPO);

(3) The Energy Conservation Center in Thailand (ECCT); and

(4) Energy Specialists.

2) Private Sector

The key informants in the private sector cover:

(1) PREs from selected designated factories;

(2) The energy consultant companies; and

(3) Accredited Companies (AC): the implementing agencies hired by DEDP.

4.5 Data Analysis Methods

Path analysis was employed to explore the causal relationships between the dependent variable (effectiveness of policy implementation) and independent variables (supporting fund, technical support, policy knowledge and experience, external fund, external impact, compliance limitation, compliance ability, and compliance willingness, and degree of compliance with the policy). The causal model is divided into five sets of multiple regression models. Stepwise regression analysis was used for each regression model. SPSS program was a tool for compiling and processing data.

4.6 Validity and Reliability

Before exploring the logical relationships between the dependent variable and independent variables it was necessary to gauge the extent of validity and reliability for each indicator used in later analysis. This section explains how both reliability and validity of such variables were tested.

4.6.1 Reliability Test

Reliability was judged via the calculation of a Cronbach alpha coefficient. The results of calculation of Cronbach alpha coefficient ranged from .5173 to .9038, which are displayed in table 4.3. Only two measures revealed an alpha coefficient less than .60. These were supporting fund and compliance cost; however, the alpha value of both measures yielded greater than .50; therefore, it could be considered as acceptably reliable.

Table 4.3 Reliability Test Results

Scale	Number of scale items	Cronbach alpha coefficient
Effectiveness of Policy Implementation	5	.7426
Supporting find	6	.5643
Properly technical support	14	.7193
Policy Knowledge and experience	11	.8523
External fund	2	.6214
External impact	2	.6973
Compliance limitations	9	.9038
Compliance cost	2	.5173
Compliance Ability	4	.6913
Compliance Willingness	5	.7608
Degree of compliance	7	.6115

4.6.2 Validity Test

The researcher investigated the content validity by checking the contents of questionnaire via expert opinion (6 energy specialists were asked to comment and later the questionnaire was revised based on their comments before mailing to sample). The construct validity was judged by comparison with previous literature to see whether they were relevant with and supported by the former ones.

4.7 Chapter Conclusion

This chapter displayed the research methodology of the study, which included sampling procedures and data collection procedures including mailing questionnaires, and in-depth interviews. Two hundred returned questionnaires were usable. In addition, the operational definitions and measurement of all variables and also research hypotheses were explained in this chapter. This chapter also displayed reliability and validity tests of the variables. The next chapter will describe the results of the study.

CHAPTER 5

DATA ANALYSIS AND THE RESEARCH RESULTS

The main objectives of this chapter are (1) to present the general characteristics of the samples, (2) to present the descriptive statistics of the dependent and independent variables, (3) to display the findings, and (4) to demonstrate the hypotheses testing and the results.

5.1 The General Characteristics of the Samples

With respect to the 200 factories in the sample, the average factory age of all groups was 17.21 years; daily working hours and yearly working hours were 15.75 and 4,986.52 respectively. Monthly working days and yearly working days were 26.05 and 307.72 respectively. The average number of employees was 876 people and the number of people responsible for energy (PREs) was 1.73; the maximum number was eight people (in a cement factory in the central region) and minimum was one person. Operating capacity of all samples was around 66.74%. Average monthly energy costs of all samples was 11.15 million baht; however, the researcher found that this value varied depending on the scale of factory. Year one factories (large scale) seemed to pay higher energy costs and year four factories (small scale) paid less.

Table 5.1 Descriptive Statistics of the Samples

Characteristics of Samples	Mean	S.D.	Min	Max	Total Samples
Factory age (years)	17.21	10.61	2	60	199
Daily working hours	15.75	7.38	8	24	200
Yearly working hours	4,986.52	2,653.13	1,600	8,748	199
Yearly working days	307.72	40.94	160	365	199
Monthly working days	26.05	3.13	14	30	199
Number of employees	875.6	1,074.04	19	13,846	197
Number of persons responsible for energy (PREs)	1.73	1.17	1	8	199
Operating capacity (percent)	66.74	23.04	4	100	190
Monthly energy cost (Million baht)	11.15	32.35	.034	281.60	179
Monthly electricity use (kWh)	2,905,183	8,441,767	20,109	278,745,550	199

Regarding energy consumption of the samples, the data reveals that electricity was the major type of energy consumed by sample factories; based on 199 factories, the average monthly electricity consumption was 4,766,194 kWh. Fuel oil was in second rank. Average consumption amounted to 561, 938 tons (based on 110 factories), followed by LPG 144,857 tons (based on 44 factories) and diesel consumption 119,346 tons (based on 28 factories). Another type of energy that was consumed by some factories was natural gas, gasoline, agricultural waste and coke and coal (details in table 5.2).

The data showed that only 15.6% of samples have currently set up an energy section to handle the energy conservation activities (ECAs) prescribed by the ECP Act. Meanwhile, more than 80% of samples assigned ECAs to other sections, namely maintenance, production, engineering, electrical, environment, or energy committee (details in table 5.3). The energy committee and engineering sections seem to be the key players performing the ECAs in most samples.

Table 5.2 Type of Energy Consumption of the Samples

Type of Energy	Mean	S.D.	Min.	Max.	Number of factories
Coke and Coal (kg)	27,380,367	45,582,510	100	80,000,000	3
Diesel (litre)	119,680	469,837	300	2,500,000	28
Electricity (kWh)	4,766,194	21,423,576	20,109	278,747,549	199
Fuel oil (litre)	561,938	1,850,701	296	17,390,000	110
Gasoline (litre)	301,800	518,058	1,600	900,000	3
LPG (kg)	144,857	455,718	400	2,680,000	44
Natural gas (MMBTU)	1,197,694	4,095,367	2,935	17,487,000	19
Agriculture waste (Ton)	31,991	53,300	30	180,000	13
Steam	3,604	3,112	379	6,525	4
Monthly energy cost (thousand baht)	11,125	32,456	34	281,600	179
Energy cost ratio (percent)	24	17	1	90	117

Table 5.3 Sections Responsible for the Energy Conservation Activities

Section	Percent	Frequency
Energy Section	15.6	31
Maintenance Section	18.7	37
Production Section	3.0	6
Engineering Section	21.2	42
Electrical and Environment Section	3.0	6
Energy Committee	25.3	50
More than one section involved	13.1	26

Considering the level of education and the degree of graduation of the PREs, the data revealed that approximately 53.3 % of PREs graduated with a bachelor degree in engineering (table 5.4). The majority of the PREs, 76 % of the sample, graduated in the electrical field and 33% of the samples with a mechanical degree. Few PREs attained degrees in science and technology, production engineering and electronic engineering (8% of the samples). Two percent of the samples have PREs who graduated in the energy field working with them (details in table 5.5).

Table 5.4 Percentage of Factories Classified by Level of Education of PREs

Qualification	Number of factories				Total
	PRE = 1 person	PRE =2 person	PRE = 3 person	PRE > 3	
Occupational certification	9.5	2.5	0.5	0.0	100.0 (199)
High occupational certification	31.2	7.5	0.0	0.5	100.0 (199)
Bachelor degree	53.3	13.1	4.0	2.0	100.0 (199)
Master degree	5.0	0.0	0.0	0.5	100.0 (199)

Table 5.5 Percentage of Factories Classified by Degree of Graduation of PREs

Degree of graduation	Number of factories				Total
	PRE = 1 person	PRE =2 person	PRE = 3 person	PRE > 3	
Electrical Engineering	61.7	10.9	2.1	1.6	100.0 (193)
Mechanical Engineering	25.9	5.7	0.5	0.5	100.0 (193)
Science and Technology	7.3	0.5	0.0	0.0	100.0 (193)
Energy	2.1	0.0	0.0	0.0	100.0 (193)
Other (Production Engineering, Electronic Engineering)	11.9	3.1	0.5	0.5	100.0 (193)

Regarding energy work experience of the PREs in term of years, the data shows that work experience of most PREs is one to three years (38.5 percent of the samples). An additional 24 percent of the samples have PREs with energy experience of four to six years working with them. In addition, 18 percent of the sample factories have PREs with seven to nine years energy experience and only 10 percent of the samples have the PREs with energy experience above ten years (details in table 5.6). It is reasonable to assume that the designated factories that have experienced PREs should be able to perform the energy tasks better than those who have not.

Table 5.6 Percentage of Factories Classified by the Years of Energy Experience of PREs

Year of energy experience	Number of factories				Total
	PRE = 1 person	PRE =2 person	PRE = 3 person	PRE > 3	
1-3 years	26.6	10.3	1.1	0.5	100.0 (184)
4-6 years	20.7	3.3	0.0	0.0	100.0 (184)
7-9 years	15.2	2.7	0.0	0.0	100.0 (184)
Above 10 years	8.7	1.1	0.5	0.0	100.0 (184)

5.1.1 Characteristics of Samples by Types of Designated Factories

Of the 200 factories, 18.0% were year one factories, 29.0% year two, 16.5% year three, and 36.5% year four. From table 5.7, it can be seen that year one factories displayed a higher age than the others (22.31 years) did. Similarly, the year one factories showed higher numbers in daily working hours, yearly working hours, yearly working days, and monthly working days (19.89 hours, 6,884 hours, 334 days, and 27.91 days respectively).

The average number of employees and of people responsible for energy (PREs) was greatest in year one factories (1,407 people and 2.23 people respectively). Average monthly energy cost was highest in year one factories, accounting for 36.53 million baht and monthly electricity use was 11,508,591 kWh, which was far higher than the other three types of designated factories. Meanwhile, the others spent from 4 to 8 million baht a month.

Considering current operating capacity, the data revealed that year two factories was greatest at 72.96%; meanwhile year one factories was 68.63%. However, both types of factories were higher than year three and year four factories, which are 63.23% and 62.33%, respectively.

Table 5.7 Characteristics of the Samples by Type of Designated Factories

Characteristics of Designated Factory	Year One (n=36)		Year Two (n=58)		Year Three (n=33)		Year Four (n=73)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Factory age (years)	22.31	12.26	16.85	9.93	15.70	8.37	15.49	10.50
Daily working hours	19.89	6.82	16.53	7.39	15.93	7.67	12.85	6.39
Yearly working hours	6,884.34	2,674.48	5,177.96	2,642.65	4,573.60	2,288.55	4.014.05	2,268.14
Yearly working days	334.57	39.60	300.30	41.59	302.83	43.20	301.67	34.64
Monthly working days	27.91	3.09	25.81	3.23	26.10	3.12	25.24	2.70
Number of employees	1,407.20	1,875.01	800.85	707.97	863.70	950.33	439.80	522.25
Number of persons responsible for energy (PRE)	2.23	1.57	1.91	1.30	1.60	0.72	1.38	0.80
Operating capacity	68.63	25.72	72.96	19.59	63.23	22.83	62.33	23.43
Monthly energy cost (Million baht)	36.53	65.75	4.85	6.62	2.85	5.32	8.96	25.47
Monthly electricity use (kWh)	11,508,591	18,373,475	2,120,970	3,599,488	881.902	1,583.698	890.963	2,013.226

5.1.2 Characteristics of Samples by TSIC Groups

Nine groups of TSIC industries were considered in the study comprising of TSIC 31 (Food and Beverage), TSIC 32 (Textiles), TSIC 33 (Wood and Furniture), TSIC 34 (Pulp and Paper), TSIC 35 (Chemical), TSIC 36 (Non-Metallic), TSIC 37 (Basic Metal), TSIC 38 (Fabricated Metal), and TSIC 39 (Others). Considering the samples by TSIC, it reveals that major respondents were from food and beverage factories, followed by fabricated metal and chemical. These three categories of factories accounted for 71.0% of samples (details in table 5.8).

Among nine categories of TSIC, non-metallic factories (TSIC 36) consumed the most electricity monthly. Electricity consumed was 8,272 MWh, followed by chemical factories (TSIC 35) 4,126 MWh, basic metal factories (TSIC 37) 2,852 MWh, fabricated metal factories (TSIC 38) 2,389 MWh, food and beverage factories (TSIC 31) 1,952 MWh, textile factories (TSIC 32) 1,133 MWh, wood and furniture factories (TSIC 33) 374 MWh, and other factories (TSIC 39) 226 MWh.

Regarding the monthly energy costs, non-metallic factories spent greater amounts on energy costs, accounting for 25.70 million Baht per month, followed by chemical factories accounting for 17.61 million Baht.

Food and beverage factories accounted for 12.40 million Baht and basic metal factories were in the fourth rank and accounted for 9.68 million Baht.

Operating capacity among sample factories ranged from 55 to 72%, TSIC 34 had the greatest operating capacity (74%), followed by TSIC 34 (71%), TSIC 35 and TSIC 36 were similarly (70%). The remaining was below 65% (details showed in table 5.8).

The number of employees was higher in TSIC 38. The average number of employees was 1,389 people. For number of PREs, TSIC 36 had greater numbers, on average (2 persons); other sample factories had one person.

Table 5.8 Characteristics of the Samples by TSIC Groups

	TSIC 31 (n= 54)		TSIC 32 (n= 18)		TSIC 33 (n= 4)		TSIC 34 (n= 6)	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Factory age (years)	19.02	11.18	16.80	7.39	14.75	13.82	14.00	10.80
Daily working hours	13.43	6.42	15.47	8.26	14.00	7.66	16.00	6.53
Yearly working hours	4,098.08	2,163.67	5,321.60	2,858.81	4,116.00	2,296.11	4,694.00	2,136.20
Yearly working days	303.49	43.06	315.13	23.12	291.50	20.42	286.75	26.50
Monthly working days	25.98	2.69	26.67	2.23	24.75	1.89	25.25	4.11
Number of employees	824.06	853.29	592.33	375.66	326.50	218.16	257.50	126.06
Number of persons responsible for energy (PREs)	1.76	1.15	1.60	0.74	1.00	0.00	1.25	0.50
Operating capacity	62.90	23.50	74.13	19.22	60.25	23.10	71.25	21.75
Monthly energy cost (Million baht)	12.34	27.10	3.83	3.34	0.73	0.42	0.53	0.04
Monthly electricity use (kWh)	1,915,501	4,142,842	1,133,261	957,282	374,027	281,026	163,718	90,110

Table 5.8 Characteristics of the Samples by TSIC Groups (Continued)

	TSIC 35 (n= 43)		TSIC 36 (n= 15)		TSIC 37 (n= 14)		TSIC 38 (n=45)		TSIC 39 (n=1)	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Factory age (years)	15.55	9.92	16.43	11.57	21.64	12.26	14.96	10.31	21.0	
Daily working hours	16.84	8.20	21.71	5.81	17.36	7.12	14.18	7.03	8.00	
Yearly working hours	5,476.00	2,781.32	7,106.57	2,258.31	5,532.79	2,689.34	4,388.40	2,604.96	2,400	
Yearly working days	310.13	36.88	328.29	49.50	313.43	39.36	294.45	42.21	300	
Monthly working days	25.97	3.19	27.36	3.91	26.43	3.08	25.03	3.35	25	
Number of employees	775.71	862.41	693.93	864.74	197.29	185.04	1,388.93	1,780.62	200	
Number of persons responsible for energy (PREs)	1.58	0.86	2.07	2.34	1.57	0.65	1.85	1.17	1.00	
Operating capacity	70.87	24.11	70.14	19.88	55.57	19.21	64.78	24.69	78	
Monthly energy cost (Million baht)	17.61	48.98	25.70	62.64	9.68	17.80	3.94	6.76	0.52	
Monthly electricity use (MWh)	4,125,786	12,098,600	8,272,006	19,891,237	2,851,709	4,991,961	2,389,247	3,88,031	226,426	

5.1.3 Characteristics of Samples by Location

Most samples were located in Bangkok and metropolitan area, accounting for 47.0%, followed by the central region (21.5%), southern region (11.0%), eastern region (12.0%), northeastern region (5.5%), and northern region (3.0%). The study revealed that average monthly electricity consumption was greater in the central region, accounting for 3,943 MWh. The eastern region followed this, where the average electricity consumption was 3,563 MWh; northeastern region was 3,291 MWh, while the sample factories in Bangkok and metropolitan area was 2,930 MWh, and the northern region was 1,349 MWh. The sample factories in the southern region consumed less electricity than those factories from other regions, accounting for 443 MWh, which may be caused from the few samples obtained (5 factories) in this region (details in table 5.9).

Table 5.9 Characteristics of the Samples by Location

	Bangkok & Metro. (n=94)		Central Region (n= 43)		Eastern Region (n= 24)	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
Factory age (years)	18.63	10.80	19.13	12.31	12.32	8.80
Daily working hours	16.43	7.44	14.28	7.58	13.91	7.46
Yearly working hours	5,245.82	2,673.07	4,552.78	2,673.14	4,245.95	2,808.38
Yearly working days	306.56	35.53	309.86	50.73	292.41	47.36
Monthly working days	25.91	3.01	26.72	3.05	24.59	3.57
Number of employees	654.80	905.04	931.08	872.24	710.18	559.74
Number of persons responsible for energy (PREs)	1.78	1.23	1.75	1.38	1.55	0.74
Operating capacity (percent)	67.94	21.98	59.61	21.33	64.73	25.41
Monthly energy cost (Million baht)	8.82	20.49	14.07	39.87	17.49	60.80
Monthly electricity use (MWh)	2,929,846	8,102,925	3,942,812	11,907,452	3,536,093	8,827,178

Table 5.9 Characteristics of the Samples by Location (Continued)

	Northern Region (n=6)		Northeastern Region (n= 11)		Southern Region (n= 22)	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
Factory age (years)	13.00	3.46	14.22	10.86	15.43	7.78
Daily working hours	21.20	6.40	13.33	6.90	15.85	7.40
Yearly working hours	6,696.00	1,387.86	3,733.33	2,029.78	5,287.30	2,469.03
Yearly working days	315.00	29.93	305.56	16.67	318.22	43.16
Monthly working days	26.60	1.95	25.78	1.64	26.57	3.51
Number of employees	1,641.40	1,456.92	1,339.44	2,875.32	1,007.83	1,232.61
Number of persons responsible for energy (PREs)	2.40	1.67	1.22	0.44	1.70	0.97
Operating capacity	89.60	13.35	60.11	26.94	72.22	24.58
Monthly energy cost (Million baht)	3.02	2.42	6.96	7.04	13.12	30.42
Monthly electricity use (MWh)	1,348,654	1,028,212	3,290,696	5,074,034	443,082	292,057

The researcher is confident that the samples are representative of the target population in this study, whether considered in terms of types of designated factories, TSIC groups industry or location of factories. Even though TSIC 39 contained only one sample, if considered in proportion with the total population, the result showed that it was reasonable since the number of factories in TSIC 39 was 51 factories or only 2% of the total population (2,497 factories).

5.2 Data Analysis and Results of the Study

Descriptive statistics of the dependent and independent variables are presented in this section including mean score and standard deviation of each variable. This section also covers the correlation results and the findings and discussion.

5.2.1 Descriptive Statistics

1) Effectiveness of Policy Implementation: Results indicated that mean score of perception on effectiveness of policy implementation was 14.83 (S.D.

3.16); the possible maximum score was 20.0 and minimum was 3.00. Regarding the mean score, which was above the median score (10.0), it could be claimed that most respondents perceived that the policy was effective and implementation could achieve its intended objectives, which included increasing energy efficiency use, reduction in energy dependence and greenhouse gas emission. Furthermore, the sample respondents also perceived that without the policy, such objectives might face difficulty in achievement. Approximately 84 % of the factories perceived that the policy was a more powerful instrument to stimulate implementing energy conservation measures and that only utilizing voluntary measures was less effective. It is remarkable that approximately 80% of the factories perceived that the implementation of the energy conservation policy was effectively executed. The extent of perception of PRE's on effectiveness of policy implementation by item is revealed in table 5.10.

Table 5.10 Perception of PREs on Effectiveness of Policy Implementation (in percentages)

Statements	Strongly Disagree	Disagree	Agree	Strongly Agree	Uncertain	Total
Energy conservation activities (ECAs) prescribed by the Act help to increase the factory productivity and decrease the production cost.	3.4	7.3	67.8	10.2	8.3	100.0 (194)
The implementation of the ECAs is beneficial to the country by reducing energy dependency and greenhouse gas emission.	2.0	2.9	53.7	36.6	2.9	100.0 (194)
Without the Act, utilizing only voluntary measures to promote energy conservation implementation is unable to achieve the reduction of energy consumption goal.	2.0	7.3	52.2	33.7	3.4	100.0 (194)
The Act is a key mechanism to reduce country energy consumption.	2.4	7.3	57.1	26.3	6.3	100.0 (194)
The implementation of the Act is effectively executed.	2.0	8.3	57.1	23.4	8.8	100.0 (194)

Mean = 14.83 S.D. = 3.17

2) Supporting fund: Results showed that the mean score of attitudes towards the supporting fund was 12.54 (S.D. = 4.08), possible maximum score was 20.0 and minimum was 1.00. The results showed that respondents perceived that the existing supporting fund was moderately acceptable in terms of its allocation, of its adequacy, and of its conditions. The extent of PRE's perception on the adequacy of the supporting fund is displayed in table 5.11. It is noticeable that approximately 42 % of the factories perceived the amount of supporting fund was inadequate and 36 % perceived fund conditions as inappropriate. However, 67 % of the factories perceived that the financial support was able to achieve its goal, and promote the implementation of energy conservation activities. In addition, approximately 57% of the factories perceived that current financial support is able to motivate and encourage the implementation of energy conservation activities.

Table 5.11 PRE's Perception of the Supporting Fund (in percentages)

Statements	Strongly Disagree	Disagree	Agree	Strongly Agree	Uncertain	Total
The supporting fund is properly allocated to all designated factories.	2.9	12.7	42.0	5.9	31.5	100.0 (193)
Current types of supporting funds are adequate	7.8	34.6	29.3	3.4	23.4	100.0 (193)
Current financial support is able to motivate and encourage implementing the ECAs prescribed by the Act.	7.8	26.3	50.7	6.8	7.8	100.0 (193)
Current criteria for requesting financial support is impractical (reversed score)	4.4	17.1	41.5	12.2	22.0	100.0 (193)
Financial support is able to achieve its objectives of promoting energy conservation implementation and reducing energy consumption in factories.	5.9	16.1	54.6	12.2	9.3	100.0 (193)
Conditions required for the designated factories to obtain financial support from financial institutions before requesting interest payment support for investing in the ECMs are appropriate.	4.4	31.7	43.9	4.4	12.7	100.0 (193)

Mean = 12.54 S.D. = 4.08

3) Technical support: Technical support in this study covered three types of measurements. First was on the extent to which the PRE's perceived proper technical support was being provided. The details are exhibited in table 5.12. Most respondents, approximately 84%, perceived that current technical provision seemed properly provided; 57% of the factories perceived the current provision of technical advice is easily and rapidly accessed and nearly 78% of the factories perceived that the training courses by DEDP helped their staffs to perform better energy conservation duties. However, it is noticeable that among several kinds of technical support, adequacy of information relevant to energy conservation and training courses provided is perceived as less than adequate (approximately 43% and 36% respectively). As a result, they should be improved to promote effective policy implementation.

Table 5.12 PRE's Perception of the Adequacy of Technical Support (in percentages)

Statements	Strongly Disagree	Disagree	Agree	Strongly Agree	Uncertain	Total
The technical advice provided by DEDP help your factory clearly understand the Act and be able to perform the tasks prescribed by the Act.	3.9	7.3	62.0	22.0	3.4	100.0 (177)
The provision of technical advice is easily and rapidly accessed.	7.3	23.7	49.8	6.3	7.8	100.0 (177)
Information provided by DEDP helped your factory know how to implement the activities prescribed by the Act.	3.9	10.2	68.3	10.7	4.4	100.0 (177)
The provision of information relevant to energy conservation by DEDP is adequate.	6.8	36.6	40.5	5.4	8.3	100.0 (177)
Training courses provided by DEDP help the factory staffs perform better energy conservation duties.	1.0	11.7	67.3	11.7	5.4	100.0 (177)
Training courses provided by DEDP are adequate.	6.3	29.8	47.8	6.8	5.4	100.0 (177)

Second, technical support also covered type of support; the respondents were asked if their factories have received four types of support, namely implementation advice, training, information, and investment advice. The extent of obtaining technical

support is demonstrated in table 5.13. Approximately 85 percent of respondents received three types of support, which were implementation advice, training, and information. Only 61 percent obtained investment advice.

Table 5.13 Percentage of Factories that Obtained Technical Support

Type of supports	Yes	No	Total
1. Implementation of the ECAs advice	85.8	14.2	100.0 (199)
2. Training provision	87.7	12.3	100.0 (199)
3. Energy information provision	87.7	12.3	100.0 (199)
4. Energy conservation investment advice	61.3	38.7	100.0 (199)

The details with regard to frequency of attaining technical support are shown in table 5.14. Results showed that a major proportion of respondents have attained technical support around one to three times a year. However, approximately 10 percent of respondents never attained three types of support, moreover; nearly 39 percent of respondents never attained energy conservation investment advice. This indicator also supported the empirical evidence on the current implementation of energy conservation activities prescribed by the Act that revealed that most factories did not reach the investment step.

Table 5.14 Percentage of Respondents that Obtained Technical Support

Type of support	More than 10 times	7-9 times	4-6 times	1-3 times	Never	No answer	Total
Advice on the implementation of the ECAs	23.4	6.3	6.3	43.4	14.6	5.9	100.0 (199)
Training provision	22.4	7.3	6.3	48.2	10.2	5.9	100.0 (199)
Energy information provision	22.9	11.7	14.1	36.6	8.3	6.3	100.0 (199)
Energy conservation investment advice	20.5	2.9	1.5	27.8	38.5	8.8	100.0 (199)

Overall technical support Mean = 8.24 S.D. = 2.67

Overall perceived technical support mean score was 8.24 (S.D. = 2.67). Possible maximum score of technical support was 14 and minimum score 0. According to the mean score, it meant that a moderate percentage of the samples perceived that adequate technical support was provided to them.

4) Policy Knowledge and Experience: Three perspectives were used to measure policy knowledge and experience.

First, policy knowledge was measured by asking, "Have the PREs been trained in energy conservation? Almost all (97 %) of the factories have trained PREs (details in table 5.15).

Second, policy experience was measured by asking, "Did the PREs have energy experience?" The findings revealed that 34.6% of the PREs had energy experience. This showed that few factories have energy experienced PREs (details in table 5.15).

Lastly, previous implementation was directly measured from the number of energy conservation activities performed previously; nine activities were proposed for rating by the samples. The data of samples in table 5.15 show that 28.6% of the factories have had experience in energy audits before becoming designated factories. Among those having experience in energy audits, approximately 70% conducted energy audits by themselves; the remaining hired energy consultants to perform such functions. Sixty five percent of the factories have experience in undertaking energy conservation measures in their factories.

Among the energy conservation measures (ECMs) performed by the sample factories, power factor improvement was the mostly frequently performed activity by the samples (43.9%). Heat loss prevention was ranked second; 40.4% of the samples had done this measure. Energy saving promotion was in third place (36.9% of the samples), following by combustion efficiency improvement (34.9 % of the samples), installing energy efficient machines (28.8% of the samples), heat recovery (27.3% of the samples) and energy substitution (11.1% of the samples). In addition, the results revealed that most of the respondents perceived that the ECMs could save energy by 1-15%.

The mean score of policy knowledge and experience calculated from the above three dimensions was 4.95 (S.D. = 2.80); the possible maximum score was 11.0 and minimum was 1.00. It is safe to say that even though most samples have trained PREs, they have limited policy knowledge and experience in energy conservation.

Table 5.15 Percentage of the Factories who have Experience in Energy Conservation Activities.

	Yes	No	Total
Having trained PREs	97.6	2.4	100.0 (199)
PREs having energy saving experience	34.6	65.4	100.0 (187)
Experienced in energy audit	28.6	71.4	100.0 (196)
Experienced in undertaking ECMs	65.3	34.7	100.0 (196)
Combustion efficiency improvement	34.9	65.2	100.0 (198)
Heat loss prevention	40.4	59.6	100.0 (198)
Heat recovery	27.3	72.7	100.0 (198)
Energy substitution	11.1	88.9	100.0 (198)
Power factor improvement	43.9	56.1	100.0 (198)
Installing energy efficient machinery	28.8	71.2	100.0 (198)
Energy saving promotion	36.9	63.1	100.0 (198)

Mean = 4.95 S.D. = 2.80

5) External funds: The mean score of perception of availability and accessibility to external funding of the respondents was 3.38 with S.D. 1.91. Possible maximum was 8.0 and minimum was 0.00; the result of the mean score was slightly below the median score, which meant that the samples perceived availability and accessibility to external funding was less than adequate. The extent of the perceptions is exhibited in table 5.16. Approximately 59% of the factories perceived difficulty in accessing external funds. Moreover, 41% perceived that energy conservation projects have a lower priority in the financial markets.

Table 5.16 PRE's Perception on Availability of External Funds (in percentages)

Statements	Strongly Disagree	Disagree	Agree	Strongly Agree	Uncertain	Total
Your factory can easily access external funds due to availability of external funds.	12.2	47.3	21.0	1.0	15.6	100.0 (193)
The energy conservation projects is in a higher rank to obtain loans from financial markets.	7.3	34.1	24.4	0.5	30.2	100.0 (193)
The fund approval conditions of financial institutions are complicated (reversed score).	9.8	44.9	12.2	3.9	26.3	100.0 (193)

Mean = 3.38 S.D. = 1.91

6) External Impact: Perception of external impacts that may affect the implementation of energy conservation activities was rated 4.68 mean score (S.D. = 1.67). Possible maximum score was 8.00, and minimum was 0.00. The mean score showed that most samples perceived moderate effects from external impact. The extent is displayed in table 5.17. Approximately 42% of the factories perceived external impact whether from economic recession or energy price fluctuation had an effect on their factories.

Table 5.17 PRE's Perception of External Impact (in percentages)

Statements	Strongly Disagree	Disagree	Agree	Strongly Agree	Uncertain	Total
The economic recession has less impact on my factory; the executives remain supportive of the implementation of the ECAs.	8.3	34.2	39.0	8.3	7.8	100.0 (195)
The fluctuation of energy prices has less impact on my factory; the implementation of the ECAs remain a high priority.	7.3	34.6	40.5	8.3	7.3	100.0 (195)

Mean = 4.68 S.D. = 1.67

7) Compliance Limitations: Mean score was 18.41 (S.D. 4.95), which revealed that most samples perceived moderate limitations in complying with the policy in

their factories. The possible maximum score was 27. Table 5.18 illustrates compliance limitations by item. Results show that budget constraint, employee lack of knowledge, and employee lack of awareness gained higher recognition in the importance of compliance limitations, followed by employee lack of coordination among departments in the factory. The results imply capacity and management constraints within the factory.

Table 5.18 PRE's Perception of Limitations in Complying with Policy (in percentages)

Type of limitations	Very much	Moderate	Less	No Answer	Total
Budget constraint	36.1	41.0	15.6	7.3	100.0 (200)
Lack of competent staff regarding energy conservation	22.9	50.2	17.6	9.3	100.0 (200)
Employee lack of knowledge	36.1	43.9	10.7	9.3	100.0 (200)
Lack of experience	24.9	46.4	16.1	12.6	100.0 (200)
Executives lack of understanding in policy	20.0	45.9	22.9	11.2	100.0 (200)
Lack of executive support due to uncertain benefit	18.0	44.9	26.8	10.3	100.0 (200)
Employee lack of awareness	32.2	48.3	9.8	9.7	100.0 (200)
Lack of coordination among departments in factory	29.8	43.4	14.6	12.3	100.0 (200)
Lack of employee cooperation	21.0	44.4	21.5	13.5	100.0 (200)

Mean = 18.41 S.D. = 4.95

8) Compliance Cost: The mean score was 5.42 (S.D. 1.70); possible maximum score was 8.0 and minimum was 1.00. The mean result showed that most samples perceived slightly higher compliance cost within their factories. Approximately 50% of the factories perceived compliance cost was over compliance benefit and nearly 65% of the factories perceived less impact of compliance cost to total cost. The perception of compliance cost was shown in table 5.19.

Table 5.19 PRE's Perception of Compliance Cost (in percentages)

Statements	Strongly Disagree	Disagree	Agree	Strongly Agree	Uncertain	Total
Cost of compliance with the policy has less impact on total cost of your factory.	2.9	25.4	54.6	9.8	5.4	100.0 (195)
By comparing cost of and benefit from compliance with the policy it seems that for your factory the benefit is over cost.	12.7	37.6	32.7	5.9	8.8	100.0 (195)

Mean = 5.42 S.D. = 1.70

9) Compliance Ability: Compliance ability was measured from the perception of samples on their existing internal capabilities that could be employed to perform energy conservation activities (details shown in table 5.20). The mean score was 9.10 (S.D. 2.82); possible maximum score was 16 and minimum was 2. The result revealed that most samples perceived that they had moderate ability to comply with the policy. Approximately 57% of the factories perceived sufficient budget to implement the ECAs prescribed by the Act and nearly 62% have energy data collecting and monitoring systems. It is remarkable that approximately 68% of the factories perceived that their staff has limited ability to conduct energy audits by themselves and nearly 37% of the factories perceived that their staff has little knowledge and experience in energy conservation.

Table 5.20 PRE's Perception of Ability to Comply (in percentages)

Statements	Strongly Disagree	Disagree	Agree	Strongly Agree	Uncertain	Total
Your factory has sufficient budget to implement the EC As prescribed by the Act.	4.9	24.4	48.3	8.3	11.7	100.0 (195)
Your factory has energy data collecting and monitoring systems and can report the results of energy conservation implementation.	2.4	22.9	55.6	6.8	10.2	100.0 (195)
Your factory staff has the ability to conduct energy auditing by themselves.	16.6	52.7	16.6	5.4	7.3	100.0 (195)
The factory energy staff has energy knowledge and experience in energy conservation.	4.9	33.2	47.3	3.9	8.8	100.0 (195)

Mean = 9.10 S.D. = 2.82

10) Compliance Willingness: Regarding table 5.21, the mean score of compliance willingness was 13.21 (S.D. 3.34) and possible maximum score was 20 and minimum was 1.00. It could be said that most samples perceived that the factories had a reasonably high level of willingness to comply with the policy. Approximately 81% of the factories indicated regular support to attend training, meetings, or seminars; 71% perceived their factories were willing to implement the ECAs even without financial support. In addition, 71% of the factories claimed their executives strongly advocate the implementation of the ECAs; nearly 66% noted consideration of energy efficiency when purchasing the new machines or equipment and 53% of the factories perceived that their employees were aware and cooperative in implementation.

Table 5.21 PRE's Perception of Compliance Willingness (in percentages)

Statements	Strongly Disagree	Disagree	Agree	Strongly Agree	Uncertain	Total
Your factory is willing to implement the ECAs even without financial support from the ECP Fund.	1.5	10.7	60	18.5	7.8	100.0 (193)
The factory executives strongly advocate the implementation of the ECAs prescribed by the Act.	1.5	17.1	57.6	13.2	8.8	100.0 (193)
The factory staff is regularly being supported to attend training, meetings or seminars on energy conservation issues.	2.4	12.2	64.4	17.1	2.0	100.0 (193)
Most factory employees are aware and fully cooperate in implementation of the ECAs.	5.9	27.8	50.3	2.9	11.2	100.0 (193)
Energy efficiency is being considered when your factory decides to buy new machine or equipment.	5.9	16.1	56.6	9.3	9.8	100.0 (193)

Mean = 13.21 S.D. = 3.34

11) Degree of compliance: There are seven energy conservation activities (ECAs) prescribed by the ECP Act that the designated factories are required to perform. In table 5.22, the data reveals the first three activities were undertaken by over 90% of the samples. The fourth activity was performed by 28% of the samples. In contrast, the last

three activities were performed by less than 10%. The reasons explaining the delay were obtained from open-ended questionnaires (Part V of the questionnaire) and from interviews. The results showed that the first two activities could be done individually. However, the later activities should be performed as a consequence of the former activities. This means that the designated factories have to perform a preliminary energy audit first, followed by a detailed energy audit, set up energy targets and plans, and then invest in energy conservation measures as determined in energy targets and plans. After investing in energy conservation measures for a while, the designated factories should follow up the implementation or evaluation to see whether or not the results come up to the targets. Moreover, the designated factories were required to hire energy consultants, (listed at DEDP) to perform the third and fourth activities. To support the implementation of such activities, the commission fee was partial paid by the ECP Fund. Also, the reports on preliminary energy audits and detailed audits were required to be submitted to DEDP for Fund approval. This process took time; the first phase may take a year for approval. As a result, the last three activities are not easily achieved in a short period of time. The exception is the designated factories that had greater capabilities; they were able to complete all activities.

Table 5.22 Extent of Degree of Compliance with the Policy (shown in percentages)

Activities	Got approval	No approval yet	Did not implement	Total
Appointed the person responsible for energy (PRE)	14.6	83.9	1.0	100.0 (199)
Submitted energy data twice a year	2.4	93.2	3.9	100.0 (199)
Conducting preliminary energy audit	20.5	72.7	6.3	100.0 (199)
Conducting detailed audit	15.1	13.7	70.7	100.0 (199)
Setting energy conservation target and plan	8.3	2.5	88.8	100.0 (199)
Investing in energy conservation measures	1.5	1.0	97.1	100.0 (199)
Monitoring and evaluating the implementation of energy target and plan	1.0	0.5	98.1	100.0 (199)

Mean = 0.43 S.D. = 0.12

With respect to table 5.22, the calculated mean score of degree of compliance was .43 (S.D .12); this value showed that the sample factories were able to perform only 40 percent of energy conservation activities prescribed by the Act. As indicated in the previous section, most factories can perform only three activities from seven. Therefore, the degree of compliance is low.

5.2.2 Findings

The association between the dependent variables and independent variable (the effectiveness of policy implementation) differ in three respects: first in terms of directness, second in relation to the form of effect, and finally in terms of the extent of effect. The findings are displayed based on those three aspects.

5.2.2.1 Direct and Indirect Effects of Independent Variables on Effectiveness of Policy Implementation

Path analysis was used to explore the causal relationship between the dependent variable (the effectiveness of policy implementation) and the independent variables (supporting fund, technical support, policy knowledge and experience, external fund, external impact, compliance limitations, compliance cost, compliance ability and degree of compliance with the policy). Path analysis breaks a causal model into five sets of multiple regression models, one for each dependent variable, which provides a clearer understanding of the associations than the use of regression alone.

Before analyzing the regression models, it was necessary to ensure that there was no multicollinaerity problem among independent variables, correlation results were employed to confirm no multicollinaerity problem. The result of bivariate correlation coefficient proved that there was no multicollinerity problem among independent variables as the value of beta coefficient ranged from .010 to .446. The correlation coefficients with values greater than .185 were statistically significant at .01 level and the coefficient with valued range .147 to .184 was significant at .05 level (the correlation matrix is shown in appendix C).

The path diagram obtained from path analysis is exhibited in figure 5.1. Only beta coefficients with statistical significance are displayed. Path coefficients obtained from the regression equations (equation 5.1, 5.2, and 5.3) were exploited to calculate the effect of independent variables on the dependent variable, whether in terms of direct or indirect effect. Effect results are displayed in table 5.23.

The regression results are demonstrated in the structural equation forms as displayed in equation 5.1, 5.2, and 5.3. The coefficients of determination (R^2) are .263, .221 and .128, and are statistically significant at .05.

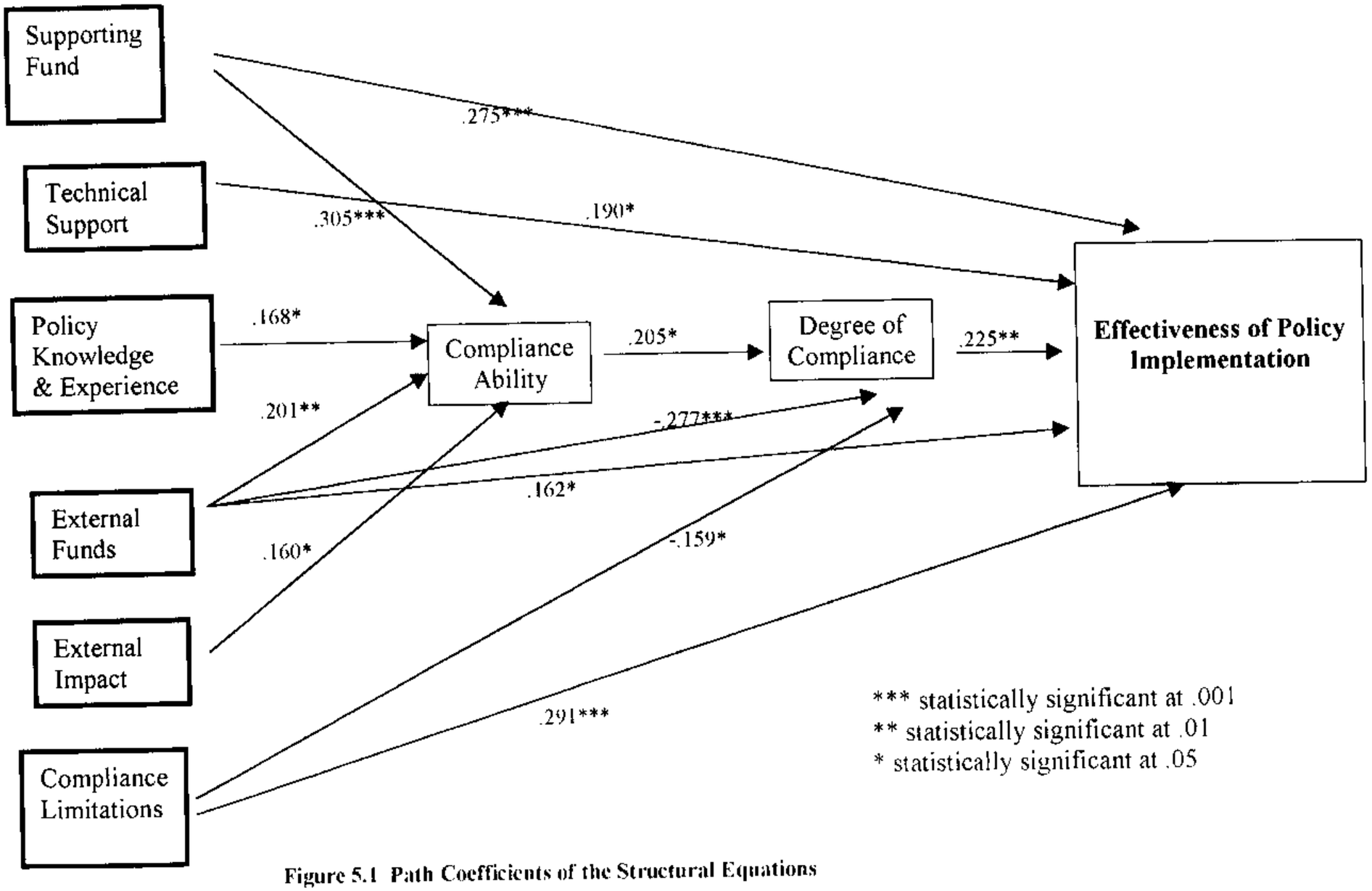


Figure 5.1 Path Coefficients of the Structural Equations

Equation 5.1

Effective = .275*** Supfund + .190* Techsup + .162* Extfund + .291***Lim + .225**Compliance
(3.732) (2.571) (2.136) (3.930) (2.966)

R^2 = .263, SEE. = 2.831, F = 4.654 (Sig. F = .034)

Equation 5.2

Ability = .305*** Supfund + .201* Extfund + .168* Know + .160* Extimpact
(4.056) (2.694) (2.279) (2.152)

R^2 = .221, SEE. = 2.534, F = 4.632 (Sig. F = .033)

Equation 5.3

Compliance = -.277*** Extfund + .205** Ability - .159* Lim
(-3.403) (2.501) (-2.012)

R^2 = .128, SEE. = .105, F = 4.049 (Sig. F = .046)

The direct and indirect effects of the independent variables, which influence the effectiveness of policy implementation, are illustrated, namely supporting fund, technical support, policy knowledge and experience, external funds, external impact, compliance limitation, compliance ability, and degree of compliance with the policy. Details of direct and indirect effects are explained below.

1) Direct Effects

Regarding figure 5.1, of the eight independent variables, five variables (supporting fund, technical support, external funds, compliance limitations, and degree of compliance) exert a direct effect (as displayed in equation 5.1). Technical support and degree of compliance exert a purely direct effect on policy implementation effectiveness, while the effects of supporting fund, external funds, and compliance limitations have both a direct and indirect effect.

Based on equation 5.1, there are five independent variables directly influencing the effectiveness of policy implementation. Among the five variables, compliance limitations reveals the greatest influence; the beta coefficient is .291, which implies that greater perceived compliance limitations will lead to higher perceived effective policy

implementation. This relation seems to contrast the previous studies, which mentioned that fewer compliance limitations would lead to greater effectiveness of policy implementation, which shows a negative relation between them. But the result from this study reveals a positive relation; it seems to be a spurious effect. However, if one considers the indirect effect of compliance limitations to effective policy implementation through degree of compliance with policy this factor supports the previous studies. The details will be explained in the indirect effect results section The direct effect of compliance limitations must be regarded as spurious and will be moved out from the analysis and from the revised model.

Second, the supporting fund reveals a direct effect and influential factor affecting the effective policy implementation, the beta coefficient is .275. It implies that the more adequate the supporting fund is perceived to be, the greater the increase in the effectiveness of policy implementation will be. This result supports the previous studies conducted by Vandre, 1986: 12-20; OECD, 2000; USEAP, 1998; May and Paterson, 1997. The supporting fund lessens financial constraint in the factories and raises compliance capability, which leads to an increased degree of compliance with the policy and consequently a greater effective policy implementation.

Third, degree of compliance with the policy also reveals a direct effect and is an influential factor contributing the effectiveness of policy implementation; the beta coefficient is .225. It shows that a greater degree of compliance with the policy will lead to higher effectiveness of policy implementation. This result also supports the previous study (Mazmanian and Sabatier, 1983: 41).

Fourth, technical support demonstrates a positive and direct effect to effective policy implementation with a beta coefficient of .190. This means that the perceived amount of technical support provided, whether in terms of adequacy or appropriate types of support, will influence the effectiveness of policy implementation. This finding supports the previous studies (Chan and Li, 2001: 589-601; Dincer, 1999: 845-854; Burby and Paterson, 1993: 753-772; UNEP/IP, 1996; USEAP, 1998). The technical support provided to the factories enhances the compliance capability of the factories in general and the PREs in particular. Technical support covers several types of support such as energy

technology information, energy conservation implementation advice, or training the PREs. Energy technology information and energy conservation advice will strengthen managing capability of the factories, meanwhile training assists human capability of the PREs. Both types of support influence compliance ability and consequently a higher degree of compliance with the policy, and finally greater effectiveness of policy implementation. Results of this study reveal that the factories perceived a moderate level of technical support has been provided to them (details in table 5.12). In particular, frequency of attaining technical support is about one to three times a year (details in table 5.14). This indicator reveals the amount of technical support, whether in forms of energy technology information, energy conservation advice, or training, is insufficient to promote the effective implementation of energy conservation policy. This issue requires serious attention of the government to lessen the degree of noncompliance with the policy.

Lastly, the availability of and accessibility to external funds also displays a positive and direct effect on effectiveness of policy implementation; the beta coefficient is .162. This implies that more availability and accessibility to external funds will promote the effectiveness of policy implementation. This finding supports the previous study (Howarth and Anderson, 1993: 262-272). It is noticeable that currently most factories have done the no-cost or less- cost activities of the implementation of energy conservation measures. The rest requires more investment costs and the factories can finance such costs by two approaches: using their own budgets or borrowing from financial markets. The factories with more financial capability seem to exploit their internal funds, but the ones with less financial ability are required to borrow external funds. As a result, the availability of and accessibility to external funding will promote the investment in energy conservation measures or projects that will lead to effectiveness of policy implementation. The finding in table 5.16 displays that the factories perceived less availability of and accessibility to external financial markets. As a result, the government should pay more attention to this issue by functioning as a coordinator between the factories and the financial institutions. The government has to raise awareness of energy conservation issues to the financial institution executives through demonstrating the real cost and benefits of energy conservation projects and to instill more confidence on a payback or

return of investment from such projects. Moreover, the government has to point out to them that the government also provides financial support to such projects in terms of interest subsidies, which can guarantee that they can get interest payments from their lending.

2) Indirect Effects

The consideration of indirect effects can be revealed through intervening variables. Four intervening variables are proposed, two variables are statistically significant, namely compliance ability and degree of compliance with the policy.

Regarding equation 5.2, four variables affect compliance ability, namely supporting fund, availability of and accessibility to external funds, policy knowledge and experience, and external impact; the beta coefficients are .305, .201, .168, and .160 respectively. Among four variables, supporting fund is the most powerful factor in determining compliance ability followed by availability of and accessibility to external funds, policy knowledge and experience, and external impact.

The four variables show the direction as expected and also support the previous studies (Stern, et al., 1986: 147-176; UNEP/IP, 1996; Howarth and Anderson, 1993: 262-272; Winter and May, 2001: 675-698; Dincer, 1999: 845-854). Supporting fund displays the greatest influential factor affecting compliance ability. Perceived adequacy and appropriateness of the supporting fund would influence compliance ability, degree of compliance with the policy, and finally the effectiveness of policy implementation. The supporting fund or financial support will strengthen the financial capability of the factories and then degree of compliance with the policy. As mentioned in the previous studies, only compliance willingness is not sufficient to promote compliance with the regulations; the target groups need to have ability to comply with such regulations. As a consequence, the provision of financial support can enhance compliance ability, particularly where financial capability seems to be limited, by lessening such limitations.

The availability of and accessibility to external funds also has a positive influence on compliance ability; greater perceived availability of and accessibility to external funds would raise compliance ability, consequently degree of compliance with the policy, and

finally raise the effectiveness of policy implementation. The factories that are able to access external funds will have more compliance ability than the ones who cannot. The energy conservation policy is not a non-cost policy. It requires investment cost, and particularly compliance with activity six of the ECAs (investment in energy conservation projects or measures). The designated factories need to provide financial resources to these activities, whether through their internal funds or borrowing from financial markets. Based on the interviews, the results show that, at present, loans in financial markets do not favor energy conservation projects. Thus they need to utilize their internal funds, which seem to be limited. Consequently, several projects or measures that require more investment costs are postponed or delayed in implementation. The availability of and the accessibility to external funds, in particular financial markets, will promote the investment in energy conservation projects and measures. The factories that face internal budget constraints will be able to exploit external funds to invest in such projects. Less difficulty of fund conditions and easy access to external funds should be of concern to the government as another policy mechanism to promote energy conservation policy implementation.

Policy knowledge and experience has a positive impact on compliance ability. The factories with greater policy knowledge and experience will have more compliance ability than the ones with less and consequently will have a greater degree of compliance with the policy, and, hence, will have a greater effectiveness of policy implementation. Compliance ability involves financial capability, human capability, system capability, and management capability. Policy knowledge and experience can strengthen management capability of the factories; with their knowledge and experience, they can realize the benefits of energy conservation whether in their factories or in the country as a whole and also have the ability to perform the ECAs prescribed by the policy. The policy experience of the factories is the point that the government can exploit to promote energy conservation implementation. Since these factories are aware and understand energy conservation policy, then the government should pick up them to use as demonstration factories or to be prototype factories in energy conservation implementation. Together with several kinds of support to these factories, the chance to attain policy objectives and goals will be high.

Regarding policy knowledge, the factories can gain energy conservation policy knowledge through training providing by the implementing agency. Currently, training on energy conservation policy substance and implementation is focusing on the PREs. The finding illustrates that the PREs in most factories have been trained on this issue. Based on the interview results (details in chapter 6), however, the contents and substance of training courses are not sufficient for the PREs to be able to comply with the policy due to the fact the principal knowledge in such courses is very basic. They need more advanced courses that focus on best practice in selected factories, which will be more useful to their factories.

Lastly, low external impact is positively related to compliance ability since perceived minimum external impact would influence greater compliance ability. The prior studies on environmental compliance demonstrated that if the policy required the target group to comply with the regulatory policy during circumstances of uncertainty, it would be possible that the external impact may hamper regulatory compliance of the companies. It would also affect the compliance cost of such regulations and lessen compliance ability of the companies. Uncertainty of the economic situation makes it difficult for the companies to comply; they may unable to reserve sufficient resources for compliance with the regulation. If they provide more resources, it may cause high opportunity costs to their companies. The finding conforms the previous studies (Carlsmith, et al., 1990; Pye and Elliott, 1998: 413-423). These studies mentioned that the uncertainty of energy price and uncertainty in economic situations lessen the compliance ability, degree of compliance with the policy, and finally the effectiveness of policy implementation.

With respect to equation 5.3, three variables influence degree of compliance with the policy, namely external funds, compliance ability, and compliance limitations. The beta coefficients are -.277, .205, and -.159 respectively. Among the three variables, the direction of availability of and accessibility to external funds is contrary to expectations. It should be a positive direction with degree of compliance with the policy, since greater availability of and accessibility to external funds should lead to a higher degree of compliance with the policy. This result indicates a negative direction, which implies that, the greater availability of and accessibility to external funds, the less effective the

implementation will be. It also differs from the previous studies. Then, this result reveals a spurious effect and will be excluded from analysis and from the revised model.

The direction of and relation between compliance ability and degree of compliance with the policy is as intended. Greater compliance ability would lead to a greater degree of compliance with the policy and consequently the greater effectiveness of policy implementation. This result supports the previous studies (Winter and May, 2001: 675-698; OECD, 2000; Coombs, 1980: 885-892; Klok, 1997). Without compliance ability, even a well-drafted policy cannot be executed. Compliance ability covers financial capability, human capability, system capability, and management capability.

In addition, the relationship between compliance limitations and degree of compliance with the effectiveness of policy implementation is as expected. Fewer compliance limitations would lead to greater degree of compliance with the policy and consequently greater effectiveness of policy implementation. This finding also supports the prior studies (DeCanio, 1993: 95-107; Pye and Elliott, 1998: 413-423; Lohani and Azimi, 1992: 533-545; SPRU, 2000). Regarding table 5.18, most factories exhibited greater compliance limitations in their factories. Four major limitations are budget constraint, employee lack of awareness, lack of energy conservation knowledge, and lack of coordination among departments. Considering these limitations, they reveal financial incapability, human incapability, and managing incapability. Therefore, if the government wishes to accelerate the implementation of energy conservation policy, they can not ignore these internal constraints; otherwise the chance that the policy will achieve its goals is less.

To lessen compliance limitations, the existing policy instruments through financial support and technical support should function as designed. However, the results from interviews show that these instruments do not perform well. Some difficulties emerged, for example, the supporting fund conditions and criteria are less practical and take more time for processing the applications. Additionally, a number of documents are required. With respect to technical support, energy conservation technology information is not widely disseminated. Non-Bangkok located factories seem to attain less information and are also unable to access necessary information regarding energy conservation policy and

implementation. As a result, the government needs to create more channels to access such information, which can lessen internal limitations. Moreover, diversification of training courses is necessary and directly enhances human capability in the factories and also strengthens compliance ability. At the same time, training courses provide assistance in raising awareness and understanding in the trainees, which will improve coordination in implementation. As a result, the training provisions lessen human incapability and management incapability in the factories, and consequently enhance greater degrees of compliance with the policy, and finally create higher effectiveness of policy implementation. The summary results of direct and indirect effects can be displayed in table 5.23.

Table 5.23 Direct and Indirect Effects of Independent Factors on Effectiveness of Policy Implementation

Independent Variables	Direct Effect	Indirect Effect source	Indirect Effect total	Total Effect
Supporting fund	.275	(.305x.205x.225)	.014	.289
Technical Support	.190			.190
Policy knowledge and experience		(.168x.205x.225)	.007	.007
External funds	.162	(.201x.205x.225) + (-.227x.225)	-.053	.109
External impact		(.160x.205x.225)	.007	.007
Compliance limitations	.291	(-.159x.225)	-.036	.255
Compliance ability		(.205x.225)	.046	.046
Degree of compliance	.225	-		.225

Based on the proposed model in figure 3.1, there are two intervening variables, namely compliance cost and compliance willingness, which do not influence the effectiveness of policy implementation whether directly or indirectly. The reasons that compliance cost and compliance willingness do not influence degree of compliance with the policy and the effectiveness of policy implementation were obtained from the interviews.

Regarding the interviewed information on compliance cost, the researcher found that the late issuance of the Ministerial Order to guide implementation caused a delay in energy conservation implementation. Most designated factories were in the beginning of the policy implementation process (assigning person responsible for energy (PRE), submitting energy use data, and conducting preliminary energy audit). This is at little or no cost to the factories due to the fact some compliance costs were reimbursed from the Fund, particularly, preliminary energy audit costs, which got full financial support up to 100,000 Baht from the Fund for the consultant fee. Moreover, the consultant companies competed with each other; they cut the fee to 100,000 Baht no matter the factory scale. Therefore, this cost did not create a burden on the factories. In addition, the assignment of a PRE did not raise factory costs because they did not hire new employees. In contrast, they assigned the plant manager or engineering manager to handle this job. As a result, the compliance cost did not affect the degree of compliance with the policy and the effectiveness of policy implementation.

With respect to compliance willingness, the researcher found that compliance willingness is positively correlated with the effectiveness of policy implementation (see table 5.23). This relation supports the previous studies (OECD, 2000; Winter and May, 2001: 675-698, University of Kiel, 1998), which propose that the regulatees with greater compliance willingness would lead to greater degree of compliance with the policy and finally the effectiveness of policy implementation. Based on the result in equation 5.1, this variable is not statistically significant and excluded from the equation. However, the researcher intends to confirm that the compliance willingness is a more influential factor and should be considered whenever the government considers the policy instruments to promote the effectiveness of policy implementation. Moreover, the results from interviews and the recommendations provided in the returned questionnaires also mention this issue. The respondents perceived that without strong support from the executives, it seems more difficult to effectively comply with the policy. The executives' support reveals the willingness to comply with the policy. This can be displayed in several forms such as setting agendas and targets to promote energy conservation activities, establishing an

energy conservation unit to handle such activities, and advocating in-house training or seminars on energy conservation issues.

5.2.2.2 Forms of the Effects

The second way in which the effects of the independent variables affect effectiveness of policy implementation is in the form of effect. Two independent variables exerting purely direct effects were positively linked to the effectiveness (technical support, total effect = .190 and degree of compliance, total effect = .225). Supporting fund, external fund, and compliance limitation, which exert both a direct and indirect influence, positively influence the policy implementation effectiveness (supporting fund, total effect = .289; external fund, total effect = .109; and compliance limitations, total effect = .225). Two of eight independent variables exerting an indirect effect were positively related with the effectiveness of policy implementation (compliance ability, total effect = .046 and policy knowledge and experience, total effect = .007).

5.2.2.3 The Extent of Effects

The third way to consider the effects of the independent variables on effectiveness of policy implementation is on the impact of total effects. A review of table 5.23 reveals that the supporting fund clearly exerted the greatest impact (total effects = .289), following by compliance limitations (total effects = .255), degree of compliance (total effects = .225), and technical support (total effects = .190). External funds had a moderate impact (total effects = .109). Policy knowledge and experience, external impact, and compliance ability had less impact (total effects = .007, .007, and .046 respectively).

In summary, to promote the effectiveness of policy implementation and be able to achieve the policy objectives and goals, the government should emphasize the following factors: supporting fund, technical support, availability of and accessibility to external funds, and compliance limitations. First, adequate and appropriate financial support whether in terms of size or conditions will promote the effectiveness of policy implementation. Second, technical support to the factories should be emphasized more strongly, since the results of the study reveal that most samples attained technical support ranging just one to three times a year. This figure seems to be disappointing. If the government wishes to promote the policy implementation, technical support can

strengthen the compliance ability and consequently degree of compliance with the policy. Third, the availability of and accessibility to external funds should be foremost in the mind of the government. It is necessary when the factories reach the investment stage; otherwise the energy conservation measures or projects may not exist and the goal to save energy is unreachable. Creating awareness and understanding among the financial institutions is necessary and urgent. Last, compliance limitations should be less, through several kinds of support, namely financial support, training provided, and information provided; the government can also lessen this problem

5.3 Hypotheses Testing and the Results

Based on the structural equations 5.1, 5.2, 5.3; the figure 5.1; and table 5.23, the findings supported both hypotheses.

Hypothesis 1: Higher amounts of supporting fund, technical support, policy knowledge and experience, and external funds are more likely to increase the effectiveness of policy implementation. **This hypothesis is accepted.**

Hypothesis 2: Less external impact and compliance limitations are more likely to increase the effectiveness of policy implementation. **This hypothesis is accepted.**

Higher amounts of supporting fund, technical support, and availability of and accessibility to external funds directly increase the effectiveness of policy implementation. Policy knowledge and experience, supporting fund, availability of and accessibility to external funds, and external impact also indirectly influence the effectiveness of policy implementation through compliance ability and degree of compliance.

According to compliance limitations, fewer compliance limitations will lead to the greater effectiveness of policy implementation through the higher degree of compliance with the policy.

5.4 Chapter Conclusion

This chapter presented the major characteristics of the samples and the results of the study using the path analysis technique to investigate the causal relationships between the dependent variable (Effectiveness of policy implementation) and six independent variables (supporting fund, technical support, policy knowledge and experience, external funds, external impact, and compliance limitations) and four intervening variables (compliance cost, compliance ability, compliance willingness, and degree of compliance). The results of the study in structural equation forms and path coefficients were also displayed in this chapter. Lastly, the results of hypotheses testing were illustrated; the study found that both hypotheses were accepted from the study. The researcher found that supporting fund is the most powerful factor influencing the effectiveness of policy implementation, followed by technical support, external funds, and compliance limitations. To devise or revise any policy instruments that promote energy conservation implementation, the government should focus on these issues.

The next chapter will present the qualitative results as well as the results of the in-depth interviews.

CHAPTER 6

THE QUALITATIVE RESULTS

This chapter presents the qualitative results obtained from Part V of the questionnaire (open-ended question) and also the results of in-depth interviews of some key informants in public and private sectors regarding energy conservation policy and implementation

6.1 Results of PRE's Opinions on Implementation

The opinions on implementing aspects of the ECP Act were collected from the designated factories by using open-ended questionnaires (Part V of the questionnaire) and interviewing selected PREs from food, textile, non-metal, and cement factories. The results could be categorized into opinions on the ECP Act, the ECP Fund, implementation procedures, and others.

6.1.1 Results of PRE's Opinions on Implementation of the ECP Act

Results in table 6.1 indicate that there are difficulties that emerged during compliance with the regulations prescribed by the Act. Such difficulties resulted both from the ECP Act, the ECP Fund and implementing procedures. With regard to the Act, the ambiguity of the substance in some clauses of the Act is viewed as the major barrier for compliance with the Act. Similarly to the Act, the ECP Fund set up to promote the energy conservation implementation seemed to confront the same problems; complicated fund conditions and unclear procedures for funding requests and fund approval was reported by the PREs. They view that the current conditions and procedures do not favor energy conservation implementation. Regarding implementing procedures, most factories perceived that the delay of compliance is caused from the ambiguity of the ECP Act and the ECP Fund. In addition, the assistance from the implementing agency to

comply with the Act is limited and unresponsive to the designated factories' demands. At the same time, the energy consultants, who should play a major role in technical support in energy conservation implementation to the designated factories, are disappointing in that many of them appear to be unqualified. These kinds of problems and difficulties need a resolution as soon as possible.

Table 6.1 PRE's Opinions on Implementation of the ECP Act

ECP Act	ECP Fund	Implementation Procedures
• Some clauses of the Act are not clear and uncertain. Therefore, the Act should be revised to make clearer. • The Act is not completely enforced; the non-compliance of designated factories remains and they do not get any punishment.	• The procedures for fund requests are complicated and a lot of documents are required. • The current provisions of the fund do not directly serve what the designated factories want. • Lack of clarity in Fund approval procedures. • Fund disbursement takes more time. • Lack of public relations on the procedures of Fund requests and Fund disbursement.	• Regarding the energy consultants, it seems that many companies are under-qualified to assist the designated factories to comply with the Act. The energy conservation measures recommended by such companies were already known by the designated factories and already implemented. In addition, the implementing agency should monitor performance of these consultants and withdraw the license and blacklist those who do not perform. • Public relations on energy conservation information and the regulations regarding the Act is limited. Moreover, some factories did not know that they are regulated by the Act and need to comply with the regulation. • Energy specialists are limited in Thailand, particularly specialists in each type of industry. • There is no feedback from the implementing agency after submitting energy data or reports. • Knowledgeable staff at the implementing agency able to assist the designated factories in time is limited.

Table1 6.2 Recommendation by PRE's on Implementation of the ECP Act

ECP Act	ECP Fund	Implementation Procedures
• Enforcement of the Act should be similar to the Safety law, which is more seriously enforced. • The Act should prescribe that the factory's owner or the executives rectify the energy data rather than the PRE s; by doing this, the factory owner or executives will realize the importance of energy conservation. • The Act should prescribe the designated factories establishing the energy conservation unit to handle the energy conservation activities prescribed by the Act. The Act should allow the designated factories to conduct energy auditing by themselves if they have capacity.	• The government or implementing agency should set up an agency directly and clearly responsible for the ECP Fund with more willingness to assist the designated factories. • With respect to energy auditing costs, the Fund should provide full support not partial support as at present. • Fund should provide support on energy conservation investment cost rather than interest payment support.	• The implementing agency should construct the indicators that demonstrate the success of implementation of the Act. • Information and new technology regarding energy conservation in factories should be provided regularly. • The implementing agency should establish an energy conservation technology center to exchange energy knowledge and provide technical advice to the designated factories. • The training courses provided to PREs should be done based on their demands. • With respect to the PRE, most PREs are assigned to perform energy conservation duties as an additional job; therefore they are unable to pay much attention to this new duty because their routine jobs are more important and are major responsibilities.

Besides the above-mentioned problems or difficulties, the PREs also gave suggestions to solve such problems and accelerate energy conservation implementation. For example, with respect to the ECP Fund, the government should set up a section that is directly responsible for the ECP Fund to facilitate the implementation of energy conservation activities. In fact, there is an ECP Fund section under the BERC to perform such jobs, but their attentions are on Fund disbursement rather than facilitating the designated factories for fund requesting.

According to implementation procedures, most factories recommend that the implementing agency should establish an energy conservation technology center to exchange know-how and provide technical advice to the designated factories. Furthermore, the energy specialists in energy conservation should be listed at the center to facilitate the designated factories that need to have further advice in details. At the same time, this center can function like a network linking to the energy efficiency suppliers and the energy efficiency users. It can also work as a channel for technology transfer from foreign countries.

Results from interviews reveal similar results as the questionnaire. However, there are some points beyond the results from the questionnaire, which will be summarized in this section. The interviewees mentioned that they have a chance to exchange experiences on implementation of energy conservation tasks with other designated factories and they perceived the same problems or difficulties. Most factories viewed that the difficulties came from internal factors and external factors. Internal factors refer to the internal capabilities of factories in terms of budget, staff, and equipment to perform tasks prescribed by the Act. Moreover, executive support also plays a major role. Some factories got the commitment from the executives and full support to perform such tasks since they aware of the significance of energy conservation to their factories and to the economy as a whole. The others perceived that their executives did not fully support implementation but just performed the minimum requirements by the Act. The latter factories really need to build awareness if the government desires to achieve the intended outcomes.

With regard to the external factors, most PREs perceived that the existing policy instruments such as the ECP Fund or the energy consultants did not perform as intended. In terms of the ECP Fund, they viewed complicated and unclear procedures in applying for funding. In addition, the amount of financial support seems inadequate and less attractive compared to time spent and the paperwork done during Fund requesting and disbursement, particularly from the large factories' viewpoint. Additionally, they viewed that financial support for energy auditing fee should be based on the actual fee, which varies by scales and types of factories; therefore the criteria should be set by considering these elements and can be easily put into practice. In terms of the energy consultants, the idea to register the energy consultant companies and permit them to assist the designated factories in performing energy conservation tasks were perceived as a good one. But in practice, several problems occurred because most consultant companies were viewed unqualified to perform such tasks and their performance seemed below the factories' expectations. Consequently, some companies were unable to finish the job. These problems caused a delay in compliance with the Act. Furthermore, they noted that there is not any action from the implementing agency to handle these problems, although it is a duty of the agency. As a result, the executives of their factory lost confidence and reduced support for the energy conservation task.

Not only the policy instruments were not performing well, but the implementing agency also performed very disappointingly. The inadequacy of staff to support the implementation of energy conservation was clearly seen. They felt inaccessibility to key information regarding the procedures to implement energy conservation tasks and delayed response from the staff. There is no assisting center that can help them to solve their problems in time.

In summary, if the above problems and difficulties are not addressed and handled with care by the government, then the intentions of the ECP Act may take more time to reach its goals.

6.2 Results of the Key Informants Opinions of the ECP Act

In-depth interviews of the key informants in the public sectors, both at the policy level or administrative level, have been conducted. Key questions of the interviews included (1) the opinion on the extent to which the Act is implemented, (2) the opinion on the extent to which the utilizing the ECP Fund to promote energy conservation implementation functioned, (3) the key success factors contributing to the success of the ECP Act, and (4) additional policy instruments that should be provided to promote such implementation. The results from these interviews could be summarized as follows:

6.2.1 The Extent of Policy Implementation

6.2.1.1 Perspectives of DEDP Officials

With respect to the extent of policy implementation, the DEDP officials noted that they could claim that the ECP Act has been able to achieve some targets. For example, the indicators indicate the achievements are comprised of the number of PREs assigned by the designated factories and the number of submissions of energy consumption data forms. These numbers have tended to increase slightly. Regarding the assignment of PREs, most of them were approved by DEDP; a few had a problem of qualifying as prescribed by the Act. To solve this problem, DEDP arranged training sessions for PREs. The ones who completed training courses would get the certificate and were qualified to be a PRE. With regard to the submission of energy data, at the beginning most designated factories may feel inconvenienced since the form contained a lot of data to fill. However, with the assistance of the energy consultant companies and training of the PREs this problem has been resolved. Consequently, the number of energy data submissions is continually increasing.

There are some activities that remain delayed in implementation such as setting up energy conservation targets and plans and investment in energy conservation projects. With respect to setting up energy conservation targets and plans, the causes of delay are from the procedures set by DEDP. The designated factories that reached this step imply that they performed the preliminary energy audit and detailed energy audit and got

approval from DEDP. It seems that almost all factories completed preliminary energy audits. This activity is viewed as a simple task and at no cost because the Fund provides an auditing fee of 100,000 baht per factory for this activity. Regarding detailed energy audits, the Fund provides 50% of the auditing fee but not above 500,000 baht. Since the detailed energy audit is a complicated job including many details, then the designated factories are required to pay 50% of the cost. The cost of undertaking a detailed energy audit seems to be high and varies depending upon the scale and type of factory. Consequently, under the recent economic situation, most factories are reluctant to perform this activity. The delay in conducting a detailed energy audit also delays setting up energy conservation targets and plans since they can happen only after the detailed energy audit has been performed.

In conclusion, it can be said that the implementation of the ECP Act can perform as intended, even though there are some difficulties that emerged during the implementation, but the implementing agency realizes such problems and is trying to resolve them by using several means. The details of resolution will be mentioned in section 6.3.

6.2.1.2 Observations of the Energy Conservation Center of Thailand

The ECCT functions as the supporting unit on implementation of the energy conservation policy and particularly on the ECP Act. They perceived that the implementation of the ECP Act was well in progress. The designated facilities have performed their duties as prescribed by the ECP Act, for example, appointing the PRE and undertaking preliminary and detailed energy auditing. They accepted that there was a delay in the implementation process of the designated facilities because of the economic recession; therefore the energy conservation activity implementation was given a lower rank compared to the goal of survival of the company. Moreover, the delay in utilizing penalty clauses became a reason for some designated facilities to avoid complying with the ECP Act. In the near future, when the government gets more serious on noncompliance of designated facilities by pursuing with punishment, the full compliance will be reached and the effective policy implementation will be strengthened.

6.2.1.3 Perspectives of NEPO Officials

NEPO officials perceived a delay in implementation of the ECP Act at the beginning, due to some difficulties resulting from internal problems that incurred in the designated facilities. Economic recession, together with a delay in issuing Ministerial Regulations regarding the ECP Act and non-readiness of DEDP to facilitate the implementation of the ECP Act were the main difficulties. With respect to the designated facilities, the appointment of persons responsible for energy (PRE) was delayed because of unqualified nominated people to perform such positions. The task of submitting energy consumption data twice a year was also delayed due to lack of understanding in the forms. Few PREs were able to fill in such forms. Consequently, the antecedent processes were delayed in implementation. As a result, the implementation of the ECP Act was not as effective as expected.

Regarding the economic recession, the designated facilities experienced difficulties accessing external funding to invest in energy conservation projects since financial support from the ECP Fund provided only partial support. Therefore the financial market is playing the major role to fund the energy conservation projects. However, because of the instability of economic conditions, all projects confront difficulty in getting funds and the financial institutions are reluctant to loan. Energy conservation projects also are affected from this matter. With regard to the delay in issuing the Ministerial Regulations, since the drafting of Ministerial Regulation in accordance with the ECP Act is based on engineering regulations that require more deliberation, this process took a lot of time before issuing. In addition, during the drafting process, the government was reshuffled many times and the key people responsible for these issues also changed, which caused a further delay in drafting. As a result, the implementation of energy conservation activities in the designated factories could not be started until 1997 after the relevant Ministerial Regulations and Orders were issued.

In terms of non-readiness of DEDP, NEPO officials viewed that, at the beginning, DEDP faced difficulties in adjusting themselves to support the implementation of the ECP Act. This was because of an inadequacy of staff to handle the duties assigned by the ECP Act and a lack of good cooperation between DEDP officials and the designated

facilities and also within DEDP themselves. However, later on, DEDP attempted to resolve such problems by hiring Accredited Consultants (AC) to perform such duties on behalf of DEDP with an expectation to accelerate the implementation of energy conservation activities.

6.2.1.4 Views of an Energy Scholar

A recognized energy scholar viewed that, at present, the ECP Act has not achieved its intended goals as expected. Several reasons can be given for this failure. First, at the beginning of implementation (in 1997) there was a recession in the Thai economy, which caused a delay in implementation. Next, lack of enforcement of the penalty clauses, in particular, the surcharge fee, also caused non-compliance with the ECP Act. The delay in applying the surcharge fee is from the political regime. In addition, the ambiguities in the Ministerial Regulations and Orders caused difficulties in understanding. Moreover, some clauses of the Ministerial Regulations or Orders were obsolete and needed to be revised to serve current situations. At the same time, DEDP officials also had different perspectives on the same issues that caused difficulties with the designated facilities. Further, the work of the energy consultants listed at DEDP was unsatisfactory. Most of their performance could meet only the minimum standard. The intention that the energy consultants should join and cooperate with the foreign consultants to perform energy conservation activities and transfer technology know-how on energy conservation did not emerge due to high costs of the foreign consultant fees. Lastly, inadequacy of public relations to inform the designated facilities regarding their duties to comply with the ECP Act caused non-compliance with the ECP Act.

6.2.1.5 Opinions of an Accredited Consultant

The Accredited Consultant perceived the delay in implementation of the ECP Act was caused from DEDP themselves as the regulators and the designated facilities as the regulatee. According to DEDP, the problems occurred because of non-readiness of DEDP to facilitate their new tasks and duties. As a result, they performed their tasks based on trial and error. Furthermore, there was a delay in reorganizing the structure necessary to serve such tasks and duties. In addition, there is ambiguity in the Ministerial Regulations or Orders both in substance and procedures, which caused

difficulties in implementation. Instead of facilitating the implementation, such regulations hinder it. With respect to the designated facilities, most of them were not aware of the importance of the ECP Act. However, some facilities recognized the importance and are advancing in the implementation of energy conservation activities beyond what is prescribed by the ECP Act.

In summary, most key informants perceived a delay in implementation of the ECP Act, and therefore the intended outcomes to reduce energy consumption can not be gained at present. In addition, they also viewed similar causes in such delay, namely the economic recession, the ambiguity of the Ministerial Regulations and Orders, the non-readiness of the implementing agency (DEDP), and the lack of awareness of the designated facilities.

6.2.2 The Extent of Utilizing the ECP Fund

6.2.2.1 Perspectives of DEDP Officials

With regarding to the extent of utilizing the Fund, DEDP officials accepted that the fund conditions might not suitable in the current economic situation. Moreover, the fund approval and disbursement mostly relied on the regulations, demanded a number of documents, and had several steps for fund approval. As a result, the designated factories feel inconvenienced in the fund application. DEDP realized this problem and at present, experts have been hired to study this issue and search alternatives to maximize the utilization of the Fund. To maximize utilizing the ECP Fund to promote the implementation of energy conservation activities (ECAs) in the designated facilities, two policy measures are proposed and will be effective at the end of this year, which are the revolving fund and the standards measures project. Beside the financial support for conducting energy auditing and interest subsidies of energy conservation projects, DEDP has launched these two policy measures to support the investment in energy conservation projects. The first measure will function as a revolving fund to the designated facilities; 2,000 million Baht was set up as a revolving fund. The second measure is an investment capital fund. One hundred million Baht was set for this measure (the ECP Fund supports 30% of investment cost and the facilities pay the remaining cost). These two measures

were started in October 2002. The outcomes of these two measures cannot be assessed currently.

6.2.2.2 Observations of ECCT

The ECCT officials perceived that the current ECP Fund is adequate to support the implementation of energy conservation activities (ECAs). Even though there were some difficulties that emerged at the beginning, the implementing agency attempted to resolve such difficulties. In addition, the implementing agency proposed other policy instruments by utilizing the ECP Fund to promote the implementation of ECAs. For example, a 2,000 million Baht revolving fund was set up to support investment in energy conservation projects. Furthermore, the standard measures project was launched. The designated facilities that preferred to invest in energy conservation measures as prescribed by the standard measures project were able to apply for financial support from the ECP Fund if their projects meet the requirements. By implementing these two types of financial support, ECCT officials believe that the ECP Fund can be used as intended.

6.2.2.3 Perspectives of NEPO Officials

NEPO officials perceived that regulations regarding the Fund disbursement seemed to be more complicated in processing, requiring numerous documents and consuming time for approval. Consequently, the designated facilities felt inconvenienced in applying for funds and hesitated to continue to the next activities. In addition, the current amount of financial support is not in accordance with the current situation and does not motivate the implementation of energy conservation activities.

6.2.2.4 Views of an Energy Scholar

The energy scholar perceived that the ECP Fund is a crucial tool to promote the implementation of energy conservation activities. The designing criteria and conditions were reasonable at the beginning but the change in the economic situation caused implementation problems. Most designated facilities view that they will comply with the regulations if they attain the financial support first; otherwise they will delay implementation. They view the financial support from the ECP Fund as a major financial source for implementation, which is a misunderstanding. The ECP Fund provided partial support to promote the implementation of energy conservation activities. The rest should

be added by the designated facilities. Therefore, it is necessary to clearly communicate to all designated facilities on the objectives of the ECP Fund, the type of support, the criteria and conditions of funds provided as well as the procedure for requesting funding. In addition, he also perceived that some emerging difficulties are from the DEDP officials who are in charge of fund disbursement. Some officials are reluctant to use their discretion on disbursement procedures when some difficulties exist, which causes the delay in the overall process.

6.2.2.5 Opinions of an Accredited Consultant

The consultant viewed that the utilization of the ECP Fund was not proper and reasonable. The current systems are on an equity basis; no matter if the scales of the designated facilities are large or small, they receive the same amount. What he recommended is that the provision of financial support should be based on capability and willingness to comply with the regulations. The designated facilities that are capable of implementing the energy conservation activities and have a willingness to do so, should receive more money than the ones with less capacity and willingness. Through this basis, he believed that the intended outcome, the reduction of energy consumption, could be gained very soon.

In summary, the key informants have different perspectives on the utilization of the ECP Fund to promote the implementation of energy conservation activity issues, particularly on criteria, conditions, procedures, type and amount of support. However, they all agree that it should be reconsidered and revised. After that, the new policies and procedures should be disseminated to all stakeholders to create clear understanding among them. This should maximize the utilization of the ECP Fund.

6.3 Key Success Factors Contributing to Effective Policy Implementation

6.3.1 Perspectives of DEDP Officials

The DEDP officials perceived that the key success factors (KSF) should include the following factors:

1) Credibility: It means that DEDP needs to build credibility among the designated factories as soon as possible. By educating and training both the PREs and the designated factories' owners they believe that the doubt in the benefits of energy conservation implementation will be reduced. Pilot projects, such as Fast Track Project, were launched to demonstrate the benefits of implementation. This project was set up to accelerate the implementation of energy conservation tasks in the government building sector. For the designated factories, DEDP, with the cooperation of the Federation of Thai Industries will speed up the implementation by selecting factories to demonstrate energy conservation implementation.

2) Acceptability: It means that DEDP needs to create acceptability among the stakeholders by executing their duties with transparency, accountability, and responsiveness to them.

3) Standards: All activities regarding energy conservation tasks should have standards to regulate the implementation.

4) Motivation: DEDP should motivate the staff to perform their job in accordance with the set standards.

5) Rules and Regulations: All rules and regulations related to implementation energy conservation activities should facilitate such implementation. Recently, DEDP has revised some current regulations, for example, allowing the capable designated facilities to undertake energy auditing work by themselves and revising the fund request process.

6) Public Relations Strategy: DEDP has employed a public relations strategy to create a good understanding between DEDP officials and the designated facilities. They also have established a client relations center to support all designated facilities.

6.3.2 Observations of ECCT

Regarding the key success factors contributing to the implementation, the following factors should be considered:

1) Implementation Regulations: Some regulations should be revised to reduce unnecessary steps and procedures. The paper work in particular needs to be reduced, and the process made clear and understandable.

2) Incentives: The current incentives, particularly financial support from the ECP Fund, should be revised. Moreover, additional types of incentives should be considered to promote the implementation.

3) Public Relations: DEDP should launch an aggressive public relations campaign to create awareness and understanding on energy conservation issues.

4) Human Resources Development: Training courses or education programs, regarding energy conservation issues, whether specific or general, should be designed and set up. The specific courses should be provided to persons responsible for energy, energy staffs, or energy consultants. The general courses would be provided for interested people or to the general public.

6.3.3 Perspectives of NEPO

NEPO officials viewed that the necessary factor is the development of awareness and understanding among target groups on the ECP Act.

6.3.4 Views of an Energy Scholar

An energy scholar viewed that the ECP Fund was an important factor and it should maximize utilization to support the implementation of the ECP Act. The financial support should be allocated to both the energy demand and the energy supply side. Energy demand means that the Fund is allocated to support the implementation of energy conservation activities. On the supply side, it means that the Fund should allocate funds to energy equipment manufacturers to produce energy efficient machinery or equipment and also create a market for such equipment.

In addition, DEDP should conduct a monitoring and evaluation of the implementation of energy conservation activities and publish the results of implementation.

6.3.5 Opinions of an Accredited Consultant

The accredited consultant has no comment on this issue.

In summary, it could be concluded that the key success factors contributing to effective implementation of the ECP Act cover three components man, money, and technology. With respect to man, it means that all related people in energy issues should be educated or trained on energy conservation issues to create awareness and understanding on the importance of energy conservation and what benefits will be gained whether on an organizational level, national level, or the global level. Regarding money, it means that the ECP Fund should be allocated properly to all agencies involved in energy conservation issues. The utilization of the ECP Fund should strictly serve the objectives of the Fund to promote the implementation of energy conservation activities. Moreover, the spending of the Fund should be evaluated to ensure that it meets the intended objectives and achieves the intended outcomes. Concerning the technology issue, the government should support research and development (R&D) on energy conservation technology to reduce the acquisition costs and create a market for energy efficient products. This is similar to the creation of the energy efficient light bulb market that was greatly successful in the past.

6.4 Chapter Conclusion

This chapter displayed the qualitative results on energy conservation policy and implementation obtained from Part V of the questionnaires (open-ended question) and from in-depth interviews of the key informants in public and private sectors. The results showed that the delay in implementation of energy conservation activities emerged from several factors, namely ambiguity of some clauses of the Act, complexity of Fund requests and approval procedures, or few qualified energy consultant companies to assist the factories. The problems also occur within the factories due to less competent energy staff, lack of awareness and understanding of the executives and staff, and budget constraint. Moreover, the implementing agency (DEDP) is unable to facilitate the implementation in time due to inadequacy of staff. It has hired the energy consultant

companies to assist them but these companies can fulfill only minimum requirements. In addition, the economic climates do not favor investment in energy conservation projects. For the key success factors to attain the policy goals (to conserve energy), three factors are proposed, namely man, money, and technology. Man refers to human resources in energy, which should have knowledge and experience in energy conservation practice. Money, the ECP Fund, should be properly allocated to all agencies. Energy conservation technology should be prevalent and affordable.

The next chapter will propose the revised model, policy recommendations, the implication of the study, and recommendations for further study.

CHAPTER 7

CONCLUSION AND RECOMMENDATIONS

This chapter covers four major sections, namely, (1) summary and conclusion, (2) recommendations including policy implications and management options, (3) implications for public policy, and (4) direction for future research.

7.1 Summary and Conclusion

As mentioned in chapter 1, the objectives of the study are to assess the effectiveness of policy implementation by considering whether the policy to promote energy conservation implementation has achieved its intended objectives or intended outcomes, to investigate the factors affecting the effectiveness of energy conservation policy implementation, and to propose the policy measures or policy alternatives that promote the effectiveness of policy implementation. The designated factories are the population of the study; four types of desiganated factories in the TSIC group and location of the factories were selected to be the study samples. Two hundred usable questionnaires were employed to collect data. The data were analyzed by using a path analysis technique to examine the association between the dependent variable (effectiveness of policy implementation) and the independent variables. The independent variables were supporting fund, technical support, policy knowledge and experience, avialbility of and accessibility to external fund, external impact, compliance limitations, compliance cost, compliance ability, compliance willingness, and degree of compliance with the policy.

The research results with respect to the first two objectives can be summarized as follows:

With regard to the first objective, the study reveals that the implementation of energy conservation policy via enacting the ECP Act has achieved its intended

objective. It has been effective in promoting the implementation of energy conservation activities in the designated factories, which is indicated from the number of energy conservation activities performed by the designated factories. For example, the number of the PREs assigned by the factories and the number of designated factories submitting the energy consumption data and preliminary energy auditing reports to DEDP is a high percentage. Even though some activities have been delayed in implementation, the delay stems from DEDP side, whether in the form of delay in report approval or delay in fund disbursement. Regarding the intended outcomes, it is too early to assess whether the policy has totally achieved its intended outcome, since all the activities are not completed yet. It may take some time for full implementation. After that, the evaluation of intended impacts can be conducted. However, based on the results of this study, it is possible to conclude that policy implementation has been effective in most of the designated factories. That is, most designated factoires perceived that the intended impacts, which are reduction in energy consumption, in energy dependency, and in greenhouse gas emission, could be achieved through compliance with the policy.

Regarding the second objective, two hypotheses were tested:

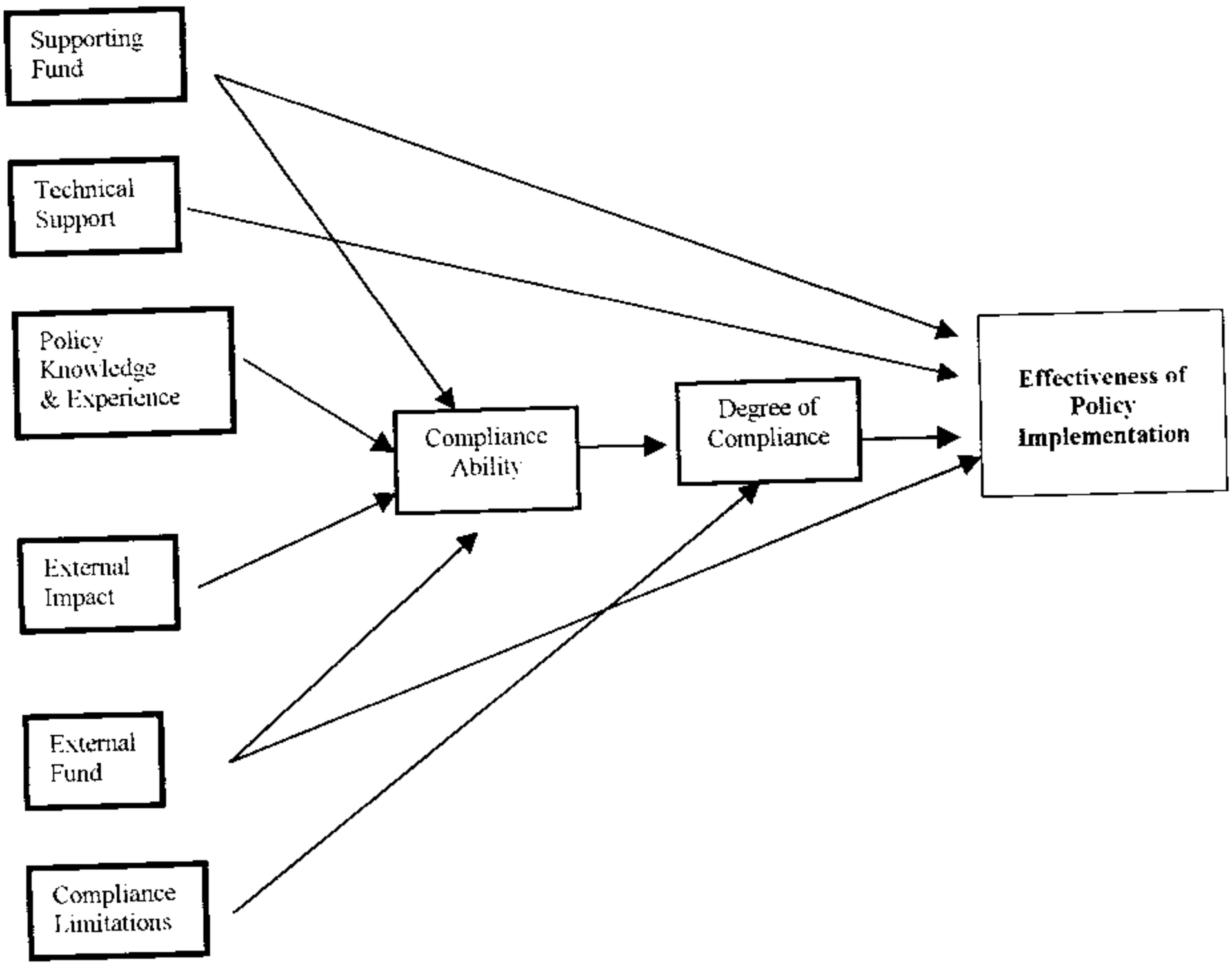
Hypothesis 1: Higher amounts in the supporting fund, technical support, policy knowledge and experience, and external funds are more likely to increase the effectiveness of policy implementation.

Hypothesis 2: External impact and compliance limitations are more likely to decrease the effectiveness of policy implementation.

The results from hypotheses testing presented in chapter 5 show both hypotheses are accepted. The results reveal that two factors have a direct effect on the effectiveness of policy implementation, namely, technical support and degree of compliance with the policy. Two factors, supporting fund and external funds, have both a direct and indirect effect on effectiveness of policy implementation. The indirect effect is through compliance ability and degree of compliance with the policy. Two factors exert only indirect effects; policy knowledge and experience displayed an indirect effect through compliance ability and degree of compliance with the policy, and compliance limitations has an indirect effect through degree of compliance with the policy. Considering the direction of effect, most factors positively influence the

effectiveness of policy implementation. In contast, compliance limitations negatively influence the effectiveness of policy implementation through degree of compliance. All these factors are displayed in a revised model in figure 7.1. This model will be used for policy recommendations, presented in the next section.

Figure 7.1 A Revised Model for the Study of Factors Contributing to the Effectiveness of Policy Implementation



Among such factors, supporting fund is the most powerful influence on the effectiveness of policy implementation, followed by the degree of compliance, technical support, external funds, compliance ability, compliance limitations, policy knowledge and experience, and external funds. Details of these factors are summarized below.

1) Supporting Fund: The supporting fund plays an important role in promoting energy conservation implementation in the designated factories. The findings indicate that if financial support is properly provided and fairly allocated, that there is an adequate amount, and little difficulty in application, then the utilizing of the ECP Fund to promote energy conservation implementation will attain its intended objectives. The supporting fund directly affects compliance ability and the effectiveness of policy implementation. The more supporting funds are provided, the more likely the result will be increasing compliance ability and the effectiveness of policy implementation. Conversely, if fund conditions are difficult to meet, this will cause less effectiveness of policy implementation and less compliance ability.

The results of the study very clearly revealed that the current financial support of the ECP Fund is less than adequate, allocation could be more appropriate, and the application process could be less complicated. (as mentioned in table 5.11). It seems very urgent to correct and revise this quickly.

2) Degree of Compliance: The number of required energy conservation activities the designated factories comply with is an indication of the degree of compliance; a greater number means a greater degree of compliance. It follows that a greater degree of compliance with the policy will lead to greater policy effectiveness. Therefore, government attention on degree of compliance with the policy will strengthen effective policy implementation. Since the degree of compliance is directly influenced by compliance ability and compliance limitations, if the designated factories have greater compliance ability and less compliance limitations, the degree of compliance will be higher. What the government should do is to enhance the capability of the designated factories via providing financial support or technical support to raise the degree of compliance ability or lessen compliance limitations. A supporting fund which is fairly allocated, is adequate in amount and easy to access will raise the compliance ability and consequently degree of compliance and finally effectiveness of policy implementation. With respect to compliance limitations, the provision of technical support (technical advice, education, information dissemination, and training courses provided) and regularly providing technical support can lessen compliance limitations and enhance the capability of designated factories to comply with the policy.

3) Technical Support: As mentioned earlier, technical support (technical advice, training or education provided,information dissemination,etc.) and regular provision of support directly influences the effectiveness of policy implementation. However, the study results show that the current provision of energy conservation information and of training courses is less than adequate (as mentioned in table 5.12). Furthermore, the channel to access such information is limited, particularly for those factories located outside the Bangkok metropolitan area. As a result, if the government wishes to achieve effectiveness of policy implementation, then they should focus more on provision of technical support.

4) External Funds: The availability of and accessibility to external funds is positively and directly related to the effectiveness of policy implementation. The study also reveals an indirect effect on effectiveness of policy implementation through compliance ability. Greater availability of and accessibility to external funds (financial markets) is more likely to result in higher effectiveness of policy implementation. Since compliance with energy conservation policy is not a cost- free policy, it requires money in energy conservation measures or projects. Such capital can be financed through two approaches, internal funds or external funds. Results of the study display that most factories have budget constraints, and need to borrow from the financial markets to finance energy conservation projects. However, they feel that current external funding is not available for energy conservation projects, not easy to access, and has complicated conditions for applying (as mentioned in table 5.16). This issue receives little attention from the government; therefore, the situation needs to be corrected if the government wants to accelerate energy conservation implementation.

5) Compliance Limitations: Compliance limitations negatively affect the degree of compliance with the policy. The limitations can be viewed in several forms such as budget constraints, lack of competent staff, or lack of know- how etc. The designated factories with higher limitations are perceived to have less internal capabilities and less degree of compliance with the policy. As a result, to eliminate such limitations, the government can employ several kinds of policy instruments such as providing financial support and technical support. With provision of financial support, it will raise the financial capability of the factories; moreover, with provision of

technical support, it will enhance human capability and also management capability of the factories. As a result, the compliance ability will be greater and compliance limitations will be less. The results in table 5.18 show that approximately 70 % of the factories perceive compliance limitations in their own factories. Therefore, it is urgent for the government to eliminate such limitations; otherwise the policy goals will not be achieved or may take a long time to achieve.

6) Compliance Ability: Compliance ability tells us about the capacity of designated factories to carry out the tasks required by the regulation. The capacity of designated factories is based on such internal resources as financial resources, human resources, and existing technology and systems. The factories that hold greater internal resources are perceived to have more capacities than the ones with less resources. With greater internal resources, the ability to comply with the policy will be higher as well as the degree of compliance and, hence, will enhance the effectiveness of policy implementation. The government can enhance the ability of the designated factories to comply by several means such as financial support, training and education, technical advice, disseminating relevant information, or factory visits. These means will directly strengthen the capability of designated factories and will further the degree of compliance and effectiveness of policy implementation. The willingness to comply is not sufficient to achieve the effectiveness of policy implementation; the ability to comply should also be considered.

7) Policy Knowledge and Experience: Policy knowledge and experience is considered in terms of previous experience in energy conservation, whether from the factories themselves or from the PREs. The policy knowledge and experience enhances compliance ability of the factories, and greater compliance ability will result in greater degree of compliance, and finally greater effectiveness of policy implementation.

Energy experience of designated factories can be considered from previous energy conservation implementation of the factories. The designated factories that have undertaken energy conservation activities, including conducting energy audits, are perceived more willing and able to comply with the policy compared to the other factories that never performed any activities. These factories have realized actual benefits from direct experience of energy conservation implementation rather than

learning second-hand from the implementing agency. This factor can also be employed as a criterion to classify the degree of willingness and ability to comply with the policy. The previous experience in energy conservation implementation will raise the degree of willingness and ability to comply with the policy, and increase the effectiveness of policy implementation.

Energy experience of the PREs is a factor that varies among the designated factories but it influences the current implementation. The factories that have PREs experienced in energy conservation working with them reveal greater compliance capability than the others that have not. This indicator is very useful if the government wants to set up criteria to classify the designated factories by the degree of willingness and ability to comply with the policy and then designs policy instruments in accordance with compliance willingness and compliance ability of the factories. Therefore, the government should support the designated factories with a higher degree of willingness and ability to comply first, if they want to accelerate the implementation of energy conservation since the probability of success in implementation and attaining its intended objectives and outcomes will be high. Consequently, it can motivate the other factories to follow the same path.

8) External Impact: The impact of external situations whether occurring from instability of the economic situation or uncertainty in energy prices are beyond the control of designated factories. They depend upon external factors such as the world economic situation, the government economic policy or the policy launched by OPEC. Consequently, they are directly influencing compliance ability of the factories. Uncertainties of economic situations cause unpredictable compliance costs with the policy, which will affect financial capabilities of the factories, and then compliance ability. Therefore, a perceived minimum external impact will lead to a rise in compliance ability and consequently degree of compliance and finally policy implementation effectiveness. Thus, the thing that the government can do is to lessen such uncertainties by providing accurate information and data and also proposing policy measures that are able to soften such impacts. Based on the results of the study, it reveals that external impact influences compliance ability of the factories and indicates that perceived minimum external impact will cause higher compliance ability.

Besides the eight factors mentioned above, the remaining two factors, namely compliance cost and compliance willingness are not statistically significant. Results from interviews also show less significance to compliance cost. The designated factories attain financial support from the ECP Fund to undertake energy conservation activities. Currently they perform only the first three activities of the requirement (assigning the PRE, submitting the energy consumption data twice a year, and carrying out the preliminary energy audit) because these activities are less costly. However, it does not mean that the compliance cost will not influence the effectiveness of policy implementation. More time is needed to consider this issue. When the designated factories reach the investment step, then the issue should be reconsidered to ensure that compliance cost does or does not affect the effectiveness of policy implementation.

In spite of the fact the regression model shows no statistical significance, the correlation result reveals that compliance willingness is significantly related to effectiveness of policy implementation (as mentioned in Appendix B, r = .235). Moreover, the results of interviews also support this factor, the PREs view that even if they have the capability to perform energy conservation activities, without support from the executives, they may not be able to perform such functions. Furthermore, if the PREs are less capable and at the same time receive less support from the top, the chance that the policy achieves its goals will be less. Therefore, the researcher will reconsider this factor when she proposes recommendations.

7.2 Recommendations

7.2.1 Policy Implications

The empirical findings emphasize that effective policy implementation is characterized by multiple factors of influence and their interrelations as mentioned in the previous section. This section reveals some policy implications obtained from empirical results, which are:

1) Revising the policy instruments by considering compliance ability and compliance willingness of the designated factories in designing the instruments

The current policy instruments are designed and applied to all types of factories regardless of compliance willingness and compliance ability of the factories. Consequently, the policy instruments do not effectively function as intended. The evidence supports that the factories with greater compliance ability and compliance willingness are able to perform energy conservation activities better than the ones with less ability and willingness. As a result, these two factors should be considered when designing any policy instruments. As shown in figure 7.2, the factories with higher compliance willingness and compliance ability should be allowed to design their own ways to implement the energy conservation activities and the implementing agency should act as a supporting unit to them by providing assistance in the areas that are requested such as provision of energy conservation technology information or advice on energy conservation implementation technique.

For the designated factories with higher willingness but less ability to comply (category 2 in figure 7.2), the policy instrument should emphasize enhancing their capabilities, whether in forms of financial support, technical advice, or training and education. With these kinds of support, the capabilities of the designated factories will be raised and then they will be able to effectively comply with the policy.

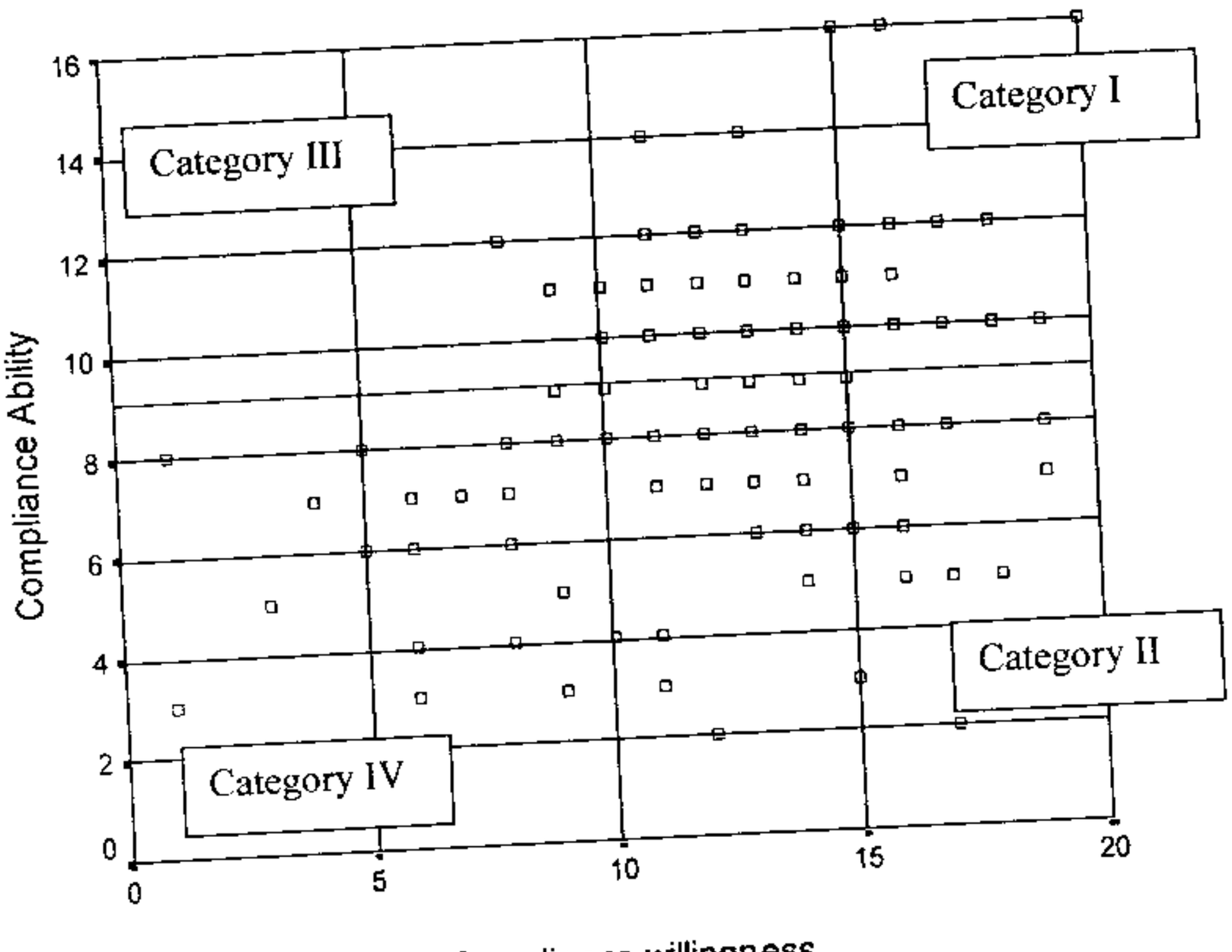
For the designated factories with less willingness to comply but higher ability to comply (category 3 in figure 7.2), the policy instruments should focus on the executives of the factories, since less willingness indicates that the executives may lack understanding of the policy intention or be unaware of the importance of the policy. Therefore, direct contact with the executives via arranging meetings or factory visitations is needed. The benefits of compliance with the policy need to be demonstrated to them. They should be made aware of how many benefits they can gain from compliance, and what level of support they can attain if they comply with the policy.

The last one is the designated factory with less willingness and ability to comply (category 4). These kinds of factories need more attention from the implementing

agency. The policy tool that can work well under this group is close monitoring and providing support and advice; if they ignore the policy, then a wide range of enforcement should be employed varying from fines, temporary closing of the factory, setting deadlines for correcting or withdrawing the factory license. Categorizing the designated factories by the degree of willingness and ability to comply will allow the implementing agency to select the appropriate policy tools to promote the implementation of energy conservation activities.

Based on the results of the study, the four categories of designated factories classified by the degree of willingness to comply and ability to comply are demonstrated in figure 7.2. The results exhibit that many designated factories with greater scores in willingness to comply have less ability to comply (category 2 factories). The designated factories in category 4 need to be attended to by the government immediately, particularly the designated factories where the willingness score and ability score was less than mean score (13.2 and 9.1 respectively). With respect to figure 7.2, the number of the designated factories in this category is approximately 10% of the samples. If the government does not do anything with this group and does not strongly persuade or coerce them to comply with the policy, then the number of non-compliance factories will increase gradually due to the fact the cost of avoidance is less than the cost of compliance with the policy. The results also showed that there are a number of designated factories in category 1 indicating this group of factories can play a major role in supporting the implementation of energy conservation policy.

Figure 7.2 The Relationship between Compliance Willingness and Compliance Ability



In addition, if we consider the compliance ability axis, it seems that approximately 50% of the samples have less compliance ability. It is urgent for the government to act on this issue through application of the policy instruments that can enhance the compliance ability of the factories.

2) Removing the large number of structural and administrative barriers related to the Fund utilization

The current policy design, particularly the regulations related to access to the Fund, creates a number of administrative barriers that slow down or hinder the exploitation of the ECP Fund to promote the implementation of energy conservation tasks. The basic principles that should be observed among financial incentives programs are (a) be simple, (b) provide proper motivation, (c) be fair, and (d) have staying power (Pfeifenberger and Tye, 1995: 769-779). Regarding simplicity, incentive mechanisms

and to find acceptance by the public. To provide proper motivation, the incentive mechanism should relate to the objectives of the enterprise. With respect to fairness, it means that incentive schemes should attempt to create the expectation of a win-win situation for all groups involved. Staying power is a very important feature, the incentive mechanism should have staying power; otherwise it will signal to all entities that this incentive will lose credibility and may defeat future regulatory action. Thus, by revising the current supporting conditions and funding criteria, and by considering such basic principles, the DEDP can ameliorate existing difficulties of financial support from the ECP Fund and also promote the implementation of energy conservation tasks.

3) Improving the channels to disseminate energy conservation policy and implementation information

The findings show that provision of technical support and provision of regular support is a powerful factor that affects the effectiveness of policy implementation. The current policy design on technical support does not pay enough attention to this issue. The evidence shows that a number of factories are unable to an access to the information related to energy conservation policy and implementation. If the factories do not know they are subject to requirements, and do not understand what steps to take to create compliance, the degree of compliance with the policy will be less. Therefore, improving the channels to disseminate information related to energy conservation policy and implementation will enhance policy knowledge of the designated factories and also strengthen compliance ability of the factories. Several types of information via a variety sources (the mass media, websites, and the press releases) as well as the substance of information provided seems to be necessary to build awareness and knowledge of energy conservation.

4) Establishing an energy management center

Due to less compliance ability of the factories, the establishment of an energy management center can play a significant role in the development and implementation of programs that aim to strengthen energy management in the country. Moreover, the center can promote innovative energy management practices in the country, organize exchanges of experts within and between other countries, and arrange training programs regarding energy conservation implementation. Additionally, this

center could be required to publish the successful cases of energy conservation projects or energy management to the public in general and to similar factories in particular. Publishing achievements in energy management can raise the confidence of the financial community in these projects and increase willingness to lend money for the projects.

5) Raising financial support for research into new energy efficiency technology, particularly affordable technology.

The results of the study reveal that current energy efficient technology seems to be limited and unaffordable, which is a major constraint to invest in energy conservation measures or projects. As a consequence, joint research and development projects by the government, the academic institutions and the private sector need to be encouraged to facilitate the transfer of technology from research institutions to private industry.

6) Increasing the financial markets roles to support the promotion of energy conservation implementation

The financial markets play an important role to support investment in energy conservation measures or projects because the current financial support from the Fund is not sufficient. The factories need to finance such projects by exploiting their internal budget, which is limited. Without financial support from the external sources, those projects are cancelled or delayed in implementation. Currently, the loans from financial markets are limited and some financial institutions do not lend to energy conservation projects due to a limited understanding of cost and benefit of the projects. As a result, the financial market environments do not favor investment in energy conservation projects. To lessen this constraint, the government needs to raise awareness and create understanding among the financial institution executives on the characteristics of energy conservation projects, particularly on the costs and benefit of the projects. It needs to point out that these projects gain interest payment support from the Fund that can guarantee that the lenders will get interest payments from the borrowers. By taking this action, the government can be ensured that the implementation of energy conservation measures is able to achieve its goals in the near future.

7.2.2 Management Options

Based on the results of the study, a major barrier that hinders the effectiveness of policy implementation is improper management, whether in the implementing agency or in the factories. This section will propose management options that are expected to lessen the management problem and also support the implementation of energy conservation policy on both sides.

7.2.2.1 Implementing Agency

The implementing agency plays a crucial role not only in supporting the implementation of energy conservation policy but also in enforcing compliance with the policy. Results of the study reveal that insufficient staff and limited managerial competence are major issues among several factors causing the delay in implementation. These need to be solved very soon. Although the implementing agency hires the consultant companies to assist them to execute their functions, it seems that these companies can achieve only minimum results and many functions remain delayed. The following recommendations are expected to lessen the managerial problems in the implementing agency.

1) Provision of special management training programs to the staff

To increase managerial competence of the staff, the implementing agency needs to arrange training programs for management personnel. The effectiveness of policy implementation will be increased if the implementing agency can induce those designated factories to completely comply with the policy. To strengthen the degree-of compliance with the policy, the implementing agency should play a major role as a supporter or a facilitator on policy compliance rather than a regulator on the policy enforcement. Playing the supporter role requires management skills that seem to be lacking in most public agencies, which adhere to the bureaucratic style of management that is not appropriate in the current situation. Therefore, provision of management training courses can lessen difficulties to deal with the factories and also raise more understanding of the business mind among the staff. As a result, the implementing agency can perform effective work and gain good cooperation from the factories, which will finally lead to effectiveness of policy implementation.

2) Introducing marketing approaches to promote energy conservation policy implementation

To increase the number of factories complying with the policy the implementing agency should reconsider the current strategy and approach. Using command and control approaches may not appropriate for this policy. On the other hand, the market strategy should be selected to promote energy conservation implementation. First, the implementing agency needs to access the factories by using several kinds of media (television, radio broadcasting, newsletter, web-site etc.) to inform them that they are the subjects that are required to comply with the policy and what they have to do to comply with it, what supports they will get, what the benefits are to their factories and to the country as a whole.. The results from the implementing agency show that they have employed this approach at the beginning phase after the policy was enacted and became effective. However, the results from interviews exhibit that there remain a number of factories who never received any information regarding the policy from the implementing agency until they were contacted by the energy consultant companies and offered technical assistance to perform energy conservation activities. Some factories attained quality work from the consultant companies but others did not and also created more burdens to them, whether in forms of unfinished work or unsatisfactory performance. These problems ruin effectiveness of policy implementation and cause distrust of the consultant companies as well as the implementing agency.

Next, related information on energy conservation implementation should be published or disseminated to the factories regularly, particularly the best practices on energy conservation measures, without waiting for requests.

Third, the implementing agency should arrange and provide monitoring systems so that the factories could be checked to see what they have done and to see whether they have any problems and provide some solutions for such problems.

Finally, the implementing agency should reward the outstanding factories in energy conservation implementation and ask these factories to be the leaders in promotion of energy conservation so that the other factories can learn from their success.

3) Strengthening third party performance

Because of limited staff of the implementing agency responsible for energy conservation tasks, the implementing agency hires consultant companies to perform some tasks under its supervision. This is a good approach to lessen the problem; however, the results from interviews reveal that some companies are less competent and are unable to function as required. Therefore, the qualifications of current consultant companies need to be reconsidered to ensure that their staffs have knowledge and experience on energy conservation issues and are qualified to perform the assignments. Otherwise, it will waste money and ruin the implementing agency's reputation as well as create distrust in the implementing agency and consequently raise the degree of noncompliance with the policy.

7.2.2.2 The Designated Factories

1) Bringing energy conservation issues onto the agenda of top management

The energy conservation implementation in the factories could be achieved if top management play an important role by bringing the energy conservation issue onto the company agenda. The empirical findings reveal less cooperation among employees in energy conservation implementation, which causes unnecessary difficulties in implementation and inability to achieve the goals (saving energy and increasing productivity). Therefore, introducing the energy conservation issues on the company agenda and declaring the goals, whether by written or verbal communication, will promote the participation of all employees in energy conservation implementation and will lead to the company's, as well as the country's, goal achievement.

2) Supporting the learning company

Success in energy conservation can be gained if the company develops energy efficiency implementation into a routine practice. Several energy conservation measures can be done without investment cost. For example, the employees need to learn to investigate any useless uses of energy and fix them if they can, or inform the responsible unit to handle problems without waiting for orders from the top. First, the company may arrange training courses or workshops on energy

conservation to raise knowledge and understanding, and then ask supervisors to survey in their departments or sections to find out the points that consume a lot of energy and propose the possible measures or solutions that can reduce energy usage. Next, they need to support the implementation of such measures and keep records of what they save and publish the outstanding results. With learning by doing, it can be ensured that the company is able save energy and reduce energy costs.

7.3 Implication for Public Policy

The results of the study are supported by the prior studies in the field of policy implementation and policy evaluation. Focusing on the factors affecting effectiveness of policy implementation, the key elements that should be considered in any policy and in regulatory enforcement in particular, are the degree of compliance, the willingness to comply, and the ability to comply. Regarding these elements, the government or the implementing agency needs to realize the factors that influence such elements, which may come from external factors (financial support and technical support of the government, external impact (instability of economic conditions) or internal factors (financial capability, human capability, management capability, or system capability). Then policy tools should be designed to strengthen them or reduce them (for example, in case of external impact). Without considering the degree of compliance, the willingness to comply, and the ability to comply, the chance that the policy can achieve its intended objectives will be low.

In addition, the research results also reveal that policy knowledge and experience influences compliance ability and consequently degree of compliance with the policy and effectiveness of policy implementation. Specifically, the target groups that have implementation experience in the requirements of the regulation seem to have more compliance ability than the ones with less experience. Furthermore, if the staff of target groups has knowledge and experience in such regulations, the chance that the policy will be implemented as intended will be high and the policy goal will be able to be achieved.

7.4 Direction for Future Research

This study was unable to include all implementation of energy conservation activities and all designated facilities prescribed by the ECP Act. Therefore there remains room for future study to fill such gaps to see if an overall energy conservation policy, via the enacting the ECP Act, can be implemented and achieve its intended objectives. In particular, a parallel study should be conducted on designated buildings. Moreover, other case studies of succesful factories should be done in the future to investigate in detail to see how such factories implement the energy conservation policy and what the driving forces were that made them successful in implementation.

Finally, since the study centers on perceived effectiveness instead of using empirical indicators to measure the policy effectiveness due to certain constraints previously discussed, future research on similar topics should focus on collecting and employing empirical data concerning reduction in energy consumption, in energy dependency, and in greenhouse gas emission to make the research more complete.

APPENDIX C:

CORRELATION MATRIX

Table Appendix C Descriptive Statistic and Correlation Matrix

Variable	Y	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10
Effectiveness of Policy Implementation (Y)	1.000										
Supporting Fund (X1)	.314**	1.000									
Technical Support (X2)	.202**	.154*	1.000								
Policy Know & Experience (X3)	.072	-.042	-.060	1.000							
External Fund (X4)	.147*	.137	.194**	.077	1.000						
External Impact (X5)	.098	.174*	.086	.057	.092	1.000					
Compliance Limitation (X6)	.267**	-.044	-.003	-.201*	.035	-.225**	1.000				
Compliance Cost (X7)	.086	.010	.069	.196**	.026	.178*	-.158*	1.000			
Compliance Ability (X8)	.228**	.268**	.144	.232**	.215**	.237*	-.127	.246**	1.000		
Compliance Willingness (X9)	.235**	.214**	.319**	.234**	.200**	.326**	-.104	.268**	.446**	1.000	
Degree of Compliance (X10)	.135	-.024	-.036	.135	-.174*	.149*	-.124	.162*	.186**	.110	1.000
Mean	14.83	12.54	8.25	4.95	3.38	4.68	18.41	5.42	9.10	13.21	.43
SD	3.17	4.08	2.67	2.80	1.91	1.67	4.95	1.70	2.82	3.43	.12
Min	3.00	1.00	.00	1.00	.00	.00	.00	1.00	2.00	1.00	.00
Max	20.00	20.00	14.00	11.00	8.00	8.00	27.00	8.00	16.00	20.00	1.00
N	194	193	177	190	193	195	171	195	195	193	199

** Correlation is significant at the 0.01 level (2-tailed)

* Correlation is significant at the 0.05 level (2-tailed)

APPENDIX A:

QUESTIONNAIRE IN THAI

แบบสอบถามการวิจัยเรื่อง

"นโยบายอนุรักษ์พลังงานของประเทศไทย: ประสิทธิผลของการนำนโยบายไปปฏิบัติ"

คำชี้แจง: แบบสอบถามชุดนี้ประกอบด้วย 5 ส่วน

ส่วนที่ 1: ข้อมูลทั่วไป

ส่วนที่ 2: ข้อมูลการใช้พลังงาน

ส่วนที่ 3: ข้อมูลกิจกรรมอนุรักษ์พลังงานของโรงงาน

ส่วนที่ 4: ข้อมูลที่เกี่ยวข้องกับการนำนโยบายอนุรักษ์พลังงานไปปฏิบัติ

ส่วนที่ 5: ข้อเสนอแนะ หรือ ข้อคิดเห็นเพิ่มเติม

ส่วนที่ 1: ข้อมูลทั่วไป

(กรุณาทำเครื่องหมาย ✔ ในช่องที่สอดคล้องกับโรงงานของท่าน หรือเติมข้อความในช่องว่างที่กำหนด)

1. ชื่อโรงงาน----------

   ประเภทอุตสาหกรรม (TSIC) ----------

2. สถานที่ตั้งโรงงาน

   ( ) กรุงเทพและปริมณฑล ( ) ภาคเหนือ

   ( ) ภาคกลาง ( ) ภาคตะวันออกเฉียงเหนือ

   ( ) ภาคตะวันออก ( ) ภาคใต้

3. ที่อยู่ เลขที่ ----------หมู่ที่----------

   ถนน----------ตำบล----------อำเภอ / เขต----------

   จังหวัด----------โทรศัพท์---------- โทรสาร----------

4. อายุโรงงาน----------ปี

5. ประเภทโรงงานควบคุม

   ( ) โรงงานควบคุมปี 1 (ติดตั้งหม้อแปลงขนาดตั้งแต่ 10 MW ขึ้นไป)

   ( ) โรงงานควบคุมปี 2 (ติดตั้งหม้อแปลงขนาดตั้งแต่ 3-10 MW)

   ( ) โรงงานควบคุมปี 3 (ติดตั้งหม้อแปลงขนาดตั้งแต่ 2-3 MW)

   ( ) โรงงานควบคุมปี 4 (ติดตั้งหม้อแปลงขนาดตั้งแต่ 1-2 MW)

6. โรงงานเริ่มดำเนินการผลิตเมื่อเดือน----------พ.ศ.----------

7. จำนวนชั่วโมงทำงานต่อวัน----------ชั่วโมง

   จำนวนชั่วโมงทำงานต่อปี----------ชั่วโมง

   จำนวนวันทำงานต่อปี----------วัน

   จำนวนวันทำงานต่อเดือน----------วัน

8. จำนวนพนักงานในโรงงาน----------คน

9. กำลังผลิตปัจจุบันคิดเป็นร้อยละ----------ของกำลังการผลิตทั้งหมด

10. ผลผลิตของโรงงาน (โดยเฉลี่ย)

ผลิตภัณฑ์	จำนวนผลผลิตต่อเดือน (ระบุหน่วยเช่น ตัน, กิโลกรัม)
1.	
2.	
3.	
4.	
5.	

ส่วนที่ 2: ข้อมูลการใช้พลังงาน

(กรุณาเติมข้อความในช่องว่างที่กำหนดให้ครบถ้วน)

11. ค่าใช้จ่ายด้านพลังงานทั้งหมด(ไฟฟ้าและเชื้อเพลิง)โดยเฉลี่ยต่อเดือน----------บาท

12. ปริมาณการใช้พลังงานทั้งหมดโดยเฉลี่ยต่อเดือนจำแนกตามประเภทพลังงาน

ชนิดพลังงาน	ปริมาณการใช้ (โปรดระบุหน่วย)
1. พลังงานไฟฟ้า	กิโลวัตต์-ชั่วโมง
2. น้ำมันเตา	กิโลกรัม, ลิตร
3. LPG	กิโลกรัม, ลิตร
4. LNG	กิโลกรัม, ลิตร
5. อื่นๆ (โปรดระบุ) 5.1---------- 5.2----------	 ----------กิโลกรัม, ลิตร หรือ-------- ----------กิโลกรัม, ลิตร หรือ---------

13. สัดส่วนค่าใช้จ่ายด้านพลังงานทั้งหมดคิดเป็นร้อยละ----------ของต้นทุนการผลิตรวมของโรงงาน

ส่วนที่ 3: ข้อมูลกิจกรรมการอนุรักษ์พลังงานของโรงงาน

(กรุณาทำเครื่องหมาย ✔ ในช่องที่สอดคล้องกับโรงงานของท่าน หรือเติมข้อความในช่องว่างที่กำหนด)

14. ปัจจุบันโรงงานของท่านมีแผนกพลังงานหรืออนุรักษ์พลังงานหรือไม่ (ถ้าไม่มีให้ข้ามไปตอบข้อ 16และ17)

( ) มี ( ) ไม่มี

15. จำนวนพนักงานในแผนกพลังงานหรืออนุรักษ์พลังงานมีจำนวน----------คน

16. ถ้าไม่มี แผนกใดเป็นผู้รับผิดชอบกิจกรรมที่เกี่ยวข้องกับการอนุรักษ์พลังงาน

( ) แผนกซ่อมบำรุง

( ) แผนกการผลิต

( ) แผนกวิศวกรรม

( ) แผนกการเงิน

( ) คณะกรรมการด้านอนุรักษ์พลังงานของโรงงาน

( ) อื่นๆ (โปรดระบุ----------)

17. จำนวนพนักงานที่รับผิดชอบกิจกรรมที่เกี่ยวข้องกับการอนุรักษ์พลังงานในแผนกตามข้อ (16)----------คน

18. ผู้รับผิดชอบด้านพลังงานในโรงงานของท่านมีจำนวน----------คน

19. ผู้รับผิดชอบด้านพลังงานในโรงงานของท่านเคยผ่านการฝึกอบรมหลักสูตรผู้รับผิดชอบด้านพลังงานตามที่ พพ. กำหนดหรือไม่

( ) เคย จำนวนกี่คน----------คน

( ) ไม่เคย จำนวนกี่คน----------คน

20. คุณสมบัติของผู้รับผิดชอบด้านพลังงาน

20.1ระดับการศึกษา

ระดับ	จำนวน (คน)
ประกาศนียบัตรวิชาชีพ (ปวช.)	
ประกาศนียบัตรวิชาชีพชั้นสูง (ปวส.)	
ปริญญาตรี	
ปริญญาโท หรือสูงกว่า	

20.2สาขาที่สำเร็จการศึกษา

สาขา	จำนวน (คน)
วิทยาศาสตร์และเทคโนโลยี	
วิศวกรรมศาสตร์ (โปรดระบุสาขา) ไฟฟ้า เครื่องกล อื่นๆ (โปรดระบุ)----------	
พลังงาน	
อื่นๆ (โปรดระบุ)----------	

20.3 ประสบการณ์ที่เกี่ยวข้องกับงานด้านพลังงานก่อนเข้าทำงานที่โรงงานแห่งนี้

ระยะเวลา	จำนวน (คน)
1–3 ปี	
4 -6 ปี	
7-9 ปี	
มากกว่า 10 ปี	

20.4 ระยะเวลาที่ผู้รับผิดชอบด้านพลังงานทำงานที่โรงงานแห่งนี้

ระยะเวลา	จำนวน (คน)
น้อยกว่า 1 ปี	
1-2 ปี	
3-4 ปี	
มากกว่า 4 ปี	

21. โรงงานของท่านเคยดำเนินการตรวจวิเคราะห์การใช้พลังงานในโรงงาน ก่อนหน้าที่จะมีกฎหมายบังคับหรือไม่
(หากไม่เคยให้ข้ามไปตอบข้อ 23)
( ) เคย ( ) ไม่เคย

22. ถ้าเคย ใครเป็นผู้รับผิดชอบดำเนินการตาม ข้อ 21
( ) ดำเนินการเองโดยเจ้าหน้าที่ของโรงงาน
( ) กรมพัฒนาและส่งเสริมพลังงาน (สำนักงานพลังงานแห่งชาติในอดีต)
( ) ว่าจ้างบริษัทที่ปรึกษาด้านอนุรักษ์พลังงานเป็นผู้ดำเนินการ
( ) อื่นๆ โปรดระบุ----------

23. โรงงานของท่านได้เคยดำเนินกิจกรรมหรือมีมาตรการอนุรักษ์พลังงานก่อนหน้าที่จะมีกฎหมายบังคับหรือไม่
(หากไม่เคยให้ข้ามไปตอบข้อ 25)
( ) เคย ( ) ไม่เคย

24. จากข้อ 23 โปรดระบุกิจกรรมและมาตรการอนุรักษ์พลังงานที่โรงงานของท่านเคยดำเนินการก่อนหน้าที่จะมีกฎหมายบังคับ พร้อมทั้งระบุผลการประหยัดที่ได้รับจากการดำเนินมาตรการดังกล่าวคิดเป็นร้อยละของปริมาณการใช้พลังงานทั้งหมด

กิจกรรม / มาตรการ	1-15 %	16-30%	31-45%	มากกว่า 46%
1. การปรับปรุงประสิทธิภาพการเผาไหม้ของเชื้อเพลิง				
2. การป้องกันการสูญเสียพลังงาน (เช่น การหุ้มฉนวน)				
3. การนำพลังงานที่เหลือจากการใช้แล้วกลับมาใช้ใหม่ (เช่น การนำ Condensate กลับมาใช้ การอุ่นอากาศก่อนเข้าห้องเผาไหม้))				
4. การเปลี่ยนไปใช้พลังงานอีกประเภท (เช่นการเปลี่ยนจากการใช้น้ำมันหรือไฟฟ้ามาใช้ก๊าซ)				
5. การปรับปรุงการใช้ไฟฟ้าด้วยวิธีปรับปรุงตัวประกอบไฟฟ้า การลดความต้องการพลังไฟฟ้าสูงสุด ในช่วงความต้องการใช้ไฟฟ้าสูงสุดของระบบ				
6. การเลือกใช้เครื่องจักรอุปกรณ์ที่มีประสิทธิภาพสูง (เช่น การใช้มอเตอร์ประสิทธิภาพสูง, การติดตั้งระบบควบคุมความเร็วมอเตอร์)				
7. การรณรงค์ให้พนักงานช่วยกันอนุรักษ์พลังงานในโรงงาน เช่นการแข่งขันกันอนุรักษ์พลังงานในแต่ละแผนก การประชาสัมพันธ์เพื่อสร้างจิตสำนึกในการอนุรักษ์พลังงาน				
8. อื่นๆ โปรดระบุ 8.1---------- 8.2---------- 8.3----------				

25. ขณะนี้ โรงงานของท่านได้ดำเนินกิจกรรมใดบ้างที่เกี่ยวข้องกับการอนุรักษ์พลังงานตามพรบ. การส่งเสริมการอนุรักษ์พลังงาน พ.ศ. 2535

กิจกรรม	ดำเนินการแล้วและได้รับความเห็นชอบจาก พพ. แล้ว	ดำเนินการแล้วรอความความเห็นชอบจาก พพ.	ยังไม่ได้ดำเนินการ
1. แต่งตั้งผู้รับผิดชอบด้านอนุรักษ์พลังงาน			
2. จัดส่งข้อมูลการใช้พลังงานแก่ พพ. ปีละ 2 ครั้ง			
3. ดำเนินการตรวจวิเคราะห์การใช้พลังงานเบื้องต้น			
4. ดำเนินการตรวจวิเคราะห์การใช้พลังงานโดยละเอียด			
5. จัดทำเป้าหมายและแผนการอนุรักษ์พลังงาน			
6. ลงทุนในมาตรการอนุรักษ์พลังงานตามที่กำหนดไว้ในเป้าหมายและแผน			
7. ติดตามและตรวจสอบการดำเนินการตามเป้าหมายและแผนอนุรักษ์พลังงาน			

26. โรงงานของท่านได้รับการสนับสนุนทางด้านเทคนิคเพื่อดำเนินงานกิจกรรมอนุรักษ์ตามที่กฎหมายกำหนดด้านใดบ้าง(ท่านสามารถเลือกได้มากกว่า 1 ข้อ) พร้อมระบุว่าใครเป็นผู้ให้การสนับสนุน พพ. หรือบริษัทที่ปรึกษาที่ว่าจ้างโดย พพ. หรือ หน่วยงานอื่น

ประเภทการสนับสนุน	ผู้ให้การสนับสนุน		
	พพ. หรือ บริษัทว่าจ้างโดย พพ.	หน่วยงานราชการอื่น	บริษัทเอกชน
1. การให้คำปรึกษาเพื่อดำเนินกิจกรรมการอนุรักษ์พลังงานตามที่กฎหมายกำหนด			
2. การให้บริการฝึกอบรมที่เกี่ยวข้องกับกิจกรรมการอนุรักษ์พลังงาน			
3. การให้บริการข้อมูลข่าวสารที่เกี่ยวข้องกับการอนุรักษ์พลังงาน			
4. การให้คำปรึกษาเพื่อดำเนินการลงทุนในมาตรการการอนุรักษ์พลังงานตามที่กำหนดไว้ในเป้าหมายและแผน			
5. อื่นๆ โปรดระบุ 5.1---------- 5.2----------			

27. โรงงานของท่านได้รับการสนับสนุนทางด้านเทคนิค โดยเฉลี่ยปีละกี่ครั้ง

ประเภทการสนับสนุน	มากกว่า 10 ครั้ง (เรื่อง)	7-9 ครั้ง (เรื่อง)	4-6 ครั้ง (เรื่อง)	1-3 ครั้ง (เรื่อง)	ไม่เคยได้รับ
1. การให้คำปรึกษาเพื่อดำเนินกิจกรรมการอนุรักษ์พลังงานตามที่กฎหมายกำหนด					
2. การให้บริการฝึกอบรมที่เกี่ยวข้องกับกิจกรรมการอนุรักษ์พลังงาน					
3. การให้บริการข้อมูลข่าวสารที่เกี่ยวข้องกับการอนุรักษ์พลังงาน (เรื่อง)					
4. การให้คำปรึกษาเพื่อดำเนินการลงทุนในมาตรการการอนุรักษ์พลังงานตามที่กำหนดไว้ในเป้าหมายและแผน					
5. อื่นๆ โปรดระบุ 5.1---------- 5.2----------					

28. โรงงานท่านมีข้อจำกัดในการดำเนินงานอะไรบ้าง ในการปฏิบัติตาม พรบ. การส่งเสริมการอนุรักษ์พลังงาน (ท่านสามารถเลือกได้มากกว่า 1 ข้อ) พร้อมทั้งระบุระดับความสำคัญของข้อจำกัด

ข้อจำกัด	สำคัญมาก	ปานกลาง	น้อย
1. โรงงานมีงบประมาณจำกัด			
2. โรงงานขาดแคลนบุคลากรที่มีความรู้ ความสามารถทางด้านการอนุรักษ์พลังงาน			
3. พนักงานส่วนใหญ่ขาดความรู้ ความเข้าใจในเรื่องการอนุรักษ์พลังงาน			
4. โรงงานไม่มีประสบการณ์ด้านการอนุรักษ์พลังงาน			
5. ผู้บริหารขาดความเข้าใจในนโยบายการอนุรักษ์พลังงาน			
6. ผู้บริหารระดับสูงไม่ให้การสนับสนุน เนื่องจากไม่มั่นใจในผลตอบแทนที่จะได้รับจากการดำเนินอนุรักษ์พลังงาน			
7. พนักงานขาดความตระหนักในเรื่องการอนุรักษ์พลังงาน			
8. หน่วยงานต่างๆในโรงงานขาดความร่วมมือในการดำเนินการอนุรักษ์พลังงาน			
9. พนักงานในโรงงานไม่ให้ความร่วมมือดำเนินการอนุรักษ์พลังงาน			
10. อื่นๆ โปรดระบุ 10.1---------- 10.2----------			

ส่วนที่ 4: ข้อมูลเกี่ยวกับการนำนโยบายอนุรักษ์พลังงานไปปฏิบัติ

จากข้อความข้างล่างต่อไปนี้ให้ท่านแสดงความคิดเห็นต่อข้อความดังกล่าวโดยทำเครื่องหมาย ✓ ในช่องที่ท่านเลือกโดยความเห็นที่ท่านเลือกขอให้ท่านแสดงความเห็นในฐานะที่เป็นผู้รับผิดชอบด้านพลังงานของโรงงาน (ระดับความคิดเห็นจะแบ่งออกเป็น 4 ระดับ คือ SA: เห็นด้วยอย่างยิ่ง, A: เห็นด้วย, D: ไม่เห็นด้วย, DA: ไม่เห็นด้วยอย่างยิ่ง U: ไม่แน่ใจ)

ข้อความ	SA	A	D	DA	U
1. เงินกองทุนฯ เพื่อสนับสนุนการดำเนินกิจกรรมอนุรักษ์พลังงานได้ถูกจัดสรรให้แก่โรงงานควบคุมแต่ละประเภทอย่างเหมาะสมและเป็นธรรม					
2. ท่านคิดว่าประเภทการสนับสนุนทางการเงินจากกองทุนฯเพื่อส่งเสริมการดำเนินกิจกรรมอนุรักษ์พลังงานในโรงงานควบคุมที่เป็นอยู่ในปัจจุบันพอเพียงกับความต้องการ					
3. ท่านคิดว่าการสนับสนุนทางการเงินจากกองทุนฯเพื่อส่งเสริมการดำเนินกิจกรรมอนุรักษ์พลังงานในโรงงานควบคุมที่เป็นอยู่ในปัจจุบันสามารถจูงใจและกระตุ้นให้โรงงานดำเนินกิจกรรมอนุรักษ์พลังงานตามที่ พรบ. กำหนด					
4. หลักเกณฑ์ในการอนุมัติเงินสนับสนุนค่าใช้จ่ายภาระดอกเบี้ยสำหรับการลงทุนในมาตรการอนุรักษ์พลังงานของโรงงานควบคุม ที่กำหนดให้ EIRR ต้องมีค่าไม่น้อยกว่า 9 % และ FIRR มีค่าไม่เกินอัตราดอกเบี้ยเงินกู้ บวก 2% เป็นไปได้ยากในทางปฏิบัติ					

ข้อความ	SA	A	D	DA	U
5. โดยรวมแล้วการให้การสนับสนุนทางการเงินจากกองทุนฯเพื่อส่งเสริมการดำเนินกิจกรรมอนุรักษ์พลังงานในโรงงานควบคุมถือว่าบรรลุวัตุประสงค์ที่ตั้งไว้คือ ส่งเสริมการดำเนินกิจกรรมอนุรักษ์พลังงานในโรงงาน และสามารถลดปริมาณการใช้พลังงานของโรงงานลงจากเดิมก่อนที่จะได้รับการสนับสนุน					
6. การกำหนดให้โรงงานควบคุมต้องได้รับการสนับสนุนจากแหล่งเงินทุนภายนอก เพื่อลงทุนในมาตรการอนุรักษ์พลังงาน ก่อนที่จะขอรับการสนับสนุนค่าใช้จ่ายภาระดอกเบี้ยจากกองทุนฯ ถือว่าเหมาะสมแล้ว เพราะช่วยประกันความเสี่ยงแก่โครงการ					
7. การให้คำแนะนำทางด้านเทคนิคที่ได้รับจาก พพ. หรือ บริษัทที่ปรึกษาว่าจ้างโดย พพ. ช่วยให้โรงงานของท่านเข้าใจ พรบ. ได้ดีขึ้นและสามารถดำเนินกิจกรรมอนุรักษ์พลังงานตามที่กฎหมายกำหนด					
8. โรงงานท่านสามารถขอรับคำแนะนำทางด้านเทคนิคจาก พพ. หรือ บริษัทที่ปรึกษาว่าจ้างโดย พพ. ได้อย่างสะดวก รวดเร็ว					
9. ข้อมูลข่าวสารที่เกี่ยวข้องกับการอนุรักษ์พลังงานที่โรงงานท่านได้รับจากพพ. หรือบริษัทที่ปรึกษาที่ว่าจ้างโดย พพ. ช่วยให้โรงงานของท่านรับทราบว่าต้องปฏิบัติตามกฎหมายอย่างไรบ้าง					
10. การให้บริการข้อมูลข่าวสารที่เกี่ยวข้องกับการอนุรักษ์พลังงานที่โรงงานท่านได้รับจากพพ. หรือบริษัทที่ปรึกษาที่ว่าจ้างโดย พพ. เพียงพอและสอดคล้องกับความต้องการ					
11. การฝึกอบรมที่จัดโดย พพ. หรือ บริษัทที่ปรึกษาที่ว่าจ้างโดย พพ. ช่วยให้เจ้าหน้าที่ในโรงงานของท่านสาสารถดำเนินกิจกรรมอนุรักษ์พลังงานในโรงงานได้อย่างเหมาะสม					
12. การฝึกอบรมที่จัดโดย พพ. หรือ บริษัทที่ปรึกษาที่ว่าจ้างโดย พพ. ที่ผ่านมา รวมทั้งที่กำลังดำเนินการในปัจจุบันที่เกี่ยวข้องกับการอนุรักษ์พลังงานเพียงพอต่อความต้องการ					
13. กำลังการผลิตที่ลดลงของโรงงานเนื่องจากภาวะเศรษฐกิจ ไม่มีผลกระทบต่อการดำเนินกิจกรรมอนุรักษ์พลังงานตามที่กฎหมายกำหนด ผู้บริหารยังคงให้การสนับสนุนการดำเนินกิจกรรมอนุรักษ์พลังงานตามกฎหมาย					
14. การเคลื่อนไหวของราคาพลังงานไม่ส่งผลกระทบการตัดสินใจลงทุนในโครงการอนุรักษ์พลังงานของโรงงานท่าน โรงงานของท่านยังเห็นความสำคัญของการดำเนินกิจกรรมอนุรักษ์พลังงาน					
15. ข้อมูลข่าวสารเกี่ยวกับแหล่งเงินทุนที่สนับสนุนการลงทุนในโครงการอนุรักษ์พลังงานมีอย่างแพร่หลาย โรงงานของท่านสามารถเข้าถึงแหล่งเงินทุนดังกล่าวโดยง่าย					
16. โครงการอนุรักษ์พลังงานได้รับการพิจารณาให้เงินทุนสนับสนุนการลงทุนจากแหล่งเงินทุนภายนอกเป็นอันดับต้นๆ					
17. เงินทุนภายนอกอื่นๆ(ที่ไม่ใช่เงินกองทุนฯ)ที่สนับสนุนการลงทุนในโครงการอนุรักษ์พลังงานมีเงื่อนไข หลักเกณฑ์การพิจารณาอนุมัติเงินทุนที่ซับซ้อน ยุ่งยาก					
18. ถึงแม้ไม่มีเงินสนับสนุนจากกองทุนอนุรักษ์พลังงาน โรงงานของท่านยังเต็มใจที่จะดำเนินกิจกรรมอนุรักษ์พลังงาน เนื่องจากเห็นความสำคัญของการอนุรักษ์พลังงาน					
19. เจ้าของโรงงาน ผู้ถือหุ้น หรือ ผู้บริหารระดับสูงในโรงงานให้การสนับสนุนการดำเนินกิจกรรมอนุรักษ์พลังงานอย่างจริงจัง โดยเป้าหมายการอนุรักษ์พลังงานถูกจัดอันดับความสำคัญไว้เป็นลำดับแรกๆ ในแผนปรับปรุงประสิทธิภาพการผลิต หรือแผนลดต้นทุนการผลิตของโรงงาน					

ข้อความ	SA	A	D	DA	U
20. เจ้าหน้าที่ด้านพลังงานของโรงงานได้รับการสนับสนุนให้เข้าร่วมประชุม สัมมนา ฝึกอบรม เรื่องที่เกี่ยวข้องกับการอนุรักษ์พลังงานอย่างสม่ำเสมอ					
21. พนักงานส่วนใหญ่ตระหนักถึงความสำคัญของการอนุรักษ์พลังงานและให้ความร่วมมือในการดำเนินกิจกรรมอนุรักษ์พลังงานอย่างเต็มที่					
22. เมื่อโรงงานต้องจัดหาเครื่องจักร อุปกรณ์ที่ใช้พลังงานใหม่ ประเด็นเรื่องการใช้พลังงานอย่างมีประสิทธิภาพของเครื่องจักร และอุปกรณ์จะถูกนำมาพิจารณาเพื่อตัดสินใจซื้อ					
23. โรงงานของท่านมีงบประมาณพอเพียงสำหรับการดำเนินกิจกรรมอนุรักษ์พลังงานตามที่กฎหมายกำหนด					
24. โรงงานของท่านมีระบบการจัดเก็บข้อมูลด้านการใช้พลังงานและระบบการติดตามและรายงานผลการดำเนินกิจกรรมการอนุรักษ์พลังงานเป็นอย่างดี และมีการปรับปรุงให้ทันสมัยตลอดเวลา					
25. โรงงานของท่านสามารถดำเนินการตรวจวิเคราะห์การใช้พลังงานในโรงงานของท่านได้ด้วยตนเอง โดยไม่จำเป็นต้องว่าจ้างบริษัททีปรึกษา (RC)มาดำเนินการให้					
26. เจ้าหน้าที่ด้านพลังงานของโรงงานส่วนใหญ่มีความรู้และประสบการณ์ด้านอนุรักษ์พลังงานเป็นอย่างดี					
27. ค่าใช้จ่ายเพื่อการดำเนินกิจกรรมอนุรักษ์พลังงานตามกฎหมาย (เช่น การแต่งตั้งผู้รับผิดชอบด้านพลังงาน การตรวจวิเคราะห์การใช้พลังงาน) มีผลกระทบต่อต้นทุนการผลิตของโรงงานท่านเพียงเล็กน้อย					
28. เมื่อเปรียบเทียบต้นทุนและผลประโยชน์ของการดำเนินกิจกรรมอนุรักษ์พลังงานแล้ว ท่านคิดว่าผลประโยชน์ยังคงสูงกว่าต้นทุน ดังนั้น โรงงานสามารถดำเนินกิจกรรมอนุรักษ์พลังงานด้วยตนเอง โดยไม่จำเป็นต้องรับการสนับสนุนจากรัฐบาล					
29. มาตรการอนุรักษ์พลังงานตามที่กฎหมายกำหนดทำให้ประสิทธิภาพในการผลิตของโรงงานท่านเพิ่มขึ้นและทำให้ต้นทุนการผลิตของโรงงานลดลง					
30. การดำเนินมาตรการอนุรักษ์พลังงานตามที่กฎหมายกำหนดเป็นผลดีต่อประเทศโดยรวมคือลดการพึ่งพาพลังงานจากต่างประเทศและจะช่วยลดการปล่อยก๊าซเรือนกระจก					
31. ถ้าหากไม่มี พรบ. การส่งเสริมการอนุรักษ์พลังงาน การใช้มาตรการส่งเสริมให้ดำเนินการอนุรักษ์โดยสมัครใจเพียงอย่างเดียว ไม่เพียงพอที่จะกระตุ้นให้ปริมาณการใช้พลังงานโดยรวมของประเทศลดลง					
32. พรบ.การส่งเสริมการอนุรักษ์พลังงาน เป็นกลไกสำคัญที่ทำให้การลดลงปริมาณการใช้พลังงานของประเทศประสบความสำเร็จ					
33. พรบ.การส่งเสริมการอนุรักษ์พลังงาน สามารถนำมาปฏิบัติได้อย่างมีประสิทธิผลคือ โรงงานควบคุมดำเนินกิจกรรมอนุรักษ์พลังงานตามที่กฎหมายกำหนด และทำให้ปริมาณการใช้พลังงานของโรงงานควบคุมและของประเทศลดลง					

ส่วนที่ 5

ข้อเสนอแนะเพิ่มเติมเกี่ยวกับการปฏิบัติตาม พรบ. การส่งเสริมการอนุรักษ์พลังงาน พ.ศ. 2535 ในส่วนของโรงงานควบคุม

ขอขอบพระคุณทุกท่านที่ให้ความร่วมมือ
นาง ศศิธร สินบรรจงจิต-สุวรรณเทพ
นักศึกษาปริญญาเอก โครงการปริญญาเอกนานาชาติ
คณะรัฐประศาสนศาสตร์
สถาบันบัณฑิตพัฒนบริหารศาสตร์

APPENDIX B:

QUESTIONNAIRE IN ENGLISH

Questionnaire on

Energy Conservation Policy: Effectiveness of Policy Implementation

This questionnaire contains 5 parts:

Part I: General Information

Part II: Energy Consumption Information

Part III: Energy Conservation Activities in the Factory

Part IV: Perception on Energy Conservation Implementation

Part V: Additional Suggestions or Recommendations

Part I: General Information

(Please check √ in the blank box where you think it represents your factory characteristics or fill information in the blank space)

1. Factory name:----------

   TSIC----------

2. Factory location:

   ( ) 1. Bangkok & Metropolitan ( ) 4. Northern Region

   ( ) 2. Central Region ( ) 5. North-eastern Region

   ( ) 3. Eastern Region ( ) 6. Southern Region

3. Address:----------

   ---

4. Number of factory working years ---------- years

5. Category of Designated Factory:

   ( ) 1. Year One (10 MW electrical transformer installed)

   ( ) 2. Year Two (3-10 MW electrical transformer installed)

   ( ) 3. Year Three (2-3 MW electrical transformer installed)

   ( ) 4. Year Four (1-2 MW electrical transformer installed)

6. Month and year of factory establishment. Month----------Year----------

7. 1) Daily operating hours----------hours

   2) Yearly operating hours----------hours

3) Yearly operating days----------days

4) Monthly operating days----------days

8. Number of employees----------persons

9. Current operating capacity----------percent

10. Type of products (by average)

Type of Products	Monthly Products (specify unit i.e., ton or kg.)
1.	
2.	
3.	
4.	
5.	

Part II: Energy Consumption Information

(Please fill the blank space completely)

11. Average monthly energy bill (electricity and other fuel)----------Baht

12. Average monthly energy consumption by type of energy

Type of Energy	Amount of consumption (specify unit)
1. Electricity	KWh
2. Fuel Oil	Kg, litre
3. LPG	Kg, litre
4. Natural Gas	Kg, litre or------
5. Other (please specify) 5.1---------- 5.2---------- 5.3----------	

13. The percentage of total energy expenditure compared to the total operation cost of factory----------%

Part III: Energy Conservation Activities Information

(Please check √ in the blank where you think the information represents your factory or fill information in the blank space)

14. Currently, does your factory have an energy unit?

(If no, go to question no. 16 and 17)

( ) No ( ) Yes

15. If yes, how many energy employees are in the energy section----------persons

16. If no, what department is responsible for energy conservation activities.

( ) Maintenance or utility department

( ) Production department

( ) Engineering department

( ) Financial department

( ) Energy conservation committee

( ) Other (please identify----------)

17. From question no. 16, how many employees are in charge of energy activities?

----------persons

18. Number of persons responsible for energy (PRE)----------persons

19. Have the PREs been trained in the Person Responsible for Energy Course prescribed by DEDP?

( ) Yes,----------persons

( ) No, ----------persons

20. What are the qualifications of energy staff?

a) Education level

Level	Person
Occupational Certification	
Higher Occupational Certification	
Bachelor Degree	
Master Degree or above	

b) Field of Study

Field	Person
Science and Technology	
Engineering (specify major) Electrical Mechanical Other (specify)----------	
Energy	
Other (Please specify) _____	

c) Years of experience with energy conservation matters prior to current position?

Year	Person
1-3 years	
4-6 years	
7-9 years	
Over 10 years	

d) Years of working with the factory?

Year	Person
Less than 1 year	
1-2 years	
3-4 years	
Over 4 years	

21. Has your factory been conducting energy auditing before being regulated by the ECP Act? (If no, go to question no. 23)

( ) Yes ( ) No

22. If yes, who is the person handling such activity?

( ) Factory staff ( ) DEDP (or NEA)

( ) Hiring an energy consultant

( ) Other (specify)----------

23. Has your factory undertaken any energy conservation activities before being regulated by the ECP Act? (If no, go to question no. 25)

( ) Yes ( ) No

24. From question no. 24, please identify any energy conservation activities that your factory has done and also specify the percentage of energy saving from such activity.

Activity or Measure	1-15%	16-30%	31-45%	Above 46%
1. Improving fuel combustion efficiency				
2. Preventing energy loss				
3. Heat recovery				
4. Energy substitution				
5. Improving power factor				
6. Installing energy efficiency machinery				
7. Promoting energy saving campaign				
8. Other (please specify) 8.1 ---------- 8.2 ---------- 8.3 ----------				

25. Currently, what are energy conservation activities that your factory has implemented since it became a DF?

Activity	Performed and got approval	Performed but not approval yet	Do not perform
Appointing the PRE			
Submitting data on energy consumption twice a year			
Conducting preliminary energy audit			
Conducting detailed energy audit			
Setting up energy target and plan			
Investing in energy conservation measures or projects			
Monitoring and analyzing implementation on energy conservation target and plan.			

26. What kinds of technical support has your factory received for implementation of the energy conservation activities prescribed by the Act? Please specify who are the providers.

Type of support	**Provider**		
	DEDP	**Other gov't agency**	**Private company**
1. Implementation of the energy conservation activities advice			
2. Training provision			
3. Energy information provision			
4. Energy conservation investment advice			
5. Other (please specify) ----------			

27. How often does your factory obtain technical support within a year?

Type of support	**> 10 times**	**7-9 times**	**4-6 times**	**1-3 times**	**never**
1. Implementation of the energy conservation activities advice					
2. Training provision					
3. Energy information provision					
4. Energy conservation investment advice					
5. Other (please specify) ----------					

28. Regarding the implementation of energy conservation activities, what are the internal limitations existing in your factory? Please specify the degree of limitation.

Type of limitation	**Degree of limitation**		
	Very much	**Moderate**	**Less**
1. Budget constraint			
2. Lack of competent staff regarding energy conservation			

Type of limitation	Degree of limitation		
	Very much	Moderate	Less
4. Lack of experience			
5. Executive lack of understanding in policy			
6. Lack of executive support due to uncertain benefit			
7. Employee lack of awareness			
8. Lack of coordination among departments in factory			
9. Lack of employee cooperation			

Part IV: Perception on the implementation of the ECP Act

Indicate your opinion about each statement in the following list of statements by putting a check (√) in the appropriate column (SA: Strongly agree, A: Agree, U: Uncertain, D: Disagree, SD: Strongly disagree).

Statements	SA	A	U	D	SD
1. The supporting fund is properly allocated to all designated factories.					
2. Current types of supporting funds are adequate.					
3. Current financial support is able to motivate and encourage implementing the energy conservation activities (ECAs) prescribed by the Act.					
4. Current criteria for requesting financial support is impractical (reversed score).					
5. Financial support is able to achieve its objectives; that is, promoting energy conservation implementation and reducing energy consumption in factories					
6. Conditions required by the designated factories to obtain financial support from financial institutions before requesting interest payment support for investing in the energy conservation measures (ECMs) are reasonable and fair.					
7. The technical advice provided by DEDP helps your factory clearly understand the Act and be able to perform the tasks prescribed by the Act.					

Statements	SA	A	U	D	SD
8. Technical advice is easily and rapidly accessed.					
9. Information provided by DEDP helps your factory know how to implement the activities prescribed by the Act.					
10. Information relevant to energy conservation is adequate.					
11. Training courses provided by DEDP help your factory staff perform better energy conservation duties.					
12. Training courses provided by DEDP are adequate.					
13. The economic recession has less impact on your factory; the executives remain supportive of the implementation of the ECAs.					
14. The fluctuation of energy prices has less impact on your factory; the implementation of the ECAs remains a high priority.					
15.Your factory can easily access external funds due to availability of external funds.					
16. The energy conservation projects are in a higher rank to obtain loans from financial markets.					
17.The fund approval conditions of financial institutions are complicated (reverse score)					
18. Your factory is willing to implement the ECAs even without financial support from the ECP Fund.					
19. The factory executives strongly advocate the implementation of the ECAs prescribed by the Act.					
20. The factory staff is regularly being supported to attend training, meetings, or seminas on energy conservation issues.					
21. Most factory employees aware and fully cooperate in implementation of the ECAs.					
22. Energy efficiency is being considered when your factory decides to buy new machinery or equipment.					
23.Your factory has sufficient budget to implement the ECAs prescribed by the Act.					
24. Your factory has energy data collecting and monitoring systems and reports the results of energy conservation implementation.					

Statements	SA	A	U	D	SD
25. Your factory staff has the ability to conduct energy auditing by themselves.					
26. The factory energy staff has energy knowledge and experience in energy conservation.					
27. Cost of compliance with the policy has little impact on total cost of your factory.					
28. By comparing cost of and benefit from compliance with the policy it seems that for your factory the benefit is over cost.					
29. Energy conservation activities (ECAs) prescribed by the Act help to increase the factory productivity and decrease the production cost.					
30. The implementation of the ECAs is beneficial to the country by reducing energy dependency and greenhouse gas emission.					
31. Without the Act, utilizing voluntary measures to promote energy conservation implementation would not achieve the reduction of consumption goal.					
32. The Act is a key mechanism to reduce national energy consumption.					
33. The implementation of the Act is effectively executed.					

Part V: Additional suggestions or recommendations regarding to the implementation of the ECP Act, particularly on the designated factory side.

Thank you for your full cooperation

Mrs. Sasitorn Sinbanchongjit-Suwannathep.

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